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Application of Quality Control Circle Activities in Reducing Loss Rate During Storage of Traditional Chinese Medicine Decoction Pieces: An Effectiveness Study

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Abstract: *Objective:* To investigate the effectiveness of Quality Control Circle (QCC) activities in reducing the loss rate during storage of Traditional Chinese Medicine (TCM) decoction pieces in our hospital pharmacy department. *Methods:* A QCC team was established to systematically analyze the causes of TCM decoction piece losses. Using quality improvement tools including Pareto charts, the 80/20 rule, and fishbone diagrams, we identified key areas for improvement and developed targeted intervention strategies. The study period spanned from January to December 2023, with pre-intervention data collected from January to December 2022. Loss rates were calculated and compared before and after QCC implementation. *Results:* According to the "80/20 rule" analysis, the primary improvement targets were identified as inadequate maintenance of decoction pieces and dispensing losses. Following QCC implementation, the loss rate of TCM decoction pieces decreased significantly from 1.27% (pre-intervention) to 0.65% (post-intervention), achieving an improvement rate of 47.40%. The total monetary loss decreased from 9,592.62 RMB to 4,546.97 RMB. *Conclusion:* QCC activities can effectively reduce the loss rate of TCM decoction pieces in hospital pharmacy departments, improve the quality of herbal medicines, ensure patient medication safety, and enhance pharmaceutical service quality. This systematic approach provides a valuable framework for continuous quality improvement in TCM pharmacy management.

Keywords: Quality control circle; Traditional Chinese Medicine decoction pieces; Storage; Loss rate; Pharmacy management

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1. Introduction

Traditional Chinese Medicine (TCM) decoction pieces serve as essential therapeutic tools in clinical practice, enabling syndrome differentiation and targeted treatment. Their quality and dosage accuracy are critical

prerequisites for ensuring medication safety and therapeutic efficacy, representing a cornerstone of hospital pharmacy management. However, during the entire pharmaceutical process from procurement to dispensing, TCM decoction pieces inevitably experience quality deterioration and quantitative losses due to their inherent characteristics and various factors including packaging, transportation, storage conditions, and dispensing procedures [1].

TCM decoction pieces are particularly susceptible to storage-related deterioration due to their complex chemical compositions and diverse physicochemical properties. Common forms of quality degradation include insect infestation, mold growth, oil rancidity, moisture loss, discoloration, volatile component evaporation, and fermentation, with insect damage and mold contamination being the most prevalent. These losses not only compromise dosing accuracy and complicate pharmacy management but also represent significant waste of valuable natural resources [2].

Quality Control Circle (QCC), first introduced by Dr. Kaoru Ishikawa in Japan in 1962, is a systematic quality improvement methodology that empowers frontline staff to organize into quality improvement circles. Using scientific management tools, QCC teams develop effective solutions for real-world operational challenges. This approach has gained widespread adoption in healthcare systems and has demonstrated significant efficacy in enhancing medication safety and operational efficiency in hospital pharmaceutical services [3].

The established QCC team has demonstrated substantial proficiency in quality improvement methodologies and possesses the necessary expertise to address complex operational challenges. Given the significant economic impact and therapeutic implications of TCM decoction piece losses, this study investigated the effectiveness of QCC activities in systematically reducing storage-related loss rates while identifying primary contributing factors and developing sustainable improvement strategies.

2. Materials and methods

This study employed a PDCA (Plan-Do-Check-Act) cycle management approach to implement QCC activities in the TCM pharmacy department from January to December 2023. The effectiveness was assessed by comparing TCM decoction piece loss rates before implementation (January-December 2023) with post-implementation results (January-December 2024).

A multidisciplinary QCC team was established using brainstorming methodology, with theme selection conducted through evaluation of five criteria: administrative policy alignment, importance, urgency, team capability, and feasibility. Based on previous successful QCC implementations, the team selected “Reducing Loss Rate During TCM Decoction Piece Storage” as the improvement focus.

2.1. Baseline analysis

Loss data were collected from January-December 2023. The pharmacy managed 489 different TCM species, with 363 species (74.23%) susceptible to storage losses. Total monetary loss was 9,592.62 RMB with approximately 11 kg of material lost, resulting in a loss rate of 1.27%. Using brainstorming methodology and checklists, four primary loss causes were identified: inadequate decoction piece maintenance, dispensing losses, poor inventory turnover, and weighing errors. According to the 80/20 rule, inadequate maintenance and dispensing losses were determined as primary improvement targets.

2.2. Target setting

Based on the baseline loss rate of 1.27‰ and using the 80/20 rule with team capability calculated at 60%, the target value was set at ≤ 0.667‰ using the formula: Target ≤ Current value – (Current value × Improvement focus × Team capability).

2.3. Root cause analysis

Comprehensive cause analysis was conducted using fishbone diagrams examining personnel, materials, methods, machinery, and environment. Key factors included inadequate maintenance practices, insufficient responsibility, processing losses, excessive inventory, inadequate equipment capacity, and poor environmental conditions.

2.4. Interventions

Five primary interventions were implemented

(1) Flexible staffing adjustments during peak periods
(2) Focused work protocols with reward/penalty systems
(3) Regular calibration of weighing instruments
(4) Dedicated personnel for systematic shelf maintenance
(5) Daily monitoring of temperature and humidity in storage areas and refrigeration units

2.5. Data analysis

Loss rates were calculated as: Loss rate (%) = Total loss amount / Total inventory value × 1000. Improvement rate was calculated as: Improvement rate (%) = [(Pre-intervention – Post-intervention) / Pre-intervention] × 100%. Statistical analysis compared monetary losses and loss rates between the two study periods. Tangible outcomes were evaluated through comparison of pre- and post-intervention data, while intangible outcomes were assessed through staff self-evaluation scores displayed using radar charts.

3. Results

3.1. Tangible outcomes

Following QCC implementation, the loss rate of TCM decoction pieces decreased significantly from 1.27% (pre-intervention) to 0.65% (post-intervention), representing a 48.82% improvement rate. The total monetary loss decreased from 9,592.62 RMB to 4,546.97 RMB, achieving a reduction of 5,045.65 RMB. The target achievement rate was 102.57% (target: ≤ 0.667%, achieved: 0.65%).

3.2. Loss distribution analysis

Among the 489 TCM species managed, 363 species (74.23%) were susceptible to storage losses in the pre-intervention period. Post-intervention analysis showed that losses were primarily concentrated in specific categories, with targeted interventions effectively addressing the main contributing factors identified through the 80/20 rule analysis.

3.3. Cost-benefit analysis

The annual cost reduction of 5,045.65 RMB demonstrates the economic effectiveness of QCC implementation.

When extrapolated across similar hospital pharmacy departments, this intervention model shows significant potential for system-wide cost savings and resource conservation.

3.4. Intangible outcomes

Staff evaluation scores improved across all assessed domains using radar chart analysis. Team members demonstrated enhanced problem-solving capabilities, increased job satisfaction, improved communication skills, and stronger commitment to quality improvement initiatives. The QCC process fostered a culture of continuous improvement and collective responsibility for quality outcomes.

3.5. Implementation success factors

The systematic application of quality improvement tools including Pareto analysis, fishbone diagrams, and PDCA cycles proved effective in identifying root causes and developing targeted solutions. The multidisciplinary team approach and structured methodology ensured comprehensive problem-solving and sustainable improvement.

4. Discussion and conclusion

The results demonstrate that QCC activities can effectively reduce storage losses of TCM decoction pieces through systematic problem identification and targeted interventions. The 48.82% reduction in loss rate from 1.27% to 0.65% exceeded the predetermined target, indicating the effectiveness of this quality improvement approach in TCM pharmacy management.

The application of structured quality improvement tools proved critical to project success [4]. Pareto analysis enabled identification of primary loss contributors, focusing improvement efforts on inadequate maintenance and dispensing losses which accounted for over 80% of total losses. The fishbone diagram methodology provided comprehensive root cause analysis across personnel, materials, methods, machinery, and environmental factors, ensuring no critical contributors were overlooked.

The five implemented interventions addressed both immediate operational issues and underlying systemic problems. Flexible staffing during peak periods and focused work protocols with accountability measures directly targeted personnel-related causes, while equipment calibration and environmental monitoring addressed technical factors. The assignment of dedicated maintenance personnel created sustainable long-term improvement by establishing clear responsibility and systematic oversight.

The annual cost reduction of 5,045.65 RMB demonstrates significant economic benefits beyond the immediate quality improvements. This cost savings represents approximately 52.6% of the original losses, indicating substantial return on investment for QCC implementation. The financial benefits extend beyond direct cost savings to include improved inventory accuracy, reduced waste, and enhanced therapeutic reliability.

The success of this QCC implementation suggests broader applications for quality improvement in TCM pharmacy management. The methodology can be adapted to address other operational challenges such as prescription accuracy, dispensing efficiency, or inventory management [5]. The systematic approach provides a replicable framework for continuous quality improvement in traditional medicine settings.

This study was conducted in a single institution with specific operational characteristics, which may limit generalizability to other settings. The one-year implementation period may not capture long-term sustainability of improvements, and continued monitoring is necessary to ensure maintained effectiveness. Long-term follow-up

studies should evaluate sustainability of improvements and identify additional applications of QCC methodology in TCM pharmacy operations. Expansion to multi-center studies would strengthen evidence for broader implementation across healthcare systems.

Disclosure statement

The authors declare no conflict of interest.

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