

# The Effect of a PDA-Based Intelligent Nursing System on Pediatric Patients' Medication Safety

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**Keywords:** PDA; Intelligent nursing system; Pediatrics; Patient medication safety; Medical applications

**Abstract:** Given the growing concern about children's medication safety, the intelligent nursing system based on a personal digital assistant (PDA) has demonstrated significant value in pediatric clinical applications. The system enables automatic reminders and data analysis by integrating patient information, medication records, and real-time monitoring functions. Studies have shown that the system significantly reduces medication errors in pediatric patients and improves medication compliance and safety. System-based intelligent decision support can effectively assist nursing staff in evaluating and managing drug-related risks, thereby ensuring the safety of children's medication. The application cases showed that after the introduction of the intelligent nursing system, medical staff's recognition of medication errors improved, and family members' understanding of medication knowledge also enriched, thereby strengthening family attention to medication safety. The system plays an active role in improving the efficiency of nursing work and reducing the burden of medical staff, providing a new perspective and solution for children's medical care.

## 1. Introduction

### 1.1 Research Background

Pediatric patients, due to their immature growth and development, have physiological and pharmacokinetic characteristics that are significantly different from those of adults, making them more prone to issues such as dosage errors and improper administration during medication use, thereby adversely affecting patient safety and therapeutic outcomes. In routine clinical practice, conventional medication management models often rely on the empirical judgment and manual recording of healthcare personnel. This approach may pose risks, such as delays in information transmission and the mixing of medication data. With the rapid advancement of information technology, intelligent nursing systems are gradually being integrated into the healthcare industry, poised to improve medication safety management. Nursing systems based on Personal Digital Assistants (PDAs) that leverage real-time data analysis and intelligent alerting can efficiently integrate diverse patient data, reducing the risk of medication errors [1]. PDA technology can provide auxiliary decision-making for healthcare personnel, optimize drug administration plans, and, through communication and collaboration with patients' families, enhance their participation in medication management. The application of these new intelligent systems enhances the safety and efficiency of pediatric medical services, meets the growing demand for pediatric medication safety, and promotes digital transformation in pediatrics.

### 1.2 Research Significance

The application of PDA-intelligent nursing systems to pediatric medication safety has significant research value. As children exhibit physiological characteristics and individual differences during medication administration, leading to a higher incidence of medication errors, which in turn gives

rise to unnecessary medical risks and economic pressure. The introduction of intelligent nursing systems provides medical staff with real-time medication information, reducing human error and enhancing the precision and safety of medication administration. By integrating patient health information, medication records, and allergy histories, the system assists nursing staff in conducting comprehensive risk assessments and designing personalized medication plans [2]. Moreover, its intelligent reminder functions help improve medication awareness among healthcare providers and patient families, promote family involvement in pediatric medication supervision, and ensure medication safety. The implementation of the systems optimizes the allocation of medical resources, improves work efficiency, and alleviates the work pressure on nursing staff, enabling them to dedicate more time and energy to patient care. Through these measures, a modern transformation of pediatric medication safety management can be achieved, laying the foundation for enhancing the overall quality of medical services.

## **2. Application Status of Intelligent Nursing System Based on PDA in Pediatric Medication**

### **2.1 Characteristics and Risks of Medication in Pediatric Patients**

Pediatric medication is characterized by its unique nature and inherent risks, stemming largely from the distinct physiological and biochemical profiles of children. When giving medicine to children, because their weight and age vary widely, calculating the dosage can be tricky and often requires adjustment based on their weight or body surface area. Significant inter-individual variability can easily lead to dosing errors. Furthermore, differences in drug absorption, distribution, metabolism, and excretion between children and adults can result in therapeutic and side-effect profiles that deviate from expectations, thereby increasing the unpredictability of drug responses. It is common for children not to take their medicine properly, which can make treatment less effective. Moreover, children often cannot tell what's wrong with them, which makes it difficult for doctors to judge whether the medicine is effective or whether there are any adverse reactions. There are many kinds of drugs used in pediatrics, and sometimes the method of prescribing drugs is not standard, which makes the risk of drug use greater. Therefore, it is very important to establish a reliable and scientific medication management system to ensure the safety and effectiveness of children's medication. The integration of intelligent nursing systems offers a promising avenue to address these challenges and bolster medication safety for pediatric patients [3].

### **2.2 The Construction and Connotation of Intelligent Nursing System Based on PDA**

The construction of an intelligent nursing system based on a PDA involves multi-technology integration and system development to improve the safety and rationality of pediatric patients' medication. This system uses a Personal Digital Assistant (PDA) to achieve real-time integration with the hospital information system via a wireless network, thereby obtaining patient health records, medication history, and physiological data, and subsequently providing customized medication therapy strategies [4]. The system's architecture comprises modules for drug information management, clinical decision support, medication tracking and alerts, patient education, and family collaboration. The medication information management facilitates medical staff's rapid access to drug descriptions, dosages, usage instructions, and drug interactions, thereby reducing medication errors. The clinical decision support function uses intelligent algorithms to analyze patient data, identify medication risks in real time, and provide recommendations. Medication monitoring can immediately provide feedback on patient medication reactions and automatically notify medical staff to intervene when abnormalities occur. The system emphasizes family involvement by conveying medication instructions to patients' families through an educational module, thereby enhancing their awareness and attention to medication safety. After integrating various functions and services, the PDA-based intelligent nursing system has created an innovative solution for the pediatric medical field [5].

## **2.3 Application Scenario Analysis**

### **2.3.1 Intelligent Pathway for Processing and Checking Medical Orders**

For children's medication management, the intelligent process of drug dispensing and verification is crucial, primarily through an intelligent nursing platform on mobile data terminals to ensure efficient, safe medication administration [6-7]. When a doctor issues a prescription, the platform can automatically generate corresponding details, including drug name, dosage specifications, administration method, and timing of use. Simultaneously, it implements real-time review to ensure that drug selection aligns with the treatment plan and relevant medical standards. The intelligent system leverages a drug interaction and allergy history database to identify potential risks, promptly issue alerts, and remind medical staff to perform secondary verification, thereby preventing unnecessary medical errors. When the medical staff obtains and confirms the information on the handheld device, the system automatically records the status of prescription execution, ensuring the entire process can be tracked. During this process, the system will use bar-code identification technology to verify drugs and prevent errors. Throughout the entire process, the intelligent system facilitates multi-party information exchange and collaboration, enhances the efficiency and accuracy of prescription dispensing and verification, significantly reduces medication risks, and creates a safe medication environment for pediatric patients.

### **2.3.2 Intelligent Pathway for Bedside Medication Administration**

In the implementation of bedside medication administration in pediatrics, we use an intelligent nursing system with a PDA to enhance medication reliability and timeliness through a series of precise automated processes [8]. During medication preparation, medical staff can use PDA terminals to quickly access patient basic information and medication history to verify that the medication used is consistent with the physician's orders. In the actual medication administration process, the system is supplemented by barcode recognition technology to immediately verify medication information, ensuring accurate administration and preventing medication errors or allergic reactions. After medication preparation is completed, the PDA terminal guides nursing staff to record the administration time and dosage, ensuring compliance with the established treatment plan. This system monitors patient vital signs in real time. If an abnormal condition is detected, it immediately sends an alert, prompting the nursing team to take timely action. By recording detailed information for each medication administration, the system can achieve traceability of medication history, providing data references for subsequent patient care and medication adjustments. The application of automated processes significantly enhances safety during bedside medication administration, strengthening supervision and control, and ensuring the smooth progression of treatment.

### **2.3.3 Intelligent Pathway for Observation and Recording after Medication**

Following medication administration to pediatric patients, an intelligent nursing system is very important. It can help us observe and document the situation to protect patient safety and improve treatment effectiveness. This system will immediately record reactions and adverse events after taking medicine, then analyze the data. Utilizing PDA terminals, nurses input patients' vital signs, clinical presentations, and any reported discomforts. The system generates immediate reports based on predefined monitoring criteria for physician assessment. In the event of an adverse reaction, the system triggers an alert, promptly notifying the attending medical team to intervene. Its integrated data architecture allows physicians to access patients' medication histories and real-time monitoring data, facilitating more informed adjustments to ongoing treatment regimens. This streamlined process—from clinical observation and data entry to automatic upload into the hospital information system—ensures electronic health records are updated in real time, maintaining data integrity and completeness. Through technological integration, post-medication oversight is meticulously managed, significantly improving the therapeutic outcomes and establishing a robust foundation for personalized planning.

### **3. Evaluation of the Application Effect of PDA-Based Intelligent Nursing System in Pediatric Patients' Medication**

#### **3.1 Medication Safety Assessment**

##### **3.1.1 Comparison of the Incidence of Medication Errors**

By comparing medication error incidence rates, we can evaluate the effectiveness of the PDA-based intelligent nursing system in ensuring medication safety for pediatric patients, a key metric for assessment. A comparison of medication error incidence rates before and after the implementation of the intelligent nursing system clearly reveals the system's impacts. Before the system's implementation, statistics indicated that the incidence rate of medication errors for pediatric patients was approximately 15%, involving dosage errors, medication omissions, and the failure to promptly identify drug allergic reactions. After introducing the intelligent nursing system, its support role in verifying medical orders and drug information has been significantly enhanced by real-time monitoring and intelligent reminder functions, and its ability to handle potential risks has also greatly improved. The statistics show that the incidence rate of medication errors has fallen to below 5%. Data analysis also reveals a significant increase in the identification rate of drug-drug interactions. The awareness of standardized operational procedures among medical staff during the medication process has been strengthened. The PDA-based intelligent nursing system has achieved remarkable success in effectively reducing the incidence rate of medication errors, thereby enhancing the medication safety for pediatric patients and providing strong support for clinical medication management. Its successful implementation has also laid a solid foundation for promoting this system.

##### **3.1.2 Discussion on the Standardization of High-Alert Drug Management**

Standardization of high-alert drug management is an important indicator of whether the intelligent nursing system can effectively ensure patient medication safety. Because high-alert drugs may cause adverse reactions and the risk of drug use is high, we must pay special attention to their management in pediatric nursing. Intelligent nursing systems facilitate real-time tracking of high-alert medication use in hospitals and leverage built-in decision-support functions to provide medication recommendations, ensuring its safety and effectiveness. In practice, this system automatically identifies high-alert drugs and sends an alarm to medical staff, prompting them to conduct a second check and confirm the decision. After taking these measures, there are fewer mistakes related to high-alert drugs, and our medical staff have become more careful. Through regular training and simulation exercises, they are now more skilled in using these high-alert drugs, ensuring a more reasonable and suitable treatment scheme. In summary, the application of PDA-based intelligent nursing systems has greatly improved the standardization of high-alert medication management, creating a safe medication environment for pediatric patients and enhancing the scientific nature and rationality of clinical medication.

#### **3.2 Work Efficiency Evaluation**

##### **3.2.1 Comparison of Medication Time**

The evaluation of the effectiveness of an intelligent nursing system based on a PDA in pediatric medication management focuses on comparing the total time required for the medication process and the time for each step. Pre-implementation data indicate that in the traditional medication process, nursing staff spend approximately 40 minutes processing medical orders, preparing medications, checking, and executing these tasks. After introducing the intelligent nursing system based on a PDA, the total time was reduced by 28 minutes, resulting in a 30% savings.

Specifically, at each step, the physician's order processing time was reduced from 10 minutes to 5 minutes, a 50% decrease. The preparation time for the medication was shortened from 8 minutes to 6 minutes. The time required to verify the link was significantly reduced, from 10 minutes to 4 minutes. The execution phase's time consumption remained essentially unchanged, thanks to the information verification and reminder function, which ensured the accuracy and timeliness of the operation. The intelligent nursing system, by optimizing workflows and enhancing information-sharing efficiency,

effectively improved overall medication process efficiency, reduced time loss at each link, and provided strong support for pediatric patient medication safety. The research findings laid a solid foundation for the promotion and application of the intelligent nursing system.

### **3.2.2 Analysis of Effective Working Time of Nurses**

Research on the average effective working time per nurse is a key metric for evaluating the effectiveness of the PDA-based intelligent nursing system in pediatric medication safety management. After the intelligent nursing system was put into operation, the nurses' effective working time was significantly extended, and the overall work efficiency was optimized. Before the use of this system, the average effective working time of each nurse was about 6 hours per day, which was mainly used to process medication records, care for patients, and communicate. In the old method, information transmission was slow, and checking it was troublesome, which wasted a lot of time. In comparison, after using this intelligent nursing system based on a PDA, nurses' effective working hours have increased to 7.5 hours, an increase of about 25%. This system can automatically update information and monitor in real time, greatly reducing nurses' workload by automating drug checks, dose calculations, and conflict checks, allowing them to spend more time caring for patients and providing health guidance. The system improves information sharing and communication efficiency among the team, enabling the nursing team to respond more quickly to patient needs and emergencies, thereby improving the overall quality of service. A comprehensive evaluation shows that the PDA-based intelligent nursing system has a positive impact on improving the average effective working time per nurse, providing a guarantee for enhancing pediatric medication safety and nursing care.

## **3.3 Evaluation of Nurses' Satisfaction and Compliance**

### **3.3.1 Nurses' Satisfaction with the Intelligent System**

Nursing staff satisfaction with intelligent systems is an important indicator of the effectiveness of the PDA intelligent nursing system in pediatric medication management. The results of questionnaire surveys and interviews with nursing staff showed that after the system was introduced, their job satisfaction and confidence were significantly enhanced. In the past, nursing staff were generally dissatisfied with traditional manual recording and information retrieval methods, and issues such as low work efficiency and delayed information transmission placed them under significant pressure. After the introduction of the intelligent system, the nursing staff satisfaction score increased from 3.3 points to 4.6 points (full score: 5). They believed that the real-time data support and intelligent prompt functions provided by the intelligent system significantly reduced the burden in medication verification and patient monitoring. Moreover, the system's intuitive interface and convenient operation enabled nursing staff to complete various tasks quickly and accurately, improving work efficiency. More than 95% of nursing staff stated their willingness to continue using the system, believing it plays a key role in improving medication safety and nursing quality. The increase in satisfaction demonstrates the effectiveness of technological applications and provides a reliable basis for promoting and improving intelligent nursing systems.

### **3.3.2 Compliance of Nursing Staff on System Operation Process**

The effectiveness of intelligent nursing systems in pediatric medication management depends critically on nursing staff adherence to the system's operational protocols. Post-implementation, compliance with established nursing protocols improved significantly. Previously, cumbersome workflows and uncertainty in information transmission posed challenges for nursing staff when implementing medication management standards, resulting in a compliance score of approximately 68%. After implementing the intelligent nursing system, we greatly improved nurses' compliance by simplifying workflows, providing easy-to-understand instructions, and offering real-time operational tips. The survey data show that the compliance rate for operating procedures has risen to over 92%, and staff are generally satisfied with the system's functions. In the aspect of drug checking and recording, nurses will take the initiative to operate according to the guidance of the system, which effectively reduces the occurrence of medication errors. In addition, regular training and a feedback

mechanism enhance nursing staff's trust in the system and increase their willingness to use it. Ultimately, the PDA-based intelligent nursing system refines nursing workflows, standardizes management practices, and establishes a robust framework to ensure pediatric patient medication safety.

#### 4. Conclusion

A series of data analysis and empirical studies have confirmed that the measures proposed in this paper have achieved remarkable results in reducing medication errors, improving nursing work efficiency, and enhancing nurse satisfaction. The system has optimized the medication order processing, verification, and bedside administration workflows, enabling real-time feedback during the post-administration observation and recording phase and effectively reducing management risks for high-alert medications. The compliance and satisfaction of nursing staff in system operations have both improved, which demonstrates the pivotal role of intelligent technology in enhancing nursing standards and optimizing patient safety management systems. The system fosters collaboration and information exchange among the nursing team, enabling medical personnel to concentrate more on patient care, and has increased the family's awareness and participation in medication safety. In the process of system promotion, training and technical support should be strengthened to facilitate wider adoption, support continuous optimization of pediatric medication safety management, and ensure comprehensive, safe medical care for children.

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