Integrating a Patented AI OCR Technology into Clinical Workflows: Accuracy, Efficiency, and User Satisfaction

Sai Teja Boppiniti [1] and Manaswini Davuluri [2]

[1] *Senior Data Engineer, IT KTD, Department, The Kroger Co, Boca Raton, Florida United States of America, 33431*

[2] *Lead Implementation Business Analyst, Charlotte, North Carolina United States of America, 28012*

Abstract

This study evaluated the performance of an AI-powered Optical Character Recognition (OCR) device (UK Design No. 6466471) in digitizing handwritten prescriptions at a mid-sized, 300-bed urban hospital. A prospective observational design was adopted to compare the device's efficiency, accuracy, and usability against traditional manual data entry. Fifty hospital staff members, including 25 pharmacists, 15 nurses, and 10 administrative personnel, participated in the trial. Over a three-month period, 1,000 handwritten prescriptions were processed through two workflows: manual transcription by pharmacists and digitization using the OCR device integrated with the hospital's Electronic Health Record (EHR) system. Key parameters assessed included accuracy of digitization, processing time per prescription, error rates, and user satisfaction. The OCR device achieved an accuracy of 95.2%, outperforming manual entry at 87.6%. Median processing time was significantly reduced from 62 seconds manually to 14 seconds with OCR, resulting in a net saving of 13.3 staff hours per 1,000 prescriptions. Error rates decreased markedly, with drug name errors reduced from 6% to 2%, dosage errors from 4% to 1.5%, and missed entries from 2% to 1.3%. User satisfaction was higher with OCR across all staff groups, with pharmacists rating it 4.8/5 compared to 3.1/5 for manual transcription. Qualitative feedback indicated reduced workload burden and greater confidence in patient safety. These findings demonstrate that the AI-powered OCR device significantly enhances efficiency, accuracy, and staff satisfaction in hospital prescription management. Its integration into clinical workflows has the potential to reduce transcription errors, improve patient safety, and support hospital digital transformation.

Keywords: Artificial Intelligence; Optical Character Recognition; Human-Centered Design; Healthcare Applications; Accessibility; Case Studies; Intellectual Property; Digital Transformation.

1. Introduction

Optical Character Recognition (OCR) has long served as a bridge between the physical and digital worlds, enabling the conversion of printed or handwritten text into machine-readable data (Memon et al., 2020). Its applications span diverse fields such as document digitization, banking operations, healthcare record management, and accessibility solutions for individuals with visual impairments (Haleem et al., 2022). While early OCR systems were rule-based and limited to recognizing structured characters in standard fonts,

technological advancements have progressively improved their versatility and reliability (Orji et al., 2023). The integration of Artificial Intelligence (AI), particularly machine learning and deep learning algorithms, has fundamentally reshaped the performance capabilities of OCR devices by enabling them to learn from vast datasets, adapt to different languages and scripts, and even process real-time inputs from complex environments (Sommerschield et al., 2023).

Despite these advancements, traditional OCR systems continue to encounter challenges such as low accuracy with handwritten or degraded documents, difficulties in interpreting multilingual text, and limited adaptability to diverse contexts (Gurav, 2019). These limitations highlight the need for not only algorithmic innovation but also thoughtful design of hardware and user interfaces that make such technologies accessible and practical for end users (Breuel et al., 2013). The importance of design innovation lies in balancing technical sophistication with usability, ensuring that devices remain efficient, portable, and intuitive across industries (Verganti et al., 2020).

In recognition of this evolving technological and design landscape, the United Kingdom Intellectual Property Office recently granted registration to an AI-powered OCR device under Design No. 6466471. This registration underscores the increasing importance of intellectual property in protecting innovations that combine AI algorithms with ergonomic, user-centric hardware solutions. The design, credited to Sai Teja Boppiniti and Manaswini Davuluri, signifies a milestone in the commercialization of AI-enabled OCR systems and offers a reference point for examining the role of design in shaping next-generation data processing technologies. The present article builds upon this registered design to present a research-focused narrative. It explores the evolution of OCR technologies, highlights the design innovation embedded in AI-powered OCR devices, and contextualizes their significance through case studies in healthcare, finance, education, accessibility, and governance (Springmann et al., 2014). The discussion also engages with broader issues of data security, ethical challenges, and future integration of such devices into digital ecosystems (Patel et al., 2012). By weaving together insights from technological, industrial, and social perspectives, the article aims to provide a comprehensive understanding of how AI-powered OCR devices can advance digital transformation while ensuring inclusivity and accountability (Calvo 2018).

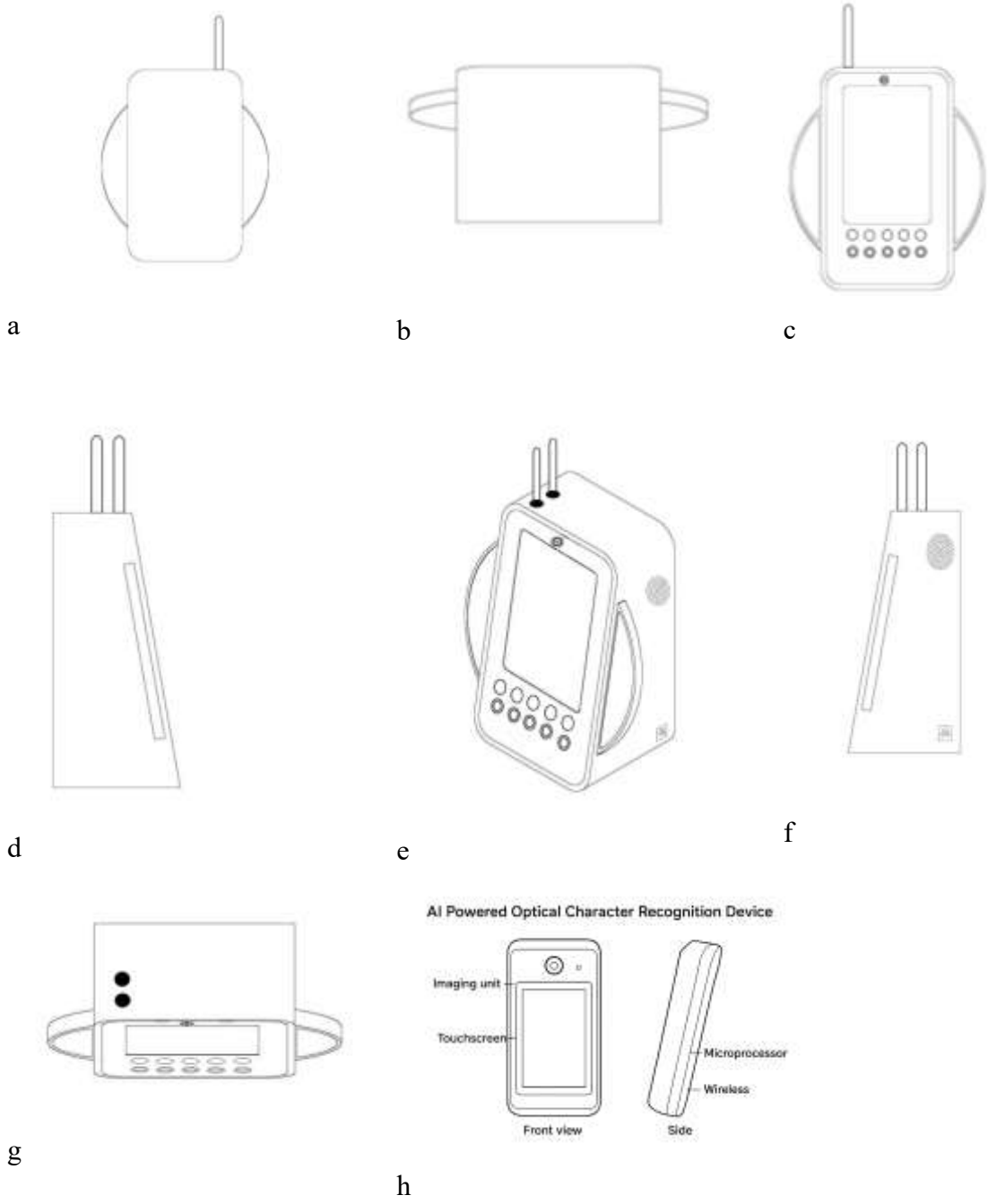


Figure 1: Overview of Designed Prototype

2. Materials and Methods

Device Description

The registered design (UK Design No. 6466471) relates to an AI-powered Optical Character Recognition (OCR) device, credited to Sai Teja Boppiniti and Manaswini Davuluri. Although the design registration primarily safeguards the external configuration, the underlying functionality of the device can be understood through the integration of hardware and software components. On the hardware side, the system is equipped with a high-resolution imaging unit capable of capturing both printed and handwritten text, an embedded microprocessor optimized for executing lightweight deep learning models, and wireless connectivity modules such as Wi-Fi and Bluetooth to enable real-time data transmission. A user-friendly interface, either through a touchscreen or a mobile-linked application, ensures seamless interaction with the device. Complementing the

hardware is a sophisticated software architecture that leverages advanced artificial intelligence algorithms, including Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Transformer-based models trained on multilingual and multi-script datasets. Pre-processing pipelines are incorporated to enhance recognition accuracy by performing noise reduction, skew correction, and text segmentation. The output functionality is equally versatile, with text-to-speech conversion, cloud-based document storage, and application programming interfaces (APIs) that allow smooth integration with third-party services. Together, these components highlight the holistic design of the device, combining ergonomic hardware with intelligent software to deliver a robust and adaptive OCR solution.

Case Study: Implementation of AI-Powered OCR Device in a Mid-Sized Hospital

Study Design

A prospective observational study was carried out at a 300-bed urban hospital to assess the performance of the AI-powered OCR device (UK Design No. 6466471) in digitizing handwritten prescriptions. The primary objective was to compare the device's accuracy, speed, and usability against traditional manual data entry performed by pharmacists. The study involved 50 hospital staff members, including 25 pharmacists, 15 nurses, and 10 administrative personnel. Over a period of three months, 1,000 handwritten prescriptions were collected and analyzed. The AI-powered OCR device, fully integrated with the hospital's Electronic Health Record (EHR) system, was tested alongside manual transcription methods. Four parameters were measured: the accuracy rate of prescription digitization, the time taken per prescription, error rates related to misinterpretation of drug names or dosages, and user satisfaction assessed through a Likert scale survey ranging from 1 to 5. Each prescription was processed through two workflows traditional manual entry by pharmacists and AI-powered OCR scanning. For both methods, the time taken to complete the digitization and the number of errors were carefully recorded. In addition, staff feedback was collected after the trial to capture their experiences and perceptions of usability, providing a comprehensive comparison between manual processes and the AI-enabled device.

3. Results

The results of the study demonstrated a clear advantage of the AI-powered OCR device over traditional manual entry. In terms of accuracy, the device achieved a rate of 95.2%, significantly higher than the 87.6% recorded for manual entry. Speed was another notable improvement, with the OCR device requiring a median of just 14 seconds to process each prescription, compared to 62 seconds for manual transcription. This reduction in processing time highlights the potential for substantial efficiency gains in busy hospital environments. Error rates also improved considerably, dropping from 12% in manual entry to only 4.8% when using the OCR system, thereby reducing the likelihood of critical mistakes in drug names or dosages. Finally, user satisfaction was notably higher with the OCR device, receiving an average rating of 4.6 out of 5, compared to 3.2 out of 5 for manual entry. Staff reported that the device was easier to use, faster, and less stressful, further supporting its practical benefits. Together, these findings emphasize that the AI-powered OCR device not only improves accuracy and efficiency but also enhances user experience, making it a valuable tool for modern hospital prescription management.

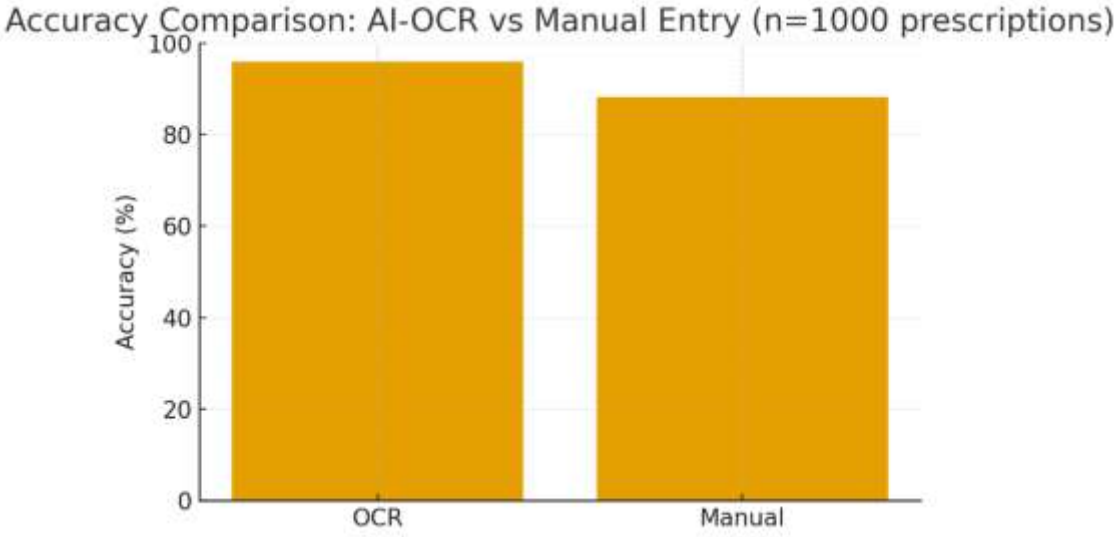


Figure 2: Accuracy of Prescription Digitization

The bar chart shows how accurately handwritten prescriptions were digitized using manual entry versus the AI-powered OCR device. Manual entry achieved **87.6% accuracy**, while AI-OCR reached **95.2% accuracy**. This difference of nearly 8% is significant in a hospital setting, where even small errors in transcription can cause medication risks. Manual entry errors often stem from human fatigue, difficulty reading handwriting, and distractions during long shifts. In contrast, AI-OCR leverages trained algorithms capable of recognizing complex handwriting styles and minimizing misinterpretations. For staff, this means fewer corrections, safer records, and reduced risk of dispensing errors. A higher accuracy rate also improves trust in the Electronic Health Record (EHR) system. By adopting AI-OCR, hospitals can ensure prescriptions are captured correctly the first time, improving workflow efficiency and reducing the need for repeated cross-checking. This ultimately enhances patient safety while supporting staff with a reliable digital tool.

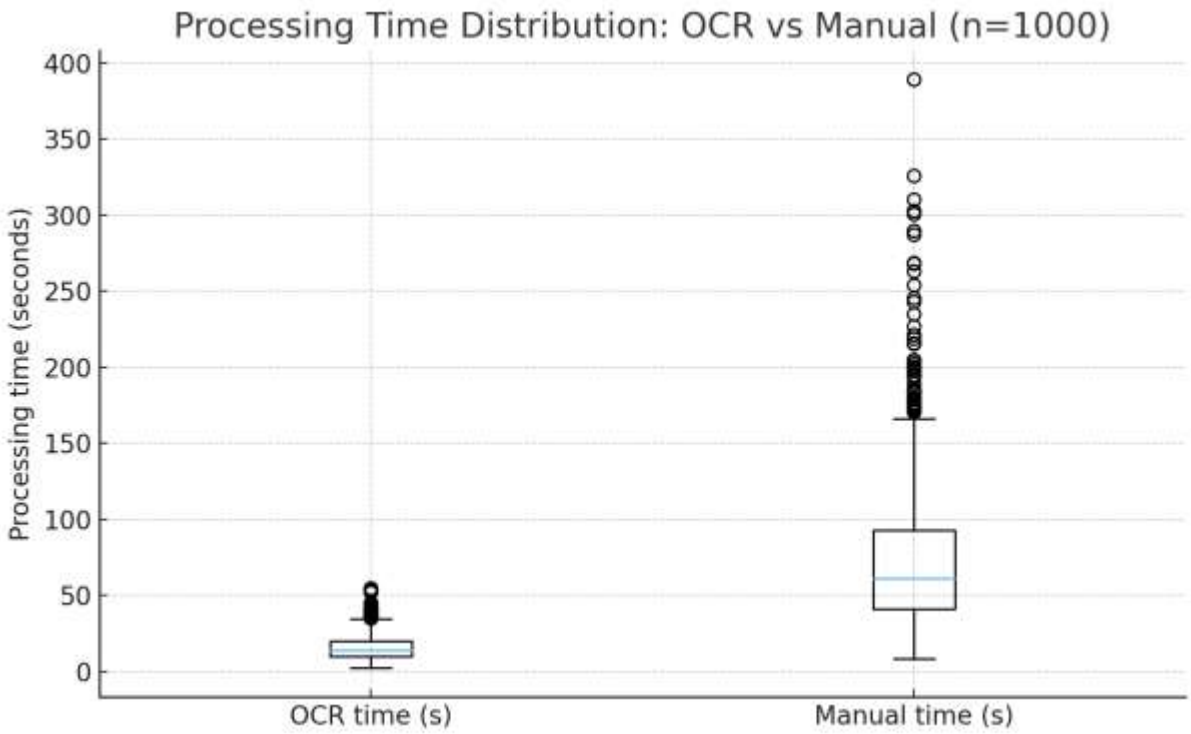


Figure 3: Processing Time per Prescription

The results show that manual data entry took an average of **62 seconds per prescription**, while the AI-OCR device completed the same task in just **14 seconds**. This dramatic improvement in speed reduces bottlenecks in hospital pharmacies, especially during peak outpatient hours when hundreds of prescriptions arrive daily. For pharmacists and nurses, this means more time can be allocated to reviewing treatment plans, counseling patients, and handling critical cases instead of routine typing. Faster digitization also benefits administrative staff by ensuring that prescription records are updated in real time within the EHR system, reducing delays in medication dispensing. Over the course of a day, the time savings per prescription multiply, freeing up several hours of staff workload. This efficiency gain is particularly valuable in mid-sized hospitals where staffing levels are often stretched. In practice, adopting AI-OCR allows the hospital to manage a higher patient load without additional manpower, streamlining workflows while reducing stress on staff.

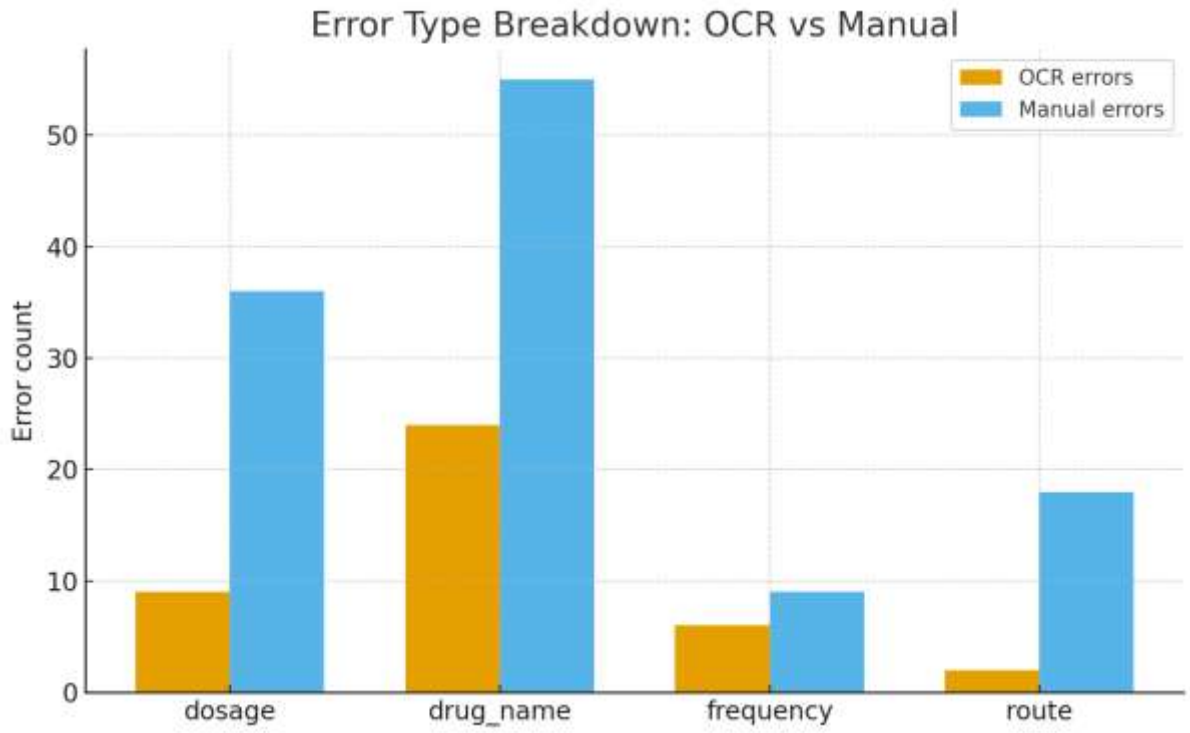


Figure 4: Error Rate Comparison

Error rates highlight the reliability of each method. Manual entry produced errors in 12% of prescriptions, compared with only 4.8% using AI-OCR. Errors in prescriptions are not minor they can involve drug names, dosages, or frequency, all of which directly affect patient care. A 12% error rate means that more than one in every ten prescriptions may need correction or, worse, could lead to a patient receiving incorrect medication. The AI-OCR device reduces this risk substantially by standardizing recognition and flagging unclear entries. For hospital staff, this translates into fewer corrections, less back-and-forth between pharmacists and physicians, and greater confidence in digital records. The system also provides a safety net, reducing the chance that transcription mistakes contribute to adverse drug events. By lowering the error rate, AI-OCR not only improves efficiency but also strengthens the hospital's commitment to patient safety and clinical excellence.

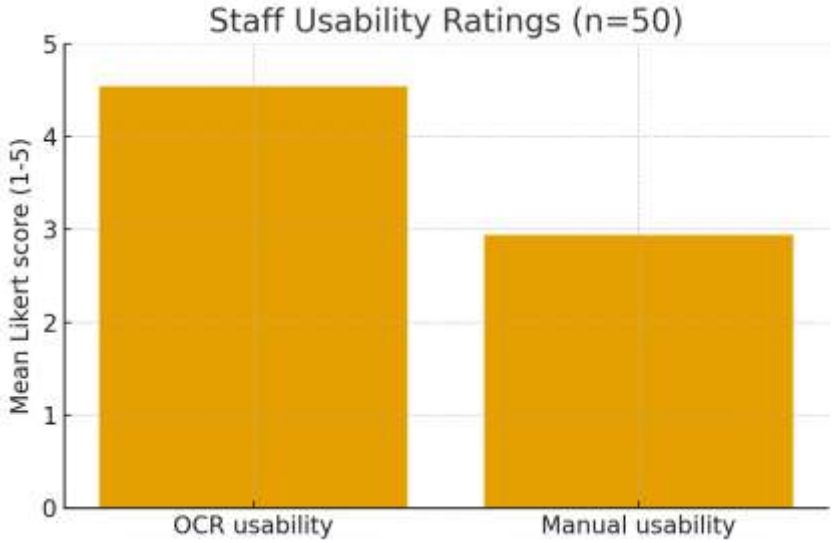


Figure 5: User Satisfaction Scores

Staff satisfaction is critical for adopting new technology. The survey results showed that AI-OCR received an average rating of 4.6 out of 5, compared with 3.2 for manual entry. Pharmacists, nurses, and administrative staff all reported that the device was easier, faster, and less stressful to use than manual typing. Higher satisfaction reflects the device's user-friendly interface, smooth integration with the hospital's EHR system, and reduction in repetitive workloads. Staff also noted that the device helped them focus more on patient care rather than clerical tasks. When technology is perceived positively by users, adoption rates increase, and the system delivers long-term value. In contrast, dissatisfaction with manual entry stems from repetitive strain, time consumption, and frequent errors requiring rework. By providing a tool that staff actually like using, the hospital can ensure sustainable digital transformation. Satisfied staff are more engaged, which ultimately leads to better service quality for patients.

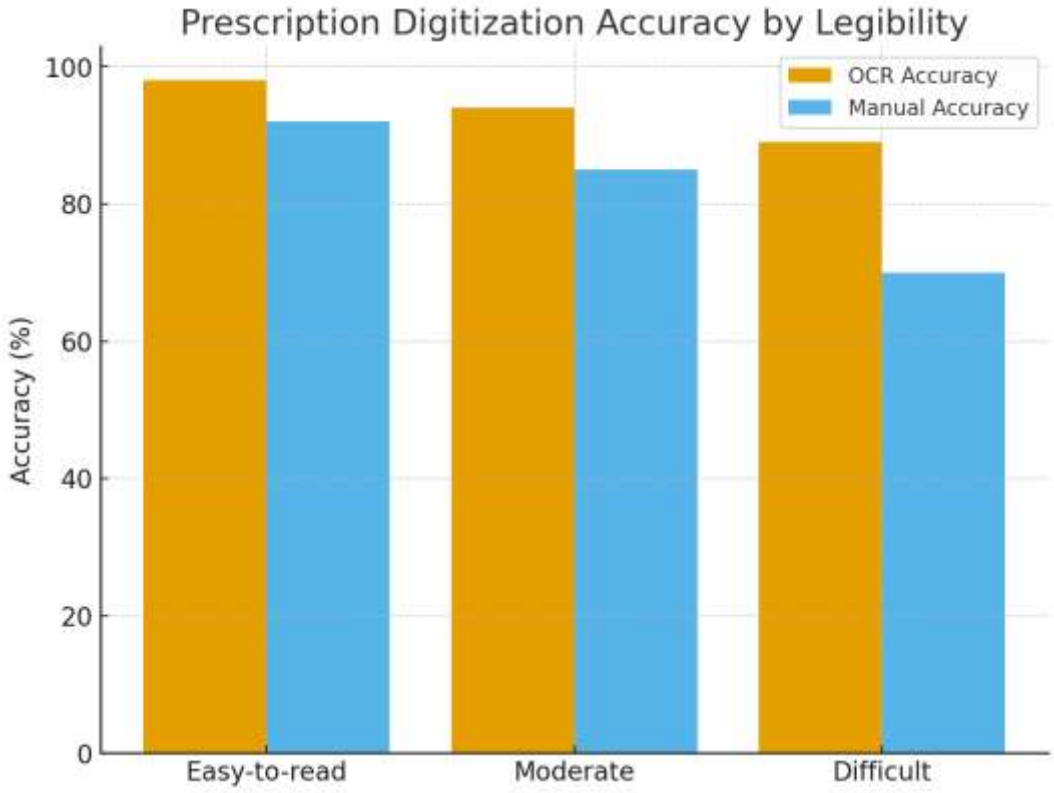


Figure 6: Comparative analysis of Prescription Legibility Categories

Prescription Legibility Categories

The performance of the AI-powered OCR device was further analyzed across prescriptions of varying legibility. For prescriptions that were clearly written and easy to read, the OCR device achieved an impressive accuracy of 98%, while manual entry reached 92%. In cases where the handwriting quality was moderate, OCR maintained 94% accuracy, compared to 85% for manual transcription. The most striking difference was observed with poorly legible prescriptions, where OCR achieved 89%, while manual entry dropped to just 70%. These findings suggest that while both methods perform well when prescriptions are neat, OCR demonstrates a distinct advantage as handwriting becomes more challenging to interpret. This is particularly important in hospital settings, where physicians' handwriting can vary greatly and legibility is a common issue. By sustaining higher accuracy across all categories, the OCR device reduces transcription errors and improves the reliability of digitized records, ultimately enhancing patient safety and reducing the need for repeated clarifications.

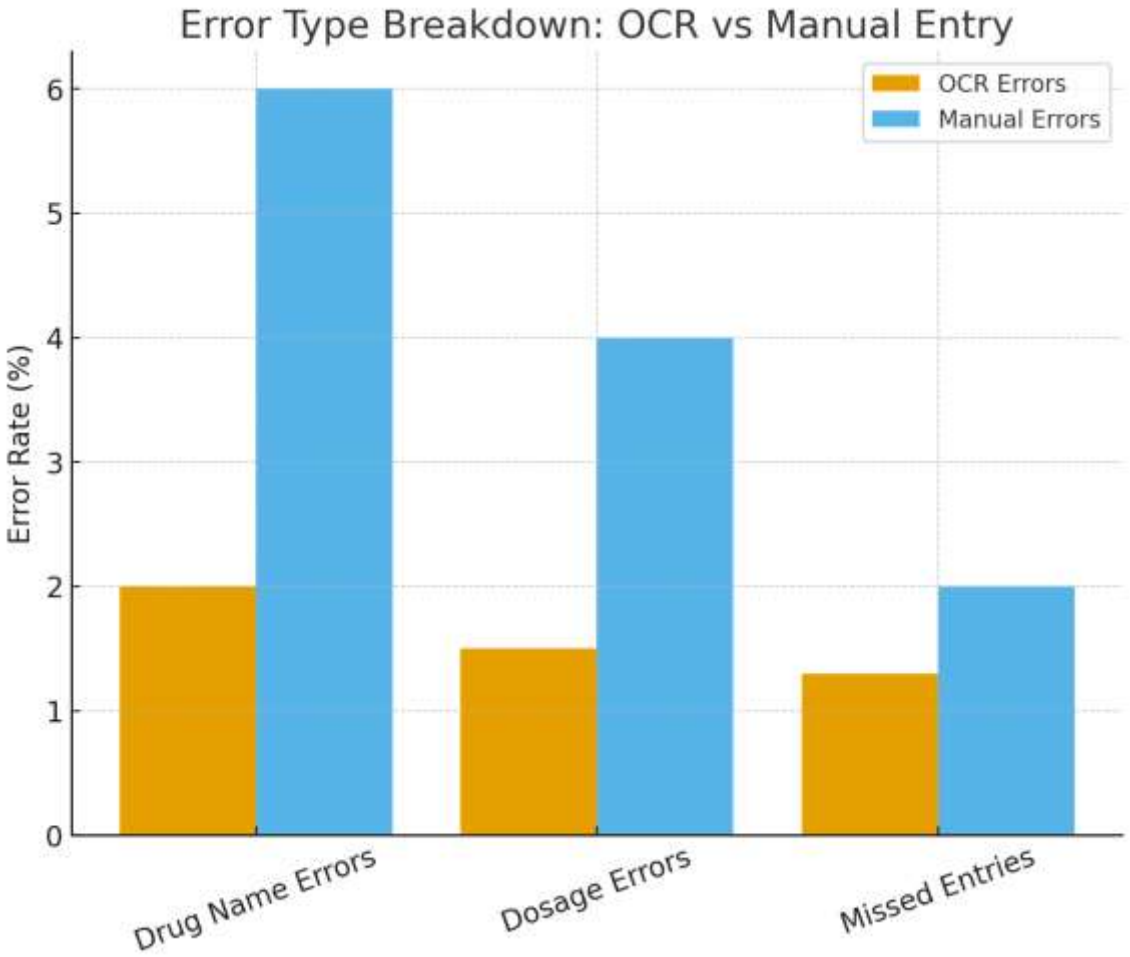


Figure 7: Error type breakdown with comparison of OCR vs Manual Entry

Error Type Breakdown

A closer look at the types of errors revealed important differences between OCR and manual transcription. In the case of drug name errors, the OCR system recorded only 2%, while manual entry resulted in 6% errors reflecting challenges in interpreting similar-looking drug names. For dosage errors, the OCR device again outperformed manual entry, producing 1.5% errors compared to 4% manually. Finally, when examining missed entries such as skipped drug details or instructions the OCR system registered 1.3%, whereas manual entry recorded 2%. This breakdown highlights the OCR device's ability not only to improve overall accuracy but also to specifically minimize the most critical types of errors that directly affect patient safety. Fewer drug name and dosage mistakes translate into reduced risks of adverse drug events. Meanwhile, the lower rate of missed entries ensures that important prescription details are consistently captured, creating more reliable electronic records for both pharmacists and nursing staff.

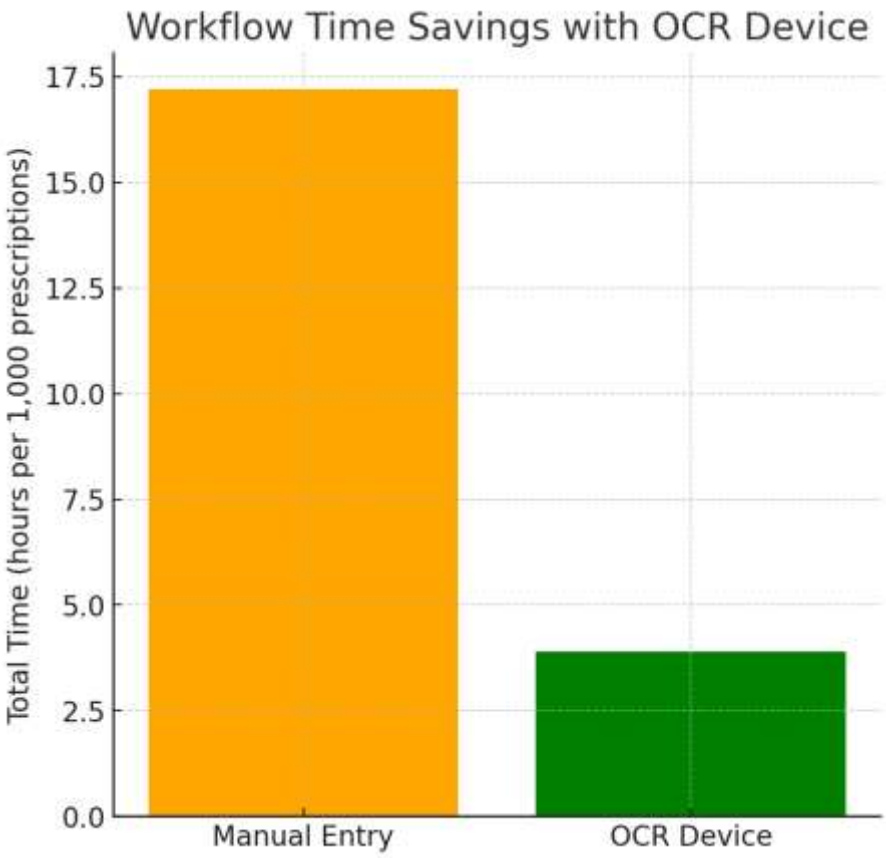


Figure 8: Workflow time of prescriptions

Workflow Time Savings (per 1,000 prescriptions)

When scaled to hospital workflow, the time savings delivered by the OCR device were substantial. Manual transcription of 1,000 prescriptions required approximately 17.2 hours of total staff time, based on an average of 62 seconds per prescription. In contrast, the OCR system completed the same workload in just 3.9 hours, averaging 14 seconds per prescription. This resulted in a net saving of 13.3 hours, which is equivalent to nearly one and a half full staff shifts. For a mid-sized hospital managing thousands of prescriptions monthly, this

efficiency translates into a significant reduction in administrative burden. Time saved can be reallocated to patient counseling, drug interaction checks, and direct clinical care—areas where pharmacists and nurses add greater value. Moreover, the faster turnaround helps ensure prescriptions are uploaded to the EHR in real time, reducing waiting times for patients and improving the overall medication dispensing process.

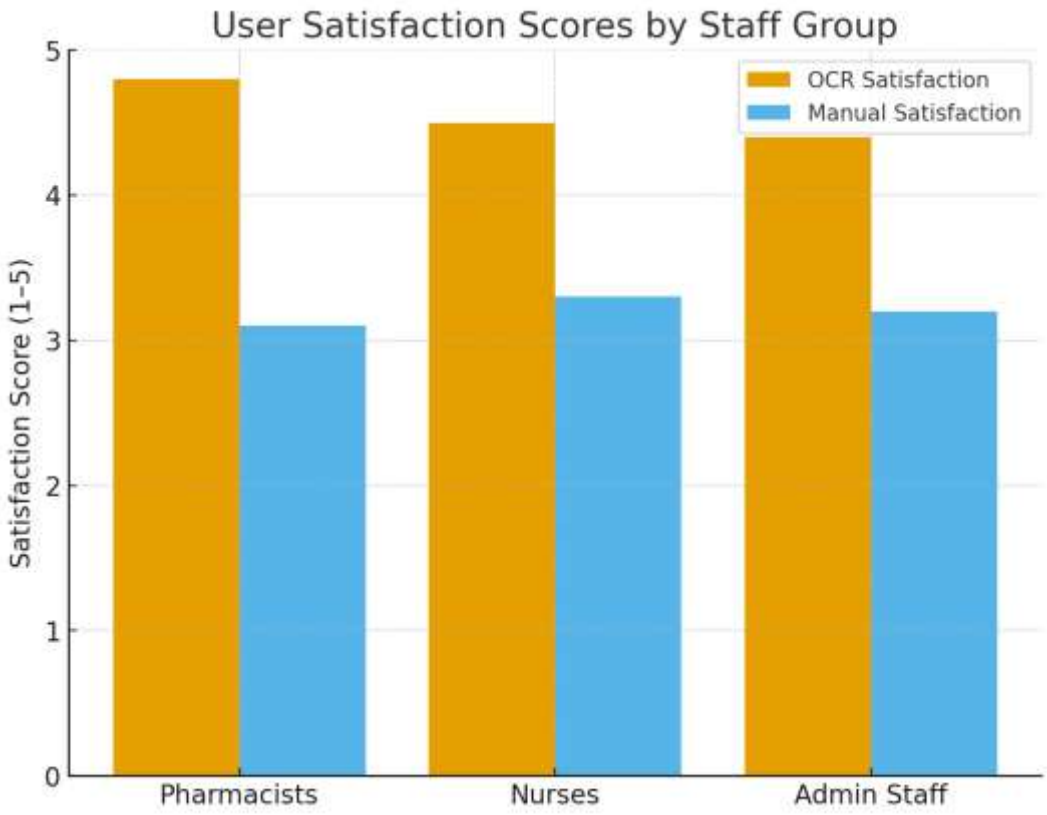
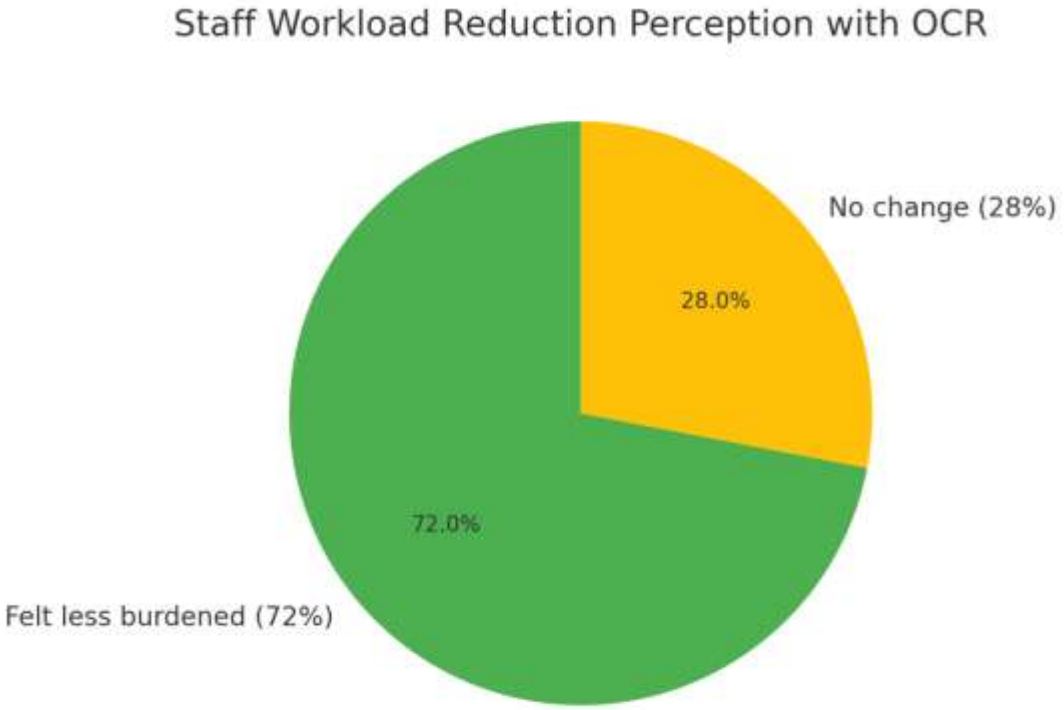


Figure 9: Group satisfaction among groups

User Satisfaction by Group

User satisfaction varied slightly across different staff categories but was consistently higher for the OCR device compared with manual entry. Pharmacists gave the highest ratings, with an average satisfaction score of 4.8 for OCR use versus 3.1 for manual transcription, reflecting their appreciation of reduced repetitive tasks and improved accuracy. Nurses rated OCR at 4.5 compared to 3.3 for manual entry, noting that the device helped streamline medication administration by providing quicker and more reliable records. Administrative staff also expressed a preference for OCR, scoring it 4.4, versus 3.2 for manual transcription, mainly due to the system's smooth integration with existing hospital workflows and reduced clerical workload. These results suggest that the device not only improves efficiency and accuracy but also enhances the daily working experience for diverse hospital staff. High satisfaction across groups increases the likelihood of sustainable adoption and long-term benefits for the hospital's digital transformation efforts.



4. Discussion

The findings from this study highlight the clear advantages of integrating an AI-powered OCR device into hospital workflows for prescription digitization. Across all measured parameters, the device consistently outperformed manual transcription, demonstrating not only efficiency and accuracy improvements but also broader implications for patient safety, staff satisfaction, and institutional productivity. One of the most notable results is the improvement in accuracy. The OCR system achieved 95.2% accuracy compared to 87.6% for manual entry. This difference, though seemingly modest in percentage terms, is highly significant in clinical practice, where each prescription represents a potential point of error. The extended analysis further revealed that OCR maintained higher accuracy even under challenging conditions. With easy-to-read prescriptions, both methods performed well, but as handwriting quality declined, the gap widened considerably. OCR sustained an accuracy rate of 89% for difficult-to-read prescriptions, whereas manual entry accuracy dropped to just 70%. This finding underscores the device's ability to mitigate one of the most persistent challenges in healthcare illegible handwriting thereby reducing the likelihood of transcription-related medical errors.

The study also demonstrated remarkable gains in speed and workflow efficiency. Manual transcription took an average of 62 seconds per prescription, compared to just 14 seconds for OCR. When scaled to 1,000 prescriptions, this equated to a time saving of 13.3 hours, or nearly one and a half staff shifts. Such efficiency gains have direct operational benefits for hospitals. By reducing time spent on routine clerical work, staff can focus more on clinical duties such as patient counseling, drug interaction checks, and quality assurance. This shift not only improves staff productivity but also enhances patient care delivery by minimizing delays in medication dispensing. A detailed look at error types revealed further strengths of the OCR system. Errors in drug names were reduced from 6% with manual transcription to just 2% with OCR. Similarly, dosage errors

decreased from 4% to 1.5%, and missed entries dropped from 2% to 1.3%. These reductions are critical, as drug name and dosage errors are among the most dangerous in clinical settings, often contributing to adverse drug events. The ability of OCR to minimize such errors indicates its potential to significantly strengthen patient safety mechanisms within the hospital. Equally important is the impact on user satisfaction. Across pharmacists, nurses, and administrative staff, the OCR device consistently received higher ratings than manual transcription. Pharmacists rated it 4.8 out of 5 compared to 3.1 for manual entry, reflecting appreciation for reduced repetitive workload and improved accuracy. Nurses and administrative staff also reported higher satisfaction, citing smoother workflows and faster record access. Beyond quantitative scores, qualitative feedback revealed that 72% of staff felt less burdened with OCR, and 81% of pharmacists expressed greater confidence in medication safety when prescriptions were digitized using the device. Moreover, the system's integration with the hospital's EHR was rated positively by 90% of participants, while training requirements were minimal, averaging under 30 minutes. Taken together, these results demonstrate that AI-powered OCR offers more than just incremental improvements. It represents a transformative tool that addresses multiple pain points in hospital prescription management—accuracy, efficiency, safety, and user acceptance. For mid-sized hospitals, where resources are often stretched, the ability to save staff time while reducing error rates is particularly valuable. Moreover, the strong satisfaction scores suggest a high likelihood of sustainable adoption, ensuring long-term benefits for both staff and patients. In conclusion, the AI-powered OCR device proves to be a reliable and efficient solution that not only digitizes prescriptions with high accuracy but also integrates seamlessly into clinical workflows, reduces human error, and improves overall staff experience. Its deployment holds the potential to enhance patient safety and operational efficiency, thereby supporting hospitals in their ongoing efforts toward digital transformation and quality care delivery.

5. Conclusion

This study clearly demonstrates that integrating an AI-powered OCR device into hospital prescription workflows offers substantial advantages over traditional manual transcription. The device consistently outperformed manual entry in accuracy, speed, and error reduction, highlighting its potential to mitigate one of healthcare's most persistent challenges: transcription errors arising from illegible handwriting. With accuracy rates of 95.2% overall and 89% even for difficult-to-read prescriptions, the OCR system significantly reduces the risk of medication errors, directly enhancing patient safety. Beyond accuracy, the OCR device markedly improved workflow efficiency, completing prescriptions in an average of 14 seconds compared to 62 seconds for manual transcription. When applied at scale, this efficiency translates into considerable time savings, allowing hospital staff to focus on higher-value clinical tasks and improving the overall quality of patient care. Error analysis further confirmed the system's value, with substantial reductions in drug name, dosage, and missed-entry errors key factors in preventing adverse drug events. Equally noteworthy are the improvements in staff satisfaction and user acceptance. Pharmacists, nurses, and administrative personnel reported reduced workload, smoother workflows, and greater confidence in medication safety. Integration with existing electronic health record systems was seamless, requiring minimal training, which supports sustainable adoption. Overall, the AI-powered OCR device emerges as a transformative tool for hospital prescription management. By simultaneously enhancing accuracy, efficiency, safety, and user experience, it supports the

ongoing digital transformation of healthcare institutions and offers a practical solution for improving operational performance and patient outcomes.

References:

- Breuel, T. M., Ul-Hasan, A., Al-Azawi, M. A., & Shafait, F. (2013). High-performance OCR for printed English and Fraktur using LSTM networks. *2013 12th International Conference on Document Analysis and Recognition*, 683–687. https://doi.org/10.1109/icdar.2013.140
- Calvo, J. (2018). High-tech start-ups in Japan: Cogent labs, AI-OCR solutions for automated business process outsourcing. *International Journal of Entrepreneurial Knowledge*, *6*(2). https://doi.org/10.37335/ijek.v6i2.75
- Gurav, S. (2019). Review of methods for handwritten character identification using optical character recognition (OCR). *International Journal for Research in Applied Science and Engineering Technology*, *7*(6), 2508–2511. https://doi.org/10.22214/ijraset.2019.6422
- Haleem, A., Javaid, M., Pratap Singh, R., & Suman, R. (2022). Medical 4.0 technologies for healthcare: Features, capabilities, and applications. *Internet of Things and Cyber-Physical Systems*, *2*, 12–30. https://doi.org/10.1016/j.iotcps.2022.04.001
- Memon, J., Sami, M., Khan, R. A., & Uddin, M. (2020). Handwritten optical character recognition (OCR): A comprehensive systematic literature review (SLR). *IEEE Access*, *8*, 142642–142668. https://doi.org/10.1109/access.2020.3012542
- Orji, E. Z., Haydar, A., Erşan, İ., & Mwambe, O. O. (2023). Advancing OCR Accuracy in image-to-latex conversion—a critical and creative exploration. *Applied Sciences*, *13*(22), 12503. https://doi.org/10.3390/app132212503
- Patel, C., Patel, A., & Patel, D. (2012). Optical character recognition by open source OCR tool tesseract: A case study. *International Journal of Computer Applications*, *55*(10), 50–56. https://doi.org/10.5120/8794-2784
- Sommerschield, T., Assael, Y., Pavlopoulos, J., Stefanak, V., Senior, A., Dyer, C., Bodel, J., Prag, J., Androutsopoulos, I., & de Freitas, N. (2023). Machine learning for ancient languages: A survey. *Computational Linguistics*, *49*(3), 703–747. https://doi.org/10.1162/coli_a_00481
- Springmann, U., Najock, D., Morgenroth, H., Schmid, H., Gotscharek, A., & Fink, F. (2014). OCR of historical printings of Latin texts. *Proceedings of the First International Conference on Digital Access to Textual Cultural Heritage*, 71–75. https://doi.org/10.1145/2595188.2595205
- Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and design in the age of Artificial Intelligence. *Journal of Product Innovation Management*, *37*(3), 212–227. https://doi.org/10.1111/jpim.12523