

One Patient, One Cannula: Building Novice-Nurse Skill and Ownership to Reduce Peripheral IV Cannula Wastage

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ABSTRACT

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Introduction: About 70% of nurses in the wards had less than six months of clinical experience. Before the project, the DIVA (difficult intravenous access) team inserted about 60% of peripheral IV cannulas (PIVCs). This supported first-attempt success. However, most of the daily cannula care was done by less experienced ward nurses. Baseline cannula wastage was 53%. Present study was carried out. **Objectives:** To reduce peripheral IV cannula wastage by at least 20% and improve average cannula dwell time from 3.0 days toward the 3.8-day average length of stay, while ensuring timely removal in case of clinical complications and/or VIP score ≥ 1 . **Materials and Methods:** A descriptive survey was conducted among 50 nurses with less than six months of experience. Of these, 90% felt disappointed when early DIVA referral took away an opportunity to cannulate under supervision. Many nurses also felt less ownership when another team inserted the cannula structured competency pathway for novice nurses along with the VIPCS IV Care Bundle was introduced. The pathway included Skillathon training, supervised insertion, competency sign-off, an individual logbook, and mentor-mentee support through DIVA Nurse. Clear DIVA escalation criteria were used. Standard flushing and hub disinfection were followed. VIP scoring was done as per the defined protocol—Q4 h and as needed. Daily IV line rounds, handover accountability, and patient education were also included. **Results:** After the intervention, novice nurses inserted about 75% of cannulas, while DIVA nurses inserted about 25%. Cannula wastage reduced from 53% to 35%, an absolute reduction of 18 percentage points and a relative reduction of 34.0%. VIP score ≥ 1 reduced from 59% to 20%, and early removal reduced from 62% to 20%. Average cannula dwell time increased from 3.0 to 3.5 days, a gain of 0.5 day (16.7%). This achieved 62.5% of the planned 0.8-day improvement toward the 3.8-day goal, leaving a 0.3-day gap. The estimated tangible cost reduced by about 34%, from ₹76,015 to ₹50,199 for every 100 cannulation opportunities. **Conclusion:** Structured skill development, supported by DIVA mentorship and the VIPCS bundle, improved novice-nurse ownership and reduced avoidable PIVC failure. Average cannula dwell time improved from 3.0 to 3.5 days, moving meaningfully toward the 3.8-day goal, although the full target was not reached.

Keywords:

Pivc, Diva, Novice nurse, Competency, Cannula ownership, VIP score, Quality improvement, Cannula wastage.

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Introduction

Peripheral IV cannulation is an important bedside nursing skill. The first six months of nursing practice are an important learning period. During this time, nurses develop confidence, technical skill, clinical judgment, and accountability. DIVA support was used early to avoid repeated failed attempts. Before the intervention, DIVA nurses inserted about

60% of cannulas, while less experienced ward nurses inserted about 40%.

This approach helped at the time of insertion. However, we noticed a gap in the later care of the cannula. The nurse who flush, fix, and monitor VIP scoring every 4 hourly was often not the nurse who inserted it. Baseline cannula wastage remained at 53%. We therefore asked whether expert insertion alone

was enough. We also wanted novice nurses to get a safe opportunity to build their own skill and take ownership of cannula care.

Novice Nurse Survey: Understanding the Learning and Ownership Gap

We gave a ten-item survey to 50 nurses with less than six months of experience. The survey covered confidence, opportunities for cannulation, DIVA referral, ownership, learning needs, mentorship and responsibility for maintenance.

Forty-five of the 50 nurses (90%) felt disappointed when they were asked to call DIVA instead of getting a chance to cannulate a suitable patient under supervision (Figure 1). Three common themes were seen. Nurses wanted to learn the skill. They felt less ownership when another team inserted the cannula. They were willing to take more responsibility once their skill and confidence improved.

The survey helped us understand the problem better. The issue was not that novice nurses could not cannulate. It was also not that DIVA was being used too often. The main opportunity was to use the first three months as a structured learning period. We introduced clear milestones, supervised practice, mentorship, and a logbook. This linked insertion competency with responsibility for cannula maintenance.

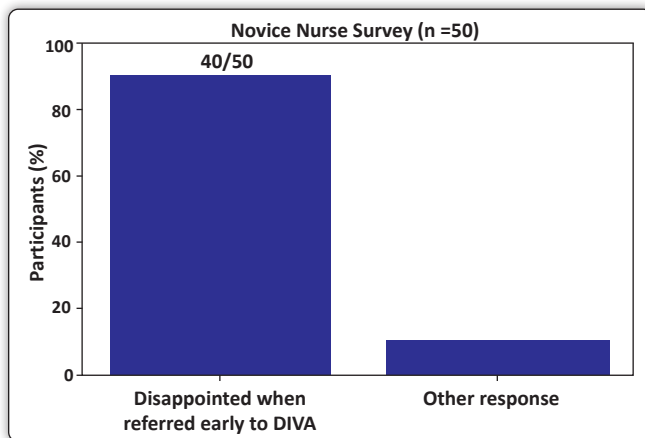


Fig. 1: Novice nurse survey results

Objectives

The aim of this quality improvement project was to reduce peripheral IV cannula wastage by at least 20% in the Deluxe and Super Deluxe wards in the defined time frame.

The average length of stay in these wards was 3.8 days, while the average cannula dwell time was 3 days. The project aimed to improve the average cannula dwell time from 3 days to 3.8 days, without compromising the timely removal in case of any signs of complications and/or VIP score ≥ 1 . The overall goal was to achieve “One Patient, One Cannula” by reducing avoidable cannula failure, improving patient comfort, and ensuring safe IV care.

Materials and Methods Innovation:

An Objective-Driven Novice-Nurse Pathway with the VIPCS Bundle

The intervention had two main parts. The first was to build the cannulation skill of novice nurses. The second was to standardize the care of every cannula. We moved from routine task substitution to supported skill development. Novice nurses did not start independent cannulation immediately. They first completed a defined learning pathway.

Skillathon, supervised practice and the competency logbook

Training started with a focused Skillathon. It covered vein assessment, site and gauge selection, aseptic insertion, fixation, flushing, and hub disinfection. It also covered identification of infiltration and phlebitis, documentation and clinically indicated removal. The trainer first demonstrated the procedure. The nurse then performed a return demonstration. Supervised bedside practice followed in suitable patients.

Each novice nurse maintained a competency logbook. It recorded learning objectives, procedures observed, supervised attempts, first-attempt success, feedback, maintenance follow-up, and competency sign-off. The logbook gave us a clear record of each nurse's progress.

The training followed a fixed step-by-step pathway. Every novice nurse entered the pathway within three months of joining. Baseline knowledge and psychomotor skills were assessed. A DIVA nurse was assigned as the personal mentor. The nurse then completed three stages of ten cannulations each. First, the nurse observed 10 insertions by the mentor (DIVA Nurse). Next, the nurse performed 10 insertions under direct supervision of DIVA Nurse. Finally, the nurse performed 10 insertions independently with the DIVA Nurse available for standby support. Competency was checked using a standard checklist. The target was to achieve competency within two months of joining (Figure 2).

Mentor-mentee support and DIVA as a coach

Every novice nurse was paired with a competent mentor. DIVA remained available for patients with predicted difficult access, rescue after defined escalation and other safety concerns. DIVA nurses also became coaches. The aim was not simply to reduce DIVA use. The aim was to protect suitable learning opportunities for novice nurses. This allowed patient safety and staff development to continue together.

The VIPCS maintenance bundle

After insertion, every cannula followed the same VIPCS maintenance pathway. This was followed regardless of who inserted the cannula. VIPCS has five points. Verify

patency and clinical need. Inspect the IV site and record the VIP score. Prompt removal when clinically indicated. Clean hands before IV manipulation. Scrub or disinfect the hub before every access (Figure 3). The bundle also included correct vein, site and gauge selection. Fixation had to be secure and transparent. Standard flushing was followed. The site was checked for pain, redness, swelling, leakage, infiltration, occlusion and dressing problems. Any suspected complication was escalated promptly. Cannula status and VIP score were included in the nursing handover. The ward in-charge or IV Champion also completed daily IV line rounds.

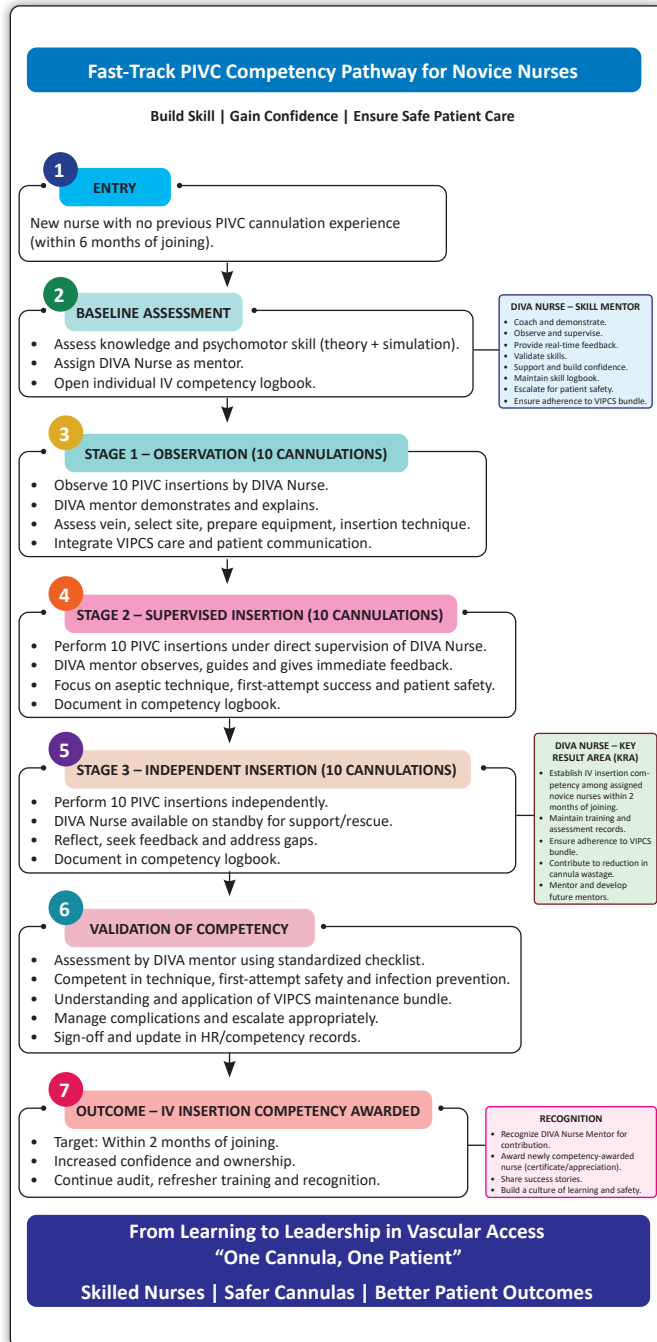


Fig. 2: Fast-track PIVC competency pathway for novice nurses

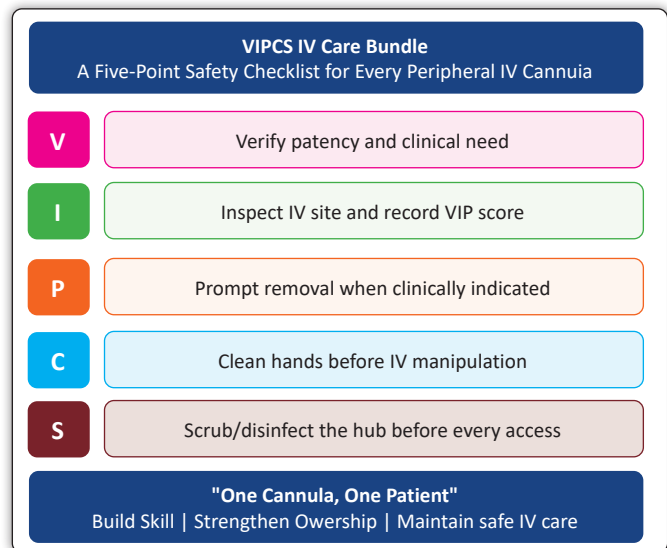


Fig. 3: The VIPCS IV Care Bundle

Ownership and partnership with the patient

The project also focused on ownership (Fig 4). Nurses were encouraged to see the cannula as part of ongoing patient care. Cannula care did not end after insertion. When a novice nurse inserted a cannula under supervision, learning continued through maintenance and follow-up. Patients and families were taught to protect the site. They were asked to report pain, redness, swelling, leakage, or discomfort early. "One Patient, One Cannula" meant safe and continuous care for as long as VIP score <1.

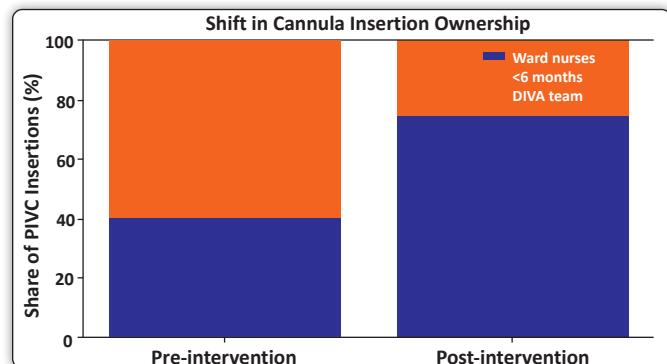


Fig. 4: Cannula insertion ownership shift after focused capability building

PDSA Improvement Approach

- Plan:** We reviewed 100 cannulation episodes at baseline. We also reviewed the staff experience profile and surveyed 50 novice nurses. We identified the need to maintain first-attempt success while building novice nurse competency and ownership.
- Do:** We introduced Skillathon training, supervised bedside insertion, competency logbooks, mentor-mentee support, DIVA coaching and escalation, and the VIPCS bundle
- Study:** We monitored insertion ownership, cannula wastage, VIP-positive events, early removal and dwell time.

- **Act:** We made competency milestones, logbook review, handover accountability, daily line rounds and DIVA escalation criteria part of routine ward practice. The model was designed for use in other units as well

Results

From Expert Dependence to Supported Novice Ownership

We evaluated 200 cannulation episodes. This included 100 episodes before and 100 after the intervention. Novice nurse insertion increased from about 40% to 75%. This was an increase of 35 percentage points. DIVA insertion reduced from about 60% to 25%. The increase in novice nurse ownership was accompanied by better cannula outcomes.

Cannula wastage reduced from 53% to 35%. This was an absolute reduction of 18 percentage points and a relative reduction of 34.0% ($\chi^2 = 6.57, p = 0.010$). VIP score ≥ 1 reduced from 59% to 20% ($p < 001$). Early removal reduced from 62% to 20% ($p < 001$). Average cannula dwell time increased from 3.0 days pre-intervention to 3.5 days post-intervention. This represents an absolute increase of 0.5 day and a relative improvement of 16.7%. Against the planned improvement from 3.0 to 3.8 days, the intervention achieved 62.5% of the required 0.8-day gain, with a remaining gap of 0.3 day. Thus, the dwell-time outcome improved meaningfully but did not fully achieve the 3.8-day target. Importantly, this improvement was accompanied by reductions in VIP score ≥ 1 and early removal; cannulas continued to be removed when clinically indicated.

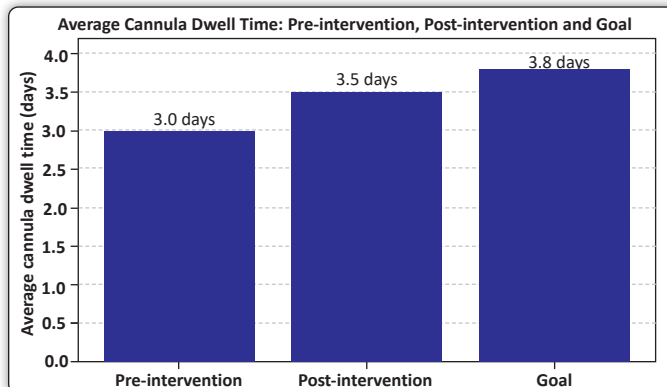


Fig. 5A: Average cannula dwell time

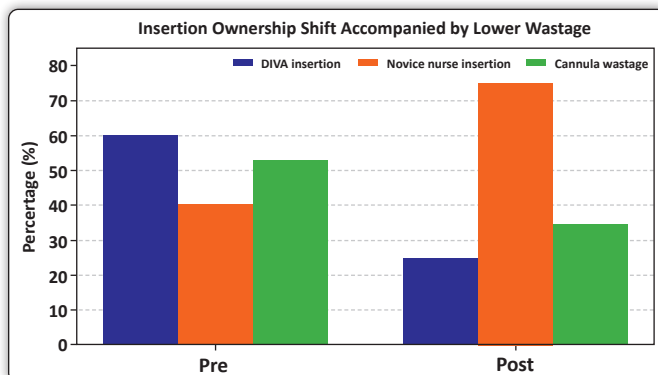


Fig. 5B: Insertion ownership shift accompanied by lower wastage

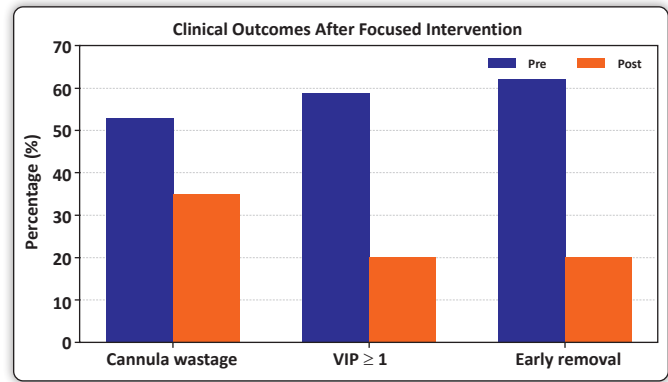


Fig. 5C: Clinical outcomes: before and after intervention

Economic Impact

The tangible cost of one wasted cannula was ₹ 1,380. Nursing time was calculated using an average staff nurse salary of ₹25,000 for 192 duty hours per month. This was equal to ₹130.21 per hour or ₹2.17 per minute. A repeat cannulation episode was estimated to take 25 minutes. This added about ₹54.25 in nursing time for each repeat cannulation. For every 100 cannulation opportunities, the estimated burden reduced from ₹76,015 at 53% wastage to ₹50,199 at 35% wastage. This was a reduction of about ₹25,817 or 34%.

For a medium-sized hospital with about 1,000 ward cannulation opportunities each month, the same rates would reduce the estimated monthly burden from about ₹7.60 lakh to ₹5.02 lakh (35% wastage reduction). The estimated annual burden would reduce from about ₹91.22 lakh to ₹60.24 lakh. This is a projected reduction of about ₹30.98 lakh or 34%. Around 2,160 repeat cannulation episodes could also be avoided each year. These are projected figures. Nursing time saved represents time available for patient care. It is not a direct cash saving.

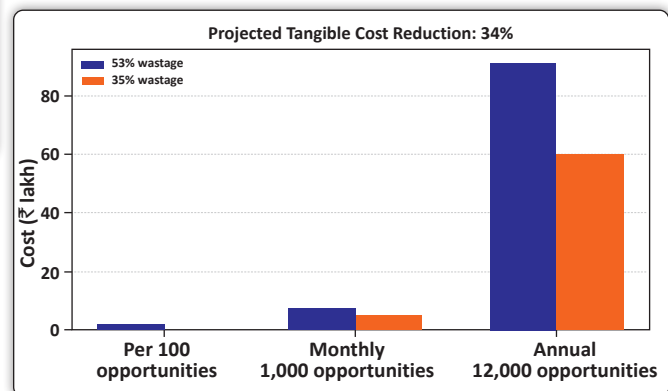


Fig. 6: Projected tangible cost reduction associated with reducing cannula wastage

Workforce Development and Scalability

This project showed that the first six months of nursing practice should be used as a structured skill-development period. Learning should not be left to chance. Novice

nurses should not learn through unsupervised trial and error. Experts should also not routinely perform every procedure for them. A structured pathway defines what the nurse should observe, perform under supervision and later perform independently. The logbook records progress. The mentor provides coaching, feedback and support.

Novice nurses can then enter a standard IV competency pathway. Targets can be set for supervised attempts, maintenance follow-up, VIP interpretation, complication escalation and competency sign-off. DIVA remains essential for difficult access. DIVA can also support coaching and skill transfer. A simple dashboard can track novice insertion, DIVA activation, first-attempt success, wastage, VIP ≥ 1 , early removal, and repeat cannulation. The goal is not to set a fixed target for DIVA calls. The goal is to achieve a safe balance between expert support and a competent bedside nursing team.

Discussion

Patient care and staff development can improve together. Before the intervention, DIVA nurses inserted about 60% of cannulas. Cannula wastage was still 53%. A successful insertion alone did not ensure good cannula outcomes. After the intervention, novice nurses performed about 75% of insertions. DIVA performed 25%. Cannula wastage reduced to 35%. These findings show that competency, opportunity and ownership should be developed together.

Published evidence also shows that nursing experience affects first-attempt cannulation success.^[1] Our findings do not mean that novice nurses should cannulate less. They show that experience can be built through supervision and mentorship. Another study found higher first-attempt failure among nurses with less than two years of experience.^[2] This supports the need for a structured route to competency.

Our training approach was similar to the structured education used during the development of the DIVA assessment tool.^[3] A recent study of newly graduated nurses also reported better PIVC knowledge and procedural competency after blended training and hands-on workshops.^[4] This is similar to the improvement we saw after Skillathon training and supervised practice.

We used DIVA as both an escalation resource and a coach. This is also supported by current difficult-access practice. A systematic review found that vascular-access specialist teams can reduce phlebitis and catheter failure.^[5] Our model kept DIVA support for difficult access. At the same time, it developed cannulation skills among ward nurses.

VIP scoring was also an important part of the project. Published reports show that phlebitis rates can be high in general ward patients.^[6] Better use of the VIP score has been linked with lower phlebitis rates.^[7] In our project,

VIP score ≥ 1 reduced from 59% to 20%. This suggests that skill development should be combined with regular site assessment and daily line review.

Mentorship was another important part of the intervention. Studies of newly graduated nurses have reported better confidence and competency after structured mentorship.^[8] Structured transition programs have also reported fewer nursing errors.^[9] Our experience was similar. The logbook and mentor support made progress visible and gave novice nurses a safer way to learn. Structured vascular-access training has also been linked with better competence and confidence.^[10]

Overall, our findings and the published evidence point in the same direction. Experience matters for cannulation success. However, experience can be built safely through structured training and supervision. This can be done without reducing phlebitis surveillance or patient safety.

Limitations

This project was conducted in two inpatient wards. Only adult patients were included. The findings may not apply directly to all clinical areas or to pediatric patients. We did not compare individual learning and performance among novice nurses. The results therefore describe the group as a whole. Pre- and post-intervention data were collected at different times. There was no concurrent control group. Other factors may therefore have contributed to some of the improvement.

Conclusion

“One Patient, One Cannula” showed that developing novice nurses skills can improve nursing confidence and patient care together. We used structured training, supervised cannulation, mentorship, competency tracking and the VIPCS bundle. Novice nurse cannula insertion increased from 40% to 75%. Cannula wastage decreased from 53% to 35%. The proportions of cannulas with a VIP score ≥ 1 and those removed early also decreased. Average cannula dwell time increased from 3.0 to 3.5 days, representing an increase of 0.5 days (16.7%). This achieved 62.5% of the planned improvement toward the 3.8-day goal; therefore, the direction of improvement was clinically meaningful, although the full dwell-time target was not achieved. The estimated cost of avoidable cannula failure reduced by about 34%. The project showed the value of using the first six months of nursing practice for focused skill development and mentorship. DIVA support remained available for patients who genuinely needed it.

Key Project Statistics

Measure	Pre	Post	Change
Novice-nurse PIVC insertion	40%	75%	+35 pp (+87.5% relative)
DIVA PIVC insertion	60%	25%	–35 pp (–58.3% relative)

Contd...

Cannula Dwell Time	3.0 days	3.5 Days	+0.5 days (+16.6%Relative)
Cannula wastage	53%	35%	–18 pp (–34.0% relative)
VIP score ≥ 1	59%	20%	–39 pp (–66.1% relative)
Early removal	62%	20%	–42 pp (–67.7% relative)
Tangible cost 100 opportunities	₹76,015	₹50,199	–₹25,817 (~34% reduction)

Declarations

Funding

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Conflict of interest

The available study record did not report any competing interests.

AI-assisted writing disclosure

This manuscript was language-edited with AI assistance; the authors remain responsible for the scientific content, interpretation and final manuscript.

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