Multi-institutional collaborative and QI network research

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Improving Antibiotic Use in Argentine Pediatric Hospitals: A Process Evaluation Using Normalization Process Theory

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ABSTRACT

Introduction: In the pediatric setting, overprescribing of antibiotics contributes to the rise of multidrug-resistant organisms. Antimicrobial stewardship programs (ASPs) are recommended to optimize antibiotic use and combat resistance. However, the implementation of ASPs in low- and middle-income countries faces several challenges. This study aimed to evaluate the implementation process of a multifaceted ASP in 2 pediatric hospitals in Argentina. **Methods:** A qualitative study was conducted in two large public children's hospitals in Argentina, using semistructured interviews with 32 healthcare providers at the beginning and end of the ASP implementation. The study was guided by the normalization process theory. **Results:** The intervention faced challenges, including limited understanding of its objectives, confusion with existing practices, and insufficient commitment from senior staff. Although junior staff were more receptive, communication barriers with external staff and workload concerns hindered broader adoption. Infectious disease specialists primarily led implementation, with limited involvement of other staff, particularly in training activities. Despite these challenges, participants reported improvements, such as the development of standardized antibiotic guidelines, better interdisciplinary collaboration, and improved communication. However, organizational support and resistance to new practices remained barriers. **Conclusions:** This study highlights the importance of organizational context and staff commitment in ASP implementation. Tailored strategies that address the specific challenges of low- and middle-income countries are needed to effectively implement ASPs. *(Pediatr Qual Saf 2025;10:e788; doi: 10.1097/pq9.0000000000000788; Published online January 7, 2025.)*

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INTRODUCTION

The inappropriate use of antibiotics has contributed to the emergence of antimicrobial resistance, which represents a significant threat to public health.[1,2] In low- and middle-income countries (LMICs), antibiotic resistance is further exacerbated by poor sanitation, low vaccination rates, and inadequate infection prevention and control practices.[3] Infections caused by multidrug-resistant bacteria are associated with higher mortality rates and prolonged hospital stays than those caused by susceptible bacteria.[4,5] In pediatrics, antimicrobials represent the most commonly prescribed drugs, with some estimates suggesting that 37%–61% of hospitalized infants and children receive antibiotics.[6] Almost half of these prescriptions are potentially unnecessary or inappropriate, and many children continue to receive broad-spectrum antibiotics for viral infections or for much longer than necessary.[7,8] This unnecessary exposure increases the risk of severe side effects, increases costs, and contributes to the global emergence of antimicrobial resistance (AMR).[7,8] Although AMR occurs naturally, the misuse of antimicrobials favors the selection of resistant organisms.[7,8]

The rate of antibiotic overuse in a pediatric Argentine population was 35%, and it was associated with lower respiratory tract and skin/soft-tissue infections.[9] Most antibiotic indications were based on empirical evidence, with only 15% driven by microbiological results.[9] Given the relationship between antibiotic overuse or misuse and the emergence of resistant bacteria, various organizations, including the World Health Organization, have endorsed action plans emphasizing the importance of antibiotic stewardship programs to monitor and promote the optimization of antimicrobial use to preserve our antibiotic armamentarium.[10,11] Stewardship programs optimize the treatment of infections, reduce infection-related morbidity and mortality, limit the emergence of multidrug-resistant organisms, and reduce unnecessary antimicrobial use.[12–18] There is a lack of research in LMICs, probably because most stewardship programs are still in development and are not yet widely accepted as standard-of-care strategies.[15] Introducing stewardships in LMICs presents challenges due to limited availability and access to antibiotics, lack of diagnostics, and poor adherence to treatment.[15,16] Research is needed to determine effective ways to implement stewardship programs in LMICs without compromising healthcare quality.

An intervention aimed at improving the quality of antibiotic prescribing—specifically reducing overuse and promoting the use of narrow-spectrum agents—was implemented as an antibiotic stewardship program in 2 pediatric hospitals in Argentina, using a quality improvement (QI) framework. This qualitative study explores the implementation process of this stewardship program, examining how professionals understood, engaged with, and integrated the intervention into their routine practice. Guided by the normalization process theory (NPT), the study seeks to understand the mechanisms that influenced the implementation, including the degree to which the program was adopted and how these mechanisms shaped the program's integration into hospital workflows.

METHODS

This qualitative study was conducted in 2 pediatric hospitals in Argentina to explore and describe an antibiotic stewardship program's implementation process through the QI framework. NPT informed the process evaluation, which provided the theoretical lens to examine how the intervention was adopted, integrated, and sustained within the hospitals.[19,20] NPT helps understand how change occurs individually, collectively, and organizationally and how dynamic implementation processes occur. NPT's key constructs are *coherence* (how individuals make sense of complex interventions), *cognitive participation* (how people engage with interventions), *collective action* (how people integrate interventions into practice; subconstructs: trust, task allocation, support), and *reflexive monitoring* (how individuals evaluate interventions).[19,20]

Intervention

The intervention evaluated here consisted of an antibiotic stewardship program implemented using a QI collaborative approach over a 12-month, including a 22-week baseline and a 30-week intervention phase. The QI collaborative approach engages healthcare teams in targeted performance improvement, emphasizing data collection and iterative testing of changes through plan-do-study-act (PDSA) cycles, supported by coaching and learning sessions.[21,22] The stewardship program aimed to improve the prescribing practices of healthcare providers in participating hospital units. Each hospital formed an implementation team that included representatives from infectious disease services. These teams designed and executed PDSA cycles tailored to their specific contexts and needs, with appointed facilitators—such as pharmacists, intensive care unit (ICU) specialists, and antibiotic use experts—assisting in developing and implementing these cycles. Each unit identified areas for improvement, set objectives, implemented changes, and evaluated their impact.

The stewardship program included several components:

1. Antibiotic class definitions: Training based on World Health Organization recommendations.
2. Audit and feedback: Focused on improving antibiotic-prescribing practices.
3. Development of treatment guidelines: Each hospital tailored treatment guidelines for common infections.
4. Antibiotic timeout: Providers ensured the necessity and appropriateness of antibiotic use.
5. Infection-based interventions: Therapy tailored to culture results; treatment duration aligned with guidelines.
6. Pharmacy-based interventions: Pharmacists document antibiotic indications, adjust dosages, prevent duplicate therapy, and avoid drug interactions.
7. Educational initiatives: Delivered through posters, electronic communications, face-to-face interactions, and virtual sessions.

The Supplemental Material provides the QI aim, key driver diagram, and implementation outcomes (**see Supplemental Material, Supplemental Digital Content 1, http://links.lww.com/PQ9/A632**).

Participants

We conducted the study in 2 public academic pediatric hospitals in Argentina. Elizalde Hospital is a public hospital in Buenos Aires, founded in 1779. It has 244 beds for general care and 325 staff physicians. Notti Hospital in Mendoza is the largest pediatric hospital in western Argentina, with 260 beds and 57 specialties, including neurosurgery, traumatology, cardiovascular surgery, complex neonatology, infectious diseases, adolescent medicine, pediatric care for children at high social risk, and nutrition. Participants were purposively recruited from services including inpatient wards, pediatric ICUs,

neonatal ICUs, and level 1 facilities with the highest standard of care. Participants included study coordinators, site coordinators, and medical staff.

Data Collection

Thirty-two semistructured interviews were conducted in 2 stages: at the beginning of the intervention and during the last month of the implementation process. The interview guide was based on NPT constructs[19,20] and addressed enrollment, information, perception of usefulness, degree of implementation, acceptability, perception of the impact, and opinions on sustainability (**Supplemental Digital Content 1, http://links.lww.com/PQ9/A632**). We conducted the interviews via telephone or the Zoom v5 platform (Zoom Video Communications, Inc., San Jose) according to the participants' preferences. Two qualitative researchers who did not participate in the implementation process conducted the interviews. Interviews were audiorecorded with the participant's consent.

Data Analysis

We transcribed interviews verbatim and preserved participant anonymity. The transcripts were uploaded to the software Atlas.Ti v8.1.3 (Scientific Software Development GmbH, Germany). A framework analysis was used, with a primarily deductive approach.[23,24] The analysis adhered to the stages of framework analysis: familiarization, thematic framework development, coding, charting, and interpretation. An initial coding framework was constructed grounded in NPT, designed to capture the theory's core dimensions. The research team refined this framework through iterative review after an in-depth immersion in the data through transcription revision. Two researchers (J.R. and J.P.A.) led the coding process to ensure rigor and consistency. The coding involved inductive and deductive approaches because the process allowed exploring additional issues. The research team discussed and revised the findings to ensure they accurately represented the original data. The team summarized the informants' information in a data matrix, which was used to systematize and compare findings within and between hospitals.

Ethical Aspects

The study followed the Good Clinical Practice and the Declaration of Helsinki. The institutions' Ethics Committees approved the protocol: Approval dates October 26, 2021, and December 22, 2021. All participants provided informed consent.

RESULTS

Thirty-two healthcare providers from both hospitals participated in the process evaluation. Table 1 shows participants' characteristics. We present the findings under NPT constructs: making sense of the intervention (coherence), willingness to accept the intervention (cognitive participation), practical tasks performed (collective action), their subthemes trust, task allocation, support, and tracking process (monitoring). Table 2 shows exemplary quotations.

Table 1. Characteristics of the Participants

Characteristics	Value, N = 32
Role in the study	
Study coordinator, n (%)	1 (3.1)
Hospital coordinators, n (%)	4 (12.5)
Facilitator in neonatal ICUs, n (%)	8 (25)
Facilitator in pediatric ICUs, n (%)	10 (31.3)
Facilitator in inpatient wards, n (%)	8 (25)
Pharmacy, n (%)	1 (3.1)
Study site	
Mendoza, n (%)	15 (46.9)
Buenos Aires, n (%)	16 (50)
General coordination, n (%)	1 (3.1)
Profession	
Neonatologist, n (%)	4 (12.5)
Pediatric intensivist, n (%)	8 (25)
Pediatrician, n (%)	2 (6.3)
Physician, n (%)	6 (18.8)
Resident physician, n (%)	4 (12.5)
Pediatric infectious disease specialist, n (%)	4 (12.5)
Other, n (%)	4 (12.5)
Sex	
Female, n (%)	23 (71.9)
Male, n (%)	9 (28.1)
Years of experience	
Less than 5, n (%)	7 (21.9)
Between 6 and 10, n (%)	8 (25)
Between 11 and 15, n (%)	9 (28.1)
More than 15, n (%)	8 (25)

Coherence (How Participants Made Sense of the Intervention)

At the study's outset, participants explained they had limited knowledge of the intervention (stewardship program) and learned about it through a newsletter and an invitation to participate in the formative phase. Some participants defined the intervention as an assessment of antibiotic use within their services; a few could identify components beyond data collection on antibiotic usage. Training was the most frequently mentioned component, and many participants struggled to distinguish the proposed activities from existing practices. Participants defined these existing practices at their hospitals that addressed AMR as regular meetings with infectious disease specialists. Because of this perceived similarity to existing practices, some participants had difficulty seeing the justification for the stewardship program. Participants recognized 2 main objectives of the program: improving antibiotic use and fostering interdisciplinary collaboration. They also noted additional benefits that could justify implementing the program (eg, providing a structured framework for existing practices with the same objectives, encouraging antibiotic days reduction, strengthening teamwork, and refining decision-making processes.)

Cognitive Participation (Willingness to Accept the Intervention)

Participants reported varying levels of acceptance of the intervention among groups.

Table 2. Exemplary Quotations

Coherence
The intervention wasn't clear in the hospital because it was a new way of working. People knew the responsibility was training, but the facilitators thought they were there to make sure the standards were met, not to train the teams or anything else. They didn't help with training. (I14, H2)
The intervention didn't add much work. It just made us pay more attention to the same things. It didn't change anything because it was already part of the work. We check lab results every day, and residents always check positive cultures. (I11, H1)
Cognitive participation
You need people ready to get involved and invest time on the study, which can often be the trickiest part. The coordinators from both hospitals met every week to discuss the project. Not everyone wants to do that. Despite the incentives, there's no reasonable payment to encourage participation. (I10, H1)
Getting the team together and working in the same place is hard. It's also hard to have a formal space for academic discussions. We're always busy with urgent tasks. (I3, H1)
Collective action
Interactional workability
The infectious diseases department was the most helpful. They insisted that everyone follow the guidelines. The infectious diseases team believed in this and made it happen. (I10, H1)
We always used Ceftriaxone first, but we stopped because it causes a lot of resistance. We started using a different antibiotic that is less likely to cause resistance. That cost, I won't deny it, but we didn't kill anyone. Everyone said everyone would die or get infected. It was an important move. (I11, H1)
The time-out was on a spreadsheet. We reviewed the decisions daily, checking if they needed to be sustained, if there were any changes, or if the antibiotics needed to be withdrawn. A spreadsheet was used to record this during the study. It was hard to keep using this form long-term, even though the procedures were well integrated. (I3, H1)
Relational integration
The antibiotic regimen was different, which made it difficult at first. Many people were afraid because they were used to prescribing more antibiotics. Using fewer antibiotics could harm the patient. This was the biggest negative. (I2, H2)
We improved teamwork by involving the microbiologist and pharmacist in sharing results. We worked together to quickly adapt treatments and get good results for the patient. (I8, H1)
Skill set workability
People knew the responsibility was training, but the facilitators thought they were there to make sure the standards were met, not to train the teams or anything else. They didn't help with training. (I14, H2)
The project also created something that I, as a manager, don't think is beneficial. When you add lots of rules and algorithms, it's suitable for doctors in training. However, for experienced professionals, it limits their autonomy. (I11, H1)
Evidence is essential, but experience is also helpful. It's good to have a guide, but we also need to be able to adapt it when things don't go as planned. You need to be able to see the exception. (I2, H2)
Contextual integration
The hospital didn't take part in the study. Some people did. I know this from therapy, neonatology and infectious diseases. We are the only hospital ward. The inpatient wards function as a whole, so it is challenging to modify treatments at the weekend or if we are not there. Other staff are not trained, and doctors are on duty for all the wards. (I 7, H1)
The lack of coordination in the hospital was a problem. Some services did not participate, so they gave the ward an antibiotic that was not in line with the new guidelines. It had to be changed in the ward. From an ethical point of view, the new guidelines should be applied in all services. (I12, H2)
Monitoring
Any institution should have up-to-date antimicrobial treatment guidelines. The biggest achievement was updated guidelines. (I10, H1)

H, hospital; I, interview.

Providers who participated in training on QI and stewardships explained that they acquired the tools to understand the intervention and its underpinning theory, could engage in the study, and led the PDSA cycles. Participants perceived junior healthcare providers as more collaborative and experienced colleagues as resistant to change. Communication issues between staff with different levels of authority and from various units were a significant barrier to acceptance of the intervention. External providers and weekend shift staff who did not participate directly in PDSA cycles or receive training were perceived as resistant to new practices proposed by the program. Therefore, participants emphasized the importance of creating spaces for interaction and reinforcing communication with staff across different shifts and roles. More active participants explained they had tried to increase colleagues' involvement throughout the study by introducing more frequent feedback and including more information about infectious diseases and treatment in handovers. They also said they consensually sought to make treatment decisions involving colleagues whenever possible. Despite initial expectations that minimal material resources would be necessary, participants identified deficiencies, such as the lack of computerized medical records, which hindered engagement.

Collective Action (Practical Task Performance)

Interactional Workability (Practical Aspects of Tasks Performed)

As most participants had difficulty individualizing intervention components, when the study started, they anticipated a minimal increase in workload without considering training or educational activities as crucial components of the intervention. Participants perceived that training activities were time-consuming, affected team workload distribution, and were not critical for the study. To mitigate this issue, we rescheduled training sessions and provided participation incentives to professionals. Only a few informants identified the tasks associated with the facilitator role, whose primary tasks were disseminating the developed guidelines and promoting training and learning sessions in the units.

PDSA cycles were most identifiable to participants when linked to updated guidelines, and few participants identified the purpose of other PDSA cycles. Professionals perceived updating guidelines as practical but time-consuming because this involved a review of national and international guidelines, adaptation to the local epidemiological context, and agreement across services. Many participants associated the stewardship program with updating and disseminating the new guidelines. However, most participants acknowledged the value of discussions of the cycles' results and lessons learned.

Some participants mentioned the practice of antimicrobial timeout, an active reassessment of prescription, as another PDSA cycle. However, they perceived the accompanying follow-up sheets as time-consuming and complex. According to some participants, teams implemented audit and feedback activities unevenly. They compared

this activity to existing consulting with infectious disease specialists and pharmacists and did not recognize it as a new element. Participants also noted challenges in improving laboratory result-reporting practices because of limitations in information systems and scarcity of diagnostic resources. Participants barely identified new practices implemented for the study to improve data collection and management.

Relational Integration (Trust in Each Other's Work and Expertise)

Participants recognized the intervention's value in enhancing teamwork, communication, and trust. However, at the beginning of the implementation process, they had anticipated resistance from senior staff, who relied on their clinical experience for prescribing decisions and were initially skeptical of the new guidelines. Participants observed that this resistance lessened after these professionals received convincing information about the guidelines and methods to update them. According to informants, the groups that continued resisting change were ward physicians, nurses, and professionals in the outpatient ward. Participants explained this reluctance resulted from fear of causing harm to patients. Instances of successful collaboration were mentioned, particularly in the PDSA cycles and in audit and feedback meetings. Participants emphasized that opportunities to interact and equal participation fostered understanding, communication, and trust.

Skill-set Workability (Task Allocation Based on Participants' Skills)

Most participants with facilitator roles viewed their primary responsibility in the study as adhering to the guidelines developed and updated by the hospital implementation teams and monitoring antibiotic use. Only a few facilitators recognized their more complex tasks as champions and their responsibility in the guideline development process and supported their implementation at each unit. Some facilitators failed to fulfill their roles, necessitating the appointment of new staff. As mentioned, the PDSA cycles were predominantly led by infectious disease teams, with limited involvement from other professionals. Essential training on QI and stewardship was incomplete for some providers, leaving them ill-equipped to participate actively in the program. Although providers trusted their skills and experience in prescribing antibiotics, some resented the intervention, perceiving it as an attempt to replace their expertise with out-of-context guidelines and algorithms. Some participants explained that the new guidelines undermined the valuable clinical experience of physicians.

Contextual Integration (Support from Host Organization)

Participants perceived limited support from hospital authorities. Participants explained that they initially received the study protocol with reservations due to concerns about potentially harming patients. Participants also identified several infrastructural deficiencies, such as inadequate equipment, which they believed reflected insufficient support from authorities. Resistance from uninvolved or senior staff and concerns about excessive workload further highlighted challenges in securing comprehensive organizational support—this lack of support created barriers to disseminating all hospital intervention components. According to participants, adoption was not extensive; because we did not include the emergency department in the intervention, patients often arrived from the emergency room on antibiotics that were not aligned with the updated guidelines, leading to inconsistencies in care.

Monitoring (Tracking Progress)

Informants reported several positive effects of the intervention on their antibiotic-prescribing practices. The most valued aspect of the intervention was developing and adopting antibiotic management guidelines, which reduced the prescribed range of antibiotics, better-matched antibiotics to patients' pathologies, and standardized prescribing practices. Other benefits included improved communication within services, enhanced interdisciplinary collaboration with other hospital departments, and adoption of timeout practice. Some informants also noted negative aspects; adopting new guidelines did not consider physicians' clinical experience and judgment. Overall, participants felt that adherence to updated antibiotic guidelines was sustainable. In contrast, less widely adopted practices, such as monitoring audits and feedback forms, would be challenging to sustain after the study's conclusion.

DISCUSSION

Our study revealed several challenges in implementing stewardship, primarily due to a lack of clarity regarding the intervention's objectives and differentiation from existing practices. Although some professionals were willing to adopt the intervention, resistance and communication barriers impeded its wider acceptance. Workload, perceived benefits, and the extent of institutional support also influenced engagement. Infectious disease specialists, responsible for the central component of the intervention, the cycles, and updating clinical guidelines, were the most active parts in the implementation. However, not all these professionals demonstrated sustained engagement. The remaining healthcare providers tended to be peripheral participants in the intervention. The limited organizational support posed significant challenges, suggesting that the organizational context played a more influential role than initially anticipated. Despite these obstacles, participants recognized the intervention's contributions to the standardization of antibiotic use and the enhancement of teamwork.

Although stewardships have reduced inappropriate antibiotic use and costs, their impact on ICUs, resistance,

and hospital-acquired infections remains unclear due to insufficient evidence.[14,25] Most research on stewardship has been conducted in high-income countries, with a gap in LMICs, where antibiotic resistance is a growing concern. We found only 1 comparable study in pediatric wards in Argentina. Implementing an educational program to improve the quality of antibiotic prescribing reduced the percentage of suboptimal treatments from 35.6% to 21.5%.[26] Enhanced data collection, standardization, and knowledge sharing are essential for optimizing pediatric stewardships and their impact on patient health, with tailored education on local resistance patterns being vital for optimal antibiotic use.[25,27]

The complexity of the intervention likely impacted how participants understood it, given the lack of clarity around its aims and components. This ambiguity raises questions about whether the intervention was too broad or unclear. Participants reported they were already managing antibiotic resistance, viewing the intervention merely as a systematization of their existing practices. This opinion may reflect a self-enhancement bias, as seen in similar studies.[28,29] Discrepancies underscore the importance of clear communication and alignment between intervention designers and implementers to ensure coherence and effective implementation.[30]

Resistance is likely when interventions are implemented by external agents, as often occurs with stewardships, and when clinicians perceive interventions as potentially risking near-term clinical outcomes. Although local staff implemented the stewardship, the initiative was external; moreover, specialists led the process of updating and disseminating guidelines, a central intervention point. Infectious disease specialists and pharmacists were pivotal in this process, whereas other providers mainly adhered to guidelines. Building consensus before introducing programs ensures that hierarchical models do not conflict with the program's objectives.[31–33] Successfully implementing any project is often contingent upon a robust multidisciplinary collaboration and locally tailored interventions. Antibiotic use standardization benefited from the involvement of leaders and the incorporation of local context, ensuring that interventions align with institutional realities.[34] The impact of education and consistent team composition were pivotal elements on sustaining commitment to stewardship programs.[35,36] These findings underscore the significance of fostering consensus and ensuring organizational support.

Nurses played a small role in this intervention. Efforts are necessary to ensure their participation and engagement in stewardship, addressing their knowledge needs and work context.[33,37] On the other hand, those with the specific role of facilitating the implementation did not always perform this responsibility. This role is crucial for successfully integrating multifaceted stewardships into clinical practice and maintaining ongoing communication.[32,38] Improving antibiotic decision-making cannot be achieved only by disseminating guidelines. Instead, optimization must balance specialist advice with the providers' clinical judgment and incorporate educational strategies considering culture, power relationships, and hierarchy within a hospital.[39] Several studies have demonstrated that hierarchy influences junior and experienced doctors, leading them to adopt practices not subject to peer questioning.[31–33] Stewardships that do not address systemic influences and dynamics are insufficient to generate long-term systemic changes in antimicrobial use.[40]

Based on our findings, we recommend implementing the following strategies: ensure all participants understand the intervention through training and continuous communication using multiple channels. We recommend that hospital staff be involved in the planning and implementation phases to promote buy-in. Incentives may be provided as opportunities for continuous professional development or financial rewards to encourage participation. It is essential to ensure the availability of resources, including adequate technology. To secure institutional support, QI leaders must engage hospital leadership and emphasize regular feedback to monitor progress and adjust. Updated guidelines should allow for a balance between standardization and individualized care. Finally, it is essential to plan for the program's sustainability by integrating it into the hospital's operations and securing long-term funding.

We conducted the study in 2 hospitals, which may limit the generalizability of the findings. A limitation is that not all study participants were interviewed. Although helpful in selecting knowledgeable informants, the purposive sampling method may have introduced selection bias, as it might not capture the full range of perspectives from healthcare providers involved in the stewardship. The study used a robust methodology to ensure a comprehensive understanding of the implementation process utilizing established frameworks.

The implementation of the stewardship resulted in a more standardized approach to antibiotic use, enhanced collaboration, and improved communication between teams. Our findings reinforce that successfully adopting new clinical practices requires understanding the organizational context. Stewardship and collaborative efforts operate within complex social systems where creating a supportive operational context is crucial. Workload, perceived benefits, and the authorities' support level significantly influenced engagement. The successful implementation of stewardship is made possible by the expertise and involvement of specialists and the creation of a culture of collective responsibility among all stakeholders. These factors guarantee that the interventions are sustainable and transformative.

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PATIENT CONSENT

Informed consent was obtained from all participants; confidentiality of information was ensured.

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