Improving Vascular Access Pathways with the Goal of Reducing Central Line Usage at UNC Children's

1. **Project Lead/Key Contact (name, email & phone number)**

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Director, Medicine Procedure Service and Point-of-care Ultrasound Education
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Key Terms (specific to this proposal):

Term (Abbreviation)	Definition / UNC Specific Information
CLABSI	Central Line Associated Blood Stream Infection *Per CDC, a CLABSI is a primary bloodstream infection in a patient that had a central line within the 48-hour period before the development of the blood stream infection and is not bloodstream related to an infection at another site.*
DIVA	Difficult Intravenous Access *Further defined within the full application.*
miniMAGIC Guidelines	*Pediatric-specific guidelines for vascular access decision making published in 2020.*[1]
PIV	Peripheral Intravenous Catheter *Traditional peripheral catheter placed in patients when intravenous interventions (fluids, medications, etc.) are needed for care. At UNC Children's, typical length is < 3 cm.*
Midline Catheter*	*Alternative to traditional PIV catheter; inserted in the arm, tip terminates at the axilla.*[2] *These catheters range in size and length depending on the size of the child, typically around 6cm-10cm in length. Midline catheters are a type of long PIV placed at the bedside under ultrasound-guidance.*
Long PIV*	*Longer than traditional peripheral intravenous catheters, typically 4cm-6cm, and placed under ultrasound guidance.* **Note: for the purposes of this application, long PIV and midline are used interchangeably.*
CVC	Central Venous Catheter
PICC	Peripherally Inserted Central Catheter

USGPIV	Ultrasound-Guided PIV *Peripheral intravenous catheter inserted with the use of ultrasound guidance. At UNC Children's, teams proficient in USGPIV placement are the PSCT, Peds Anesthesiology, PICU, NICU, EM physicians, select bedside nurses, and hospitalists with additional training.*
Pediatric Specialty Care Team (PSCT)	*Also known as pediatric sedation team, this team is composed of specially trained nurses who work closely with pediatric anesthesiology. Their team includes a resource nurse Monday-Friday 8am-5pm, responsible for USGPIV consults and pediatric PICC consults.*
PICU	Pediatric Intensive Care Unit

2. **Why are you interested in participating in the Improvement Scholars Program?**

I am a current pediatric hospital medicine fellow interested in solving problems through quality improvement. As a fellowship trainee and future internal medicine and pediatric hospitalist, I am hopeful the IHQI Improvement Scholars Program will provide additional formal support, mentoring, and training on how to successfully implement, evaluate, and maintain an initiative of this scope early in my career. I have support of my program to participate in the IHQI Improvement Scholars Program throughout fellowship.

Additionally, I am really passionate about this project. Difficult intravenous access is a common problem for our pediatric patients that causes pain, anxiety, trauma, and delay in care. We can improve on this problem and we hope our project will lay the groundwork for the development of improved peripheral vascular access pathways throughout UNC Children's and beyond.

SPECIFIC PROJECT AIM

Early identification of patients with DIVA with a m-DIVA scoring system to identify DIVA population at UNC and improve care of these patients within the newly created pediatric vascular access pathway and reduce avoidable central venous catheters and their associated complications through the introduction of alternative peripheral intravenous options including long PIV/midlines.

3. **Which UNC Health improvement priority will your project address?**

The main UNC Health improvement priority our project addresses is patient harm prevention and mortality reduction through early identification of pediatric DIVA patients and implementation of a pediatric vascular access pathway that ensures our pediatric patients receive the right line at the right time. Our lag measure is reduction of CLABSIs and obviating the need for CVC use. Furthermore, secondary aims of our project target additional UNC Health improvement priorities of improving patient and family experience and potentially reducing disparities in which patients receive central lines. There is evidence that midline catheters have lower failure rates and lead to higher satisfaction.[Error! Bookmark not defined.] In regard to health equity, tools for identifying DIVA patients use poor visibility of the vein as one indicator for DIVA and there is evidence that black patients have higher DIVA scores.[6] We aim to compare DIVA scores in patients of all racial and ethnic backgrounds and gather data regarding midline and central line usage in different pediatric populations to help guide further improvement efforts at UNC Children's.

4. **What is the problem or gap in quality you seek to improve?**

Our stretch goal of avoiding unnecessary central venous access is in accordance with our institutional goal of "right line, right patient, right time." Intravenous access is very important for the care and management of pediatric patients at UNC Children's Hospital and is one of the most common procedures performed throughout the hospital. Our proximal and main goals are early identification and documentation of pediatric patients with DIVA, earlier use of ultrasound guidance for PIV placement, and appropriate use of long PIV/midline catheters.

In our current state, we do not objectively identify or document patients at risk for DIVA nor does our children's hospital have a vascular access pathway. As a result, patients endure multiple failed blind attempts before involving the pediatric specialty care team (PSCT), the team trained in ultrasound-guided PIVs. Unfortunately, patients with DIVA often end up needing a CVC for reliable access, a procedure that carries additional mechanical risk as well as infectious and sedation risks compared to PIV catheters. Furthermore, patients who are not candidates for a PICC sometimes receive surgical central lines due to lack of pediatric interventional radiology at our institution. Importantly, CVCs carry the infectious risk of CLABSI, a complication that UNC has made an organizational goal of reducing across the hospital. [1]

Identifying patients at risk for DIVA is an important first step to help select the best team, procedure, and vascular access device for improved patient care. We propose initiating a validated measure, modified-DIVA (m-DIVA) scoring, to objectively identify these patients.[3,4] The use of this objective scoring system will help establish the foundation for management of our DIVA population in pediatric patients admitted to the hospital. After identifying patients at risk for DIVA, we can then use this validated scoring system to shunt them more efficiently into a pediatric vascular access pathway that will be created as another step in our project.

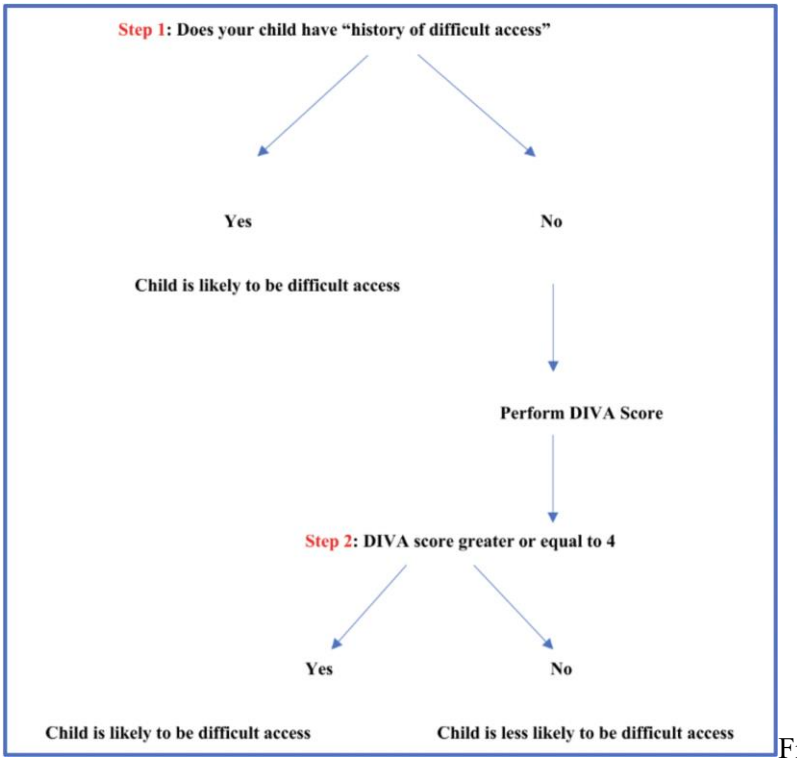

Figure 1. m-DIVA Scoring Tool[4]

Predictor	0 Points	1 Point	2 Points	3 Points
Visible Vein	Visible		Not Visible	
Palpable Vein	Palpable		Not Palpable	
Age	>/= 3 years old (older)	1-2 years old (toddler)		< 1 year old (infant)
History of prematurity	No			Yes

Figure 2. DIVA Scoring System[3]

A recent JAMA randomized clinical trial has shown that midline products have longer dwell times and obviate the need for additional vascular access to complete treatment.[Error! Bookmark not defined.] With the support of the newly created Pediatric Central Line Standardization Subgroup of the UNC Children's CLABSI Prevention workgroup, we have already started to introduce a midline product into UNC Children's Hospital. Ultimately, the creation of a UNC Children's vascular access pathway will include this as an option between a PIV and a CVC with the goal of reducing avoidable CVCs and subsequent rates of CLABSI.

5. **Describe the patient population affected, scope, and impact of the problem**
    a. **What is the specific patient population your project will impact?**
    b. **How many patients are in the population?**
    c. **How frequently does the problem occur?**
    d. **What is the impact of the problem?**

Our population is inpatient pediatric patients requiring PIV access. Obtaining appropriate PIV access in patients with DIVA is a daily problem for pediatric units within our children's hospital, as supported by observations and discussions with providers, parents, and unit leadership including bedside nurses, nurse managers, and nurse educators. Most days there are patients in our children's hospital that endure multiple unsuccessful PIV attempts. Every day, nurses are documenting PIVs being placed and performing assessments of PIVs throughout their shifts, but currently m-DIVA scores are not being documented in the EMR. The PSCT receives multiple consults per day for DIVA patients needing ultrasound-guided intravenous access. This team works Monday-Friday from 8am-5pm, but DIVA patients require intravenous access 24-hours per day. The conclusion of these observations is that we currently have no validated tool to identify DIVA patients, no place to document this evaluation, no pathway to standardize their care, and a paucity of providers that are equipped to place ultrasound guided traditional PIVs and long PIV/midline catheters. As a result, these children suffer from painful procedures and some end up getting avoidable CVCs for improved access.

Hundreds of CVCs are placed at UNC Children's Hospital per year. There are around 10-12 patients with CVCs on any given day in the PICU and 1-4 on 7-Children's as supported by the CLABSI workgroup. It is unknown how many could be avoided with improved peripheral access pathways and methods; this baseline project is currently in process.

We intend to target the PICU population first as we expect these more critically ill children to need intravenous access more frequently and for longer periods of time. This limited scope will allow us to refine our processes to increase success as we expand to other units in UNC Children's.

6. **What do you think are the underlying causes of the problem? Why do you think the problem is happening?**

As mentioned, we have a DIVA problem at UNC Children's. Observations support that our institution likely has a large DIVA population and this combined with high PIV access needs for care and limited options for ultrasound-guided PIV catheters creates the major underlying cause for this problem.

Picture a child, perhaps your own, admitted to UNC Children's who needs intravenous antibiotics for 7 days. The bedside nurse assesses for peripheral veins for cannulation and immediately can tell this patient will be a difficult stick. They hope there is a nurse currently working on their floor who is known to be good at placing PIVs because they want help. You watch helplessly as your child undergoes multiple PIV catheter placement attempts without success. It is nighttime, so the PSCT is unavailable, therefore ultrasound-guidance is unavailable. Unfortunately, this means that your child's much needed antibiotics are delayed. The next morning, PSCT is consulted. Their team is very busy because there is one resource nurse for the entire children's hospital as well as several outpatient clinics located within the hospital. Finally, after lots of needles, tears, and stress, an USGPIV is successfully placed for intravenous antibiotics. This is our current state. Our project directly aims to improve this story.

In the fall of 2023, a young patient required PIV access for antibiotics for 10 days. A long PIV/midline catheter was successfully placed on first attempt with ultrasound guidance by a qualified proceduralist on the internal medicine procedure team. This was after this child was stuck multiple times for PIVs throughout his prolonged antibiotic course, a traumatizing experience for the patient and family. The long PIV remained in place for the duration of antibiotic needs (10 days) and the patient did not require any additional PIVs. What if this patient was identified with a high m-DIVA score early in their hospitalization? With this information, ideally all attempts would have been ultrasound guided. Perhaps knowing that this patient needed 10 days of treatment could have led to starting with a long PIV/midline instead of a standard PIV with a higher failure rate. Improving these "what ifs" are possible. We are capable of making these improvements and it starts with m-DIVA scoring.

7. **What is the history of improvement or attempted improvement at UNC Health? What work will your proposed improvement build on?**

This is the first proposed improvement project for this issue in pediatrics. For adult patients at UNC, there is a vascular access pathway and a dedicated adult vascular access team. Additionally, for adult patients in whom the vascular access team is unable to place a PIV, there is an internal medicine procedure service and adult interventional radiologists who can assist. These teams are all interconnected and frequently communicate to ensure adequate access for their patients.

8. **Please complete the "Measures Table". Please describe the anticipated outcome measure(s), 2-3 process measures, and one balancing measure. Please do not include more than 5 measures total.**

Measure Name	Measure Type	Measure Calculation	Measure Exclusion	Data Source	Baseline & Goal	Collection Frequency
Documentation of m-DIVA Scores	Process (lead measure)	Numerator: # of pediatric patients (ex. PICU) who require IV access with documented m-DIVA score Denominator: # total number of	Exclusion Criteria: None	EHR	Baseline: 0 Increase the Use of m-DIVA Documentation Goal 80% of patients admitted to the PICU have a	Monthly

		inpatient (PICU) pediatric patients who required IV access during admission (nearly all PICU admissions)			documented m-DIVA score	
Documentation of ultrasound guidance	Process (lead measure)	Numerator: # of PICU patients who had ultrasound guidance of PIV or long PIV/midline Denominator: # of PICU patients who required IV access with elevated DIVA score	Exclusion Criteria: Patients who do not require PIV	EHR	Baseline: unknown Goal: 80% of patients with m-DIVA score > 4 who have a PIV or long PIV/midline placed do so with ultrasound guidance	Monthly
% avoidable pediatric CVC (if midline available)	Outcome (lag measure)	Numerator: # of pediatric patients with indications for peripheral access per miniMAGIC Guidelines at the time of central line insertion Denominator: # of total pediatric patients with central venous access insertion CPT codes	Exclusion: CVC device placed before admission, port, dialysis indication, PLEX indication	EHR	Baseline: current project ongoing to assess baseline over the previous 1-2 years Reduction in % of avoidable central lines over time	Bi-Monthly (review patients with CVC in the PICU on the 1st and 15th of each month)
Long PIV/Midline Utilization Rate	Outcome (lag measure)	Numerator: # of long PIV/midline catheter days for patients admitted to the PICU Denominator: # of PICU patient days	Exclusion Criteria: None	EHR	Baseline: 0 Increase the appropriate use of midline catheters/long PIVs over time Increase product use of longer peripheral intravenous catheters (4cm+) Increase proceduralists	Monthly

					with competency in ultrasound-guided long peripheral intravenous catheter placement	
Complications from long PIV/Midline use	Balancing Measure	Numerator: Cases of thrombosis and extravasation Denominator: Number of long PIV/midline catheter insertions	Exclusion Criteria: None	EHR	Baseline: 0 Goal: < 10%	Monthly

9. **What ideas do you have for changes that will result in improvement (your improvement strategy)?**

We have specific ideas for changes that will result in improvement as described in the strategies below.

1. Strategy 1: Epic Documentation Improvements
    - Over the past 6 months, we have worked hard with our stakeholders to discuss implementation of m-DIVA scoring. We have already submitted request for Epic changes that are currently in-process that would allow m-DIVA scoring within the IV Assessment area of Epic at UNC, the flowsheet nurses use to document intravenous access placement and daily assessments. By using this flowsheet for m-DIVA documentation, we hope to seamlessly integrate this process into daily use. This should be available in Epic prior to the start date of the IHQI Improvement Scholars timeline.
    - We hope to make similar changes in Epic over the next 4-6 months to also incorporate peripheral intravenous length into Epic. Currently, the gauge of the PIV is documented (ex. 22g) but not the length (ex. 4.5cm). By documenting length, we will be able to measure future improvement efforts around use of longer peripheral intravenous catheters and midline catheters. The lack of documentation around PIV attempts is also an area we hope to address over time. We would love to improve documentation of PIV attempts because this could become another important measure moving forward; we are exploring how best to obtain these types of data moving forward.
2. Strategy 2: Creation of Pediatric Vascular Access Pathway
    - The CLABSI Workgroup sub-committee, line standardization and selection, is currently in the process of developing a pediatric vascular access pathway. This multidisciplinary group meets monthly and completed an express workshop in January 2024. A major branchpoint on this pathway will be correct identification and documentation of DIVA patients. Additionally, an "ideal state" vascular access pathway will be created that will incorporate the use of USPIVs and ultrasound-guided long PIVs/midlines. This work is ongoing in parallel to our work discussed in this project proposal.
    - We hope to provide additional training sessions in ultrasound-guided midline catheter/long PIV placement to nurse practitioners and physician trainees. We are currently in the process of applying for additional grant funding for vessel trainers and midline kids that could be used for hands-on USGPIV training sessions.

- A major branchpoint on the future pediatric vascular access pathway will be m-DIVA scores, likely with high m-DIVA scores promoting additional consultation for ultrasound-guided access needs. We would also like to look at the number of pediatric specialty care team consults over time as an additional balancing measure, as they are the group usually consulted for DIVA patients and this will help us explore the needs and demands on this consult team over time.

3. Strategy 2: Education
    - We have begun education of the importance of identifying patients with DIVA and implementation of long peripheral intravenous catheters at UNC Children's within the CLABSI workgroups and with meetings with stakeholders over the last 6 months. We would like to continue these efforts with bedside nursing, residents/fellows, and attendings.
    - We also hope to use visual aids and ongoing bedside education to promote the concept of m-DIVA scores to patients and parents. We hope to empower patients and families to identify patients with DIVA early in their hospitalization to improve care.
4. Strategy 3: Project Scope
    - In order to best implement and eventually scale our project with success, we anticipate starting with a single unit within UNC Children's Hospital, most likely the pediatric intensive care unit (PICU, 20 beds) or 7-Children's (floor and stepdown patients, 24 total beds). These units were identified because of their patient populations, need for intravenous access, and staff champions (physicians and nurse managers) who strongly support our mission.
    - Additionally, starting this project in the PICU will allow for procedural training for ultrasound-guided PIVs, ultrasound-guided long PIVs, and midline catheters involving nursing, nurse practitioners, residents, fellows, and attendings. We hope this project can then be expanded to a single pediatric floor, likely 7 Children's.
5. Strategy 3: Feedback
    - To be a successful quality improvement effort, we need to routinely assess our impact and incorporate feedback to sustain improvement. Obtaining and documenting m-DIVA scores relies heavily on bedside nursing. We hope to engage in monthly or bi-monthly rounding sessions to obtain direct feedback from bedside nursing (within the PICU) to determine how obtaining and documenting m-DIVA scores are affecting workflow, vascular access planning, and patient care. We also hope to implement a quick survey to bedside nurses at quarterly checkpoints through the project to elicit honest and anonymous feedback.
6. Strategy 4: Patient/Family Engagement and Feedback
    - Patients and families are at the heart of this project's aim. Parents often can identify their child as someone with DIVA without a score.
    - We have already identified a patient and family champion. We hope to communicate with this family semi-annually.
    - There is no specific question related to vascular access on the inpatient unit Child-CAHPS survey for patients/families, however, we hope to review with unit leadership monthly if any concerns or positive or negative feedback are solicited from survey responses in regards to difficulty with intravenous access.

10. **How has this problem has been addressed successfully elsewhere?**

The Children's Hospital of Philadelphia (CHOP) has an Inpatient Clinical Pathway for Vascular Access and a specific component of this pathway is for DIVA patients.[Error! Bookmark not defined.] They define difficult venous access as a clinical condition where multiple attempts or special interventions are anticipated to achieve PIV success.[5]

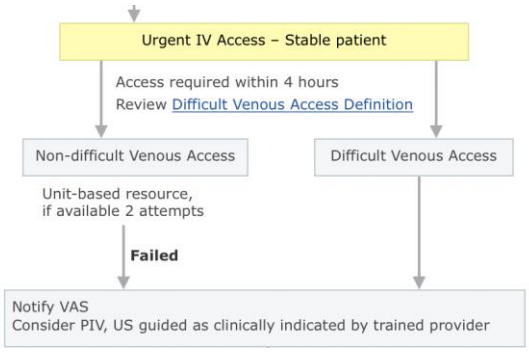

Figure 3. CHOP Vascular Access Pathway

Identifying patients with DIVA is an important part of their pathway as you can see above (Figure 3). They use a broad definition to determine difficult venous access, and we hope by using m-DIVA scores that the process of identifying DIVA patients is easy to learn, incorporate in clinical use, and eventually guides future vascular access pathways at our institution.

Wisconsin Children's recently started a long peripheral intravenous catheter program that showed success longer dwell times with long PIVs compared to traditional catheter use without serious complications (catheter-associated infection or thrombosis).**Error! Bookmark not defined.** They found success with starting their long PIV initiative in the PICU and then expanding to the floors. We aim for a similar process.

11. **How will Carolina Quality tools (Just Culture, SAFE reporting, team communication and teaming skills, huddles, and visual management boards) be used to support the work? Although use of these tools is not required, applications including them will be strengthened.**

We will encourage the use of SAFE reporting while implementing the new vascular access pathway. We anticipate that the new pathway may shunt DIVA patients into the part of the pathway that recommends ultrasound guidance or a procedure that is not available at all times. There will be other unanticipated consequences that we hope SAFE reporting will identify. This will help refine the process and advocate for resources such as ultrasounds and training.
Since use and documentation of m-DIVA scoring will be a new part of the workflow for bedside nursing, we will partner with nurse educators and nurse managers to provide education and support and to help us troubleshoot obstacles. We will work with nurse managers to find the best opportunities to provide regular feedback and positive reinforcement while implementing this change. Since our main process measure, which is the basis for all other improvements, is documentation of m-DIVA, we can create a visual management board which shows a monthly run chart of this measure.

12. **Please describe how your project addresses one or more of the 5 elements reflected in the Quintuple Aim for Health Care Improvement.**

- **Improved health**
- **Enhanced patient experience**
- **Enhanced clinician and staff experience**
- **Health equity**
- **Reduced costs**

Improved health: The management of most diseases severe enough to necessitate pediatric hospitalization involves intravenous therapy. This may range from intravenous fluids for dehydration to days or weeks of antimicrobial therapy. Improving IV access by identifying DIVA patients, facilitating ultrasound guidance, and using long PIV/midlines when appropriate will avoid delays and interruption in treatment.

Enhanced patient experience: A recent RCT has already shown that use of midlines/long PIVs leads to increased patient and parent satisfaction.[Error! Bookmark not defined.] We also expect that early identification of DIVA patients and use of ultrasound guidance will lead to better patient experience.

Health equity: Prior work has shown that black children have higher DIVA scores.[6] Since vein visibility is part of DIVA scoring systems, we anticipate that children with darker skin will have higher scores. We intend to compare m-DIVA scores across races with the goal of ensuring that children with DIVA do not needlessly suffer blind PIV attempts.

Reduced cost: While reduction in CVC usage by shunting DIVA patients into a pathway that aims to avoid unnecessary central access is a stretch goal, we anticipate a significant cost reduction as a result. In children, these costs include personnel needed to safely sedate them and OR time to place surgical lines in the absence of a pediatric interventional radiology team. In addition, we will avoid all complications of CVCs, including CLABSI, arterial laceration, and pneumothorax.

13. **Please describe the support and engagement you have from leadership for the work you are proposing. Please indicate leaders with whom you have consulted about this proposal.**

With the initial discussions and proposals for this quality improvement project, we are fortunate to have a wide range of support and engagement from physician, nursing, and interdisciplinary leaders. We work closely with the multidisciplinary Pediatric CLABSI workgroup and consulted with QI leaders throughout the departments of internal medicine and pediatrics (including Drs. Ashley Sutton, Carlton Moore, and Katie Weistreich). Drs. Benny Joyner and Lane Donnelly, quality improvement leaders at our institution, have been supportive of our project within the pediatric CLABSI initiative including creation of a multidisciplinary sub-committee for line selection (right line, right time). We meet monthly with the multidisciplinary Pediatric CLABSI workgroup and sub-committee for line selection and standardization.

Many of the process measures for our project rely on bedside nursing and nursing leadership for implementation. We have received positive feedback from nursing leadership throughout the children's hospital when discussing implementation of documentation measures as previously described. Per feedback from our nursing leaders, the need to address this problem is so high that it will likely justify the added documentation burden required for success. We are working closely with Amber Kirkley, RN, CN-IV who is the Children's Nursing Quality Coordinator. We also have additional support from Carl Seashore, MD with his experience with informatics.

Please also see additional letters of support from Dr. Benny Joyner and Dr. Lindsay Chase.

14. **Who will comprise the project team? List names and roles of team members, describe how the project team will function and how the team's work impacts other teams/units and/or is impacted by other teams/units. Successful improvement project teams are interprofessional, multidisciplinary, and often include patient and family members. Although not required, applications listing interdisciplinary co-leads (e.g., nurse and provider co-leads, or pharmacist and provider co-leads) will be strengthened. Access this link to learn additional helpful information about improvement teams.**

Since August 2023, we communicated the intentions of our aims and goals with multidisciplinary leaders throughout UNC Children's Hospital. Furthermore, our project has been presented to the Pediatric CLABSI Workgroup, which is a truly multidisciplinary and interprofessional team. In conjunction with our improvement efforts, a sub-committee (line standardization and selection committee) was created with the goal to help support our aims and help use our project as the foundation to build upon a pediatric vascular access pathway. This sub-committee includes physicians from multiple specialties (hospital medicine, intensive care, radiology, anesthesiology, infection disease, etc), nurses

(nursing managers, nurse educators, bedside nurses, hospital epidemiology), and leaders in quality and safety throughout the UNC Children's Hospital. We are currently in the process of developing a core cohort of physicians and nurses in the PICU to help champion this project moving forward. Additionally, we have project champions throughout other units within the children's hospital including the 7th floor unit (7CH) that would likely naturally be the next best place for project growth and expansion outside the PICU.

PROJECT TEAM	
Team Member	Project Role
Katie Butler	Team Lead Pediatric Hospital Medicine Fellow
Erin Finn	Mentor, Co-Lead Internal Medicine & Pediatric Hospitalist Attending
Ria Dancel	Mentor, Co-Lead Internal Medicine & Pediatrics Hospitalist Attending
Benny Joyner	Sponsor PICU Attending
Amber Kirkley	Children's Nursing Quality Coordinator
Patient/Family (de-identified for this application)	Patient/Family Champion

15. **How will you ensure sufficient time to dedicate to the project over the scholar year? Although time commitment to the program varies throughout the year, Scholars may expect to spend at least 2 hours per week (with range from 1 hour minimum to 5 or more hours a week) on project-related activities.**

As a pediatric hospital medicine fellow, I have dedicated my fellowship scholarly work to this quality improvement project. Currently, I have 10 weeks of dedicated research time during the 2024-2025 academic year from July 2024-June 2025, which will allow for ample time to devote to this project. I have no hesitation that I can meet the recommended expectation for time allotted for project-related activities. Additionally, I have division support for this project from my fellowship program director (Dr. Jen Fuchs), associate fellowship program director (Dr. Wade Harrison, recent IHQI Improvement Scholar), and division chief of hospital pediatrics (Dr. Lindsay Chase).

16. **What factors do you anticipate will foster and hinder improvement?**

We have identified a high-volume, high-impact problem with a path to high-quality solutions that is truly supported by our multidisciplinary team throughout UNC Children's Hospital. Identifying patients with DIVA is just the start; once we are able to identify these patients, we can truly start to better understand the gaps in quality related to their care plan. We have created a multidisciplinary team and support system through the CLABSI workgroup and line standardization sub-committee, all of whom are invested in the success of this project and how it will lead to the development of future vascular access improvements and initiatives to improve patient care.

Currently, we are still awaiting approval for Epic changes that were requested (m-DIVA scoring incorporation into nursing flowsheets). We anticipate this to be completed by Spring 2024 but it may need modifications after implementation. We also hope to request additional Epic changes as described, but these are for secondary aims and measures that would not hinder the advancement of our initial goals. Our strategy to improve documentation around PIV and long PIV/midline documentation will be a time-intensive process and we recognize the additional Epic changes that need to be made. We acknowledge this dilemma but on our current timeline, we should have m-DIVA score documentation available in Epic by the time of the IHQI Improvement Scholars start date. Additionally, if there is any

unanticipated delay in incorporating m-DIVA scoring into the IV Assessment flowsheet, we will overcome this by distributing a dot-phrase to document m-DIVA scoring within nursing daily assessment documentation so that we can begin assessing our measures by day 1.

Strong communication and education will be vital to the success of our project. We realize that we are adding to some of the documentation burdens that members of the medical team already experience. While we have received very positive feedback from our multidisciplinary team, including nurses and nursing leadership, we are aware and respectful that we are asking our teammates to document more to help these patients. We hope that by starting in a specific unit within the children's hospital, we can overcome the initial challenges that may arise before expanding to other parts of the children's hospital.

17. **What ideas do you have for sustaining the improvement at the end of the Improvement Scholars Program?**

Sustaining the primary aim of documenting m-DIVA scoring will very much depend on whether the documentation leads to an easier process for nurses to obtain vascular access in the children they care for. The effort to document will not be worth it to a busy bedside nurse if the pediatric vascular access pathway fails. Why take the time to score and document if there is still no ultrasound on the unit or providers who can place USGPIV or long PIV/midlines? Alternatively, if patients, families, and bedsides nurses have fewer painful procedures and more reliable vascular access because the vascular access pathway succeeds **and** m-DIVA scoring starts them down that pathway, there is powerful motivation to continue scoring patients. Increasing the number of providers proficient in placing USGPIVs/midlines and facilitating access to ultrasounds will help sustain this improvement.

While our project is focused on pediatric patients and will be initiated in a specific unit, the problem of DIVA affects patients of every age and the full spectrum of medical illness. Identifying patients with DIVA is the first step to improving their care and developing strategies for sustainability for improved vascular access pathways moving forward.

18. **Implementation Timeline**

Task	Feb-June	July-Sept	Oct-Dec	Jan-March	April-May	June-July
IHQI Improvement Scholars		X				
Finalize m-DIVA Epic Integration	X					
PIV Length Epic Integration Request	X					
Initiate m-DIVA Documentation into workflow (PICU)		X				
Audit Feedback from m-DIVA Documentation		X	X	X	X	X
Process Monitoring and Refinement		X	X	X	X	X
Midline Catheter Utilization	X	X	X	X	X	X
Patient Education – Midline Catheters			X	X	X	X
Audit Feedback from Midline Catheters	X	X	X	X	X	X
Procedural Training for Ultrasound Guided Vascular Access Procedures			X	X	X	X
Finalize PIV Length Documentation into Epic			X			

Initiate PIV Length Documentation into workflow				X	X	X
Initiative m-DIVA Documentation into workflow outside the PICU (initial outreach)				X	X	X
CLABSI Subcommittee (line selection and standardization) Express Workout	X					
CLABSI Subcommittee (line selection and standardization) feedback and vascular access pathway refinement		X	X	X	X	X
Patient and Parent Satisfaction Feedback				X	X	X
Analyze and Present Results					X	X

19. **References**

Please see footnotes at the end of application.

20. **Letters of Support: Two letters of support are required. One from the project sponsor (defined below) and one from your supervisor. Submit both letters with the application.**

Project Sponsor:
Benny Joyner, MD
Professor, Pediatric Critical Care Medicine
Departments of Pediatrics, Anesthesiology & Social Medicine
Chief, Division of Pediatric Critical Care Medicine
Vice-Chair, Quality & Safety, Department of Pediatrics

Project Supervisor:
Lindsay Chase, MD
Professor of Pediatrics
Chief, Division of Hospital Pediatrics
Director of Inpatient Services, UNC Children's Hospital

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