

Tier 1: Implement Global Strategies to Improve PICC Safety

Convene a Vascular Access Committee to review PICC use and outcomes	Use MAGIC or a related decision-tool (e.g., INS Standards) to determine PICC appropriatenes	Reduce short term PICC use (PICC $\leq$ 5 days)	Increase use of single lumen PICCs; decrease use of multi-lumen PICCs	Avoid PICC Placement in patients with eGFR < 45ml/min (CKD Stage IIIb)
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Tier 2: Implement Focused Practices to Targeted Problems

(Each hospital will be assigned *one* of these three conditions)

Catheter Occlusion	PICC-Related Deep Vein Thrombosis or Thromboembolism	PICC-Related Bloodstream Infection (e.g, CLABSI)
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TIER 1: GLOBAL STRATEGIES TO IMPROVE PICC SAFETY

Recommendation	Background, Rationale and Suggested Implementation Strategies	Resources, References & Tools
1. Convene a Vascular Access Committee to review PICC use and outcomes on a monthly to quarterly basis	- Numerous studies suggest audit and feedback of data related to utilization and outcomes of central lines (including PICCs) to frontline clinicians improves outcomes - A multi-disciplinary team consisting of key stakeholders that includes (but is not limited to), organizational leadership (e.g., CMO, CQO, CNO), vascular access team members, interventional radiology, critical care physicians, hematology/oncology physicians, emergency room physicians and hospitalists is suggested for maximal impact - The multidisciplinary team should meet quarterly, identify opportunities for improvement (e.g., PICC use <5 days) by reviewing HMS data and outline strategies, resource requirements and next steps for implementing change. - The team should follow the impact of their interventions using both local and HMS data to fully understand barriers, facilitators and outcomes affected as a result of the changes made or workflow improvements performed. - Designate an internal facilitator for all PICC-related QI efforts. The internal facilitator may be a member of the Vascular Access Committee but focuses their work on implementing changes recommended from the committee. The internal facilitator will work with the coordinating center to identify barriers and facilitators in implementing PICC QI efforts - Designate a physician champion to assist with PICC initiatives. The physician champion should work closely with the vascular access team and HMS PICC abstractor to facilitate changes and support initiatives throughout the project.	Resources & Tools: - HMS site reports (hard copy distributed at collaborative wide meetings and live reports available daily via the HMS data entry system) References: - Pronovost PJ, et al. <u>An Intervention to Reduce CLABSI in the ICU</u>. <i>New England Journal of Medicine</i> 2006 - Participation in a statewide initiative- MHA Keystone- resulted in a large and sustained reduction (up to 66%) in rates of catheter-related bloodstream infection. - Bosk C, et al. <u>The art of medicine: Reality Check for Checklists</u>. <i>Lancet</i> 2009 - To achieve results in wider contexts: recruit advocates within the organization, keep the team focused on goals, create an alliance with central administration to secure resources, shift power relations, create social and reputational incentives for cooperating, open channels of communications with units that face the same challenges, and use audit and feedback. - Holden RJ, et al. <u>SEIPS 2.0: A human factors framework for studying and improving the work of healthcare professionals and patients</u>. <i>Ergonomics</i> 2014 - This model uses a systems engineering model to identify the types of factors, barriers and facilitators to consider when implementing a change or improvement process. The model identifies technologies, tools, environment, people and the work environment as key components for a Vascular Access Committee to consider. <u>Infusion Therapy Standards of Practice 2016 – Overview Presentation</u> <u>Infusion Therapy Standards of Practice – Purchase Site</u> - Kirchner JE, et al. <u>Outcomes of Partnered Facilitation Strategy to Implement Primary Care- Mental Health</u>. <i>Journal of General Internal Medicine</i> 2014 - The addition of a highly Partnered Implementation Facilitation strategy to national level support resulted in greater Reach and Adoption of the mandated PC-MHI initiative, thereby increasing patient access to VA mental health care.
2. Use a decision tool to guide the appropriateness of PICC use prior to insertion	- Identify, adapt and deploy a decision-tool to guide clinicians in determining the appropriateness of CVC or PICC placement prior to insertion - Ensure that the decision to use a PICC is made in consultation with operators familiar with recommendations from the decision tool; - Designate a physician champion to support use of the decision tool and assist with resolving disagreements between inserter and ordering physician or managing uncertainty regarding best practice	Resources & Tools: - Decision Tools: <u>The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC)</u>. - Video – <u>How to use the MAGIC App</u> - Video- <u>The Michigan MAGIC, PICC Appropriateness & Mindful Medicine</u> - App- <u>ImprovePICC MAGIC App</u> <u>Badge Card for Peripherally Compatible Infusates</u> - Ascension Genesys Hospital <u>Infusion Therapy Standards of Practice 2016 – Overview Presentation</u>

	• Share the proposed decision tool with front-line clinicians and members of the vascular access committee to ensure buy-in and feedback of the tool • Communicate use of decision-tool to clinicians and front line staff through educational sessions (morning report, grand rounds, nursing huddles/blitzes, etc.) • Implement the decision-tool via approaches such as a nursing checklist for PICC use vs. use of other non-central venous access devices, computerized decision support within the electronic health system, etc.	○ Infusion Therapy Standards of Practice 2016 (Paid) ○ Intermountain Medical Center Algorithm for IV Access ○ Vascular Access Dashboard (PICC Excellence) • Example Inpatient PICC Order set Criteria • Tools to Assist with Determining Potential Vesicants ○ INS List of Noncytotoxic vesicant list ○ Cincinnati Children’s List of Venous Infusion Extravasation Risk ○ Intermountain Medical Center Irritants and Vesicants Guide ○ Michigan Medicine List of Medications with Irritant or Vesicant Properties References: • Chopra V, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). <i>Annals of Internal Medicine</i> 2015 ○ Criteria for the use of PICCs was developed, adopting the RAND/UCLA Appropriateness Method. After a review of 665 scenarios, 43% of PICCs were flagged as inappropriate. Applying these criteria as a guide can help decrease the likelihood of an inappropriate catheter, improve care, and inform quality improvement efforts. • Centers for Disease Control & Prevention Guidelines for Prevention of IV catheter-related infections, 2011 • SHEA Compendium for preventing catheter-related infections 2014 • Moureau N, et al. Making the MAGIC: Guiding vascular access selection for intensive care – a summary of Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). <i>ICU Management & Practice</i> 2016 ○ MAGIC provides guidance through which to assess the appropriateness of PICCs and other vascular access devices for the intensive care patient. Application of MAGIC by clinicians and providers within intensive care areas may assist hospitals in establishing reliable access, improving outcomes, achieving infection prevention goals and reducing burden of thrombosis.
3. Reduce short term PICC use (e.g., PICC < 5 days) for peripherally compatible therapies	• Use the WISE Tool to understand drivers of short-term PICC use • Assess staff knowledge and competency in placing peripheral IV catheters. Lack of skills in placing peripheral IV devices is a key driver of PICC use. • Consider developing a method to identify patients who may have difficult intravenous access. • Consider supervised peripheral IV insertion to ensure staff competency in placing these devices in appropriate sites with appropriate strategies • Consider incorporating vein visualization technology (infra-red viewers) for patients with difficult or poor intravenous access. Visualization technology has been shown to improve success rates, decrease unsuccessful insertion attempts, improve satisfaction and avoid PICC placement	Resources & Tools: • HMS site reports (hard copy distributed at collaborative wide meetings and live reports available daily via the HMS data entry system) • The WISE Tool for Assessment of Short Term PICC Use ○ Tool that guides data collection/analysis regarding where the PICC was located, indication, who ordered the PICC, and events leading to PICC insertion/removal determine key drivers of short term PICC use. • Chopra V, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). <i>Annals of Internal Medicine</i> 2015 ○ Video- The Michigan MAGIC, PICC Appropriateness & Mindful Medicine ○ App- ImprovePICC MAGIC App ○ Video – How to use the MAGIC App

- Consider training staff in use of ultrasound technology to obtain access with short or long peripheral intravenous catheters in patients who have difficult venous access - Consider developing a difficult IV Access team to manage patients who are either known to have difficulties with obtaining venous access or where attempts to place peripheral intravenous devices have failed after 2 or more attempts by experienced providers. - Invest in alternatives to PICCs (especially if venous access <14 days is anticipated) including devices such as ultrasound guided peripheral intravenous catheters (USGPIV) and midlines. - Understand and analyze peripheral IV failure rates and identify opportunities to reduce failure rates, maximize dwell times and reduce complications - Consider creating specialized IV teams for difficult IV access to help gain access in patients with poor peripheral veins - Assess rates of accidental catheter dislodgement. If accidental catheter dislodgement is identified as a potential reason for PICC use less than 5 days, the following strategies are recommended: - Assess catheter securement practices - Careful consideration for patients with confusion or acute delirium	- Badge Card Infusion Therapy Standards of Practice 2016 (Paid) Vascular Access Dashboard (PICC Excellence) Example Inpatient PICC Order set Criteria <u>HMS Hospital Examples:</u> Hospital Example 1 Hospital Example 2 Hospital Example 3 <u>References:</u> - Assessing and Addressing Difficult Access WOCOVA Difficult Intravenous Access Pathway (DIVA)- Slides - Ehrhardt BS, et al. Making it stick: Developing and testing the difficult intravenous access (DIVA) tool. <i>American Journal of Nursing</i> 2018 - Literature reports that venipuncture skills are one of the hardest for novice nurses to master. The DIVA tool is created to help identify patients that will result in difficult IV access. 80% of nurses agree DIVA is a good indicator of IV access difficulty. - Whalen M, et al. Outcomes of an innovative evidence-based practice project: Building a difficult-access team in the Emergency Department. <i>Journal of Emergency Nursing</i> 2018 - A dedicated difficult venous access team in the emergency department reduced the amount of time between physician orders to administration of medication. A dedicated DVA technician is recommended as they are a “concrete solution to threats of patient safety, as well as ED crowding, and [have] the potential to affect both patient- and department-level care.” - Vein visualization as an important tool for patients with decreased vein visibility: - Chiao F, et al. Vein visualization: patient characteristic factors and efficacy of a new infrared vein finder technology. <i>British Journal of Anesthesia</i> 2013 - Vein finder technology increased vein visibility particularly in populations with decreased vein visibility utilizing conventional methods. - Aulagnier J, et al. Efficacy of AccuVein to facilitate peripheral intravenous placement in adults presenting to an emergency department: A randomized clinical trial. <i>Academic Emergency Medicine</i> 2014 - Randomization to the use of AccuVein technology vs conventional methods did not improve IV cannulation in ED patients. - Value of ultrasound guidance for peripheral IV placement: - Stolz A, et al. Ultrasound- guided peripheral venous access: a meta-analysis and systematic review. <i>The Journal of Vascular Access</i> 2015 - Systemic review and meta-analysis of available literature concluding that ultrasound guidance improves peripheral IV cannulation success rates.
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4. Increase use of single lumen PICCs; decrease use of multi-lumen PICCs	• Create or share educational materials regarding the importance of lumens and risk of complications associated with central venous catheters, including PICCs. • Consider implementing a strategy that defaults to use of single lumen PICCs unless an approved indication/rationale for placing a multi-lumen PICC exists • If/when a double lumen or greater PICC is requested, ask clinical providers for justification regarding why a multi-lumen PICC is necessary • Develop a list of criteria for when a multi-lumen PICC might be necessary. One such criteria is the Michigan “Less Lumens / Less Risk” criteria (link) • Inserters placing PICCs should review justification for multi-lumen PICCs and make the final decision regarding the appropriate number of lumens in conjunction with ordering providers • Include pharmacists for discussions regarding medication incompatibility to understand whether strategies such as spacing out medication administration or diluting medications to ensure safe peripheral infusion can be considered	<u>Resources & Tools:</u> • HMS site reports (hard copy distributed at collaborative wide meetings and live reports available daily via the HMS data entry system) • <u>Sample hospital guide for the use of single vs. multi-lumen PICCs</u> • <u>Estimate cost and complication savings from greater use of single lumen PICCs</u> • <u>The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC)</u> ○ Video- <u>The Michigan MAGIC, PICC Appropriateness & Mindful Medicine</u> ○ App- <u>ImprovePICC MAGIC App</u> ○ <u>Badge Card</u> for Peripherally Compatible Infusates – Ascension Genesys Hospital • <u>Hospital Example of educational screen saver</u> • <u>Example Inpatient PICC Order set Criteria</u> <u>HMS Hospital Examples:</u> • <u>Hospital Example 1</u>

	If a PICC is required for continued treatment in the outpatient setting, consider down-grading to single lumen device to reduce risk of complications	Hospital Example 2 Hospital Example 3 Hospital Example 4 Hospital Example 5 References: - Ratz D, et al. Limiting the Number of PICC Lumens to Improve Outcomes and Reduce Cost: A Simulation Study. <i>Infection Control & Hospital Epidemiology</i> 2016 - Every 5% increase in single-lumen PICC use would prevent 0.5 PICC-related central line-associated bloodstream infections and 0.5 PICC-related deep vein thrombosis events, while saving \$23,500. - Swaminathan L, et al. Improving PICC use and outcomes in hospitalized patients: An interrupted time series study using MAGIC criteria. <i>BMJ Quality & Safety</i> 2018 - A multi-modal intervention based on MAGIC resulted in a modest decrease in inappropriate PICC use. - Bozaan D, et al. Less lumens-less risk: A pilot intervention to increase the use of single-lumen peripherally inserted central catheters. <i>Journal of Hospital Medicine</i> 2019 - An intervention involving setting PICC default orders to single-lumen devices, establishing criteria of when multi-lumen PICCs are appropriate, and provider, nursing, and pharmacy education resulted in significant decrease in inappropriate PICC use as well as an overall increase in single lumen PICC use - Lam PW, et al. Impact of defaulting to single-lumen peripherally inserted central catheters on patient outcomes: An interrupted time series study. <i>Clinical Infectious Diseases</i> 2018 - Defaulting non-ICU PICC orders to single-lumen devices resulted in a sustained decrease in PICC-associated complications. - Chopra V, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). <i>Annals of Internal Medicine</i> 2015 - Criteria for the use of PICCs was developed, adopting the RAND/UCLA Appropriateness Method. After a review of 665 scenarios, 43% of PICCs were flagged as inappropriate. Applying these criteria as a guide can help decrease the likelihood of an inappropriate catheter, improve care, and inform quality improvement efforts.
5. Avoid PICC Placement in Patients with eGFR < 45 ml/min (CKD Stage IIIb)	- Use of PICCs in patients with advanced kidney disease (per the National Kidney Foundation, those with an estimated GFR (eGFR) < 45 ml/min) is contraindicated as these patients are likely to progress to hemodialysis. PICC placement in such patients is the strongest risk factor for subsequent fistula failure and is contraindicated if renal replacement therapy is likely. - When PICC placement in patients with eGFR < 45 is requested, empower PICC inserters to ask for approval from nephrology and explore alternative devices prior to placing the PICC	Resources & Tools: - HMS site reports (hard copy distributed at collaborative wide meetings and live reports available daily via the HMS data entry system) Clinician Education Pamphlet – Vein Preservation Save the Vein: A Handout and Guide for Nurses Algorithm for Managing CVAD in Patients with Chronic Kidney Disease Renal Network Toolkit Example Inpatient PICC Order set Criteria

	• Patients with eGFR < 45 are candidates for small bore central catheters (SBCCs) rather than PICC if long-term venous access is necessary. SBCCs do not lead to stenosis of arm veins • Develop strategies to place SBCCs in consultation with interventional radiology or other operators that oversee PICC placement • Consider changes to the electronic health system that flag patients with reduced eGFR to indicate a contra-indication to PICC use	HMS Hospital Examples: • <u>Hospital Example 1</u> References: • National Recommendations: ○ <u>National Kidney Foundation</u> ○ <u>ESRD National Coordinating Center</u> ○ <u>Fistula First- Vein Preservation and Hemodialysis Fistula Protection</u> ○ <u>Choosing Wisely- American Society of Nephrology</u> ○ <u>American Society of Diagnostic and Interventional Nephrology</u> ○ <u>The Renal Network- Guidelines for PICC Avoidance in Chronic Kidney Disease, End-Stage Kidney Disease and Renal Transplant Patients</u> • Shingarev R, et al. <u>Peripherally Inserted Central Catheters and Other Intravascular Devices: How Safe Are PICCs for Hemodialysis patients? American Journal of Kidney Disease 2012</u> ○ Given the deleterious effects of PICC lines on the veins that are used to create an AVF, it is likely that PICC placement affects the subsequent ability to create successful AVFs in patients with CKD. • McLennan G, <u>Vein Preservation: An Algorithmic Approach to Vascular Access Placement in Patients with Compromised Renal Function. Journal of the Association for Vascular Access 2007</u> ○ The decision to place PICCs in patients with Chronic Kidney Disease requires physician oversight and involvement. An algorithm is presented for access assessment with particular attention to patients with CKD Stages 4 and 5. Development and implementation of such an algorithm is recommended. • McGill RL, et al. <u>Inpatient Venous Access Practices: PICC Culture and the kidney patient. The Journal of Vascular Access 2015</u> ○ PICC placement and invasion of the non-dominant arm are both frequent in patients with abnormal kidney function, in spite of guidelines discouraging their use • Hoggard J. <u>Guidelines for Venous Access in Patients with Chronic Kidney Disease. Seminars in Dialysis 2008</u> ○ Identifying CKD patients at risk and adoption of a vein preservation care path will enhance our ability to achieve a higher percentage of native AVFs. • Drew DA, Weiner DE. <u>PICCs in CKD: PICC'ing the best access for CKD patients. American Journal of Kidney Disease 2016</u> ○ This commentary highlights the important role nephrologists should play in making decisions regarding PICC use in patients with CKD. The comment emphasizes protocols, use of electronic tools and patient engagement to avoid PICC use when their kidney function declines. • McLennan LA. <u>Guidelines and recommendations for PICC avoidance in patients with CKD. Journal of the Association for Vascular Access 2007</u>
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		○ This guideline provides brief recommendations that emphasize the role and ways in which vascular access teams and nephrologists can work together to reduce PICC placement in patients with CKD. • Paje D. <u>Use of Peripherally Inserted Central Catheters in Patients with Advanced Chronic Kidney Disease: A Prospective Cohort Study</u>. <i>Annals of Internal Medicine</i> 2019 ○ In hospitalized patients who received PICCs, placement in those with CKD was common and not concordant with clinical guidelines. 1 in 4 patients who get a PICC have CKD. <i>Note: Publication is based on data provided by the Michigan Hospital Medicine Safety (HMS) Consortium</i> • Kalloo S. <u>Nephrologists Versus Peripherally Inserted Central Catheters: Are the PICCs Winning?</u> <i>Clinical Journal of American Society of Nephrology</i> 2016 ○ Nephrologists must accept the responsibility for protecting patients’ venous real estate both before and after hemodialysis initiation
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