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Developing Pediatric Appropriateness Criteria for Intravenous Catheters

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Consider this scenario: an 8-month old infant with osteomyelitis needs intravenous (IV) access for 3-weeks of antibiotics – what device will best ensure successful therapy and low risk of complications? Or this: a teenager with cystic fibrosis is hospitalized for the third time this year with an acute exacerbation. Despite multiple efforts by experienced clinicians, an IV catheter cannot be successfully placed in a peripheral vein. Frustrated, the nurse says, “Let’s just put in a PICC”. Is this the best choice for the patient?

These scenarios – and many more like them – occur for hundreds of pediatric patients in hospitals every day. Yet, the approach to these decisions is far from consistent.¹ Ask a provider why they choose a specific device or consult a certain specialist for an IV access procedure, and you may hear “that’s how I have always done it,” or “this is how I was trained.” In part, these monocentric styles have evolved as a result of evidence gaps in pediatric vascular access. Compared to adult populations, the evidence-base for risk, benefits and alternatives of IV access devices in pediatrics is limited and largely informed by single-center, observational studies. This evidence gap has important implications. For example, when managing acutely ill pediatric patients or those with complex chronic conditions, decisions around which device to use, which vessel to insert it into, and how to insert them, varies widely across centers.^{2,3} Choices are also often made with a limited time horizon – what will get them through this admission, rather than what is the best long-term strategy for a child. The painful truth is that we rely more on device availability than device appropriateness. And on the culture of our practice, rather than evidence, when selecting an IV device for pediatric patients.

A lackadaisical approach to choosing IV catheters has consequences. Many children with chronic conditions transition into the adult world with permanent vessel damage, limiting treatment options.⁴ Reports of significant infections, extravasation injuries and procedural harm by IV devices are common.⁵ Growing concerns about inappropriate use of IV devices (especially PICCs) also abound in the literature.^{2,6} Thus, for many reasons, the need for a tool to inform decision-making related to IV devices had reached a deafening crescendo. And that tool – miniMAGIC – is what we present here.

miniMAGIC was not born out of a whim. Its adult forerunner - the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC)⁷ – was created in 2015 and has served to address the gaps in decision-making for IV access in hospitalized adult patients. The impact of MAGIC has been substantial: hospitals all over the US, professional societies, guidelines and

health systems in many parts of the world have adopted MAGIC as policy.⁸⁻¹⁰ The medical device industry has been affected, leading to innovations and emphasis on less invasive alternatives.¹¹ And early evidence from clinical studies suggests that MAGIC not only improves IV device selection, but also leads to a reduction in morbid and costly complications.^{12, 13} The desire to replicate this success for pediatrics was too strong to resist.

To create miniMAGIC, we began with a systematic review of the literature to understand what is currently known about vascular access devices in pediatrics. Armed with this evidence, scenarios for use of various devices were created with the input of experts so as to delineate the most common and most challenging decisions in pediatric vascular access. We established an outstanding team of panelists – leaders in the field that represented virtually every discipline related to insertion, management and use of IV devices – to help define what makes sense, what doesn't and where the gaps lie. With support from the Association of Vascular Access Foundation, we spent countless hours refining and distilling the key recommendations and wisdom of our experts into tangible, concrete and measurable appropriateness criteria. The task was challenging, but the labor was one of love.

What happens next, however, lies not in the hands of those that created miniMAGIC – but those that will use it in their clinical decisions. With this document, we place the combined science, expertise of the panel and evidence - into your hands. Like MAGIC, we know what we have established here represents the first iteration of a living document. Important gaps remain and areas of uncertainty within miniMAGIC need clarity. These are not shortcomings, but rather key opportunities for clinicians, researchers, funders and policy makers to improve decisions for children all over the world. Whether it's during an acute, complex, or chronic health condition – we hope no child will ever need to receive an IV without miniMAGIC in some way informing that choice.

That is a future we will look forward to. For our children, and theirs.

References

1. Gibson C, Connolly BL, Moineddin R, Mahant S, Filipescu D, Amaral JG. Peripherally inserted central catheters: use at a tertiary care pediatric center. *Journal of vascular and interventional radiology : JVIR* 2013; 24: 1323-1331.
2. Miller JW, Vu DN, Chai PJ, Kreutzer JH, John JB, Vener DF, Jacobs JP. Upper body central venous catheters in pediatric cardiac surgery. *Paediatric anaesthesia* 2013; 23: 980-988.
3. Borretta L, MacDonald T, Digout C, Smith N, Fernandez CV, Kulkarni K. Peripherally Inserted Central Catheters in Pediatric Oncology Patients: A 15-Year Population-based Review From Maritimes, Canada. *Journal of pediatric hematology/oncology* 2018; 40: e55-e60.
4. Sieverding L, Busch A, Gesche J, Blumenstock G, Sturm E, Tsiflikas I, Piersma F, Hauser A, Wiegand G, Hartleif S, Hofbeck M, Fuchs J, Warmann SW. Hybrid interventions for catheter placement in pediatric intestinal rehabilitation patients with end-stage venous access. *J Pediatr Surg* 2018; 53: 553-557.
5. Ullman AJ, Marsh N, Mihala G, Cooke M, Rickard CM. Complications of central venous access devices: a systematic review. *Pediatrics* 2015; 136: e1331-1344.
6. Noailly Charny PA, Bleyzac N, Ohannessian R, Aubert E, Bertrand Y, Renard C. Increased Risk of Thrombosis Associated with Peripherally Inserted Central Catheters Compared with Conventional Central Venous Catheters in Children with Leukemia. *The Journal of pediatrics* 2018; 198: 46-52.
7. Chopra V, Flanders SA, Saint S, Woller SC, O'Grady NP, Safdar N, Trerotola SO, Saran R, Moureau N, Wiseman S, Pittiruti M, Akl EA, Lee AY, Courey A, Swaminathan L, LeDonne J, Becker C, Krein SL, Bernstein SJ. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multispecialty Panel Using the RAND/UCLA Appropriateness Method. *Ann Intern Med* 2015; 163: S1-S40.
8. O'Grady NP. Demystifying Vascular Access in Hospitalized Patients. MAGIC Makes a Difference. *Ann Am Thorac Soc* 2015; 12: 1434-1435.
9. Woller SC, Stevens SM, Evans RS. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) initiative: A summary and review of peripherally inserted central catheter and venous catheter appropriate use. *Journal of hospital medicine* 2016; 11: 306-310.
10. Amado P, Cocuzzi I, Butler G, Cienfuegos H, Del Rosario L, Estrella J, Hall S, Huynh T, Natividad E, Pai A, Perez C, Raad I, Salvacion R. Vascular Access Device (VAD) Selection and Procedures. The University of Texas MD Anderson Cancer Center; 2019.
11. Kamran Zamanian, Collins S. New Appropriate Use Guidelines & Their Impact On The U.S. Vascular Access Device Market. Med Device Online; 2016.
12. Swaminathan L, Flanders S, Rogers M, Calleja Y, Snyder A, Thyagarajan R, Bercea P, Chopra V. Improving PICC use and outcomes in hospitalised patients: an interrupted time series study using MAGIC criteria. *BMJ Qual Saf* 2018; 27: 271-278.
13. DeVries M, Lee J, Hoffman L. Infection free midline catheter implementation at a community hospital (2 years). *American journal of infection control* 2019; 47: 1118-1121.