

# Screening for Pediatric Malnutrition with the Mid-Upper Arm Circumference Measurement Tool

## Featuring:

Susan Abdel-Rahman, PharmD

## TRANSCRIPT

**Maura Bowen:** I'd like to read something to you quickly. It's a passage from the 2020 Global Nutrition Report, which if you don't know, is the world's leading independent assessment of the state of global nutrition. We at Abbott Nutrition Health Institute eagerly review this report every year because it consolidates the best available data on malnutrition. It also offers a kind of up-to-date analysis and insights we can use in our educational resources.

Anyway, here's the quote:

"Latest data revealed some progress towards select 2025 global nutrition targets, including maternal, infant and young child nutrition. Childhood stunting has dropped globally from 165.8 million in 2012 to 149 million in 2018, representing a 10% relative decrease."

That's great news, right? But here's another quote:

"Overall, progress toward global nutrition targets is far too slow or non-existent. Malnutrition is persisting at unacceptably high levels with marked differences between countries, within countries and by population characteristics." So the message is obvious, no matter where we are, malnutrition persists. It's undeniable and it's on us to keep turning a keen eye toward the state of nutrition for everyone. That's certainly clear, but especially for our youngest populations.

I'm Maura Bowen podcasting for Abbott Nutrition Health Institute and I am excited to introduce Dr. Susan Rahman, director of healthcare innovation for Children's Mercy Research Institute in Kansas City, Missouri here in the United States. Dr. Rahman is the brain behind the MUAC z-score tape that has changed how pediatric malnutrition is evaluated at Children's Mercy and around the world. Talk about thought leadership and making a difference. Dr. Rahman, thank you for being here.

**Dr Rahman:** It's my pleasure, Maura. Thank you for having me.

**Maura Bowen:** First, Dr. Rahman, would you mind telling us a little bit about yourself and your background and how you came to focus your career on nutrition??

**Dr Abdel-Rahman:** I'm actually a pediatric clinical pharmacologist and I was running up against the problem of how to optimize medication dosing in resource-restricted settings, where we're not able to obtain the weight of children. Our listeners are likely aware that nearly all therapeutic interventions in children--be it medicine doses, intravenous-fluid volumes, breathing-tube sizes and shock voltages used during CPR, are based on the weight of a child. So that was really how it started and the application to nutritional status evolved as a direct extension of that work. Personally, the issue of childhood hunger has also played a big role in my volunteer work. So it's a nice marriage of interests.

**Maura Bowen:** Great. Thank you for that. Let's start at the beginning. What is mid-upper arm circumference or MUAC, and why should we measure it in children?

**Dr Abdel-Rahman:** Mid-upper arm circumference is one of those helpful medical terms that doesn't really leave much room for confusion. It's the measurement of the distance around the middle of the upper arm. The exact location is found halfway between the acromion and the olecranon, and it really does give us a really good understanding of nutritional status and body habitus. It's a very marker of kind of lean muscle mass.

**Maura Bowen:** How is this measurement different from tracking things like height, weight and BMI?

**Dr Abdel-Rahman:** MUAC can be tracked in the exact same way as height and weight and BMI, and it tells us a very similar story. The primary difference is that MUAC represents a single measurement, it doesn't involve expensive equipment, and it can be performed with the child standing, sitting, lying down, cradled by a parent, really in almost any context.

**Maura Bowen:** And I think MUAC is a validated measurement to assess malnutrition, right? Who can use it?

**Dr Abdel-Rahman:** Maura, many people I chat with are not aware that MUAC has been in use since the 1950s. In that time, we've learned a lot about its correlation with other anthropometric indicators. We've learned about its superiority in settings of protein-calorie malnutrition, where children are affected by edema or ascites, and we know that it's able to predict morbidity and mortality associated with malnutrition in some cases better than height or weight-based indicators. And with respect to who can use it, research published by us and others confirmed that it can be used as effectively by parents and community health workers as it can be by healthcare professionals.

**Maura Bowen:** And so you, in collaboration with two local organizations, developed the MUAC score tape to help healthcare professionals measure mid-upper arm circumference, and then you work with us here at ANHI to help produce and distribute the tool. So I'm hoping we can spend some time talking about that, but first let's pause for a moment and level set. What are z-scores?

**Dr Abdel-Rahman:** Maura, that is a really good question and it's an important question. A z-score is a number that tells me how far away the measurement I'm making is from the average individual of the same age and gender, and there are several distinctions between z-score and percentiles, which we're used to using in pediatrics. But in my mind, the most important distinction is that the values are really not bounded at the extremes. Because z-scores can move without limit in both the positive and the negative direction, you can more easily evaluate measurements and the changes in these measurements for children who are otherwise off the standard growth curve.

**Maura Bowen:** Oh, that makes sense. So with that in mind, how did you come to lead this tool's development and what was that process like?

**Dr Abdel-Rahman:** Yeah, I mentioned earlier that it started with the challenge of getting an accurate weight in children. To accomplish that, I had developed a validated tool for estimating weight that's since been cleared by the US Food and Drug Administration. That tool also uses several measurements of the upper arm. And then when AND and ASPEN published their consensus statement that included MUAC z-scores among the indices for malnutrition, the dietitians at my organization asked if the existing weight estimation tool would satisfy their purposes and their needs for MUAC z-score estimation. And it didn't, but the process of validating that tool had me collecting large amounts of data that could be easily used to develop a tool that would meet their needs. So I set about developing the tool that we now are referring to as the MUAC z-score tape.

**Maura Bowen:** And how has the MUAC z-score tape helped to change the way pediatric malnutrition is evaluated at Children's Mercy?

**Dr Abdel-Rahman:** You know, I would say that the biggest changes we've seen are probably related to decentralization and education. So the first is that our dietitians can use these tapes anywhere in any inpatient or outpatient setting whether or not they have height and weight of a child. So it's very easy to carry and take along and use no matter where they are. They've also found that it's much easier to have a conversation with a parent or caregiver when the parent can see the child is in the red zone, rather than simply indicating the percentile where the child is. I think the colors generally mean more to the families.

**Maura Bowen:** What is the benefit of having z-scores on the MUAC tape?

**Dr Abdel-Rahman:** Yeah, that's also a good question. I mean, the z-scores are essential. We know that a fixed threshold, so just a single number that we see used in other contexts really has significant limitations for any measurement in children, whether it's MUAC or height or weight or BMI. You really want a frame of reference. You need to be able to understand how that child compares to other children that look the same as that child. Same age, same gender, that type of thing. So z-scores are really critical to our understanding of these very important measurements and children.

**Maura Bowen:** And from what I understand, there are a few different sets of z-scores. I know the Center for Disease Control has one set and the World Health Organization has another. So which z-scores are on your tape and why?

**Dr Abdel-Rahman:** Yeah. Our tape can actually be modified for any sets of z-scores, any combinations of age, gender, or reference population. However, the current tape that we're using has CDC as a reference and understanding the distinction is kind of important. The WHO data represent a growth standard. So in essence, how a child should grow based on breastfed children raised in optimal conditions. The CDC data represent a growth reference, which is a snapshot of how children actually do grow as measured in a broad cross section of children.

The WHO data are also limited to children under the age of five years. And for us, it was very important to have a [ ] reference that could track a child from infancy through adolescence. As our providers were also getting comfortable with the measurement of MUAC, they expressed an interest and understanding how the measure compared to the broader population, rather than an ideal population, which is why the first version of the Abbott and ANHI tape is a printed reference as based on the CDC data.

**Maura Bowen:** So I know UNICEF has its own tape. What's the difference between the Mercy Children's z-score tape and the UNICEF tape?

**Dr Abdel-Rahman:** Yeah, absolutely. So there are a couple of distinctions. The UNICEF tape is only valid for children six months through five years of age, but the bigger distinction is that it uses single cutoff for moderate and severe malnutrition, irrespective of whether the child is six months of age or five years of age. It introduces bias and frankly misses the vast majority of children with malnutrition.

**Maura Bowen:** And of course, the Mercy MUAC z-score tape is validated, right?

**Dr Abdel-Rahman:** It is. We validated it in over 10,000 children in North America, Central America and Asia. However, I will say that the MUAC z-score ranges recommended by AND and ASPEN are just that, recommended ranges based on the thresholds that are also used for BMI. We're seeing in our work and it's likely that as others collect more data, we're going to learn that the thresholds may need to look a bit different for MUAC. In actuality, even the BMI thresholds may need to be re-examined, but we can save that for another podcast.

**Maura Bowen:** So now I have two similar questions for you and the first is, can the Children's Mercy MUAC z-score tape be used to screen patients for malnutrition?

**Dr Abdel-Rahman:** Screening really is the primary role for this device. It's a quick and easy to implement, and can be used to identify children that would benefit from a more thorough evaluation.

**Maura Bowen:** And secondly, can we use the Children's Mercy MUAC z-score tape to assess malnutrition status?

**Dr Abdel-Rahman:** Yeah, you can. I mean, as a screening tool, it stratifies children at risk for mild, moderate, or severe malnutrition, and it can also be used to identify overweight and obese. But again, the goal is to get them referred to somebody that can do a more extensive workup.

**Maura Bowen:** And, where can healthcare professionals order MUAC z-score tapes?

**Dr Abdel-Rahman:** If I'm not mistaken, they can order it directly on the Abbott website or they can speak with their Abbott representative.

**Maura Bowen:**

Fabulous. Well, Dr. Rahman, I am so glad you joined us today. Thank you so much for being here. It really goes without saying, you are welcome on the ANHI Power of Nutrition podcast anytime.

**Dr Abdel-Rahman:** Be careful, Maura, I just may take you up on that. Thank you very much for having me.

**Maura Bowen:**

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