Technology & Innovation in Pediatric ICUs: A Connected Look at Oceania

SPEAKERS

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Emma Haisz

Hello and welcome to the Oceania region podcast for WFPICCS PICU Awareness Week. My name is Emma Haisz, and I am a Clinical Nurse Consultant in a PICU in Brisbane, Australia. The theme for this year's PICU Awareness Week is technology and innovation in pediatric intensive care. Today, I am pleased to introduce our two guests, Dr Trevor Duke, a pediatric intensive care specialist at Melbourne Royal Children's Hospital, Professor of Pediatrics at the University of Melbourne, Department of Pediatrics, and Professor of Child Health at the School of Medicine, University of Papua New Guinea. Dr Monica Brooks is a pediatric intensivist in the PICU at Auckland, New Zealand Starship Children's Hospital. She's an Indigenous Fijian who completed her initial medical school training in Fiji. Welcome to today's podcast. For those listeners who are not familiar with the region of Oceania, it is a region in the Pacific Ocean that contains 1000s of islands. There are 14 countries, the two largest being Australia and New Zealand, who are well known for their high-quality, innovative pediatric intensive care units and research collaborations. Many of the rest are still developing and face challenges related to limited resources, population isolation, and vulnerability to natural disasters and climate change. We've chosen to focus today's podcast on a couple of the smaller nations in Oceania to enable discussion on how technology and innovation have been used to develop and improve pediatric critical care for their populations. Monica, as the first pediatric intensivist to complete their training outside of New Zealand and Australia in our region, we would love to hear a bit about that experience and also some of the challenges and innovative progress that you've been part of across your career.

Monica Brooks

Thank you, Emma, thank you for the invitation to this podcast, and thank you for the lovely introduction, both for myself and Trevor, and also Oceania. Yes, I am the first Indigenous Fijian-trained intensivist, trained through the College of Intensive Care and Medicine of Australia. I graduated, got my fellowship last year, and I've just started my intensivist job here at Starship Children's Hospital in Auckland. I did most of my medical training and my pediatric training in Fiji at the Fiji School of Medicine. Indeed, most of my pediatric initial experience on training in the Colonial War Memorial Hospital, which is based in Suva, the capital of Fiji. I also worked in Lautoka Hospital, which also has a smaller PICU that were shared with the adult ICU team at the time. The experiences working in Fiji at the time was we had a lot of kids that were dying from diseases, that in Australia, New Zealand, they wouldn't have. Things like asthma. We saw a lot of sepsis, and a lot of the deaths were also because of late presentations and the geographic locations as well. It's not always accessible to get to see kids the hospital, either by road or even by boat. At times, the experience I had in Fiji was amazing and fantastic. There are a lot of skills that I learned that carried me through into my training in Melbourne. I did most of my pediatric ICU training in Melbourne, which was amazing, and it was definitely such different contrast between training and working in Fiji versus coming across and working in an institution like the Royal Children's Hospital in Melbourne, where there were resources were so plentiful and such a massive difference in comparison to what we were Using in Fiji. As an example, I'll talk about retrieval service in Fiji when I was there as a pediatrician. So, the ICU is looked after by pediatricians. Now, we all train as general pediatricians, but we have to look after NICU PICU retrievals and the emergency department, but also along with the wards in clinic. When we would do retrievals to outer islands or even to remote areas within the mainland, it meant us going with the nurse. And we had a little toolbox that had, you know, the basics. It had the laryngoscope; you were allowed one blade, whichever one you could find that was in the drawers or in the airway trolleys. So you'd end up with a Mac two grade or a Miller one. But you would take what you had. We would take ET tubes that we thought would be enough for the child, and you would be sure that with that one ET tube, you got it in the right spot, because you didn't have many options, and we also didn't have enough endotracheal tubes in the hospital that you could take. You know, no more than three ET tubes at a time in our little toolbox. We had adrenaline, atropine, suxamethonium, and morphine. And we would have a cannula, 24-gauge or 22-gauge cannula, and an Intraosseous

middle. We had a SATs probe, that was all we could take for monitoring. We didn't have ECGs or a portable ECG monitor to take with us. We also didn't have an intraosseous tube. Nor did we have a ventilator, a transport ventilator, so you had to hand back babies, either on choppers or on planes, or by road, if we're in the truck. So it made for very interesting medicine. I have no regrets about training and working in Fiji. It built a lot of resilience in people. You had to make do with what limited resources you had. And the greatest, I think, the greatest gift, we thought that was that at the end, if you know, were successful, and you could then discharge the child home, that was amazing. And that was well worth the effort. And despite the limitation of resources, we could still sort of save a life or make a difference. And I also then realized that there was benefit in gaining more training or further training in intensive care medicine, specifically for pediatrics, in the hope that we could then change outcomes or do something differently. And by using the basics, I don't think that we need lots of fancy equipment or resources. I think if we focus on what we've got and the basics, we can change outcomes if we learn to use it better or learn to use it in a different way.

Emma Haisz

Thank you for sharing that. That was very interesting to hear your journey and be reminded of how well-resourced and lucky some nations in our region are in comparison. Can you think of any examples of maybe some of that resourceful innovation that has come in over the last few years in pediatric critical care in Fiji?

Monica Brooks

Yes, I think in terms of resources, the one resource that we have, which I think speaks true for most of the South Pacific islands, is that we have human resources. And our workforce is what we can actually work on and develop, and they will then contribute to change or changing outcomes for pediatric populations. The South Pacific region is limited by finances. Health budgets aren’t exactly a priority. There's lots of other priorities in the community that take precedence over a health budget, unfortunately. And also we're limited by resources and equipment, which is not something that we can change quickly. And that's been an ongoing sort of challenge over many years. And so that's a bit more difficult for us to try and change in a hurry. We are grateful in the sense that we get a lot of support for our workforce. And that

comes in terms of mentoring telecommunications with our overseas counterparts in different areas. So there are a few in the Zoom platform, and the Teams platform has really contributed a lot to sort of ensuring that there's ongoing knowledge sharing with the Pacific. Also at the same time, those of us that work away from the Pacific or work in Australia, New Zealand or other European countries, can also learn from the Pacific as to what disease processes they had and what pathologies they have, in terms of infective diseases, and what strategies they have in place. Do we take some of that with us, or do we learn how to change how we're managing some of the infective pathologies in our community, now, in our societies? So, the equipment we have includes ventilators. You know, we don't have ECMO, which is okay. It's not a necessity, and it's not something that the budgets can afford. But we have airway tools and circulatory devices, or drugs, that will allow us to at least provide the best care that we can for our children. We've seen other best knowledge that we have is the best that we have. So I think that telecommunications and the Zoom platforms, that's really improved that and changed the knowledge for our Pacific communities. But it's also we've gained from that as well out here in Australia, New Zealand. I would think that that's really what you would work on is a workforce. I think the other aspects, in terms of equipment and resources, are a lot more difficult than a bigger, sort of a bigger issue you could deal with. I think forging networks within our own South Pacific region. Like, we forge just a critical care group for the South Pacific to see what each country has in terms of resources, and share our knowledge, and share how we're using those resources. That's probably a great way to start with. Then we just have our colleagues. We have people who have our experiences. We work in the same settings. And then you have the all, how many, average knowledge. You know, Trevor was a great mentor for me, and even a great resource person when I was still training in Fuji. I remember, I'll share a short story where I had a baby that I intubated for aspiration syndrome. He may not remember this, but there was a newborn that was quite unwell, and I'd run out of ventilators. And so I was thinking, what else can I do? I've got a tube in the endotracheal. What else can I do? And we had a bubble CPAP set up. So then I thought, “Oh, well, let's just put this baby, let him breathe, put him on bubble CPAP and see how we go.” And then I called, I messaged Trevor, like afterwards, going, this is what I've done. Is that an okay thing to do? Because I've never done it before, but we've run out of options. You don't have a ventilator. And Trevor's advice was, yes, you've done it, see how it goes. And that kid actually survived. And we extubated onto

CPAP, and survived to discharge. But those were useful networks and extremely valuable information and knowledge that I could then tap into very quickly—with emailing someone in Australia, and this is what we've done. Is that okay or not? So I think having the right people in the right places is extremely helpful.

Emma Haisz

Thank you for sharing that I loved, that you demonstrated how the two-way communication is learning in both directions, not just the more developed nations helping the developing ICUs, but that learning goes the other way as well. And you have linked into Trevor and how he was supportive for you in that story, and I hoped maybe now Trevor could share with us a bit about pediatric critical care, the state of pediatric critical care, or the development of that service currently in PNG.

Trevor Duke

Thanks, Emma. To me, Monica's story is an incredible one, really, of it's really great to hear. It's a story of personal achievement, but it's also a story of advancement of pediatric intensive care and pediatrics in general in Pacific countries. And Monica has an ongoing commitment to training in Fiji. I think that those networks of the Diaspora helping back, and people considering it an Oceania community of practice, if you like is very important. But, the region is very diverse, as you said, Emma, and it's huge in size, and it's relatively modest in population, in terms of other regions in the world. And there are many countries of those 14 that you mentioned that haven't had that history of development of pediatric intensive care like Fiji has had, and, of course, Australia and New Zealand. That actually goes for most of the other small island states. Now, you said we're going to focus on two small countries, but actually, PNG is not a small country. There's actually 11.6 million people, at least, even a conservative estimate. So it's actually, if I'm not mistaken, Monica, it's larger than New Zealand. It's certainly a huge country, both in size and like Fiji, very geographically dispersed, but just in different ways—in some similar and rather different ways. It's also one of the least resourced countries in the region. And I say that in some ways, it's well-resourced because it has a lot of mineral wealth, and it has an incredible natural environment, just like Fiji, and it has human resources. Nonetheless, the economy is not as strong and health service funding has not been strong.

That, plus many other things, culminates in in child mortality rates being about, at the moment, about 42 per 1000 live births. Now, you contrast that to Fiji, where it's about, if I'm not mistaken, Monica, about 28 per 1000 live births. There's some estimates, are maybe 26 but it's probably 28 per 1000 live births for under five. And then contrast that to Australia and New Zealand, where under five mortality rates are four per 1000 live births. So you've got a tenfold difference between Australia and Papua New Guinea. That's not to say that PNG hasn't made progress. In 1990, the undefined mortality rate was around 90 to 100 per 1000, so there has been a substantial reduction in child mortality in that time. I give that as a background because until recently in Papua New Guinea, it didn't seem appropriate to introduce anything that looked like pediatric intensive care services, but, actually, the fall in child mortality has been very substantial, as I say, in that last couple of decades. And still the best things one could do for children in that country were still immunization and nutrition and education in improving the quality and access to basic health services. We have 22 provincial hospitals around the country and a major tertiary hospital, and many children present to those hospitals and smaller district hospitals have critical illness, and they need a higher level of care than has traditionally been able to be provided. We we have a draft strategy for PICU in Papua New Guinea, and it’s very basic. It links to the overall national child health strategy and what's been done in the last 20 years of trying to improve basic quality of care. And the aim has been to start with access to good quality pediatric care throughout the country. That starts with training and not just training, but deployment of the right staff in every province, which, on average, are about 300 to 400,000 people. That's a very large provinces. Some provinces are up to five or 600,000 people. Every province now, bar two, have had pediatricians and and there's one or two pediatricians per about 500,000 people. And so we now have a ratio of children to pediatricians of about .5 per 100,000 and and that still equates with what exists in most of the least developed African countries, actually .5 per 100,000. So, the first step is really to have adequate human resources, both not just pediatricians, but also pediatric nurses, child health nurses who know about the delivery of good quality basic pediatric care at a province level and even at a district level, even lower down. At the moment, in Port Moresby, there is a small pediatric intensive care unit, and that's a 12-bedded ICU that's within the general pediatric ward. And at the moment, we don't do mechanical ventilation there, so children who do need mechanical ventilation actually get admitted, as they have done for a long time, for at least a

decade or so, to the adult intensive care unit. And the most common reasons for needing mechanical ventilation in children in Papua New Guinea and in many countries throughout Oceania are snake bite or Guillain Barre Syndrome, those sorts of things, where the lungs are relatively normal, but there are neuromuscular problems that are likely to resolve over time. So there's many children who require short term or even long term, mechanical ventilation for those conditions and for post-operative care and for trauma. It's not ideal to be providing mechanical ventilation for children with very severe pneumonia. It's often a distraction from providing the most basic of services. And I've seen that happen before. So the sort of program we've had in place for the last 15 years or so has been to try to improve the quality of basic acute care. That includes technology, includes getting oxygen, for example, down to certainly at a province level and and even at a district level. And there's a program for oxygen concentrator use throughout the country. Even during COVID, clearly, oxygen became a very important issue and visible deficit and and new innovations include mobile oxygen plants that can be transported in a container, that can generate oxygen as long as there's a continuous power supply. And so those plants have been sent to several of the provinces now, the seven around the country. But more importantly, there are oxygen concentrators that get even further down the health service chain, down to a district-level hospital, where, in fact, electricity supplies are unreliable, but they've been run off solar power. So there are 40 health centers throughout the country that have solar-powered oxygen supplies now, and they've been running since 2015. They're running very well, and they've been shown in large-scale field research projects to reduce the mortality rate for pneumonia and reduce the need for referral, and that sort of thing.

Emma Haisz

That is incredible innovation that for someone like me, who has worked only in Canada and Australia, would not have even thought to ask about. Thank you for sharing that solar-powered oxygen concentrators is amazing because oxygen is the first-line medication or treatment for pediatric critical care or adult critical care. Thank you for sharing that you both mentioned the human resource aspect and training of these healthcare providers. What are some of the challenges and the solutions that are being implemented in these regions to help overcome these shortages?

Trevor Duke

Maybe if I could also say that the mortality reductions we've seen in in provincial level, hospitals in Papua New Guinea over the last 15 years have not just been because of technological innovation. In fact, I think that's a very small part. It's a support for healthcare workers to have technology when they didn't have it before, but still, I think the key part has actually been in training. And the World Health Organization has a program for training healthcare workers, for nonspecialist doctors and nurses. And in PNG, we have health extension offices, their clinical officers and community health workers, and we have training for them in hospital care for children. There's a program called hospital care for children, and that's been extended to almost all provinces in PNG now. And I think that training which covers all the common illnesses, acute illnesses, of children, and how to manage emergency triage and assessment and and and management and a holistic approach to pediatric care that's been probably the it's been as necessary as any improvements in commodities or technology or other resources. And that builds on what Monica said, which is, just to you know, the richness of the human resources in all countries that need to be supported, to improve the quality of services. And that's been a very successful program, hospital care for children.

Monica Brooks

And I can just add on a bit more from the Fiji experiences or what all was mentioned. It's the populations are small, but the vastness of the area in which you have these islands, and the distance to travel, because it's not, some of them is by ship or by boat, or it's inland on horseback, or whatever it might be. But there are not enough doctors or pediatricians for us to have a pediatrician or a critically care trained person in these areas. And so we have nurse practitioners and we have nursing stations in a lot of the more remote islands and villages. And one of the training that I've found has been very beneficial for those healthcare workers is APLs training that was it was done for all nurses, nurse practitioners, medical students, in their final year of training, they would do the APLs course before they were then sent up to different villages and islands, because they would then become the only doctor in those areas. But that also meant that by the time these fresh doctors would call a pediatrician in the mainland, they had really done most of the resuscitation and just following the A pillar algorithm, which was

quite useful for them. You know, they didn't have to necessarily intubate, but they would have them on oxygen, they would have put an intraocci, and they would have started antibiotics. And then they call and say. This is where we're at we now need a retrieval team to come across. So there's programs like APLs, who Trevor has mentioned. There's a who pocketbook or blue handbook that lists so just the management of gastroenteritis and diarrhea and how to manage them with other oral rehydration salts or IV fluids. And that's used all across the hospitals, plus the smaller health centers. And then we also have other programs, like peds basic that has come in as well, and that's allowed further training of pediatricians, the anesthetists, and also the other medical doctors as well, in terms of training to look after critically ill children and how to manage them in an ICU setting. And all of those training for our healthcare workers, whether they be nurses or nurse practitioners or doctors, is fantastic because it this gives them an idea of basic resuscitation that they can do, and they can at least start before they then get more experienced hands, or they get it transferred to a bigger referral hospital.

Emma Haisz

I've also heard that some nations, or some healthcare settings in our region, used a group called taking pediatrics abroad for education purposes. They, I'm told, have online education sessions available for nursing medical and allied health practitioners.

Monica Brooks

Yeah,thank you for raising that. I might actually forgot to mention them as well. So yes, they have been doing quite regular teaching and training programs for pediatricians in the region on different specialties, not just ICU specific topics, but it's on all specialties that they have questions for, and they discuss cases as well. So that's a way of bringing Australia and New Zealand into the actual room and into the actual space, because they then discuss patients that are right in front of them, and they can get some idea of whether they need to change their managements or not. So that's been a great initiative that's been developed.

Emma Haisz

Before we conclude our session today. Is there anything else that either of you would like to share about the healthcare provision education or partnerships that you have been part of in the work that you provided in either Papua New Guinea or Fiji.

Trevor Duke

There is a need for a systems approach to thinking about good clinical care, and that includes things that we often take for granted, which, as you know, includes having some sort of early warning system or met system, or an early warning and response system. Now those types of things you know can be put in place, in in in settings where resources are more limited and still make a big difference, because the detection of the deteriorating patient, for example, is a something that's been one is not a technical, technological innovation, but it's been A very important aspect of dealing with the prevention of of deterioration, the prevention of critical illness in in in in many countries, countries all throughout the world now and and having those types of systems can support human resources, can support healthcare workers to to better prevent, deaths, I think. But there are things that we take for granted, actually, and even things like commodities for any technological advance, whether it's CPAP or whether it's even oxygen, or having a biomedical engineer available to help maintain equipment. They're things we take for granted, and those, those are things that, at an overall systems level, need to be addressed in countries that have ambitions for pediatric intensive care.

Monica Brooks

Thanks Trevor. I think, from my perspective, it's encouraging training locally, but also ensuring that there's ongoing collaboration region. There's most recently, the Fiji School of Medicine has just introduced a master's in intensive care, that they've allowed those with Masters in anesthetics to then proceed to do this as the other Masters. And that's been a great achievement for the school. And last year, they had their first four graduates that they had in the program, three of which were from Fiji. And one was from Tara, and that's great, because then they all go to the different islands, and they continue to run intensive care hospitals, and they become the leaders of intensive care medicine or training in their individual countries. There's in terms of training the encouraging local training and trying to see whether, as you know, at the national level and at the regional level, how we continue to support medical

schools locally, like the PG School of Medicine, or their programs, and ensuring that the programs are in par with the rest of the Oceania. I think that encourages more people to do those trainings and to get them more started them. And also focusing on upselling and capacity building. You know, we we do visits and we come in with our own international teams and nursing staff as well, and just trying to integrate the local teams into those teams as well, so that you're not leaving them with with all the knowledge that you brought in with just on what you need to do and then move away, but you actually encourage the local teams to learn, so that they can then look at how they then sustain the program, and more so now in this environment where I find that global funding for a lot of projects in and training, which is important for less developed countries and less resource but funding is also becoming quite a new shape and in a lot more discussions about funding. So I think the focus we really need to focus on just ensuring that we're upscaling, that we're building their capacity as well, so that if the funding doesn't come through, there's not enough, they can then just step in and take over some of those projects as their own. Because the trainings being done, we've upskill them, and we've built the programs. And then now those of us in the region can just say, Great, now we can take it up, because we actually had more security people to build those, whatever the visits might be for. And you know, Tom specifically about cardiac surgical visits, or whether it's plastics, or Traci prepares. Most recently, we've got a vascular surgeon now in Fiji who's just finished some time in Melbourne as well. He's done a two-year attachment, so he's now kind of one the vascular surgical program in Fiji. So there is growth in different parts, not just in pediatrics, but there is growth in other specialties as well.

Trevor Duke

One last thought, perhaps I believe we should reimagine what the Oceania region could be in the next two decades. It could be a region where the gap between countries in regard child mortality and other child health outcomes virtually disappears. But this will only occur with much more cooperation and overall, the links between the Pacific and Australia and New Zealand have frayed in the last 50 years, and this has been for many reasons, but now is a good time to reimagine these links in education and training and health service provision, addressing climate change together and reducing the barriers to cooperation. These barriers are complex. They're legislative, economic, structural, and historical. But if we can break down

some of these barriers and develop in the in the generation to come, the notion that we're all part of Oceania, where communities help each other and learn from each other, I think, I truly think that will enrich us all and will help close the gaps.

Emma Haisz

Thank you. I want to thank you both for making the time to speak with me today. I really enjoyed learning about more of the challenges and successes in the growth and development of pediatric intensive care outside of Australia and New Zealand, and I'm sure that our listeners will appreciate the learning that they have received today. Thank you.