

## ORIGINAL ARTICLE

# Survey of neurodevelopmental allied health teams in Australian and New Zealand neonatal nurseries: Staff profile and standardised neurobehavioural/neurological assessment

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**Aims:** The primary aim of this study was to establish how many neonatal nurseries in Australia and New Zealand had a neurodevelopmental allied health team, to ascertain the disciplines involved, their qualifications and experience. The secondary aim was to evaluate which standardised neurobehavioural/neurological assessments were currently being implemented, and the existing practice in relation to their use.

**Methods:** A descriptive cross-sectional survey, sampling 179 eligible public and private hospital neonatal intensive care units (NICUs) and special care nurseries (SCNs) throughout Australia and New Zealand, was purpose-developed and administered electronically from the 5th April to 23rd July 2013.

**Results:** A total of 117 units (65%) overall, and 26 of 26 (100%) NICUs responded to the survey. NICUs had more neurodevelopmental allied health staff than SCNs, with physiotherapists and speech pathologists the most common disciplines. Physiotherapists were more likely to administer standardised neurobehavioural/neurological assessments in NICUs, while medical staff were more likely to do so in SCNs. A wide variety of standardised neurobehavioural/neurological assessment tools were used, with Precht's General Movements Assessment the most common in the NICUs (50%) and the Hammersmith Neonatal Neurological Examination the most common in the special care units (25%). Standardised neurobehavioural assessments were not administered in 22% of SCNs.

**Conclusions:** Although neurodevelopmental allied health teams and standardised neurobehavioural/neurological assessments are valued by many, there was little consistency across Australian and New Zealand neonatal nurseries.

**Key words:** neonatal intensive care unit; occupational therapy; physiotherapy; preterm infant; speech pathology; survey.

## What is already known on this topic

- 1 An increasing number of high-risk preterm infants are being cared for in neonatal nurseries.
- 2 Neonatology is a developing area of speciality for neurodevelopmental allied health disciplines of physiotherapy, occupational therapy and speech pathology.
- 3 Standardised neurobehavioural/neurological assessments are recommended for use in neonatal nurseries.

## What this paper adds

- 1 Almost all neonatal intensive care nurseries and more than half of special care nurseries in Australia and New Zealand have neurodevelopmental allied health staff.
- 2 Physiotherapists and speech pathologists are the most likely neurodevelopmental allied health team members.
- 3 Best practice guidelines regarding standardised neurobehavioural/neurological assessments are needed.

Traditionally, focus has been on survival of high-risk infants in neonatal nurseries, however with survival rates improving, quality of survival and morbidity have increased in importance.<sup>1,2</sup> The neurodevelopmental allied health disciplines of physiotherapy, occupational therapy and speech pathology are established providers of a broad range of developmental therapy within acute and community settings.<sup>3,4</sup> Neonatology has

become an increasing area of speciality for neurodevelopmental allied health staff, and in the last three decades physiotherapists, occupational therapists and speech pathologists have had a growing presence in neonatal intensive care units (NICUs) and special care nurseries (SCNs).<sup>5,6</sup>

The composition of neurodevelopmental allied health staff within individual nurseries is often historical, influenced by which discipline initiated the service.<sup>3</sup> The role of neurodevelopmental allied health within the multidisciplinary team is to work with medical staff, nursing staff and parents in executing and assimilating developmental care into the nursery environment serving to avert long-term developmental dysfunction.<sup>3,7–9</sup> Due to their fragility, working with preterm infants in NICU/SCN is deemed an advanced specialisation for physiotherapists,

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occupational therapists and speech pathologists,<sup>10</sup> with staff requiring specific skills, knowledge and training.<sup>4</sup>

Neurodevelopmental allied health staff have a key role in the administration of standardised neurobehavioural/neurological assessments, including when and which assessment tools to use. These assessments provide valuable insight into an infant's multifaceted developmental capabilities, which can be shared with parents and staff.<sup>11,12</sup> Moreover, standardised assessment tools affect clinical decision-making, facilitate treatment options and support clinical research.<sup>11,13</sup> Many standardised neurobehavioural/neurological assessment tools have been developed for use in NICU/SCN.<sup>14,15</sup>

Although standardised neurobehavioural/neurological assessment tools are recommended,<sup>15–17</sup> it is unclear which tools are used throughout Australian and New Zealand NICUs/SCNs; their implementation policy; and whether assessments inform clinical decisions regarding infant treatment and follow-up. The other unknown is how many NICUs/SCNs have staff, either neurodevelopmental allied health, nursing or medical, who are implementing standardised neurobehavioural/neurological assessments.

The study aims were: (i) To establish how many NICUs and SCNs in Australia and New Zealand have allied health staff with a neurodevelopmental focus, and to ascertain the disciplines involved. (ii) To evaluate which standardised neurobehavioural/neurological assessments are currently used in Australian and New Zealand NICUs and SCNs during the primary hospital admission.

## Methods

### Study design

This study was a descriptive cross-sectional survey design using a purposive sampling strategy administered electronically, reported according to recommendations of Bennett *et al.*<sup>18</sup>

### Sample selection

Nurse unit managers, neonatologists, physiotherapists, occupational therapists and/or speech pathologists from Australian and New Zealand public and private hospital NICUs and SCNs (level II–IV) formed the target population. Participant recruitment entailed identifying hospitals with a neonatal nursery from numerous sources, including the local neonatal transport services, the New Zealand Nurses organisation website and the Australian and New Zealand Neonatal Network report.<sup>19</sup>

### Ethics

Approval as an audit was obtained from The Royal Women's Hospital Melbourne Human Research Ethics Committee. Informed consent was implied when completed survey forms were received.

### Survey administration

The questionnaire was piloted on a convenience sample of four independent discipline-specific representatives from the Victorian Infant Brain Studies team who had knowledge and/or experience

within neonatal nurseries. Minor changes improved clarity, reduced ambiguity and eliminated redundancies. Revised questionnaire clinical sensibility testing was undertaken 3 weeks later by the aforementioned convenience sample to ensure face and content validity, plus ease of use. A standard series of five questions modified from Burns *et al.*,<sup>20</sup> were asked.

Nurse unit managers were emailed a letter of invitation containing an electronic survey link, with the nurse manager either completing the survey or forwarding it to the eligible team member deemed most appropriate. A reminder email was sent to non-respondents after 2 weeks, with a 4-week extension. Following the second deadline, the response rate was analysed and deemed too small. A third and final email was sent to non-respondents stating response rate statistics to boost participation and increase survey power. No financial or other incentives were offered to encourage survey completion. Survey responses were entered directly into the REDCap software package by participants, from the 5th April to 23rd July 2013.

### Sample size

A sample size of 123 was required to be 95% confident that the results had a margin of error no greater than 5% (Fluid Surveys; <http://fluidsurveys.com/survey-sample-size-calculator/>).

### Statistical method

Survey data were transferred from REDCap into STATA 13 (Stata-Corp LP, College Station, TX, USA) for editing and analysis. The response rate was calculated using the  $RR_6$  formula recommended by The American Association for Public Opinion Research.<sup>21</sup>

Nonresponse bias was analysed using descriptive statistics and  $\chi^2$  test for homogeneity, by comparing two known respondent and non-respondent demographic characteristics; Region and Unit Type.<sup>22</sup>

Survey answers were analysed using descriptive statistics (including frequencies and percentages). Logistic regression analysis compared NICUs and SCNs for staffing profile and standardised neurobehavioural/neurological assessments used, and results were presented as odds ratios and 95% confidence intervals. A Mann–Whitney *U*-test compared continuous variables where data were not normally distributed. Questions with missing data were excluded from analysis.

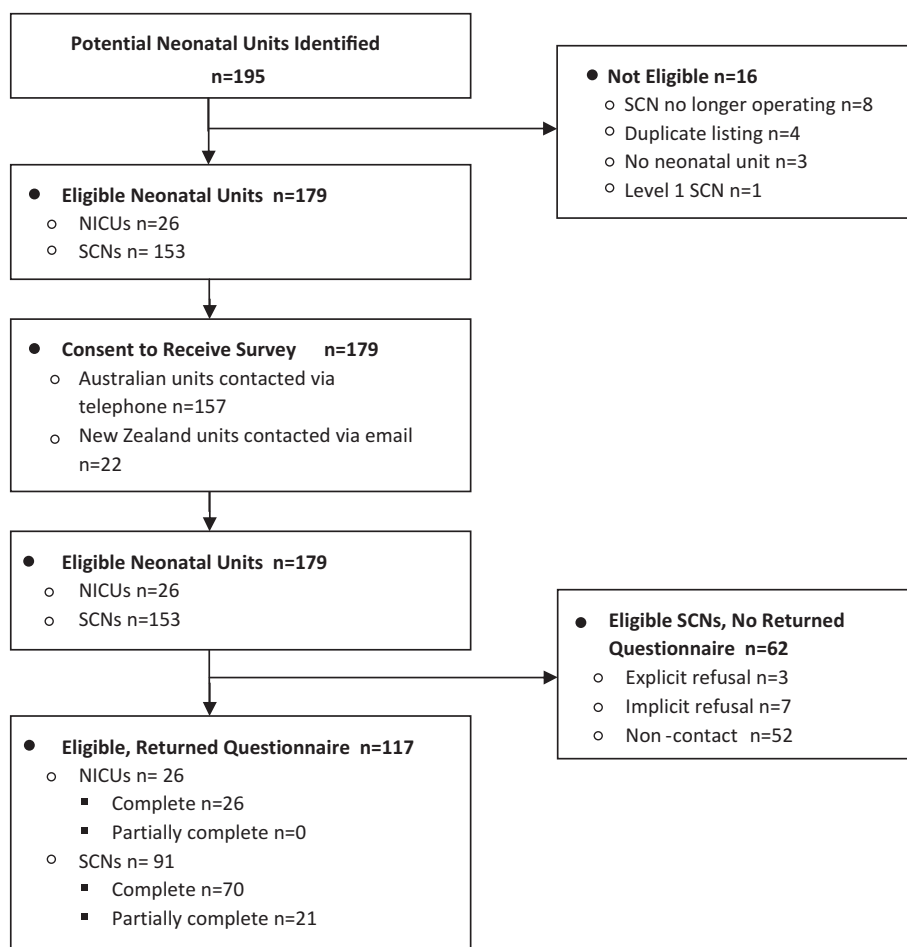
## Results

### Survey response rate, nonresponse bias and respondent demographics

Of 179 units in the sample frame, 117 (65%) units responded. All NICUs (26/26) and a little over half of SCNs (91/153) participated (Fig. 1). The  $\chi^2$  test for homogeneity showed no difference between respondents and non-respondents with respect to region ( $\chi^2(9) = 11.0$ ;  $P = 0.28$ ).

### Staff profile

Ninety-six percent of NICUs and 46% of SCNs had at least one neurodevelopmental allied discipline represented on staff. Most NICUs had physiotherapists and speech pathologists, but fewer



**Fig. 1** Flow diagram of sample frame selection. Definitions: Explicit refusal, emailed to say no longer wanted to participate or hospital board would not allow participation; implicit refusal, opened survey but did not complete. NICU, neonatal intensive care unit; SCN, special care nursery.

occupational therapists (Table 1). SCNs had fewer neurodevelopmental allied health staff in all categories than NICUs. Infants had their neurobehaviour assessed by a variety of health professionals, but predominantly by physiotherapists in NICU, and medical staff in SCN. Of the 48 responding units that did not have a neurodevelopmental allied health team, 65% (1 NICU and 30 SCNs) reported they would like one. Only 8% (4 SCNs) reported they were currently establishing a neurodevelopmental allied health team. NICUs had been providing this service for longer than SCNs (Fig. 2; Mann–Whitney *U*-test;  $Z = 2.98$ ;

$P = 0.003$ ). Physiotherapists and occupational therapists in NICU reported the highest qualification levels (Fig. 3). Physiotherapists reported higher levels of experience in NICU/SCN than occupational therapists or speech pathologists (Fig. 3).

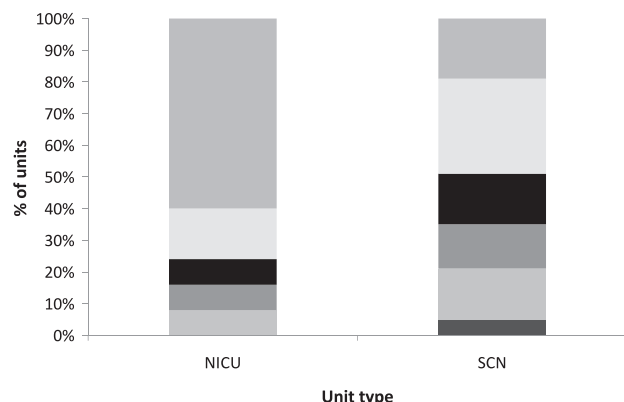
### Standardised neurobehavioural/neurological assessment

The most common assessment tool in NICUs was Prechtl's General Movements, and in SCNs it was the Hammersmith Neonatal

**Table 1** Professional staff available to assess infants by level of nursery

Profession	On staff				Assess infants			
	NICU	SCN	OR	95 % CI	NICU	SCN	OR	95 % CI
	<i>n</i> = 26 (%)	<i>n</i> = 91 (%)			<i>n</i> = 26 (%)	<i>n</i> = 91 (%)		
Physiotherapist	96	41	35.8†	4.6–276.1*†	92	22	42.6†	9.3–195.8*†
Occupational therapist	38	10	6.4†	2.2–18.8*†	27	2	16.4†	3.2–85.2*†
Speech pathologist	85	32	11.4†	3.6–36.1*†	8	1	7.5	0.6–86.2
Nursing staff	100	100	NC	NC	8	13	0.55	0.11–2.62
Medical staff	100	100	NC	NC	27	36	0.65	0.25–1.7

\* $P < 0.005$ . †Significant values. CI, confidence interval; NC, not calculable; NICU, neonatal intensive care unit; OR, odds ratio; SCN, special care nursery.



**Fig. 2** Length of neurodevelopmental service provision. (■), >14 years; (■), 10–14 years; (■), 7–9 years; (■), 4–6 years; (■), 1–3 years; (■), <1 year. NICU, neonatal intensive care unit; SCN, special care nursery.

Neurological Examination (HNNE) (Table 2). All tools were used more frequently in NICU than SCNs. Twenty-two percent of units did not administer standardised neurobehavioural assessment tools.

The most common gestational age and birthweight for referral to neurodevelopmental allied health teams for assessment was <32 weeks and <1500 g, respectively. Thirty-eight percent of NICUs and 8% of SCNs reported using another gestational age, whilst 8% of NICUs and 49% of SCNs reported gestational age was not an eligibility criterion. Concerning birthweight, 23% of

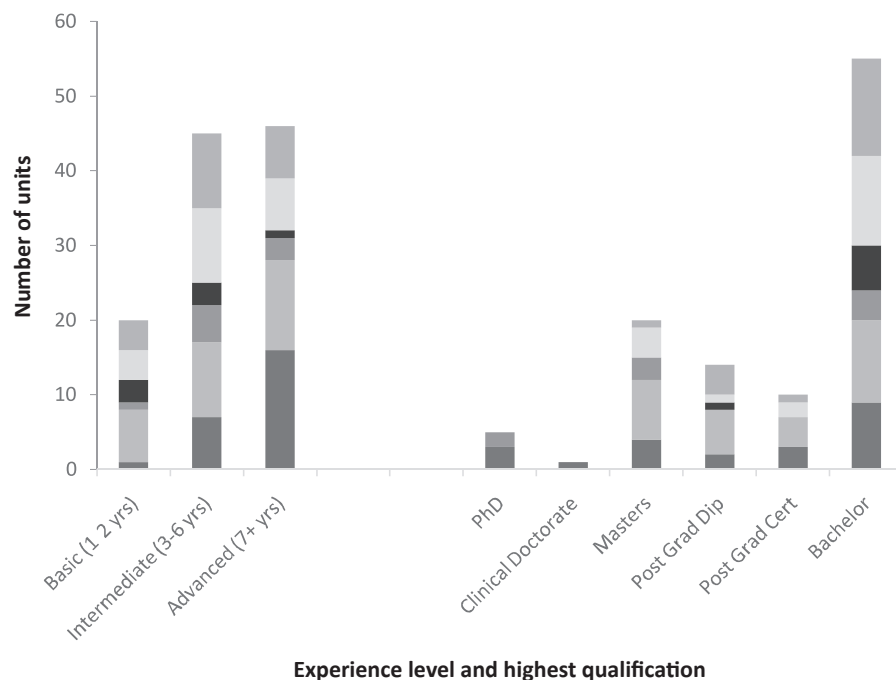
NICUs and 6% of SCNs reported using another birthweight, whilst 23% of NICUs and 54% of SCNs reported birthweight was not an eligibility criterion.

The earliest postmenstrual age for administering assessments was 32 weeks in most NICUs, and in SCNs was 34 weeks. Two NICUs reported commencing assessments at 25 and 26 weeks, respectively. The most common assessment quantity for NICUs and SCNs was one assessment per infant stay. NICUs/SCNs implementing more than one assessment per infant stay had no consensus regarding how often they should be administered (i.e. weekly/fortnightly). Thirty-one percent of NICUs and 47% of SCNs reported using an alternative assessment quantity.

Neurobehavioural assessment results were requested to be shared by other NICUs or SCNs on transfer to their unit in 42% and 14% of NICUs and SCNs, respectively. Whilst 72% of NICUs and 24% of SCNs provide neurobehavioural assessment results to other units when infants were transferred, 85% of NICUs and 27% of SCNs provided results of neurobehavioural assessments to follow-up services.

## Discussion

Our survey of neurodevelopmental allied health staff and neurobehavioural/neurological assessment tools used in Australia and New Zealand had an acceptable minimum response rate of 65%.<sup>20,23,24</sup> Most NICUs and almost half the SCNs had a neurodevelopmental allied health staff member, with a preference for physiotherapists and speech pathologists. The lack of occupational therapists was unexpected. NICUs had established allied health staff for longer than SCNs. The most common neurobehavioural/neurological assessment used overall was the HNNE, but



**Fig. 3** Neurodevelopmental allied health staff experience level and highest qualification within NICU/SCN environment (■), SCN speech pathologists; (■), NICU speech pathologists; (■), SCN occupational therapists; (■), NICU occupational therapists; (■), SCN physiotherapists; (■), NICU physiotherapists. NICU, neonatal intensive care unit; PhD, Doctor of Philosophy; Post Grad Dip, Post Graduate Diploma; Post Grad Cert, Post Graduate Certificate; SCN, special care nursery; yrs, years.

**Table 2** Standardised neurobehavioural/neurological assessments currently utilised

Neurobehavioural/neurological assessment tools	NICU <i>n</i> = 26 (%)	SCN <i>n</i> = 91 (%)	OR	95% CI	<i>P</i> -value
Dubowitz/Hammersmith neonatal neurological examination	38	25	1.85	0.74–4.64	0.19
Prechtl's general movements	50	5	17.2†	5.26–56.25†	<0.001†
Lacey assessment of preterm infants	31	8	5.34†	1.71–16.59†	0.004†
Neonatal Behavioural Assessment Scale	12	10	1.19	0.3–4.75	0.81
Test of infant motor performance	27	5	6.34†	1.81–22.13†	0.004†
Neuromotor behavioural assessment	12	5	2.24	0.5–10.1	0.29
NICU Network Neurobehavioural Scale	12	5	2.84	0.59–13.58	0.19
Assessment of preterm infant behaviour	4	4	0.87	0.93–8.14	0.90
Neurobehavioural assessment of the preterm infant	0	4	1	NC	NC
Premie-neuro	4	1	3.6	0.22–59.6	0.37

†Significant values. CI, confidence interval; NC, not calculable; NICU, neonatal intensive care unit; OR, odds ratio; SCN, special care nursery.

the General Movements was the most common assessment in NICUs.

A survey of 50 NICUs in the USA found occupational therapists most commonly represented (70%), physiotherapists (50%) and speech pathologists (10%).<sup>8</sup> The current study's finding may be due to overlapping physiotherapy/occupational therapy roles in neurodevelopmental therapy within Australia and New Zealand. This may also be due to the historical role of physiotherapists providing chest physiotherapy, with the role of the physiotherapist changing from respiratory to neurological and orthopaedic management with changes in evidenced based practice.<sup>25</sup> There is also a growing role for occupational therapists in supporting infants within the nursery environment in social interactions with parents, and environmental stimulation.<sup>3</sup>

Of the SCNs without a neurodevelopmental allied health team, more than half wanted one, but few were currently establishing one. These findings are slightly higher than Rapport<sup>5</sup> where 55% of units believed that occupational therapy and physiotherapy services were needed in NICU. Interestingly, 35% of units in this study did not consider neurodevelopmental allied health teams as necessary, a surprising statistic given mounting evidence to the contrary.<sup>3</sup>

Increasing evidence mandates that neurodevelopmental allied health staff across all disciplines possess higher level qualifications, and have graduated entry into the NICU/SCN environment.<sup>3,6,9,10</sup> In the current study on average, physiotherapists and occupational therapists reported the highest qualifications, with speech pathologists reporting the lowest. Rapport<sup>5</sup> surveyed 709 NICUs across the USA: 60% of physiotherapists and occupational therapists had completed or were completing a masters or other advanced course, while 40% had no postgraduate certifications/qualifications. Experience level varied between disciplines with physiotherapists reporting higher experience levels in NICU and SCN, and occupational therapists reporting lower experience levels. The current study's findings reflect the emerging status of occupational therapists in Australian and New Zealand NICUs/SCNs. Limperopoulos and Majnemer<sup>4</sup> reported that physiotherapists and occupational therapists (33%) had less than 2 years' NICU experience, similar to our study. Our survey suggests more advanced training similar to that undertaken by medical and nursing staff<sup>9</sup> is required for neurodevelopmental allied health staff, especially in SCNs.

There was little consistency in which disciplines administered neurobehavioural/neurological assessments, although of the neurodevelopmental allied health staff, physiotherapists were most likely, followed by occupational therapists and speech pathologists. This finding is consistent with a Canadian study that found that NICU therapists were not routinely implementing standardised neurobehavioural assessments (physiotherapists 32%; occupational therapists 19%; speech pathologists 20%); however, Canadian speech pathologists completed more assessments.<sup>4</sup> In Australia and New Zealand speech pathologists spend more time on feeding, and may leave neurobehavioural/neurological assessments to their other allied health colleagues.

Many different neurobehavioural/neurological assessment tools were used, with the HNNE being the most common overall, possibly because it is the assessment in which the majority of medical staff are trained. The HNNE can be a component of the broader medical monitoring of neurologic integrity, helping to decide which infants require more invasive and expensive evaluations, for example, a computed tomography scan.<sup>26,27</sup> In contrast, neurodevelopmental allied health staff use standardised neurobehavioural/neurological assessments to guide individual developmental care plans to support the infant's neurodevelopment. As medical staff are more likely to complete these assessments in SCN and there are more SCNs than NICUs, this finding is understandable. Limperopoulos and Majnemer<sup>4</sup> also reported a variety of assessments being used in Canadian NICUs, however, no single assessment was preferred. When implementing assessments most NICUs and SCNs complete one assessment, with very few reporting serially assessing an infant during their hospital stay. On the other hand, Ashbaugh *et al.*<sup>8</sup> reported that assessments were completed fortnightly in 21% of units in the USA, with the majority assessing on request from medical or nursing staff.

Eligibility criteria allow neurodevelopmental allied health staff to prioritise infants most in need of neurodevelopmental therapy service. The most common gestational age and birthweight criteria across both countries NICUs/SCNs were the same. Ashbaugh *et al.*<sup>8</sup> reported that the most common criteria were a gestation of <28 weeks and birthweight of <800 g. The lower criteria may be

due to the study's age, as recent evidence shows infants are at risk even with higher gestational ages and birthweights. Rapport<sup>5</sup> mentioned low birthweight as an eligibility criterion but did not report a specific birthweight cut off. The postmenstrual age at which these assessments are first administered also varied, the most common being 32 weeks in NICU and 34 weeks in SCN. These findings align with a systematic review that recommended the most appropriate age for standardised neurobehavioural/neurological assessments to commence was 32 weeks. Also, infants who are medically unstable regardless of eligibility criteria should be excluded from standardised neurobehavioural/neurological assessments requiring handling.<sup>14</sup>

In the current study, standardised neurobehavioural/neurological assessments were not administered in 22% of SCNs. One reason could be that smaller SCNs may deem infants not high risk enough to warrant their use. Alternatively, these units may not have neurodevelopmental allied health teams and their medical team may assess an infant's development using more informal medical examinations.

A strength of the current study was that all eligible NICUs responded, allowing comprehensive assessment of current NICU practice across both countries. Furthermore, of the participating SCNs, a substantial number without neurodevelopmental allied health staff responded to questions concerning the perception of the importance of these staff, and whether they would like such staff in smaller units.

A study limitation was the reliance on open self-reporting of practices from NICU/SCN staff. Although all answers were de-identified potential individual unit bias was difficult to control. The electronic method of survey delivery may have limited response numbers due to email being lost. No single technique completely analyses nonresponse bias.<sup>22</sup> However, with a complete and acceptable response rate for NICUs and SCNs, respectively, across all regions, it is likely that survey results best reflect current practice in Australia and New Zealand.

## Conclusion

There was little consistency in physiotherapy, occupational therapy or speech pathology staffing, or in the use of neurobehavioural/neurological assessments across neonatal nurseries in Australia and New Zealand. With greater appreciation of the role of allied health teams within neonatal nurseries, and the benchmarking of current practice, improved allied health staffing may ensue.

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