

**Survey of Neurodevelopmental Allied Health Teams in Australian and New Zealand  
Neonatal Nurseries: Staff Profile and Standardised Neurobehavioural/Neurological  
Assessment**

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## Abstract

**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 and special care nurseries throughout Australia and New Zealand, was purpose-developed and administered electronically from the 5<sup>th</sup> April - 23<sup>rd</sup> July 2013.

**Results:** A total of 117 units (65%) overall, and 26/26 (100%) of neonatal intensive care units responded to the survey. Neonatal intensive care units had more neurodevelopmental allied health staff than special care nurseries, with physiotherapists and speech pathologists the most common disciplines. Physiotherapists were more likely to administer standardised neurobehavioural/neurological assessments in neonatal intensive care units, while medical staff were more likely to do so in special care nurseries. A wide variety of standardised neurobehavioural/neurological assessment tools were used, with Prechtl's General Movements Assessment the most common in the neonatal intensive care units (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 special care nurseries.

**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:** Preterm infant; neonatal intensive care unit; physiotherapy; occupational therapy; speech pathology; survey; benchmarking.

<b>What is already known on this topic</b>	<b>What this paper adds</b>
<ul style="list-style-type: none"><li>• An increasing number of high-risk preterm infants are being cared for in neonatal nurseries</li><li>• Neonatology is a developing area of speciality for neurodevelopmental allied health disciplines of physiotherapy, occupational therapy, and speech pathology</li><li>• Standardised neurobehavioural/neurological assessments are recommended for use in neonatal nurseries</li></ul>	<ul style="list-style-type: none"><li>• Almost all neonatal intensive care nurseries and more than half of special care nurseries in Australia and New Zealand have neurodevelopmental allied health staff</li><li>• Physiotherapists and speech pathologists are the most likely neurodevelopmental allied health team members</li><li>• Best practice guidelines regarding standardised neurobehavioural/neurological assessments are needed</li></ul>

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## Introduction

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.(1, 2) 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.(3, 4) 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).(5, 6)

The composition of neurodevelopmental allied health staff within individual nurseries is often historical, influenced by which discipline initiated the service.(3) 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.(3, 7-9) Due to their fragility, working with preterm infants in NICU/SCN is deemed an advanced specialisation for physiotherapists, occupational therapists and speech pathologists,(10) with staff requiring specific skills, knowledge and training.(4)

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.(11, 12) Moreover, standardised assessment tools affect clinical decision-making, facilitate treatment options and support clinical research.(11, 13) Many standardised neurobehavioural/neurological assessment tools have been developed for use in NICU/SCN.(14, 15)

Although standardised neurobehavioural/neurological assessment tools are recommended(15-17), 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: 1) 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: 2) 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. (18).

### ***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(19).

### ***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 (VIBeS) 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 three

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. (20), 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 four 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 5<sup>th</sup> April - 23<sup>rd</sup> 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%.(21)

### **Statistical Method**

Survey data were transferred from REDCap into STATA 13(22) for editing and analysis. The response rate was calculated using the  $RR_6$  formula recommended by The American Association for Public Opinion Research.(23)

Nonresponse bias was analysed using descriptive statistics and chi-squared test for homogeneity, by comparing two known respondent and non-respondent demographic characteristics; Region and Unit Type.(24)

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 (OR) and 95% confidence intervals (CI). 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 (Figure 1). The chi-squared 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 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 (Figure 2; Mann Whitney U-test;  $Z=2.98$ ;  $p=0.003$ ). Physiotherapists and occupational therapists in NICU reported the highest qualification levels (Figure 3). Physiotherapists reported higher levels of experience in NICU/SCN than occupational therapists or speech pathologists (Figure 3).

### ***Standardised Neurobehavioural/Neurological Assessment***

The most common assessment tool in NICUs was Prechtl's General Movements (GMs), and in SCNs it was the Hammersmith Neonatal 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 birth weight 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 birth weight, 23% of NICUs and

6% of SCNs reported using another birth weight, whilst 23% of NICUs and 54% of SCNs reported birth weight 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, 25, 26)</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 the GMs was the most common assessment in NICUs.

A survey of 50 NICUs in the United States of America 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.(27) There is also a growing role for occupational therapists in supporting infants within the nursery environment in social interactions with parents, and environmental stimulation.(3)

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 (5) where 55% of units believed occupational therapy and physiotherapy services were needed in NICU. Interestingly, 35% of units in this study didn't consider neurodevelopmental allied health teams necessary, a surprising statistic given mounting evidence to the contrary.(3)

Increasing evidence mandates that neurodevelopmental allied health staff across all disciplines possess higher level qualifications, and have graduated entry into the NICU/SCN environment.(3, 6, 9, 10) In the current study on average, physiotherapists and occupational therapists reported the highest qualifications, with speech pathologists reporting the lowest. Rapport (5) surveyed 709 NICUs across the United States of America: 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 (4) 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(9) 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.(4) 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, e.g., a CT scan.(28, 29) 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 (4) 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. (8) reported assessments were completed fortnightly in 21% of units in the United States, 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 birth weight criteria across both countries NICUs/SCNs were the same. Ashbaugh, et al. (8), reported the most common criteria were a gestation <28 weeks and birth weight <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 birth weights. Rapport (5), mentioned low birth weight as an eligibility criterion but did not report a specific birth weight 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.(14)

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>(24)</sup> However, with a complete and acceptable response rate for NICUs and SCNs respectively across all regions, it is likely survey results best reflect current practice in Australia and New Zealand.

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

Profession	On staff				Assess infants			
	NICU n=26 (%)	SCN n=91 (%)	OR	95 % CI	NICU n=26 (%)	SCN n=91 (%)	OR	95% CI
Physiotherapist	96	41	<b>35.8</b>	<b>4.6-276.1*</b>	92	22	<b>42.6</b>	<b>9.3-195.8*</b>
Occupational Therapist	38	10	<b>6.4</b>	<b>2.2-18.8*</b>	27	2	<b>16.4</b>	<b>3.2-85.2*</b>
Speech Pathologist	85	32	<b>11.4</b>	<b>3.6-36.1*</b>	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

Abbreviations: NC, Not Calculable; \*,  $p < 0.005$

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

<b>Neurobehavioural/Neurological Assessment Tools</b>	<b>NICU n=26 (%)</b>	<b>SCN n=91 (%)</b>	<b>OR</b>	<b>95% CI</b>	<b>P-value</b>
Dubowitz/Hammersmith Neonatal Neurological Examination	38	25	1.85	0.74-4.64	0.19
Prechtl's General Movements	50	5	<b>17.2</b>	<b>5.26-56.25</b>	<b>&lt;0.001</b>
Lacey Assessment of Preterm Infants	31	8	<b>5.34</b>	<b>1.71-16.59</b>	<b>0.004</b>
Neonatal Behavioural Assessment Scale	12	10	1.19	0.3-4.75	0.81
Test of Infant Motor Performance	27	5	<b>6.34</b>	<b>1.81-22.13</b>	<b>0.004</b>
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

*Abbreviations: NICU, neonatal intensive care unit; SCN, special care nursery; %, percentage; OR, odds ratio; CI, confidence interval; n, number; NC, Not Calculable*

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**Figure 1 Flow diagram of sample frame selection**

*Abbreviations: NICU, neonatal intensive care unit; SCN, special care nursery*

*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*

**Figure 2 Length of neurodevelopmental service provision**

*Abbreviations: NICU, neonatal intensive care unit; SCN, special care nursery; %, percentage; >, greater than; <, less than*

**Figure 3 Neurodevelopmental allied health staff experience level and highest qualification within NICU/SCN environment**

*Abbreviations: NICU, neonatal intensive care unit; SCN, special care nursery; PhD, Doctor of Philosophy; Post Grad Dip, Post Graduate Diploma; Post Grad Cert, Post Graduate Certificate; %, percentage; yrs, years; +, plus*

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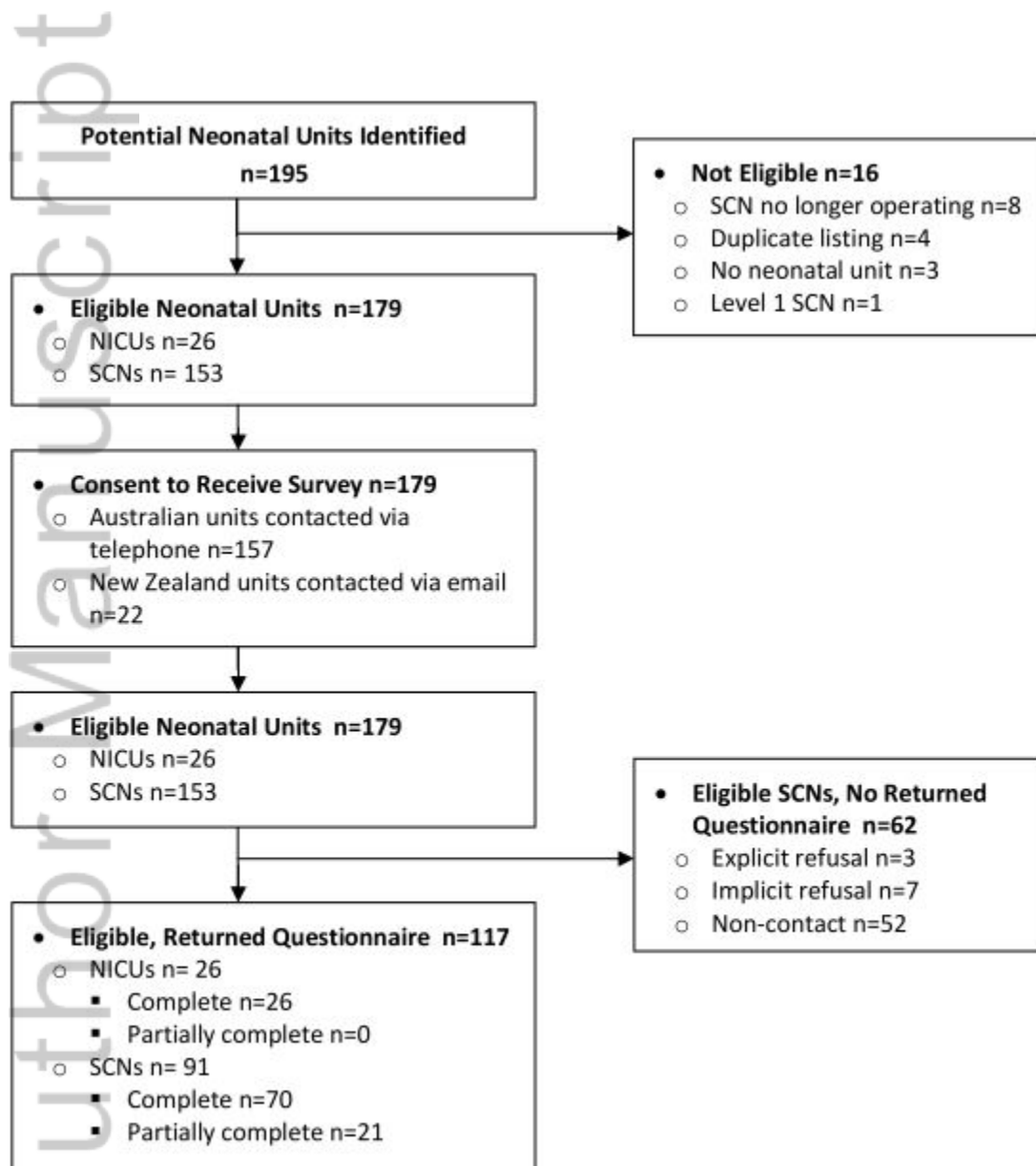


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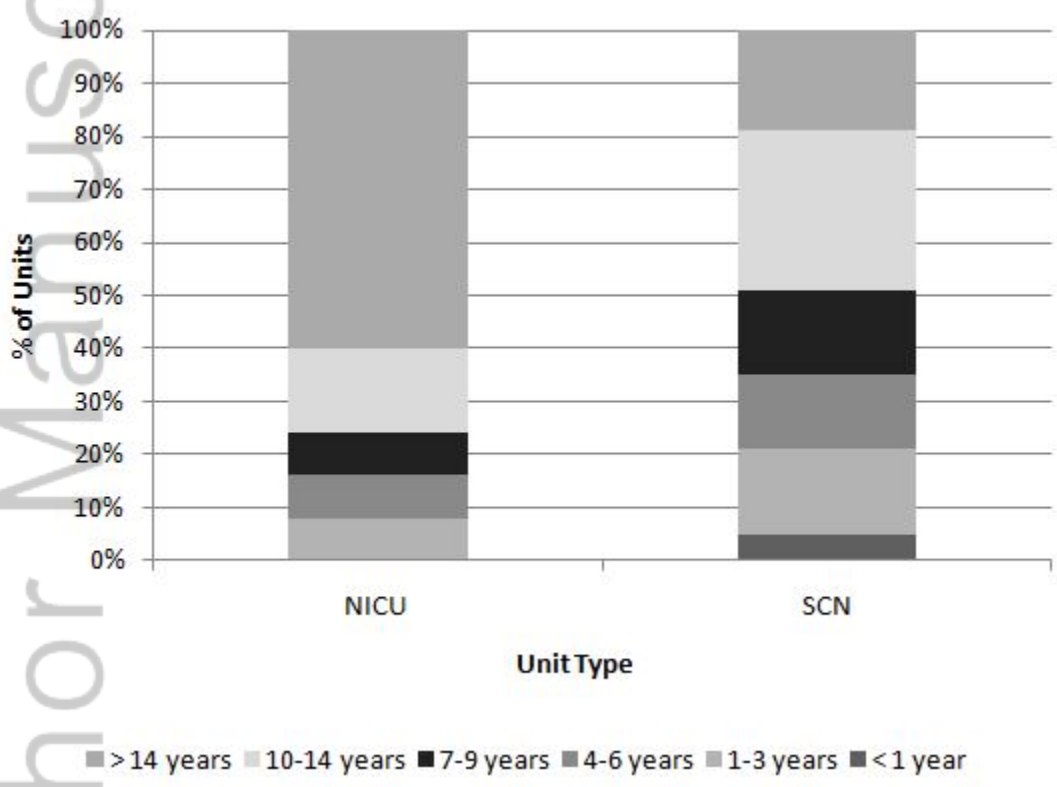


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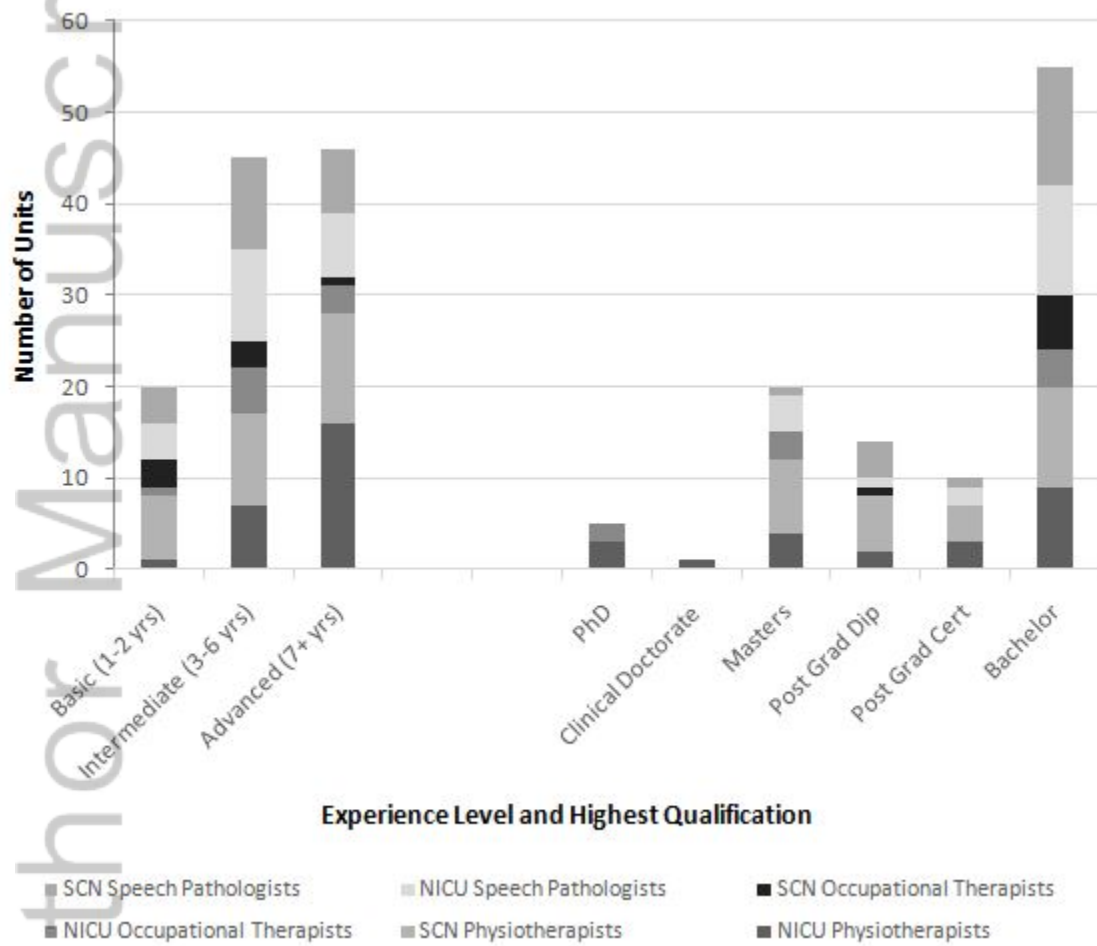


Figure 3.tif



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