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Australian Critical Care

The effects of education levels of developmental care in Australian: perceptions and challenges --Manuscript Draft--

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Abstract:	<p>Background</p> <p>Developmental care consists of a range of clinical, infant, and family focused interventions designed to modify the neonatal intensive care environment and caregiving practices to reduce stressors on the developing brain. Since its inception in the early 1980s it has been recommended and adopted globally as a component of routine practice for neonatal care. Despite application for almost 40 years, little is known of the attitude of neonatal nurses in Australia toward the intervention.</p> <p>Aims and objectives</p> <p>Establish Australian neonatal nurse perceptions of developmental care, exploring associations between nurse developmental care education levels and personal beliefs in the application of developmental care.</p> <p>Design</p> <p>Cross sectional survey design.</p> <p>Methods</p> <p>An online questionnaire was completed by 171 neonatal nurses. Participants were members of the Australian College of Neonatal Nursing (n=783). Covariate associations between key components of developmental care and respondents' geographical location, place of employment, professional qualifications and developmental care education level were analysed. Reporting is in accordance with the EQUATOR Checklist for Reporting Results of Internet E-Surveys (CHERRIES).</p> <p>Results</p> <p>Differences were observed between groups for geographical location, place of employment and professional qualification level. Rural nurses were less likely to support the provision of skin to skin (OR: 0.6, 95% CI 0.2-1.8) than nurses in a metropolitan unit. Nurses working in a NICU and nurses with Postgraduate qualifications were more likely to support parental involvement [(OR: 2.3, 95% CI 0.9-6.2) and (OR: 2.1, 95% CI 0.6-7.4) respectively]. Rural respondents were more likely to have attended off-site education (OR:3.6, 95% CI 1.3-9.9) than metropolitan</p>

	<p>respondents.</p> <p>Conclusion</p> <p>The application of developmental care in Australia may be influenced by inadequate resources and inequitable access to educational resources, similar challenges have been reported in other countries. Overcoming the challenges, requires a focused education strategy and support within and beyond the Neonatal Intensive Care Unit.</p>
Response to Reviewers:	

The effects of education levels of developmental care in Australian: perceptions and challenges

Abstract

Background

Developmental care consists of a range of clinical, infant, and family focused interventions designed to modify the neonatal intensive care environment and caregiving practices to reduce stressors on the developing brain. Since the inception of developmental care in the early 1980s it has been recommended and adopted globally as a component of routine practice for neonatal care. Despite its application for almost 40 years, little is known of the attitude of neonatal nurses in Australia toward the intervention.

Aims and objectives

To establish Australian neonatal nurse perceptions of developmental care and explore associations between developmental care education levels of the nurses and personal beliefs in the application of developmental care.

Design

A cross sectional survey design.

Methods

An online questionnaire was completed by 171 neonatal nurses. Participants were members of the Australian College of Neonatal Nursing (n=783). Covariate associations between key components of developmental care and respondents' geographical location, place of employment, professional qualifications and developmental care education level were analysed. The reporting of this paper is in accordance with the EQUATOR Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

Results

Differences were observed between groups for geographical location, place of employment and professional qualification level. Rural nurses were less likely to support the provision of skin to skin care (OR: 0.6, 95% CI 0.2-1.8) than nurses in a metropolitan unit. Nurses working in a NICU and nurses with Postgraduate qualifications were more likely to support parental involvement in care

1 [(OR: 2.3, 95% CI 0.9-6.2) and (OR: 2.1, 95% CI 0.6-7.4) respectively]. Rural respondents were more
2 likely to have attended off-site education (OR:3.6, 95% CI 1.3-9.9) than metropolitan respondents.
3

4 **Conclusion**

5
6 The application of developmental care in Australia may be influenced by inadequate resources and
7 inequitable access to educational resources, similar challenges have been reported in other
8 countries. Overcoming the challenges, requires a focused education strategy and support within and
9 beyond the Neonatal Intensive Care Unit.
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15 **Keywords**

16 Neonatal nurse, developmental care, neurodevelopmental care, neonatal unit, Neonatal Intensive
17 Care Unit, attitude, belief
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24 **Introduction**

25 Neonates cared for in neonatal intensive care units are exposed to unexpected stress and
26 interventions during a period of rapid brain development. The effects of early stress on human
27 development is considered a marker for adult health, forming a trajectory for lifelong health and
28 social experiences,¹⁻⁴ minimising stress and its effects is considered a priority. Individualised
29 developmental care described in the literature since the early 1980s is focused on tailoring
30 caregiving to be more responsive to the individualised needs of each infant with consideration of
31 physiological responses and behavioural state,⁵ at all gestational ages. Family centred care (FCC) is
32 intimately linked to the application and evaluation of developmental care interventions. FCC
33 acknowledges the family as central and essential to the care of the infant or child.⁶ Developmental
34 care embeds further the importance of family centrality by facilitating parent presence and
35 involvement in neonatal care as the primary caregiver.⁷
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52 Australia is a large country of 7.692 million square kilometres (km²) with population densities
53 ranging from <3.2 people per km² in rural areas to > 4000 people per km² in coastal metropolitan
54 cities.⁸ To meet population needs neonatal care is regionalised across hospitals with care delivery
55 ranging from small rural to tertiary referral hospitals. The provision of neonatal services occurs
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1 across tiered levels, Levels 1 to 3 provide care to neonates >32 weeks gestation in a Special Care
2 Nursery (SCN), Levels 4-6 provide care to infants <32weeks gestation in a Neonatal Intensive Care
3 Unit (NICU).⁹ Approximately 48 000 neonates, one every six hours require admission to a SCN or
4 NICU, 3% of the total births annually.⁹ Given care is provided to neonates across a range of settings
5 in Australia, establishing an understanding of the context of its practice is important.
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10 **Background**

11 The concept of 'developmental care' evolved from the Synactive Theory of Infant Development and
12 subsequent Newborn Individualised Developmental Care Assessment Program (NIDCAP).¹⁰
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14 Developmental care provides a framework that incorporates specialised staff education, infant
15 behavioural observation and a range of strategies designed to modify the clinical environment and
16 care giving to reduce the effect of stressors on the developing brain.¹¹ Whilst developmental care is
17 considered a foundational philosophy of practice in the NICU, the consistent application of core
18 concepts is reported to vary, influenced by individual clinician attitudes, working conditions, lack of
19 training, patient acuity, organisational barriers and the cultural context of the clinical setting.¹²
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33 Research exploring the practice of developmental care in different countries has been published
34 since the early 2000s resulting in the global spread of the practice across many settings.¹³⁻²¹ Clinician
35 perspectives of developmental care is predominately explored through questionnaire based
36 research designs,^{14-18, 20, 21} with two studies examining qualitative perspectives through interviews.^{13,}
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44 In Sweden, a questionnaire of neonatologists (n=139) found 93% believed NIDCAP had a positive
45 influence on the infant.¹⁷ A comparable questionnaire study in Spain of nurses and doctors (n=566)
46 found similar findings; a positive attitude and willingness to utilise the principles of NIDCAP, with
47 neonatologists viewing the intervention more favourably than nurses.¹⁸ Possible reasons for the
48 differing views were cited as an increased workload for nurses and the decreased lighting as part of
49 the intervention, influencing workplace satisfaction.¹⁸
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1 An American survey of n=59 neonatal nurses developmental care was identified as vital, with its
2 application influenced by both nurses and doctors.¹⁵ A buffering effect was identified as access to
3 and the availability of on-site developmental specialists.¹⁵ Infant developmental specialists in this
4 study were trained in the developmental needs of the infants and knowledgeable in the concepts of
5 FCC.¹⁵ A follow up study three years later found nurses (n=59), supported by on-site developmental
6 specialists were more likely to have positive beliefs relating to FCC and skin to skin practices.¹⁴
7 Nurses identified the application of FCC as influenced by the attitudes of the multidisciplinary team,
8 with lack of support acting as a barrier to its application.¹⁴

9 Danish research using in-depth interviews of nurses (n=7) suggested neonatal care is a balance of
10 'walking the line between the possible and the ideal'.¹⁹ Study findings demonstrated nurses balance
11 a dual responsibility of involving and empowering parents in the care of their infants whilst being
12 concerned about the infants wellbeing.¹⁹ Multiple areas were identified as influencing the capacity
13 to provide quality developmental care including unit acuity and activity, teamwork, and
14 management.¹⁹

15 Surveys of nurses in China²⁰ n=207 and Iran²¹ n=400 found higher patient caseloads, the length of
16 the shift worked, level of education and experience of the nurse were influential in the application of
17 developmental care. The authors cited inconsistencies in application occurred due to a lack of
18 personal knowledge and hospital policies.^{20,21} Developmental care practices are based on cumulative
19 experience rather than education exposure, leading to variability in practice and its application.^{21, 21}

20 Developmental care has been practiced in Australia since the late 1990s. Its implementation was
21 likely driven by personal interest from the global spread of the practice through conference
22 presentations and publications. Australian research to date has focused on medical outcomes of
23 neonate's pre and post the implementation of the model²² and evaluation of the effect of
24 developmental care on parent wellbeing.²³ The studies found developmental care provided a safe

1 and appealing model of caregiving that is reliant on staff flexibility, peer and administrative
2 support.^{22, 23}
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4
5 Currently there is no published literature exploring Australian neonatal nurses' perceptions and
6 practices relating to developmental care. Research strategies and questions suggested as necessary
7 to forge ahead with integrating the philosophy of developmentally supportive caregiving in the
8 neonatal setting were proposed in 2011.⁶ Understanding how staff knowledge, attitudes and beliefs
9 about developmental caregiving affect the application of these practices was suggested as research
10 necessary to support this trajectory.⁶ This research was undertaken to provide a contextual
11 understanding of the developmental care attitudes and practices of neonatal nurses within Australia.
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22 **Methods**

23 ***Design***

24 A cross sectional anonymous electronic survey design was used. Ethics approval for the study was
25 granted through Western Sydney University, approval number H12516. This article adheres to the
26 Improving the Quality of Web Surveys: Checklist for Reporting Results of Internet E-Surveys
27 (CHERRIES).²⁴ The CHERRIES checklist was utilised as part of the Enhancing the Quality and
28 Transparency of Health research (EQUATOR) guidelines. A process designed to ensure standardised
29 reporting and quality of research publications that contain information to be both understood by a
30 reader and replicable by a researcher.²⁴
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44 ***Participants***

45 The study was conducted with members of the Australian College of Neonatal Nurses (ACNN). ACNN
46 is a national, not-for-profit organisation that is a professional body for neonatal nurses in Australia.
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48 Members must be working in the neonatal context to meet membership requirements. The ACNN
49 population represented a convenience sample with membership in most states of Australia based in
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51 both metropolitan and rural settings (>100km from nearest city).
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59 **Data Collection**

1 **Survey development and testing**
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3 An online electronic survey was modified from previous research.^{14, 15} The original survey utilised a
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5 24-item Likert Scaled questionnaire to explore domains of practice specific to developmental care;
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7 light, sound, handling, skin to skin and FCC.¹⁴ The survey was chosen as it explored the application of
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9 developmental care across several settings, enabling comparison between Australian responses and
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11 other countries.
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16 Three experienced Australian neonatal nurses tested the survey for contextual relevance, technical
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18 functionality, and usability. Following review, five questions focused on the perception of medical
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20 staff involvement were removed as several Australian rural units do not have dedicated
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22 neonatologists. Five questions were added to the survey to differentiate between the type of
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24 developmental care education accessible to respondents. The survey was divided into the three
25
26 parts, Part A: Demographics, Part B: Developmental Care Education and Part C: Original survey
27
28 format. The final survey consisted of 24 Likert Scaled questions exploring respondent attitudes
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30 toward FCC, skin to skin, and the sensory environment. For each question respondents rated their
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32 perception and experience using a 5-point Likert scale ranging from 1=strongly disagree to
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34 5=strongly agree.
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40 Recognised education programs in this study were limited to programs with published literature on
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42 the program content and educational outcomes; WEE Care, NIDCAP and Family and Infant
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44 Neurodevelopmental Education Program (FINE).²⁵⁻²⁷ NIDCAP provides specialist education in
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46 developmental observation, application and assessment for health care professionals it is designed
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48 to modify the caregiving culture, interactions and the NICU environment.²⁵ WEE Care is a
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50 developmental care education and change management program designed to optimize the NICU
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52 environment and caregiving practices.²⁶ FINE is a tiered education pathway designed to assist
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54 neonatal health care professionals in applying the theoretical and evidence based components of
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56 developmental care into practice.²⁷
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Recruitment and sampling

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2 Recruitment occurred January to March 2018 with ACNN members invited by email to participate in
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4 the survey. The recruitment process was managed through the ACNN Executive Committee. This is
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6 undertaken to protect the ACNN members and ensure all surveys or research undertaken within the
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8 group follows the same approach. The closed survey was hosted through the QUALTRICS © platform
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10 via an electronic link.
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Analysis

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16 Demographic statistics were provided using count and percentages for each category. Variables
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18 were dichotomised and odds ratios and 95% confidence intervals (CI) calculated to determine the
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20 influence of: Rural versus metropolitan, Bachelor versus Postgraduate neonatal qualifications, SCN
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22 versus NICU and Length of Education < 1day versus > 1 day. Due to the skewed distribution of the
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24 data for age, professional qualifications and place of employment these variables were further
25
26 dichotomised. For age, 21-30- and 31-40-years groups were combined as <40 years of age (29.6%),
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28 the remainder of the group >40years (70.4%). Professional qualifications were dichotomised as,
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30 hospital certificate (5.7%) and bachelor's degree (19.5%) combined as 'Bachelor or less' (25.2%). All
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32 Postgraduate qualifications: Graduate Certificate (34.9%), Graduate Diploma (18.6%), Masters
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34 (19.2%) and Doctorate Degrees (1.8%) were combined as Postgraduate neonatal qualification group
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36 (74.8%). Place of employment was standalone SCN (28%), or NICU (65%). The response variables for
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38 items 'agreed' and 'somewhat agreed' were combined and all other categories were classified as 'did
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40 not agree'. All analyses were conducted using SPSS v.25.²⁸
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Results

Sample Characteristics

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53 Seven hundred and eighty-three ACNN members were contacted, 179 participated and 171
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55 completed the survey, a 22% completion rate. The 171 nurses participating in the survey are
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57 representative of the Australian neonatal nursing workforce as previously reported in research by
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1 Spence et al (2016), in terms of sex and age distribution. Most respondents were female (98.2%),
2 registered nurses (55.8%), working in a metropolitan setting (87.7%), over 40 years of age (70%)
3
4 working in the neonatal setting for >10 years (68%) (Table 1). One hundred and twenty-three nurses
5
6 (74.5%) held a post graduate neonatal qualification. New South Wales and Queensland had the
7
8 highest state-based response rates 31% respectively. The ACNN has a similar member demographic
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10 spread to the survey respondents, with the two largest membership groups in Queensland (39.9%)
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12 and New South Wales (21.4%).³⁰
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19 ***Family centred care: support and application***

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21 NICU respondents and post graduate qualified nurses were more likely to support parental
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23 involvement in caregiving [(OR:2.3, 95% CI 0.9-6.2) and (OR:2.1, 95% CI 0.6-7.4) respectively].
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26 Welcoming families in the neonatal unit was more likely in NICU respondents (OR:5.2, CI 95% 1.2-
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28 21.5) (Table 2).
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31 ***Application of developmental care interventions: perception and practice***

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33 All respondents (100%) agreed skin to skin care (SSC) was beneficial as neonates were less stressed
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35 during episodes of SSC. Yet, perception of multidisciplinary team support towards SSC was lower
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37 across all groups in comparison to other responses. With rural respondents were less likely to
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39 support the provision of skin to skin (OR:0.6, 95% CI 0.2-1.8) (Table 2).
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47 There were high levels of agreement across all groups that neonates prefer low light (95%) and low
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49 sound (98.7%), and 100% agreement that supportive positioning and handling influence the
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51 neonate's level of comfort. Unit design and its influence on the caregiving environment was viewed
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53 as more important by two separate groups; Postgraduate qualified staff (OR:5.5, 95% CI 1.3-24.3)
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55 and NICU staff (OR:4.2, 95% CI 1.0-18.3) (Table 2).
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59 ***Attitudes towards developmental care***

1 Ten of the survey questions explored staff attitudes towards developmental care and its application.
2 Levels of agreement were collapsed for analysis. Location (rural versus metropolitan) and education
3
4 (Postgraduate versus Bachelor) demonstrated no statistical difference in attitudes towards
5
6 developmental care. Predominately attitudes were positive with levels of agreement ranging from
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8 87% to 98.1% (Table 3.) Lower levels of agreement were seen for support of skin to skin from
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10 nursing peers (79%) and privacy for conversations (87%).
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16 ***Developmental care education: attendance, access, and equity***

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18 Most recent attendance at developmental care education is outlined in Table 4. Thirteen (13) per
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20 cent had attended more than one day of training, 64% one hour or less, and 8% of the respondents
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22 reported they had never attended developmental care education. Almost half (47.1%) of the
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24 education occurred at hospital-based in-services with 16.9% completing a recognised education
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26 program.
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33 Access to education differed between respondent groups (Table 5). Rural respondents were more
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35 likely to have attended off-site education (OR: 3.6, 95% CI 1.3-9.9) and less likely to have attended
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37 education in the last six months (OR: 0.4, 95% CI 0.2-1.0) compared to staff working in the
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39 metropolitan setting (Table 5). Staff employed in the NICU were more likely to have attended
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41 education in the last six months (OR: 2.9, 95% CI 1.4-5.9) compared to their SCN colleagues (Table 6).
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47 **Discussion**

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49 The motivation for this research was to examine Australian nurse's perception and application of
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51 developmental care in the neonatal clinical setting. Given the recognised long term effects on the
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53 developing brain from admission to an intensive care setting ensuring the consistent application of
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55 developmental care is a priority.
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1 Development care is considered foundational practice in the neonatal setting. Yet, nurses are
2 described as gate keepers, with their training and expertise likely to influence family centred
3 practices.³¹ A number of these components are reflected in our results with Postgraduate education
4 and NICU setting positively influencing support for parental involvement in care. Given the current
5 focus on partnering with parents to improve outcomes in the neonatal setting,³² it is unsurprising
6 that there is a level of awareness of the concept. The potential influence of place of employment
7 may be linked with staffing factors. The authors hypothesise location of employment (rural versus
8 metropolitan), type of unit (SCN versus NICU), nurse to patient ratio and nurse level of specialist
9 education are all factors that may potentially impact the capacity to enact developmental care on a
10 shift by shift basis. The impact of these factors and their effect on parent involvement in caregiving is
11 not clearly understood within the Australian context and warrants further investigation.
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27 Reassuringly there were high levels of agreement across all groups in relation to the sensory
28 environment, its effect on developmental outcomes and the need for modification to support the
29 infant in the neonatal unit. In the past five years, there have been over 150 publications highlighting
30 the effect of the environment and strategies to support sensory development. Current research
31 suggests whilst health care professionals are aware of a range of sensory-based interventions, there
32 are few clinical practice guidelines in place, leading to practice variation and no set clinical
33 standard.³³ The development of national evidence-based guidelines to support the application of
34 developmentally supportive caregiving whilst promoting consistency in practice should be a priority.
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48 Attitudes towards developmental care in this study were predominately positive. Lower levels of
49 agreement for privacy of family conversations were reported and may be associated with unit
50 layout. Historically in Australia units have consisted of open plan spaces, as national and
51 international unit design recommendations have changed units are evolving. An Australian study
52 exploring the experience of staff and families in a redesigned unit, found dual occupancy pods
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1 maintained patient confidentiality and supported more effective communication between staff and
2 families when compared to an open unit design.³⁴ Further exploration of the impact of unit design
3 on FCC practices in Australia is warranted. The perception of peer support towards skin to skin
4 presented the lowest level of agreement for participants in this study. Nurse attitudes towards skin
5 to skin has previously been described as 'ambivalent', where they do not consistently facilitate what
6 they consider to be optimal care.³⁵ The source of NICU nurses' ambivalence, is described as a
7 complex interplay between personal beliefs, cultural norms, and evidence, influenced by the
8 multidisciplinary team.³⁵ The effect of unit culture on developmentally supportive practices is not
9 well understood in the Australian context with further research required. As evidenced in this study
10 attitudes towards developmental care in Australia are positive, there is a need to build on this, and
11 explore further the perception and influence of peer practice on FCC.
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28 Like research in other countries, access to education and support from peers and the
29 multidisciplinary team appear to be influencing factors. Universally, developmental care education is
30 reported as a necessary component for its successful application,^{13, 14, 16, 20, 36, 37} yet access to, and
31 what type of education is required to deliver effective developmental care in practice remains
32 problematic. Recognised developmental care education programs in this study were identified as set
33 within a theoretical framework with published data on their implementation outcomes. Less than
34 20% of the respondents in this study had attended a recognised developmental care education
35 program. Within the Australian context this is likely representative of geographical and historical
36 challenges for nurses in accessing this level of education. Since 2017 NIDCAP and FINE education
37 have been offered in Australia, with ad hoc NIDCAP education occurring at one urban site since the
38 late 1990s resulting in limited access. Previous comparisons of the application of high-level
39 developmental care education (i.e. NIDCAP) to generalised caregiving found developmental care
40 education decreases physiologic and behavioural responses to nursing procedures in preterm
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1 neonates.³⁸ The complexity of developmentally supportive care and the necessary comprehensive
2 education to support its implementation has led to criticisms of its cost-effectiveness.¹⁷
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7 The importance of specialist knowledge, skills, and standardised education pathways in the provision
8 of developmentally supportive care has recently been recognised in Europe.³⁹ NIDCAP has been
9 highlighted as expensive, with certification previously reported as approximately USD\$4000 per
10 person.¹⁷ Numerous studies have identified the implementation of NIDCAP as reducing the overall
11 cost of admission by up to USD\$120,000 per admission,^{11, 17, 39} suggesting the benefits are worthy of
12 the initial financial investment. FINE, developed by NIDCAP educator's aims to deliver a universal
13 education program.²⁷ FINE offers an educational pathway based upon Benner's novice to expert
14 education framework.⁴⁰ Programs consist of foundational workshops to more in-depth work-based
15 learning programs, focused on translating and integrating knowledge within the individual's clinical
16 setting.²⁷ NIDCAP and FINE education have been highlighted as models that are based on sound
17 theoretical frameworks with formalised processes that ensure NICU professionals have the
18 necessary knowledge and skills needed to implement high quality IFCDC.⁴¹
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38 Given the vast geographical nature of Australia disparities in access to education occurred between
39 rural and metropolitan respondents. Challenges in meeting the education needs of the Australian
40 rural nursing work force have been described for decades.^{42, 43} In our study, nurses in rural settings
41 identified lower support from the multidisciplinary team for the provision of SSC, a reduction in skin
42 to skin may affect bonding, breastfeeding and neurodevelopmental outcomes.⁴⁴ Lack of support, and
43 knowledge of developmental care in the broader clinical team, may explain the decreased likelihood
44 to offer SSC in these settings. Increasing access to education for rural clinicians is necessary to
45 ensure a skilled critical care workforce. Although only a small number of respondents were from the
46 rural setting, we see these nurses as important to ensure continuity of care for recovering neonates
47 and their parents within a knowledgeable framework of developmentally supportive care. The
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1 provision of rural funding grants and scholarships is one option. A longer-term, more sustainable
2 approach is to build capacity in the rural workforce to deliver the education locally.
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7 The way neonatal nurses prefer to learn can influence attendance and engagement with different
8 educational modes. An Australian study of neonatal nurses working knowledge found nurses with
9 less than one-year experience preferred to learn 'on-the-job' from their peers, followed by
10 independent learning.²⁹ Attending workshops and conferences were popular amongst both
11 inexperienced and experienced nurses, with the authors cautioning that contemporary approaches
12 to education should include a combination of 'hands on' and clinically focused education.²⁹ Flexibility
13 in the provision of established developmental care education programs is required to ensure
14 sustainability and access to these resources.
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26 27 28 **Limitations**

29 A limitation of this study was the low response rate and a relatively small sample of nurses. Thus,
30 caution is needed when interpreting the findings and conclusions drawn from this convenience
31 sample. Several of the results may be influenced by the demographic spread of respondents which
32 was focused largely on two states. Seventy per cent of respondents worked in a combined
33 NICU/SCN, 75% had a post graduate qualification and 90 % lived in the metropolitan setting. All
34 these factors potentially influence the findings and results may not represent the views of novice
35 nurses, rural nurses or nurses practicing in the SCN setting. Electronic and web-based surveys are
36 frequently cited as achieving very low response rates²⁴ and this was reflected in our results. A more
37 extensive survey of neonatal nurses is required to confirm findings from this study. However, the
38 results do highlight some important issues in terms of access, equity, and the application of
39 developmental care in the Australian setting between different groups of neonatal nurses.
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59 **Conclusion**

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1 To date, an understanding of how developmental care might be applied within the Australian
2 context has been elusive. This study provides some insight into the challenges faced. As in other
3
4 global settings, there are challenges in implementing and evaluating clinical practice. The neonatal
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6 nurses surveyed supported the key tenants of skin to skin and a supportive sensory environment in
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8 the delivery of developmentally supportive care. Place of employment (NICU versus SCN), location of
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10 employment (rural versus metropolitan) and level of education (Bachelor versus postgraduate) all
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12 affected respondents perceptions of its application. Understanding the effect of individual unit
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14 practices, unit culture and application of different levels of developmental care education in the
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16 clinical setting warrant further investigation.
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22 The importance of developmentally supportive caregiving within the neonatal unit and its link to
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24 adult health outcomes has been established. We are faced with an opportunity to support and
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26 improve neurodevelopmental outcomes for neonates and their families. Ensuring there are
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28 adequate resources to meet the education needs, ensuring equity and access to education
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30 regardless of geographical location, and national guidelines to support the consistent application of
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32 caregiving should be prioritised by Australian neonatal nursing leaders and managers.
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38 **References**

- 39
40 1. Weber A, Harrison TM. Reducing toxic stress in the neonatal intensive care unit to improve
41
42 infant outcomes. *Nursing Outlook*. 2019;67(2):169-89. doi: 10.1016/j.outlook.2018.11.002.
- 43 2. D'Agata AL, Sanders MR, Grasso DJ, Young EE, Cong X, McGrath JM. Unpacking the burden of
44
45 care for infants in the NICU. *Infant mental health journal*. 2017;38(2):306-17.
- 46 3. Casavant SG, Cong X, Moore J, Starkweather A. Associations between preterm infant stress,
47
48 epigenetic alteration, telomere length and neurodevelopmental outcomes: A systematic review.
49
50 *Early Human Development*. 2019;131:63-74. doi:
51
52 <https://doi.org/10.1016/j.earlhumdev.2019.03.003>.
- 53 4. Moore TA, Berger AM, Wilson ME. A New Way of Thinking About Complications of
54
55 Prematurity. *Biological Research For Nursing*. 2012;16(1):72-82. doi: 10.1177/1099800412461563.
- 56 5. Thoman EB. Temporal Patterns of Caregiving for Preterm Infants Indicate Individualized
57
58 Developmental Care. *Journal of Perinatology*. 2003;23(1):29-36. doi: 10.1038/sj.jp.7210859.
- 59 6. McGrath JM, Samra HA, Kenner C. Family-centered developmental care practices and
60
61 research: what will the next century bring? *The Journal of perinatal & neonatal nursing*.
62
63 2011;25(2):165-70.
64
65

7. Roué J-M, Kuhn P, Maestro ML, Maastrup RA, Mitanchez D, Westrup B, et al. Eight principles for patient-centred and family-centred care for newborns in the neonatal intensive care unit. *Archives of Disease in Childhood-Fetal and Neonatal Edition*. 2017;102(4):F364-F8.
8. Australian Bureau of Statistics. Australian Demographic Statistics. Australian Bureau of Statistics, 2019. Cat no:3101 [accessed March 2020].
9. Chow SSW, Creighton P, Chambers GM, Lui K. Report of the Australian and New Zealand Neonatal Network 2019. ANZNN. Sydney.
10. Als H. Toward a synactive theory of development: Promise for the assessment and support of infant individuality. *Infant Mental Health Journal*. 1982;3(4):229–43. doi: [https://doi.org/10.1002/1097-0355\(198224\)3:4<229::AID-IMHJ2280030405>3.0.CO;2-H](https://doi.org/10.1002/1097-0355(198224)3:4<229::AID-IMHJ2280030405>3.0.CO;2-H).
11. Als H, McAnulty G. The newborn individualized developmental care and assessment program (NIDCAP) with kangaroo mother care (KMC): comprehensive care for preterm infants. *Current women's health reviews*. 2011;7(3):288-301.
12. Westrup B. Family-centered developmentally supportive care: The Swedish example. *Archives de Pédiatrie*. 2015;22(10):1086-91.
13. Austin B, Downing C, Hastings-Tolsma M. Experience of neonatal intensive care unit nurses in providing developmentally-supportive care: A qualitative study. *Nursing & health sciences*. 2019.
14. Hendricks-Muñoz KD, Louie M, Li Y, Chhun N, Prendergast CC, Ankola P. Factors that influence neonatal nursing perceptions of family-centered care and developmental care practices. *American journal of Perinatology*. 2010;27(3):193-200. Epub 2009/08/03. doi: 10.1055/s-0029-1234039. PubMed PMID: 19653141.
15. Hendricks-Muñoz KD, Prendergast CC. Barriers to Provision of Developmental Care in the Neonatal Intensive Care Unit: Neonatal Nursing Perceptions. *American journal of Perinatology*. 2007;24(2):071-7. doi: 10.1055/s-2006-958156.
16. Park J, Kim J-S. Factors influencing developmental care practice among neonatal intensive care unit nurses. *Journal of pediatric nursing*. 2019.
17. Westrup B, Stjernqvist K, Kleberg A, Hellström-Westas L, Lagercrantz H. Neonatal individualized care in practice: a Swedish experience. *Seminars in Neonatology*. 2002;7(6):447-57. doi: 10.1053/siny.2002.0150.
18. Mosqueda R, Castilla Y, Perapoch J, de la Cruz J, López-Maestro M, Pallás C. Staff perceptions on Newborn Individualized Developmental Care and Assessment Program (NIDCAP) during its implementation in two Spanish neonatal units. *Early Human Development*. 2013;89(1):27-33.
19. Hall EO, Kronborg H, Aagaard H, Ammentorp J. Walking the line between the possible and the ideal: lived experiences of neonatal nurses. *Intensive and Critical Care Nursing*. 2010;26(6):307-13.
20. Zhang X, Lee S-Y, Chen J, Liu H. Factors influencing implementation of developmental care among NICU nurses in China. *Clinical nursing research*. 2016;25(3):238-53.
21. Soleimani F, Torkzahrani S, Rafiey H, Salavati M, Nasiri M. Assessing Factors Influencing the Quality of Developmental Care in Neonatal Intensive Care Units of Tehran. *Iranian Journal of Pediatrics*. 2017;27(1).
22. Prentice M, Stainton C. Outcomes of developmental care in an Australian neonatal intensive care nursery. *Neonatal Network*. 2003;22(6):17-23.
23. Bredemeyer S, Reid S, Polverino J, Wocadlo C. Implementation and evaluation of an individualized developmental care program in a neonatal intensive care unit. *Journal for Specialists in Pediatric Nursing*. 2008;13(4):281-91.
24. Eysenbach G. Improving the Quality of Web Surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *Journal of Medical Internet Research* 2012;14(1):e8. doi: 10.2196/jmir.2042.
25. Hedlund RE. Newborn individualized developmental care and assessment program training and education. *The Journal of perinatal & neonatal nursing*. 2008;22(2):133-44.

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26. Altimier L, Kenner C, Damus K. The wee care neuroprotective NICU program (Wee Care): The effect of a comprehensive developmental care training program on seven neuroprotective core measures for family-centered developmental care of premature neonates. *Newborn and Infant Nursing Reviews*. 2015;15(1):6-16.
 27. Warren I, Mat-Ali E, Green M, Nyathi D. Evaluation of the Family and Infant Neurodevelopmental Education (FINE) programme in the UK. *Journal of Neonatal Nursing*. 2019;25(2):93-8.
 28. IBM. *SPSS Statistics for Windows*. New York: IBM Corp; 2017.
 29. Spence K, Sinclair L, Morritt ML, Laing S. Knowledge and learning in speciality practice. *Journal of Neonatal Nursing*. 2016;22(6):263-76.
 30. New K. Australian College of Neonatal Nursing Membership Numbers un-published email correspondance 2020. p. 1.
 31. Gooding JS, Cooper LG, Blaine AI, Franck LS, Howse JL, Berns SD, editors. Family support and family-centered care in the neonatal intensive care unit: origins, advances, impact. *Seminars in perinatology*; 2011: Feb;35(1):20-8. doi: 10.1053/j.semperi.2010.10.004.
 32. Brødsgaard A, Pedersen JT, Larsen P, Weis J. Parents' and nurses' experiences of partnership in neonatal intensive care units: a qualitative review and meta-synthesis. *Journal of clinical nursing*. 2019. Sep;28(17-18):3117-3139. doi: 10.1111/jocn.14920.
 33. Pineda R, Roussin J, Heiny E, Smith J. Health care Professionals' perceptions about sensory-based interventions in the NICU. *American journal of perinatology*. 2019;36(12):1229-36.
 34. Broom M, Kecskes Z, Kildea S, Gardner A, Herd J. Exploring the Impact of a Dual Occupancy Neonatal Intensive Care Unit on Staff Workflow, Activity, and Their Perceptions. *Health Environments Research Design Journal*. 2019;12(2):44-54.
 35. Kymre IG. NICU nurses' ambivalent attitudes in skin-to-skin care practice. *International journal of qualitative studies on health and well-being*. 2014, vol. 9 23297. doi:10.3402/qhw.v9.23297
 36. Mosqueda-Peña R, Lora-Pablos D, Pavón-Muñoz A, Ureta-Velasco N, Moral-Pumarega MT, Pallás-Alonso CR. Impact of a developmental care training course on the knowledge and satisfaction of health care professionals in neonatal units: A multicenter study. *Pediatrics & Neonatology*. 2016;57(2):97-104.
 37. Macho P, Zukowsky K. Individualized Developmental Care in the NICU. *Advances in neonatal care*. 2017;17(3):162-74.
 38. Sizun J, Ansquer H, Browne J, Tordjman S, Morin J-F. Developmental care decreases physiologic and behavioral pain expression in preterm neonates. *The Journal of Pain*. 2002;3(6):446-50. doi: <https://doi.org/10.1054/jpai.2002.128066>.
 39. Altimier LB, Eichel M, Warner B, Tedeschi L, Brown B. Developmental care: changing the NICU physically and behaviorally to promote patient outcomes and contain costs. *Neonatal Intensive Care*. 2005;18(4):12-16.
 40. Benner P. *From novice to expert*. Menlo Park. 1984.
 41. EFCNI. European Standards of Care for Newborn Health Education and training of the multidisciplinary team working in neonatology. <https://newborn-health-standards.org/education-training-ifcdc/#Rationale>; EFCNI; 2019.
 42. Kenny A, Duckett S. Educating for rural nursing practice. *Journal of Advanced Nursing*. 2003;44(6):613-22.
 43. Francis KL, Mills JE. Sustaining and growing the rural nursing and midwifery workforce: Understanding the issues and isolating directions for the future. *Collegian*. 2011;18(2):55-60.
 44. Bastani F, Rajai N, Farsi Z, Als H. The effects of kangaroo care on the sleep and wake states of preterm infants. *Journal of nursing research*. 2017;25(3):231-9.

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Tables for paper

Table 1 Demographic and Characteristics of Neonatal Nurse Survey Participants (n=171)

Characteristics	Nurse Respondents n=171
Location and type of employment n=%	
Rural	21 (12.3%)
Metropolitan	150 (87.7%)
Employed SCN	48 (28%)
Employed NICU	113(66%)
Non-clinical setting	10 (5.9%)
<i>State of employment</i>	
Australia Capital Territory	7 (4%)
New South Wales	54 (31%)
Northern Territory	0 (0%)
Queensland	54 (31%)
South Australia	16 (9.2%)
Tasmania	8 (4.6%)
Victoria	30 (17.2%)
Western Australia	5 (2.9%)
Demographics	
Female	168 (98.2%)
Male	3 (1.8%)
<i>Age n=159</i>	
21 – 30 years	16 (10.1%)
31 – 40 years	31 (19.4%)
41 – 50 years	40 (25%)
51 – 60 years	56 (35%)
>61 years	16 (10%)
<i>Level of Education</i>	
Hospital Certificate	9 (5.2%)
Bachelor's degree	35 (20.4%)
Post Graduate Certificate	60 (34.9%)
Graduate Diploma	32 (18.6%)
Master's degree	33 (19.2%)
PhD	3 (1.8%)
<i>Employment Type</i>	
Registered Nurse	96 (55.8%)
Registered Midwife	29 (16.9%)
Nurse Practitioner	7 (4.07%)
Educator	21 (12.2%)
Manager	10 (5.8%)
Nurse Researcher	5 (2.9%)
Academic	4 (2.3%)
<i>Length of employment in neonatal care</i>	
0-5 years	23 (13.3%)
6-10 years	32 (18.6%)
11-15 years	24 (13.9%)
16-20 years	23 (13.4%)
21-25 years	23 (13.4%)

26-30 years	30 (17.4%)
>30years	17 (9.9%)

Table 2. Dichotomised Group comparison application of family centred and developmental care

Q. Support parental involvement at all times			
	Adjusted OR	95% CI Lower	95% CI Upper
NICU compared to SCN	2.3	0.9	6.2
Post Graduated compared to bachelor's degree	2.1	0.6	7.4
Q. Welcome parents and siblings at anytime			
	Adjusted OR	95% CI Lower	95% CI Upper
NICU compared to SCN	5.2	1.2	21.5
Q. Support parents to provide skin to skin			
	Adjusted OR	95% CI Lower	95% CI Upper
Rural compared to Metropolitan	0.6	0.2	1.8
Q. Unit layout			
	Adjusted OR	95% CI Lower	95% CI Upper
Post Graduate Qualification compared to bachelor's degree	5.5	1.3	24.3
NICU compared to SCN	4.2	1.0	18.3

Table 3. Respondent attitudes to Developmental care

Question	Percentage of total respondent agreement
I feel that staff in my workplace always make parents feel welcomed in the neonatal unit	92%

I feel that parents are included as part of the team in the care of their baby	87%
Conversations with families are conducted with respect and privacy	85.8%
I welcome parents and their children to come into the neonatal unit at any time they wish	93.8%
I feel that staff are supportive in helping mothers to provide skin to skin for their baby	79%
Skin to skin should be provided to the baby everyday where possible	93.2%
Supportive positioning and handling influence the infant's comfort	98.1%
The level of support offered by staff in the NICU environment is important to me	98.1%
Skin to skin is something I discuss with all families that they can do for their baby	92.6%
I believe skin to skin is something that the baby enjoys and benefits from	97.5%

Table 4. Last attendance at Developmental Care Education

Timing of last attendance	Percentage
In the last week	7.02% (10)
In the past month	8.19% (13)
Within the past 3 months	18.71% (30)
Within the past 6 months	19.30% (31)
Within the past 12 months	12.28% (19)
Greater than 12 months	11.70% (20)
Greater than 2 years	14.62% (22)
Never attended NDC education	8.19% (14)

Table 5. Type of Developmental Care Education attended

Type of Education	N=171 (%)
Lecture at University	12.8% (22)
Hospital based in-service	48.5% (83)
Workshop/Short course or Online Workshop	21.8% (37)
Formal Neurodevelopmental Care Program*	16.9% (29)

* Formal education was defined as NIDCAP, FINE, Weecare

Table 6. Dichotomised Group comparison attendance at Developmental Care education

	Q. Attendance at external education			Q. Attendance at education in past 6 months		
	Adjusted OR	95% CI Lower	95% CI Upper	Adjusted OR	95% CI Lower	95% CI Upper
Rural compared to Metropolitan	3.6	1.3	9.9	0.4	0.2	1.0
NICU compared to SCN				2.9	1.4	5.9

Author Agreement Statement: Revision

Paper Title: The effects of developmental care education in Australian: perceptions and challenges

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs

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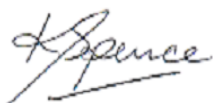
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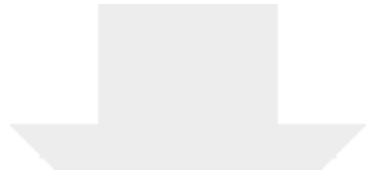
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Conflict of interest

Paper: The effects of developmental care education in Australian: perceptions and challenges

For all authors of this paper: 'Declarations of interest: none'

Signed by all authors as follows:

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Handwritten signature of Nadine Griffiths in black ink, featuring a large, stylized 'N' and 'G'.

Claire Galea

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