CHAPTER 5

Conclusion and Recommendations

This chapter is divided into four parts including conclusion of findings, implications of findings, limitations, and recommendations for further study.

5.1 Conclusion of Findings

What is unique about the clinical pain scale is that it was developed from clinical observations and in close collaboration with clinical and content experts based on their expertise in NICU leading to appropriate clinical practice. This study was designed to develop a clinical pain assessment scale for preterm neonates in NICU. In this study, the instrument development processes consisted of three phases encompassing a guideline of scale development mainly based on DeVellis (2012) with a careful adding of literature review related to substantive knowledge (Burns & Grove, 2005) to achieve the goal of the study. To construct the initial instrument in the first phase, four steps were conducted comprising defining the concept by concept analysis, generating pain indicators by clinical observations, determining the format for instrument by interviewing the clinical experts, reviewing indicators by content expert panel. The second phase was field testing in a target group. The third phase comprised using the scale in clinical setting by the professional nurses for clinical utility evaluation. Results of this study are summarized as follows:

5.1.1 A clinical pain scale for preterm neonates in NICU is a multi-dimensional instrument. The scale has two age ranges (< 32 weeks' gestation and ≥ 32 to $36^{6/7}$ weeks' gestation) and two dimensions consisting of three behavioral indicators (upper facial expression, lower facial expression, and sleep-wake states) and one physiological indicator (an increased heart rate). Each indicator has a possible score of zero, one or two. The total score of the scale is obtained by summing raw score across the four indicators on two dimensions and can range from zero to eight. A high score indicates a high level of pain.

5.1.2 With regard to the psychometric properties of the scale, content validity was ensured by six experts with I-CVI ranging from .83 to 1.00 and S-CVI/Ave of .94. The four-indicator clinical pain scale showed a moderate internal consistency with Cronbach's alpha of .86 for puncture phase (n = 53) and .94 for all three phases of painful procedures (n = 159). The intraclass correlation coefficient of the two observers across three phases ranged from .91 to 1.00. Construct validity ascertained by the hypothesis testing approach revealed significantly higher pain scores in the puncture phase than the other phases ($p < .001$). The evidence of convergence validity was supported by positive relationships between the pain scores measured by newly developed scale and PIPP-R scale with a Spearman rank correlation coefficients of .36, .79, and .88 ($p < .001$) in baseline, puncture, and recovery phases, respectively.

5.1.3 With regard to clinical utility of the scale, four aspects including appropriateness, accessibility, practicability, and acceptability for assessing pain in preterm neonates in NICU were evaluated. The clinical utility scores of four aspects rated by NICU nurses were satisfactory.

Overall, the four-indicator clinical pain scale is a reliable and valid scale for preterm neonates in NICU. The trained NICU nurses could use the clinical pain scale for routine pain assessment. Training time and users' estimated time in assessing pain are major issues for adopting a new scale occurring on a routine basis in the clinical setting.

5.2 Implications of Findings

The findings can implicate in nursing practice, nursing science, and nursing research as follows:

5.2.1 Implications for nursing practice

The four-indicator clinical pain scale is appropriate for routine assessment in the NICU, especially in heel stick procedure in early gestational age of preterm neonates, because it provides behavioral indicators corresponding with different maturity, a small number of indicators, and a clear instruction of observation for capturing their delayed pain responses. Nurses can use this scale to assess pain in preterm neonates and to differentiate the preterm neonate's pain reactivity on other clinically relevant characteristics or non-pain events.

Therefore, they can detect and manage the procedural pain in the vulnerably preterm neonates appropriately.

5.2.2 Implication to nursing science

The findings of this study can enhance nurses' understanding related to pain reactivity of preterm neonates corresponding with their unique neurodevelopment transition. It supports the knowledge that younger preterm neonates as 24 weeks gestational age is ready for pain perception and their delayed and dampened pain reactivity involves with many factors such as immaturity of CNS. Even though respiratory support, length of NICU stay, and previous pain exposures did not include in the clinical pain scale, they should be concerned when explaining their pain reactivity.

5.2.3 Implications for nursing research

The findings of this study can increase the knowledge and comprehension of pain reactivity in preterm neonates providing foundational knowledge for further research. This clinical pain scale was mainly developed for clinical use, however, it can be used in research examining pain in preterm neonates. Moreover, the development process of this clinical pain scale can be an example for other scale construction which involves both physiological and behavioral indicators.

5.3 Limitations of the Study

All research instruments have limitations and the clinical pain scale for preterm neonates is no exception. Firstly, the scale is to be used only in assessing acute pain. Therefore, it would be inappropriate for use with post-operative pain or chronic pain and needs for testing for other types of procedural pain that caused prolonged pain such as IV insertion. Secondly, the clinical pain scale cannot be used to assess paralyzed infants since they cannot perform behavioral responses. Thirdly, sensitivity and specificity of the scale were not examined due to lack of the standard scale. Fourthly, two score levels of previous pain exposures indicators which were formatted based on one previous study may limit variation of the scores. Finally, the scores of lengths of NICU stay and previous pain exposures indicators were the constant values across three phases of painful procedures. Therefore, the variance scores of those two indicators were small which influences their inter-item correlation and item-total correlation.

5.4 Recommendations for Further Study

The scale developed for the first time may not be perfect. Based on the findings, the following recommendations for further studies are derived.

5.4.1 A cohort study should be conducted to identify the number of previous pain exposures in preterm neonates. Then, score level of previous pain exposure indicator should be reformatted before correlational study in the same target group will be performed.

5.4.2 There is a need for reexamining factors affecting pain reactivity, especially length of NICU stay and previous pain exposures. Further study should include a large group of sample. Moreover, sample size should be estimated using number of infants rather than number of occasions in order to increase score variations of those two factors.

5.4.3 Cut-off core is essential for determination and management of pain in preterm neonates. Further study with a large sample and same painful procedures is recommended for establishing cut-off scores of two age ranges (< 32 weeks' gestation and ≥ 32 to $36^{6/7}$ weeks' gestation).

5.4.4 Further study with other invasive procedures rather than heel sticks should be conducted to confirm construct validity of the clinical pain scale. It would enable the study to be generalized more widely.