

Elsevier required licence: © <2018>. This manuscript version is made available under the CC-BY-NC-ND 4.0 license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

“IMPROVING EVIDENCE BASED PRACTICE IN POSTGRADUATE NURSING PROGRAMS: A SYSTEMATIC REVIEW”

Bridging the Evidence practice gap (BRIDGE project)

Authors

- 1) Associate Professor Louise D Hickman RN, MPH, PhD, Director of Postgraduate Nursing Studies (corresponding author).
Faculty of Health, University of Technology Sydney, Building 10, Level 7, Rm 212 PO Box 123 Broadway NSW 2007 Australia. Ph: +61 2 9514 4577. Email: louise.hickman@uts.edu.au.
Twitter: @DrLouiseHickman
- 2) Dr Michelle DiGiacomo BA, MHSc, PhD, Senior Research Fellow.
Centre for Cardiovascular & Chronic Care, Faculty of Health, University of Technology Sydney; Email: michelle.digiacom@uts.edu.au
- 3) Professor Jane Phillips RN, PhD, Director
Centre for Cardiovascular & Chronic Care, Faculty of Health, University of Technology Sydney; Email: jane.phillips@uts.edu.au
- 4) Ms Angela Rao RN, BN (Hons), PhD Candidate, Research Assistant.
Faculty of Health, University of Technology Sydney; Email: angela.rao@uts.edu.au
- 5) Dr Phillip J Newton RN, BN (Hons), PhD, Associate Professor.
Centre for Cardiovascular & Chronic Care, Faculty of Health, University of Technology Sydney; Email: phillip.newton@uts.edu.au
- 6) Professor Debra Jackson RN, PhD, FACN, Director
Oxford Institute for Nursing and Allied Health Research (OxINAHR), Professor of Nursing, Oxford Brookes University; Oxford University Hospitals
University of New England, Armidale NSW, Australia Email: djackson@brookes.ac.uk
- 7) Dr Caleb Ferguson RN, BScN, MHlth, PhD Chancellors Postdoctoral Research Fellow
Centre for Cardiovascular & Chronic Care, University of Technology Sydney; Email: caleb.ferguson@uts.edu.au

Word count: 4,525

Conflicts of Interest

The authors declare there are no conflicts of interest.

ABSTRACT

Background: The nursing profession has a significant evidence to practice gap in an increasingly complex and dynamic health care environment.

Objective(s): To evaluate effectiveness of teaching and learning strategies related to a capstone project within a Masters of Nursing program that encourage the development of evidence based practice capabilities.

Design: Systematic review that conforms to the PRISMA statement. Sample: Master's Nursing programs that include elements of a capstone project within a university setting.

Data sources/Review methods: MEDLINE, CINAHL, Cochrane Database of Systematic Reviews, ERIC and PsycInfo were used to search for RCT's or quasi experimental studies conducted between 1979 and 9 June 2017, published in a peer reviewed journal in English.

Results: Of 1592 studies, no RCT's specifically addressed the development of evidence based practice capabilities within the university teaching environment. Five quasi-experimental studies integrated blended learning, guided design processes, small group work, role play and structured debate into Masters of Nursing research courses. All five studies demonstrated some improvements in evidence based practice skills and/or research knowledge translation, with three out of five studies demonstrating significant improvements.

Conclusions: There is a paucity of empirical evidence supporting the best strategies to use in developing evidence based practice skills and/or research knowledge translation skills for Master's Nursing students. As a profession, nursing requires methodologically robust studies that are discipline specific to identify the best approaches for developing evidence-

based practice skills and/or research knowledge translation skills within the university teaching environment. Provision of these strategies will enable the nursing profession to integrate the best empirical evidence into nursing practice.

Key words: Curriculum; evidence-based practice; nursing; review, systematic; students; teaching; translational medical research

INTRODUCTION

With population growth, ageing and continued fiscal constraints, never before has it been so important to explore the best way to bridge the evidence practice gap in our expert nurse population group. This is particularly important in the current healthcare environment where between 10 to 40% of patient care is not based on the best available evidence (Breimaier, Halfens, & Lohrmann, 2011; Flores-Mateo & Argimon, 2007). Nursing as the largest health care professional group has an important role in addressing these evidence based practice gaps, but nurses need the capabilities to address the changing nature of the care environment (American Association of Colleges of Nursing, 2011).

The World Health Organisation (2010) current Strategic Statement has identified that improving outcomes for families and communities is dependent upon nursing services underpinned by evidence-based practices. Evidence based practice is defined as the integration of best available evidence with clinician experience and patient preference and values (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). As the scope of advanced nursing practice evolves there is a need for all nurses, especially our expert nurses such as nurse practitioners, nurse consultants, educators and managers to underpin all practice with the best available evidence. This is evidenced by requirements of masters level graduates to demonstrate capacity to “...lead change to improve quality outcomes, advanced a culture of excellence through lifelong learning, build and lead collaborative inter-professional care teams, navigate and integrate services across the health system, design innovative nursing practices and translate evidence into practice” (American Association of Colleges of Nursing, 2011). In the European context the Bologna Process has been implemented as a means to facilitate of Master’s degree programs and innovative structures to facilitate collaboration between tertiary education settings and health care organisations as part of a

reconceptualisation of nursing as a practice discipline that integrates practical and theoretical knowledge (Öhlén et al., 2012).

BACKGROUND

There has been significant research into identifying optimal ways of teaching and implementing EBP and research in both academic health and clinical settings (Coomarasamy & Khan, 2004; Ilic & Maloney, 2014; Windish, Price, Clever, Magaziner, & Thomas, 2005).

Undergraduate and postgraduate education needs of registered nurses differs to other health professional groups due the need for nurses to be both users of evidence based clinical information in the context of individuals and families, as well as generators of new evidence based knowledge, as opposed to medical practitioner requirements for appraisal skills in relation to specific disease contexts (Stiffler & Cullen, 2010).

A common, internationally agreed taxonomy for classifying reliable and valid tools to measure evidence based practice learning, that includes consideration of behaviour, skills, knowledge, self-efficacy, attitudes and reaction to the educational experience has been developed (Tilson et al., 2011). The CREATE Framework identifies the need to develop tools for assessment of evidence based practice learning that have a focused intent, and clearly defined operational definitions (Tilson et al., 2011). A conceptual framework that guides patient mediated knowledge translation strategies whilst considering the impact of intervention design, delivery and context is also required (Gagliardi et al., 2011).

One approach to research knowledge translation is a Capstone experience, defined as a values based process that utilises a multidisciplinary perspective; is based on real world problems and involves collaboration between students and faculty in anticipation of transition to practice (Schroetter & Wendler, 2008). Capstone projects, whilst varying from

university to university, are experientially designed projects that enable students to apply the specific content they have learned throughout the course of their graduate program to examine a specific idea or problem.

A recent Cochrane review identified a lack of interventions addressing organisational infrastructure to support EBP integration and guide EBP related policy and practice among clinical nurses (Flodgren, Rojas-Reyes, Cole, & Foxcroft, 2012). Two further systematic reviews of knowledge utilisation and/or translation among acute care nurses have identified single component educational strategies (Jennifer Yost et al., 2014); or education utilising local opinion leaders or multidisciplinary committees (Thompson, Eastabrooks, Scott-Findlay, Moore, & Wallin, 2007) as successful strategies for increasing research use. However, best available evidence around strategies to integrate evidence based practice into tertiary education curriculum is not available (Melnyk, Fineout-Overholt, Feinstein, Sadler, & Green-Hernandez, 2008). This systematic review aims to evaluate the effectiveness of teaching and learning strategies designed to build the evidence based practice capabilities of Masters Nursing students.

METHODS

Design

Systematic Review conducted in accordance with the PRISMA statement (Higgins et al., 2011)

Eligibility criteria

The population in this review was limited to postgraduate nurses completing a Masters of Nursing degree. Included interventions aimed at improving evidence based practice skills or research knowledge translation skills within a capstone Master's program and/or piece of scholarship including a literature review or research thesis proposal. All outcomes were

considered. Undergraduate and doctoral students, non-nursing health care professionals and hospital based interventions were excluded.

Information Sources and Search Strategy

Databases searched included MEDLINE, CINAHL, Cochrane Database of Systematic Reviews, PsycInfo and ERIC from 1979 to current, last searched on 9 June 2017. Other sources included manual searches of reference lists and Google Scholar. The search strategy from MEDLINE is included in Supplementary Appendix 1.

Search Outcome

All quantitative studies including randomized controlled trials, quasi-experimental (pre and post-test) studies, pilot and feasibility studies of university based programs specifically related to the uptake of evidence based practice skills or research knowledge translation skills among Masters of Nursing students were included. The initial database search generated 1588 articles, with a further 2 articles located from hand searching of reference lists. Sixty duplicate articles were excluded, leaving 1532 articles for screening. The screening and eligibility processes are detailed in Figure 1.

Data Extraction and Quality Appraisal

Titles and abstracts were screened for eligibility and all duplicates were removed (AR). Discrepancies regarding article selection were resolved by consensus (AR, LH, PN). Quality of the included studies was appraised using the McMaster Critical Review Form for quantitative studies (Law et al., 1998) (Refer Supplementary Appendix 2).

Data Synthesis

Meta-analysis was not conducted due to heterogeneity between intervention results, and results were synthesised in a narrative review. Data were extracted for outcomes including: attitudes towards research, research knowledge, and EBP self-efficacy. EBP skills related

outcomes included: ability to locate evidence, targeted literature searching, critical appraisal understanding, critical appraisal skills, the capacity to find specific journal articles, and evaluation of quality, qualitative and survey research designs, RCT's systematic reviews and meta-analyses.

RESULTS

There were no identified RCT's or quasi experimental studies specifically designed to enhance the acquisition of evidence based practice skills and/or research knowledge translation skills within a Masters of Nursing capstone program. After a process of review, hand searching and elimination five quasi-experimental studies within Masters of Nursing research courses (four pre and post-test studies, 1 cohort study) were identified and included (Refer Figure 1).

Study characteristics

The five included studies were conducted in high income countries: US (n=1), Australia (n=2), Norway (n=1) or Canada (n=1). The mean number of participants were (mean, SD), and were predominately female, which is broadly reflective of the nursing student demographic. Half of the EBP capability building interventions (n=3) required the completion of a research proposal (Selby & Tuttle, 1985) or proposal for a critical literature review (Jones, Crookes, & Johnson, 2011); while the remainder required a critical review of the literature (n=2) (Chang & Levin, 2014; Jones et al., 2011). In another study students could chose to complete either a: EBP literature review, research proposal or supervised group role play (Graue, Bjarkøy, Iversen, Haugstvedt, & Harris, 2010). Another study involved discussion of plans for thesis investigation (Brogan, 1982) (Refer Table 1).

Quality Assessment

Quality appraisal of the five included studies is described in Supplementary Appendix 2. Potential for bias due to study design was addressed in two studies (Graue et al., 2010; Selby & Tuttle, 1985), whilst possible bias in conclusions drawn due to use of low level (anecdotal evidence) was identified in a further study (Jones et al., 2011). Characteristics of the sample were poorly described in three studies (Brogan, 1982; Chang & Levin, 2014; Jones et al., 2011), and numbers of participants were unclear in two out of five studies (Jones et al., 2011; Selby & Tuttle, 1985). Whilst differences existed between groups in the two studies that utilised two group comparisons, results for these two groups were analysed separately which reduces the potential for bias to impact the findings (Brogan, 1982; Jones et al., 2011). Justification for sample size was not included in all five studies. Reliable outcomes were not utilised in four out of five studies (Brogan, 1982; Chang & Levin, 2014; Graue et al., 2010; Jones et al., 2011) whilst validated outcome measures were not used in three out of five studies (Brogan, 1982; Graue et al., 2010; Jones et al., 2011). Two studies did not use significance testing, with sample sizes too small to show potential important differences between groups (Graue et al., 2010; Jones et al., 2011). Several positive clinical implications were identified across studies however the clinical significance of improvements was not clearly delineated. Unclear reporting of dropouts occurred in four out of five included studies (Brogan, 1982; Chang & Levin, 2014; Jones et al., 2011; Selby & Tuttle, 1985).

Frequency/ Duration

EBP capacity building interventions took place for 11 weeks over a summer school session (Selby & Tuttle, 1985), four half day seminars over a one semester period (Jones et al., 2011), or three hours of lectures and two hours of small group discussion weekly for six

months (Brogan, 1982), over three semesters (Graue et al., 2010), or was not stated (Chang & Levin, 2014).

Interventions

The interventions were broadly heterogeneous in nature making it difficult to directly compare studies (refer Table 1).

One intervention included a **guided design** research course adapted for nursing research where learning on closed problems is incorporated into class discussion and study guide exercises, whilst open ended problems are solved creatively in small group discussion; and students are guided to identify a research problem, and develop a research proposal to address the problem in a hypothetical reality based clinical situation (Selby & Tuttle, 1985).

Guidance in the application of a systematic review appraisal tool was used as a teaching strategy in two studies where students were taken step by step through the application of a systematic review appraisal tool (CASP) prior to conducting a systematic review on a self-selected topic (Chang & Levin, 2014; Jones et al., 2011). Guided study and readings were also used to facilitate self-directed learning in one study (Jones et al., 2011).

Small group work was included as a teaching and learning strategy in four interventions; in the critical interpretation of literature (Brogan, 1982; Jones et al., 2011) and/or assessment of quality (Graue et al., 2010); or in the identification of a research problem and research proposal development (Brogan, 1982; Selby & Tuttle, 1985). Group work fostered a collegial environment for critical appraisal that included prompt feedback from staff and clarification of issues (Jones et al., 2011).

The use of supervised group video-taped role play was incorporated into discussions and debate around research evidence as a part of EBP curriculum integration (Graue et al.,

2010). A blended learning approach was included in one intervention where students engaged with both online and face to face modes of delivery (Jones et al., 2011). Jones et al. (2011) also incorporated flipped learning as a teaching and learning strategy where students were required to read preparation materials prior to attending class. Class time thereby provided an opportunity to apply critical thinking skills through a process of structured analysis (Jones et al., 2011).

Outcome measures

Outcome measures were varied among studies and included an author developed Attitudinal Scale, and a 20 item multiple choice questionnaire for knowledge of research (Selby & Tuttle, 1985); an Evidence Based Practice Tool (Chang & Levin, 2014), Attitude Towards Statistics Scale (Brogan, 1982) or author developed Likert questionnaires (Brogan, 1982; Graue et al., 2010; Jones et al., 2011).

Outcomes

All of the included studies generated positive outcomes. Three out of five studies generated significant improvements in research knowledge translation related outcomes.

Improvements were found in attitudes towards research ($p < 0.001$) in traditional ($p < 0.01$) (Brogan, 1982) and guided design research coursework (Selby & Tuttle, 1985); and research knowledge ($p < 0.001$) in a guided design research course (Selby & Tuttle, 1985). Self-efficacy related to evidence based practice ($p < 0.001$) (Chang & Levin, 2014) and utility of research to nursing practice ($p < 0.01$) (Brogan, 1982) also increased post EBP or research related coursework.

Evidence-based practice skills

One study demonstrated significant improvements in evidence based practice skills including the ability to locate evidence ($p < 0.001$) and critical appraisal application ($p < 0.001$)

(Chang & Levin, 2014). Whilst two other studies demonstrated improvements in evidence based practice skills including a 33% increase in the ability to locate evidence (Graue et al., 2010), 14.4% increase in critical appraisal skills (Graue et al., 2010), critical thinking (0.7% increase), improved ability to evaluate qualitative and survey research designs, RCT's, systematic reviews, and meta-analyses (Jones et al., 2011) and improved understanding of critical appraisal (0.9 point mean score increase) (Jones et al., 2011) it is unclear whether the findings of these studies were significant.

DISCUSSION

No studies were identified that specifically addressed EBP skills, utilisation and translation within a Capstone Masters of Nursing program. Whilst the results of five quasi experimental studies that integrated blended learning, guided design processes, small group work, role play and structured debate into Masters of Nursing research courses demonstrated some improvements in EBP skills and research knowledge translation, given the limitations in study design the clinical significance of these results are unclear.

Whilst no previous review specifically addressed knowledge translation within a Masters Capstone program, previous systematic reviews have found knowledge translation among advanced practice nurses to be most successful with multidisciplinary collaboration occurred (Thompson et al., 2007); and the use of single component educational strategies as opposed to multi-component strategies such as mentorship and use of educational meetings effective among acute care nurses generally (J. Yost et al., 2015). Strategies such as small group discussion and exposure to a blended learning format with positive student teacher and student to student interaction will likely enhance confidence and capability for research engagement and collaboration in the clinical setting. This is supported by previous findings of Jacobs, Rosenfeld, and Haber (2003), where the degree of learner instructor

interaction significantly predicted perceived learning in a research course for Masters of Nursing students. Therefore whilst the capability to learn and engage may be enhanced, perceived barriers within clinical settings such as lack of time, workplace environment, and lack of structural and organisational support (Graue et al., 2010) will need to be identified and students adequately prepared for such interactions in order to facilitate translation of research to practice. Strategies that encourage a supportive professional learning environment and promotion of research culture will facilitate knowledge translation (Graue et al., 2010).

Research integration will enhance the capacity of nurses to collaborate in local and international contexts with stakeholders such as non-governmental organisations (NGO's), educational institutions, government, professional associations and civil society (World Health Organisation, 2010). Such collaboration could facilitate Masters level nurse requirements to utilise research evidence at an institutional level in the adaptation, revision or development of relevant practice guidelines and protocols; and assess the readiness of individuals and organisations for practice change, including the development of appropriate strategies to achieve this end (Burke et al., 2005; Ciliska, 2005). A strategy for knowledge translation could be the design of a Masters Capstone project that caters to the needs of either the academic organisation, or the clinical organisation and area of specialty in which the student is based (Segrott, McIvor, & Green, 2006). Collaboration with research familiar personnel such as a clinical nurse consultant could be included as a necessary component of the Masters Capstone project design that is more likely to foster collaboration and EBP integration that is consistent with facility values, and is likely to enhance learning (Öhlén et al., 2012). Focusing on current clinical problems in EBP teaching will engage the health care

team as a whole and creates potential to integrate an EBP approach as routine care (Graue et al., 2010).

From an international perspective, a suggested model for didactic development for postgraduate nursing education projects that facilitates involvement between universities and clinical practice settings and supports translation of research to practice includes interrelated components of motivation “why”, learning strategies “how”, focus of learning “what”, and parties involved “who” (Öhlén et al., 2012). A model that facilitates the development of research skills within a Masters Capstone program must ideally be led by skilled researchers and support and invest in the development of the research capacity of the faculty by fostering a research culture and environment through practices such as mentorship and facilitation of training and collaboration (Segrott et al., 2006).

Implications for teaching and learning

One identified teaching and learning strategy included the availability of lecture content online allowing classroom time to be utilised for hands on activities and interaction between students and the lecturer as they engage with applying EBP content (Jones et al., 2011). This approach encompasses elements of flipped education, which has been shown to demonstrate a deeper learning that is not available using the traditional lecture format (Critz & Knight, 2013; Schwartz, 2014). Flipped education encompasses integration of pre-recorded lecture material and allows for progressive transition of students through various domains of skill development (Schwartz, 2014). Given the difficulties for graduate students to obtain EBP knowledge and skills that is predominately influenced by behaviours and attitudes to EBP, guided approaches with gentle progression through various levels of difficulty and critical thinking requirements are ideal for the development of confidence among students in EBP knowledge, utilisation and translation. Further given that content is

covered prior to attending class, gaps in knowledge can be readily identified during class activities, with the lecturer able to tailor responses that facilitate and accelerate learning (Critz & Knight, 2013; Schwartz, 2014). Students are also able to self-monitor their progress by their ability to participate in small group discussions. Allowing for multiple points of contact for learning is also more likely to include the preferred learning style of the majority of students (Schwartz, 2014) and has demonstrated better student performance when compared with traditional lecture delivery (Lancaster, Wong, & Roberts, 2012).

Successful strategies for enhancing competence around the EBP knowledge and skill development, and ability to translate EBP knowledge should include a variety of teaching approaches to enhance learning, such as small group exercises, article review and critique, case studies to facilitate conceptual understanding and EBP skill development (Schwartz, 2014). Whilst there is limited evidence around its efficacy, the results of one study included in this review support the use of an integrated curriculum approach to develop EBP skills (Graue et al., 2010). This finding is supported by Melnyk et al. (2008) who recommend that integration strategies be embedded in all stages of postgraduate degree programs to ensure advanced practice nurses are able to translate knowledge on entry to practice and through the progression of their careers.

A survey of nurse practitioner educators teaching across masters and doctoral level nurses found that whilst nurse educators believed that EBP was related to improved clinical practice, their beliefs were not as strong regarding the extent to which research is being used to guide clinical practice (Melnyk et al., 2008). Utilising a guided format to introducing research appraisal may adequately address perceived reduced research self-efficacy among

nurses and may be enhanced by verbal encouragement and positive reinforcement (Chang & Levin, 2014).

Research outside of nursing is developing evidence of ways of learning and developing principles that can guide the development of innovative teaching strategies for EBP integration within Masters of Nursing programs (Tanner, 2008). Three previous systematic reviews of application of research evidence to practice among medical students found clinically integrated teaching approaches (Coomarasamy & Khan, 2004) that included role play, reflection and feedback (Windish et al., 2005); and trainee centred, problem based multi-faceted journal clubs that that integrate theory to practice as successful strategies for the development of EBP skills, knowledge, attitude and behaviours, clinical reasoning and skills, and increased reading, lifelong learning, critical appraisal skills and ability to apply results to practice respectively (Ilic & Maloney, 2014). However given that the nursing profession places value on research designs beyond the clinical trial, including qualitative methods, the information needs of nurses for evidence based practice skills and research knowledge development are unique from their medical counterparts, for example, who have a predominately clinical trials focus (Jacobs et al., 2003). Critical thinking of Masters of Nursing students has been found to be lower compared to education and medicine occupational and academic groups (Drennan, 2010). Masters Capstone programs should therefore be tailored specifically for nursing specialties to ensure contextual relevance and enhanced engagement.

Whilst problem based learning has been utilised to enhance clinical reasoning skills in nursing, it has not been used as a teaching strategy to enhance research knowledge and translation skills. Whilst a hypothetical research problem was used in the development of a

research problem in one study included in the current review (Selby & Tuttle, 1985) this did not expand to address the needs of knowledge translation into clinical practice. Given that problem based learning (PBL) aims to teach in an integrated way in the development of problem solving and clinical reasoning skills, the use of case studies or clinical problems could be used as a context in which to develop confidence and ability to translate EBP knowledge into practical solutions that have potential through a collaborative process to be integrated into clinical settings (Rochmawati & Wiechula, 2010). However a systematic review determined that there is currently insufficient evidence to support the use of PBL to develop critical thinking skills (Yuan, Williams, & Fan, 2008). The use of PBL for learning research among postgraduate students has also been found to be feasible and supported by both students and faculty, however further research is required to discern the role of the researcher as a conveyor of information or to support the PBL group process (Carlisle & Ibbotson, 2005).

Given the paucity of available data this review adds a valuable contribution to generating understanding of the effectiveness of innovative teaching strategies with a capstone Masters of Nursing research program. There have been very few quantitative papers published since 1985 that address the integration of evidence based practice skills and research knowledge translation within a Masters of Nursing capstone program. The included studies are limited by inadequate detail regarding course structure and facilitation that limits study replication (for example the frequency and duration of interventions were poorly described). Methodological rigour was also lacking, with inadequate description of study designs, time points for assessment of outcome measures, and lack of statistical analysis across papers. Given the small sample sizes descriptive statistics were used in 40% of the included papers which generates difficulty determining the clinical significance of the

findings. Bias was not adequately addressed in the included studies, for example, information provided regarding the involvement of the researchers in course delivery was unclear. Half of the included studies used author developed Likert scales to measure outcomes which decreased individual study validity. This is likely due to the limited availability of validated outcome measures for evaluating evidence based practice and research knowledge translation skills (Shaneyfelt et al., 2006).

Further studies should include the use of methodological rigorous experimental designs that adhere to reporting guidelines, with clearly stated primary and secondary outcomes, adequate detail around intervention design and implementation, the development and implementation of validated tools to measure EBP and knowledge translation outcomes, and where possible the inclusion of larger sample sizes.

Limitations

The findings of this review are limited by the small number of available studies. There is a need for RCT's or mixed method studies to be conducted that shed light on university based teaching strategies for graduate nurses that facilitate the development of EBP knowledge and skills and integration of EBP knowledge and skills into clinical settings. Use of only quantitative study designs excludes approaches to learning research that incorporate qualitative methodology and analysis.

CONCLUSION

Nursing as a profession has its own unique needs to enhance the facilitation of research to practice. Given that no studies were located that specifically addressed EBP skills and research knowledge translation within a Masters of Nursing Capstone experience, the best teaching and learning strategies to guide the development of EBP and research knowledge translation skills is unclear. However teaching and learning strategies within a Masters of Nursing program, including guided learning, small group work for critical appraisal, blended learning, role play and structured debate have demonstrated some capacity to improve EBP skill development and research knowledge translation. Further methodologically strong experimental designs are required accurately assess the capacity for teaching and learning strategies to enhance Masters of Nursing students' research utilisation and translation to practice.

Clinical Resources

University of Adelaide Joanna Briggs Institute. <http://joannabriggs.org/jbi-approach.html>

CASP critical appraisal checklists. <http://www.casp-uk.net/casp-tools-checklists>

Virginia Henderson Global Nursing e-repository. <http://www.nursinglibrary.org/vhl/>

REFERENCES

- American Association of Colleges of Nursing. (2011). *The Essentials of Master's Education in Nursing: American Associates of Colleges of Nursing*.
- Breimaier, H. E., Halfens, R. J. G., & Lohrmann, C. (2011). Nurses' wishes, knowledge, attitudes and perceived barriers on implementing research findings into practice among graduate nurses in Austria. *Journal of Clinical Nursing, 20*(11-12), 1744-1756. doi: 10.1111/j.1365-2702.2010.03491.x
- Brogan, D. R. (1982). Professional socialization to a research role: interest in research among graduate students in nursing. *Research In Nursing & Health, 5*(3), 113-122.
- Burke, L. E., Schlenk, E. A., Sereika, S. M., Cohen, S. M., Happ, M. B., & Dorman, J. S. (2005). Developing research competence to support evidence-based practice. *Journal Of Professional Nursing: Official Journal Of The American Association Of Colleges Of Nursing, 21*(6), 358-363.
- Carlisle, C., & Ibbotson, T. (2005). Introducing problem-based learning into research methods teaching: student and facilitator evaluation. *Nurse Education Today, 25*(7), 527-541.
- Chang, A., & Levin, R. F. (2014). Tactics for teaching evidence-based practice: improving self-efficacy in finding and appraising evidence in a master's evidence-based practice unit. *Worldviews On Evidence-Based Nursing / Sigma Theta Tau International, Honor Society Of Nursing, 11*(4), 266-269. doi: 10.1111/wvn.12050
- Ciliska, D. (2005). Educating for evidence-based practice. *Journal Of Professional Nursing: Official Journal Of The American Association Of Colleges Of Nursing, 21*(6), 345-350.
- Coomarasamy, A., & Khan, K. S. (2004). *What is the evidence that postgraduate teaching in evidence based medicine changes anything? A systematic review* (Vol. 329).
- Critz, C. M., & Knight, D. (2013). Using the Flipped Classroom in Graduate Nursing Education. *Nurse Educator, 38*(5), 210-213. doi: 10.1097/NNE.0b013e3182a0e56a
- Drennan, J. (2010). Critical thinking as an outcome of a Master's degree in nursing programme. *Journal of Advanced Nursing, 66*(2), 422-431. doi: 10.1111/j.1365-2648.2009.05170.x
- Flodgren, G., Rojas-Reyes, M. X., Cole, N., & Foxcroft, D. R. (2012). Effectiveness of organisational infrastructures to promote evidence based nursing practice. *The Cochrane Library*(2).
- Flores-Mateo, G., & Argimon, J. M. (2007). Evidence based practice in postgraduate healthcare education: A systematic review. *BMC Health Services Research, 7*, 119.
- Gagliardi, A. R., Légaré, F., Brouwers, M. C., Webster, F., Wiljer, D., Badley, E., & Straus, S. (2011). Protocol: developing a conceptual framework of patient mediated knowledge translation, systematic review using a realist approach. *Implementation Science, 6*(1), 25-29. doi: 10.1186/1748-5908-6-25
- Graue, M., Bjarkøy, R., Iversen, M., Haugstvedt, A., & Harris, J. (2010). Integrating evidence-based practice into the diabetes nurse curriculum in Bergen: perceived barriers to finding, reading and using research in practice. *European Diabetes Nursing, 7*(1), 10-15.
- Higgins, J., Altman, D., Gøtzsche, P., Jüni, P., Moher, D., Oxman, A., . . . Sterne, J. (2011). Cochrane Bias Methods Group; Cochrane Statistical Methods Group. 2011 The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ, 343*, d5928.

- Ilic, D., & Maloney, S. (2014). Methods of teaching medical trainees evidence-based medicine: a systematic review. *Medical Education*, 48(2), 124-135. doi: 10.1111/medu.12288
- Jacobs, S. K., Rosenfeld, P., & Haber, J. (2003). Information literacy as the foundation for evidence-based practice in graduate nursing education: a curriculum-integrated approach. *Journal of Professional Nursing*, 19(5), 320-328.
- Jones, S. C., Crookes, P. A., & Johnson, K. M. (2011). Teaching critical appraisal skills for nursing research. *Nurse Education in Practice*, 11(5), 327-332. doi: 10.1016/j.nepr.2011.03.002
- Lancaster, J. W., Wong, A., & Roberts, S. J. (2012). 'Tech' versus 'talk': a comparison study of two different lecture styles within a Master of Science nurse practitioner course. *Nurse Education Today*, 32(5), e14-e18. doi: 10.1016/j.nedt.2011.09.018
- Law, M., DStewart, D., Pollock, N., Letts, L., Bosch, J., & Westmorland, M. (1998). McMaster University Critical Review Form -Quantitative Studies. Retrieved 16 December, 2015, from https://www.unisa.edu.au/Global/Health/Sansom/Documents/iCAHE/CATs/McMasters_Quantitative%20review.pdf
- Melnyk, B. M., Fineout-Overholt, E., Feinstein, N. F., Sadler, L. S., & Green-Hernandez, C. (2008). Nurse practitioner educators' perceived knowledge, beliefs, and teaching strategies regarding evidence-based practice: implications for accelerating the integration of evidence-based practice into graduate programs. *Journal of Professional Nursing*, 24(1), 7-13.
- Öhlén, J., Berg, L., Björk Brämberg, E., Engström, Å., German Millberg, L., Höglund, I., . . . Wijk, H. (2012). Students' learning as the focus for shared involvement between universities and clinical practice: a didactic model for postgraduate degree projects. *Advances in Health Sciences Education*, 17(4), 471-487. doi: 10.1007/s10459-011-9323-2
- Rochmawati, E., & Wiechula, R. (2010). Education strategies to foster health professional students' clinical reasoning skills. *Nursing & Health Sciences*, 12(2), 244-250. doi: 10.1111/j.1442-2018.2009.00512.x
- Sackett, D. L., Rosenberg, W. M. C., Gray, J. A. M., Haynes, R. B., & Richardson, W. S. (1996). *Evidence based medicine: what it is and what it isn't* (Vol. 312).
- Schroetter, S. A., & Wendler, M. C. (2008). Capstone experience: Analysis of an educational concept of nursing. *Journal of Professional Nursing*, 24(2), 71-79. doi: 10.1016/j.profnurs.2007.06.019
- Schwartz, T. A. (2014). Flipping the statistics classroom in nursing education. *The Journal Of Nursing Education*, 53(4), 199-206. doi: 10.3928/01484834-20140325-02
- Segrott, J., Mclvor, M., & Green, B. (2006). Challenges and strategies in developing nursing research capacity: a review of the literature. *International Journal of Nursing Studies*, 43(5), 637-651.
- Selby, M. L., & Tuttle, D. M. (1985). Teaching nursing research by Guided Design: a pilot study... graduate nursing students' attitudes toward, and performance in, research. *Journal of Nursing Education*, 24(6), 250-252.
- Shaneyfelt, T., Baum, K. D., Bell, D., Feldstein, D., Houston, T. K., Kaatz, S., . . . Green, M. (2006). Instruments for evaluating education in evidence-based practice. A systematic review. *JAMA*, 296(9), 1116-1127.

- Stiffler, D., & Cullen, D. (2010). Evidence-based practice for nurse practitioner students: A competency-based teaching framework. *Journal of Professional Nursing, 26*(5), 272-277. doi: 10.1016/j.profnurs.2010.02.004
- Tanner, C. A. (2008). Clinical judgment and evidence-based practice: toward pedagogies of integration. *The Journal Of Nursing Education, 47*(8), 335-336.
- Thompson, D. S., Eastabrooks, C. A., Scott-Findlay, S., Moore, K., & Wallin, L. (2007). Interventions aimed at increasing research use in nursing: a systematic review. *Implementation Science, 2*, 15.
- Tilson, J. K., Kaplan, S. L., Harris, J. L., Hutchinson, A., Ilic, D., Niederman, R., . . . Zwolsman, S. E. (2011). Sicily statement on classification and development of evidence-based practice learning assessment tools. *BMC Med Educ, 11*, 78. doi: 10.1186/1472-6920-11-78
- Windish, D. M., Price, E. G., Clever, S. L., Magaziner, J. L., & Thomas, P. A. (2005). Teaching Medical Students the Important Connection between Communication and Clinical Reasoning. *Journal of General Internal Medicine, 20*(12), 1108-1113. doi: 10.1111/j.1525-1497.2005.0244.x
- World Health Organisation. (2010). Nursing and Midwifery Services: Strategic Directions. Geneva, Switzerland: World Health Organisation.
- Yost, J., Ganann, R., Thompson, D. S., Aloweni, F., Newman, K., Hazzan, A., . . . Ciliska, D. (2015). The effectiveness of knowledge translation interventions for promoting evidence-informed decision-making among nurses in tertiary care: a systematic review and meta-analysis. *Implementation Science, 10*, 98.
- Yost, J., Thompson, D., Ganann, R., Aloweni, F., Newman, K., McKibbin, A., . . . Ciliska, D. (2014). Knowledge Translation Strategies for Enhancing Nurses' Evidence-Informed Decision Making: A Scoping Review. *Worldviews on Evidence-Based Nursing, 11*(3), 156-167. doi: 10.1111/wvn.12043
- Yuan, H., Williams, B. A., & Fan, L. (2008). A systematic review of selected evidence on developing nursing students' critical thinking through problem-based learning. *Nurse Education Today, 28*(6), 657-663. doi: <http://dx.doi.org/10.1016/j.nedt.2007.12.006>

Table 1: Characteristics of included studies

Author(s)	Study design	Outcomes	Population	N	Intervention	Frequency/ Duration	Outcome Measures	Results
Brogan 1982	Prospective cohort design	Attitude to research, utility of course, further research interest	Full time Masters of nursing students	119	Half semester in graduate research methods coursework: lecture and facilitated small peer discussion groups – literature critique, research project, discussion of plans for thesis with faculty and doctoral statistics student.	3 hr lecture; 2 hr facilitated peer discussion group/ weekly for 6 months	Attitude toward statistics scale	Significantly greater anticipated interest in research compared to statistics course (1976: $p<0.001$); Research course significantly more useful than statistics course ($p<0.01$: 1976) ($p<0.01$: 1977); Valued utility of research course to nursing career (1976: $p<0.01$). No improvement in interest towards conducting research.
(Selby & Tuttle, 1985) US	Pre and post-test design	Attitudes towards research; knowledge of research process/skill	Masters nursing research students	25	Guided design research course including clinical vignette , group interaction, development of a hypothetical proposal	Not stated /11 weeks	Attitudinal Scale, 20 item MCQ for knowledge of research	Significant improvement in attitude towards research ($p<0.001$), research knowledge ($p<0.001$) Improved attitude around the importance of research (71%), interest in research (75%), confidence in ability to conduct supervised research (92%)
Graue et al. 2009 Norway	Pre and post test	Ability to find, read and critique research literature, perceptions of barriers to implement new knowledge into practice	Post graduate diabetes course students	33	Semester 1: General introduction to EBP, information sources, database searching, Semester 2: working in groups to critically analyse and interpret research studies, assess methodological quality; Semester 3: supervised groups, video-taped role-plays of research arguing and discussion, literature reviews, articles or research proposals , conference participation: oral presentation or posters	Not stated /3 semesters (1.5 years)	Author developed Likert questionnaire	Increases in: Skills in locating research (33.3%); Critical appraisal skills (14.4%) English as a language barrier to reading research literature (-14.7%); Reading ≥ 11 English articles (63.8%); Knowledge to practice barriers: lack of time (69%); work place environment (30.4%); lack of structural or organisational support (25%).
Jones et al. 2011. Australia	Pre and post-test design	Critical appraisal, critical thinking skills	HDR students (graduate certificate Health Research, Masters Nursing), supervisors	24	Flexible delivery online and face to face (Australia). Intensive format (Hong Kong). Lecture slides, handouts, individual/group activities, recommended readings, e-learning site, assessment. Research method overview, critical appraisal using CASP or structured tool, feedback from teaching staff, preparation of proposal for critical literature review, undertaking review on self-selected topic.	7 seminars/ 5 days (Hong Kong); 4 half day seminars (2 day blocks week 1 & 7) (Australia); one semester	Likert scales	Improvements in (mean difference): Understanding of purpose of critical appraisal (AU: 0.7; HK: 0.9); evaluating qualitative research (AU: 0.9; HK: 0.9); evaluating RCT research (AU: 0.3; HK: 0.8); evaluating survey research (AU: 0.6; HK: 0.9); evaluating systematic reviews and meta-analyses (AU:1.1; HK: 0.9); evaluating statistics in research (AU: 1.1; HK: 1)
Chang et	Pre and	Self-efficacy;	Masters	60	EBP project: Find a relevant systematic review or	1 unit,	Efficacy in	Significantly improved:

al. 2014 Australia	post-test	finding and appraising evidence	EBP students		clinical guideline related to area of clinical practice; introduction to appraisal tools, guided appraisal in class exercise using CASP; self-guided completion of systematic review appraisal	duration not stated.	Evidence Based Practice Tool	EBP self-efficacy (p<0.001); ability to find evidence (p<0.001) evidence appraisal (p<0.001)
-----------------------	-----------	---------------------------------	--------------	--	--	----------------------	------------------------------	--

Supplementary Appendix 1: Search Strategy

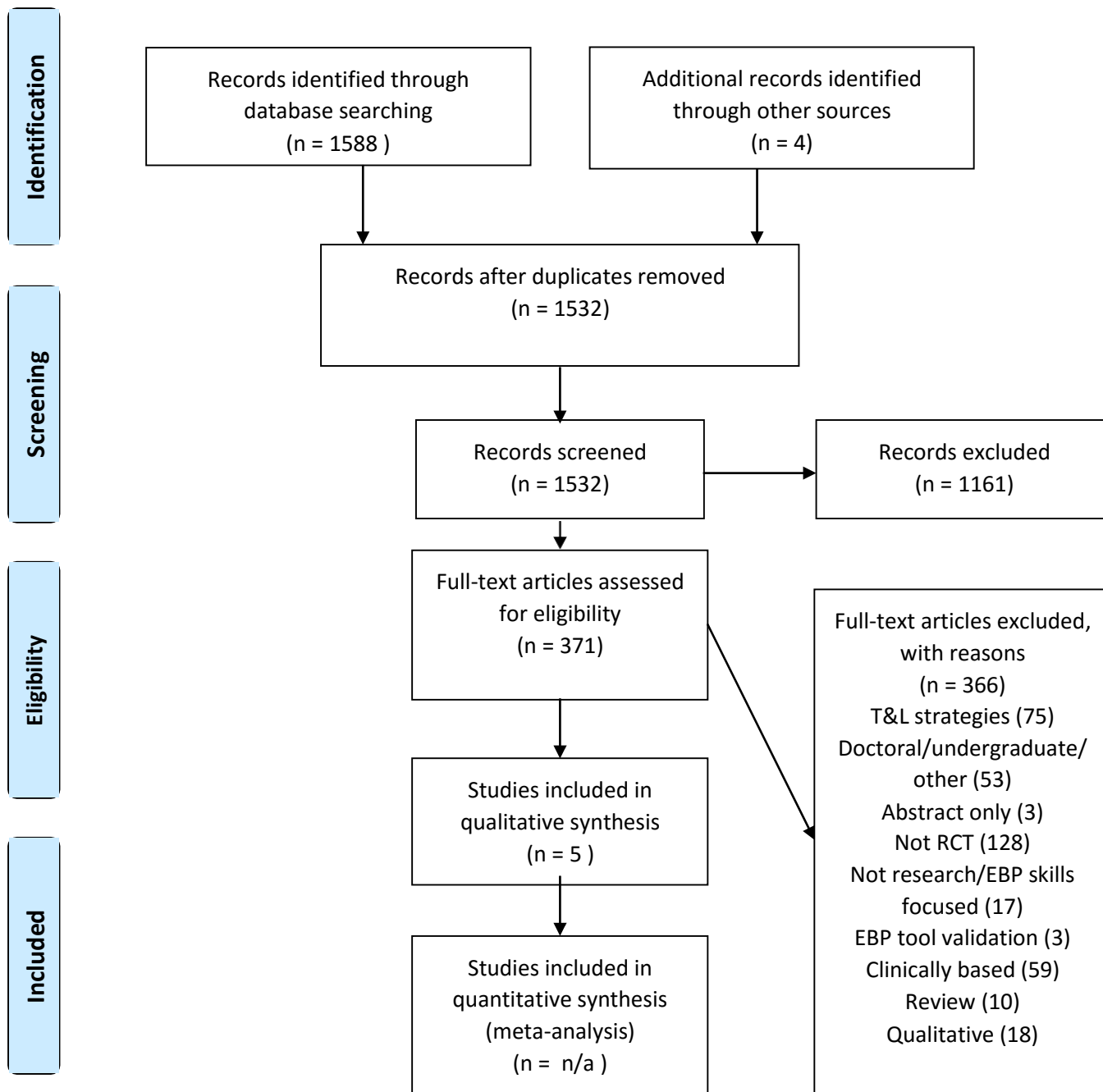
S1: MH Education Nursing Graduate OR MH Students, Nursing Graduate
S2: Post graduate nurses
S3: MH Students, Post RN
S4: MH Education, Nursing, Post-Doctoral OR MH Education, Nursing, Research-Based OR
MH Education, Nursing, Doctoral OR MH Education, Nursing, Masters
S5: S1 OR S2 OR S3 OR S4
S6: Experiential learning OR Kolb's experiential learning theory
S7: Promotion of student learning model OR MH Student Performance Appraisal
S8: MH Curriculum development
S9: MH Nursing Practice, Evidence-Based
S10: MH Program Implementation
S11: Flipped education
S12: MH Critical Thinking
S13: MH Problem Based Learning
S14: MH Learning Environment OR MH Learning Methods OR MH Outcome Assessment
S15: MH Teaching Methods
S16: Research Utilisation
S17: Translational Practice
S18: MH Professional Practice, Research Based
S19: Research Evidence
S20: EBP
S21: PICO
S22: MH Nursing Practice, Research Based
S23: Knowledge Utilisation
S24: Knowledge Transfer
S25: Capacity Building
S26: Knowledge application
S27: Evidence Based Practice Skills
S28: Research
S29: Capstone
S30: Project
S31: S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17
OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR
S29 OR S30
S30: S5 AND S29 limit to English Language; Peer Reviewed; Human

Supplementary Appendix 1: McMaster University Critical Review Form

	Brogan 1982	Selby 1985	Graue et al. 2009	Jones et al. 2011	Chang et al. 2014
Study purpose	Y	Y	Y	Y	N
Literature	Y	Y	Y	Y	Y
Design	Y	Y	N	Y	Y
knowledge	Y	Y	Y	Y	Y
Outcomes	Y	Y	Y -loose	Y-loose	Y
Ethical issues-confidentiality	Y	Y	Y	N	N
Bias	N	Highly motivated students advised of difficulty prior to commencing course (summer session)	Bias minimised by use of two researchers to conduct analysis.	Anecdotal evidence used to draw conclusions	N
Sample who	Y	Y	Y	Y	Y -minimal
Sample characteristics	N	Y	Y	N	N
Sample numbers	Y	N	Y	N –unable to ascertain how many received survey	Y
How sampled	Y –detail given but method not stated. Implied convenience	Non-probability sample	Y- convenience sample	Y-email –but sampling method not stated. Implied convenience	N
Similarity between groups	N-one group 6 months post –in workforce –additional questions asked	n/a one group design	n/a one group design	No- different language, campus, country –slightly different structure –HK-intensive	n/a single group evaluation
Sample size justified?	N	N	N	N	N
Outcomes reliable?	N	Y	N	N	N
Outcomes valid	N	Y	N	N	Y
Ethics approval?	N	N	Y	N	N
Informed consent?	N	Y	Y	N	N
Intervention detail	Y	Y	Y	Y	Y
Intervention Contamination avoided	Y- results analysed separately for each cohort	Y- single group design	y-single group design	Y- cohorts (HK and W) analysed separately	Y- single group design
Results –statistical significance	Y	Y	N- no significance testing, sample too small to show important difference	N- no significance testing, sample too small to show important difference	Y
Analysis methods appropriate	Y	Y	Y –descriptive only	Y –descriptive only	Y
Clinical importance reported? Differences clinically meaningful?	N	N	N	N	N

Dropouts reported (reasons given)?	N	N	Y	N	N
Conclusions	N -unclear	Y	Y	Y- based on low level evidence (anecdotal)	Y
Implications	Y-for further nursing research	Y (for nursing research)	Y –identify lack of tools for evaluating EBP, workplace barriers etc.	Y	Y
Limitations/Biases	Y Students had not started thesis writing when results collected, results (interest) influenced by coursework only	Y	Y female only cohort, reduced generalisability	Y	Y

Figure 1: PRISMA 2009 Flow Diagram



Research highlights

- Integration of blended learning, guided design process, small group work, role play and structure debate into the Masters of Nursing research courses demonstrated some improvements in evidence-based practice skills and research knowledge translation.
- Strategies that encourage a supportive professional learning environment and promotion of research culture will facilitate knowledge translation.
- Collaboration with research familiar personnel such as a clinical nurse consultant as a component of the Masters Capstone project is likely to foster collaboration and evidence-based practice integration.
- Guided approaches with gentle progression through various levels of difficulty and critical thinking are ideal for the development of confidence among students in evidence-based practice knowledge, utilisation and translation.