Evidence-based practice

in Bachelor healthcare education

A survey of attitudes, knowledge and behaviour

Anne Kristin Snibsøer

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Scientific environment

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Abstract

Background: Educational programmes in healthcare are expected to integrate evidence-based practice (EBP) into their curricula to ensure that Bachelor students have the requisite EBP attitudes, knowledge and behaviour when they graduate. To assess EBP profiles, instruments with evaluated measurement properties should be used. Few studies have explored EBP profiles among Bachelor students across health disciplines and educational institutions, and research is needed to enhance the understanding of EBP teaching and learning at the Bachelor level.

Aim: The overall aim of this PhD project was to contribute to the understanding of measurement and outcomes of EBP learning among healthcare students at the Bachelor level.

Methods: Three studies with two different designs were conducted. *Paper 1:* The Evidence-Based Practice Profile (EBP^2) questionnaire was translated and the measurement properties of the Norwegian version (EBP^2-N) evaluated among Bachelor students and healthcare professionals. We performed forward-backward translation and evaluated measurement properties related to reliability, validity and responsiveness. *Paper 2:* We applied the EBP^2-N and surveyed final year Bachelor students in nursing, occupational therapy, physiotherapy and radiography from four educational institutions in Norway. We performed regression analyses to analyze differences in mean EBP^2-N domain (Relevance, Terminology, Confidence, Practice and Sympathy) scores between health disciplines, Cohen's d to illustrate the magnitude of the largest differences, and Spearman's rho (r_s) to assess the monotonic relationship between EBP^2-N domains and students' assessment of EBP teaching and expectations of EBP performance, respectively. *Paper 3:* In this survey, we invited Norwegian and Canadian students to answer the EBP^2 Terminology domain items (self-reported), an additional item of 'evidence-based practice' and six random open-ended questions (objective) corresponding to the domain items. We used weighted kappa (K_w) to investigate inter-rater agreement between self-reported and objective items, and intraclass correlation coefficient (ICC) to estimate overall agreement.

Results: *Paper 1:* The forward–backward translation was repeated three times. Adequate reliability and discriminative validity were found for three of the five EBP^2-N domains (Relevance, Terminology and Confidence). The confirmatory factor analysis did not indicate a five-factor model fit. Responsiveness was as expected or better for all domains, except Sympathy. *Paper 2:* The highest overall mean score was found for Relevance, with an estimated standardized mean of 81.2 (CI 95% = 80.4–82.0). Standardized means were 54 and less for the other EBP^2–N domains. Differences between health disciplines were found for all domains ($p < 0.03$), and between educational institutions for three domains (Relevance, Terminology, Sympathy). We observed positive associations between Relevance and students' assessment of EBP teaching ($r_s = 0.31$), and expectations of EBP performance from teachers ($r_s = 0.36$); and between Confidence and students' assessment of EBP teaching ($r_s = 0.46$). *Paper 3:* For all research terms, mean self-reported scores were higher than objectively assessed scores ($p < 0.001$). Agreement between self-reported and objectively assessed open-ended items varied ($K_w = 0.04$ to $K_w = 0.69$). The overall agreement for the EBP^2 Terminology domain was poor (ICC = 0.29).

Conclusions: The EBP^2-N was valid and reliable for the domains of Relevance, Terminology and Confidence, and responsive to change for all domains, except Sympathy. Bachelor students found EBP relevant, but reported limited understanding of EBP terminology, limited confidence with EBP skills, and infrequent use of EBP. We found that there were statistically significant, but small differences between health disciplines for all EBP^2-N domains, and between educational institutions for three domains. There was overall low agreement between students' self-reported and objectively assessed knowledge of EBP terminology. Before further use of the EBP^2-N, adequate structural validity and reliability should be enhanced for all EBP^2-N domains. For the purpose of educational assessment, users should be aware that self-ratings on the Terminology domain would be higher than objectively assessed knowledge. Efforts are needed to further develop the understanding of EBP and to explore strategies for enhancing EBP in curricula and in teaching across Bachelor programmes in healthcare.

List of publications

Paper I Titlestad KB, Snibsoer AK, Stromme H, Nortvedt MW, Graverholt B, Espehaug B**.** Translation, cross-cultural adaption and measurement properties of the evidence-based practice profile. BMC Res Notes 2017;10(1):44.

Paper II Snibsøer AK, Graverholt B, Nortvedt MW, Riise T, Espehaug B. Evidence-based practice profiles among Bachelor students in four health disciplines: a cross-sectional study. BMC Medical Education 2018;18(1):210.

Paper III Snibsoer AK, Ciliska D, Yost J, Graverholt B, Nortvedt MW, Riise T, Espehaug B. Self-reported and objectively assessed knowledge of evidence-based practice terminology among healthcare students: a cross-sectional study. PLoS One. 2018;13(7):e0200313.

Abbreviations

CASP	Critical Appraisal Skills Programmes
CFA	Confirmative Factor Analysis
COSMIN	Consensus-based Standards for the selection of health Measurement Instruments
CREATE	Classification Rubric for EBP Assessment Tools in Education
EBHC	Evidence-Based Health Care
EBP^2	Evidence-Based Practice Profile
EBP^2-N	Evidence-Based Practice Profile – Norwegian version
ECTS	European Credit Transfer and accumulation System
EFA	Exploratory Factor Analysis
GREET	Guideline for Reporting EBP Educational interventions and Teaching
KTA	Knowledge-to-Action
NEHL	Norwegian Electronic Health Library
PICO	Populations/People/Patient/Problem, Intervention, Comparison, Outcome
RETHOS	Nasjonal retningslinjer for helse- og sosialfagutdanningene (National Guidelines for the health and social care educations)

Definitions

Allied health	Allied health professions are those health professions that are distinct from medicine and nursing.
Bachelor student	Bachelor student, undergraduate student or undergraduate is a student undertaking an academic degree at an institution of higher education, such as a college or university.
Bachelor degree	Bachelor degree is an undergraduate academic programme that typically takes 3 to 4 years to complete. A Bachelor degree is usually needed for admittance into a graduate programme; a Master degree.
Healthcare professional	Healthcare professional, health professional or practitioner is a qualified and authorized person who may operate within their branch of healthcare and thereby provide a healthcare service to a patient.

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Appendix

1. Introduction

Evidence-based practice (EBP) is a systematic approach to clinical decision-making that integrates the best available research evidence with clinical expertise and the patient's unique values and preferences within a given context (1, 2). Internationally, EBP has become a standard required by health professions and an evidence-based approach to healthcare is recognised by many as a core competency for healthcare professionals (3-6). Within the nursing and allied health professions, there are expectations that practitioners apply knowledge and skills based on the best available evidence, use evidence to inform practice, and constantly strive to use evidence-based approaches to improve healthcare performance (7-9).

For upcoming healthcare professionals to learn and apply EBP, it is recommended that health professions integrate the necessary knowledge, skills and attitudes of EBP into their undergraduate education (1). Competency frameworks that advocate educational programmes to integrate EBP into curricula and prepare students to practice in an evidence-based way have been promoted by international healthcare professional federations (10-13). In Norway, EBP has become increasingly emphasised in Norwegian policies related to higher education in healthcare (14-19). At the commencement of this PhD project, it was expected that Bachelor students in nursing and allied health could read research reports and make use of research results (20-23). Additionally, mandatory training in EBP had just been proposed for all Bachelor programmes in healthcare (15).

The teaching and learning of EBP has become part of curricula in many countries (24-27). International surveys report inconsistent findings of undergraduate healthcare students' levels of knowledge, skills, attitudes and behaviours related to EBP (27-36). The overall aim of this project was to contribute to the understanding of measurement and outcomes of EBP learning among healthcare students at the Bachelor level.

1.1 Evidence-based practice

1.1.1 Evidence-based practice definition

EBP derives from evidence-based medicine (EBM). EBM was introduced in 1991 within the context of clinical epidemiology and medicine (37). An often-used definition describes EBM as:

> "the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research" (38, p. 71).

As professions allied to health and social care began to support the advantages of an evidence-based approach to practice and learning, EBP was introduced to broaden the concept and to reflect the benefits of all professions in healthcare adopting a shared evidence-based approach (1). The Sicily statement on EBP (1), a consensus statement from an international group of EBP teachers, describes the concept as follows:

> "EBP requires that decisions about health care are based on best available, current valid and relevant evidence. These decisions should be made by those receiving care, informed by the tacit and explicit knowledge of those providing care, within the context of available resources" (1, p. 4).

Multiple definitions of EBP have been proposed, some specific to health disciplines, such as evidence-based nursing (39), evidence-based occupational therapy (40), evidence-based physiotherapy (8), and evidence-based radiography (41). EBP is also referred to as evidence-based health care (EBHC) (1). In this thesis, EBP will be used for all these related terms.

In Norway, EBP translates into ‘knowledge-based practice’ (kunnskapsbasert praksis). Illustrated by a model (Figure 1), it states:

> “to make professional decisions based on systematically retrieved knowledge from research, experience, and the patient’s preferences and needs in the given situation” (42, p. 17).
>
> [«In Norwegian: å ta faglige avgjørelser basert på systematisk innhentet forskningsbasert kunnskap, erfaringsbasert kunnskap og pasientens ønsker og behov i den gitte situasjonen»] (42, p. 17).

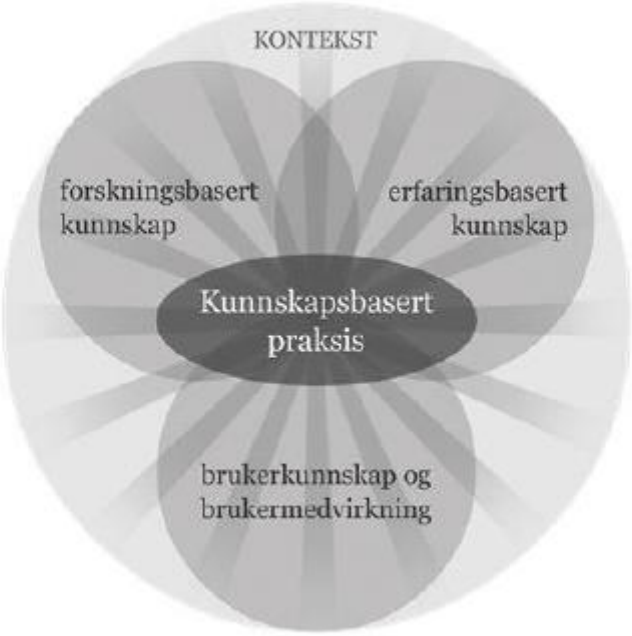

Figure 1. The Norwegian model of knowledge-based practice. Used with permission from kunnskapsbasertpraksis.no (43).

Fundamental to EBP is the integration of the best research evidence with clinical expertise and the individual patient’s values and preferences (2). To clarify these concepts, a brief description will be given on how research evidence, clinical expertise and patient values and preferences are understood in the context of EBP.

Best *research evidence* refers to clinically relevant research that comes from patient-centered clinical research into questions of diagnosis, prognosis, and effect of therapeutic, rehabilitative, and preventive treatments (2, 38). It also derives from qualitative studies examining questions about the meaning and nature of patients' experiences (44, p. 26), and from the basic sciences of medicine, such as genetics or immunology (38). A core principle of EBP state that clinical decisions are best informed by systematic reviews (i.e. summaries of research that address a focused clinical research question in a systematic, reproducible manner (45)) (46).

Clinical expertise involves the ability to use both clinical skills and past experience to identify a patient's individual health condition and diagnosis, their personal values and expectations, and the unique risks and benefits of possible interventions (2). According to the Sicily statement, it incorporates explicit knowledge obtained from research information, and non-research knowledge, such as tacit knowledge or accumulated wisdom that come from clinical experience (1). Clinical expertise may involve multiple dimensions and include personal attributes such as communication and interpersonal skills, professional judgement, technical clinical skills, and a sound knowledge base (47). Expertise could be viewed as a continuum based on clinical practice experience gained over time, which differs between novices and experts in the field (48).

A patient's values and preferences refers to the unique preferences, expectations and predicaments an individual brings to a clinical encounter (2). It relates to the collection of beliefs and goals that a patient has for decision outcomes (49). Underpinning EBP is the acknowledgement that evidence is necessary, but never sufficient to make clinical decisions (2, 49). To achieve optimal clinical decisions, individual values and preferences must balance the evidence and the benefits, risks and costs related to alternative management strategies (2, 49).

1.1.2 Evidence-based practice process

The practice of EBP includes the iterative process of following the steps involved in EBP. The Sicily statement on EBP describes a 'five-step model' of EBP: 1) translation of uncertainty into an answerable question, 2) systematic retrieval of best available evidence, 3) critical appraisal of evidence for validity, clinical relevance and applicability, 4) application of results in practice, and 5) evaluation of performance (1). A premise to this process, or a 'step 0', is practitioners' attitudes and abilities to manage uncertainty and reflective learning (1). Without a spirit of inquiry that questions current clinical practices, the steps of the EBP process are not likely to happen (50, 51). To emphasise its importance, the Norwegian 'six-step model' of EBP explicitly integrates reflection upon practice as a first step (42, p. 21).

Various types of knowledge and skills are required to perform the core steps of EBP (Figure 2). To perform the first three steps, practitioners need abilities to question current clinical practices and frame answerable clinical questions (Step 1), knowledge of medical databases and skills in literature searching (Step 2), an understanding of scientific methods and statistics (biostatistics and epidemiology) (Step 3), and a critical approach (Step 1-3) (1, 52-56). In applying the evidence (Step 4), clinicians rely on their clinical expertise to define and judge characteristics with the treatment, patient and context that may affect the applicability of results to individual patients (49). Sensitivity and communication skills are needed to understand the patients' personal situation and thereby be able to make clinical decisions (49). Finally, to evaluate performance (Step 5), practitioners need to be able to self-evaluate and reflect on their own performance of the EBP steps, and on the application and integration of evidence into clinical practice (2).

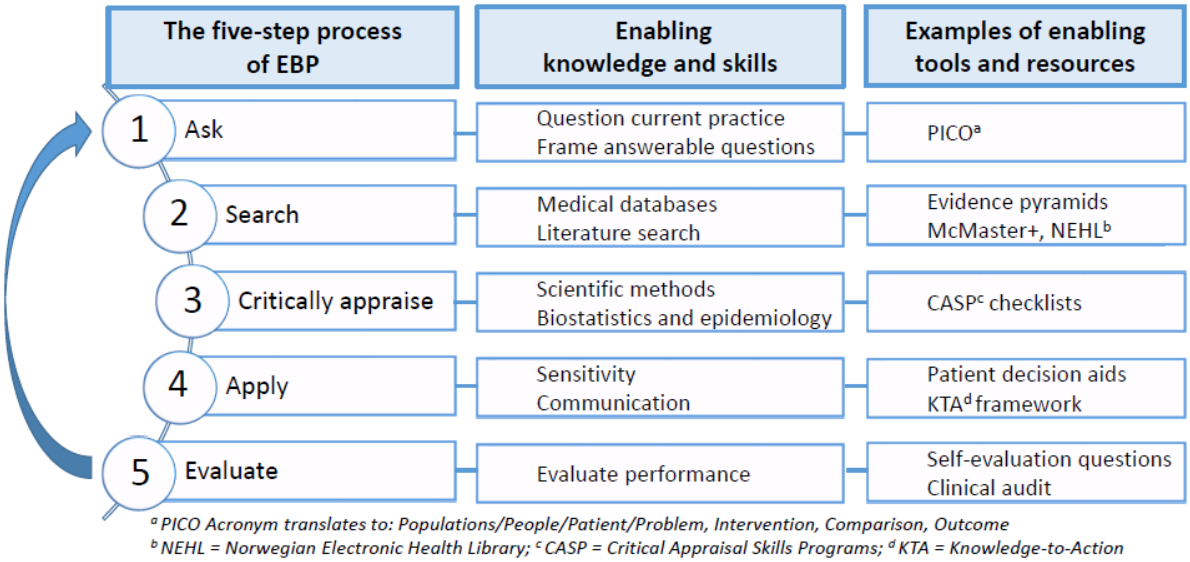

Figure 2. The five-step process of EBP, enabling knowledge and skills, and examples of enabling tools and resources

Critical thinking and clinical reasoning are underpinning the steps of EBP. Critical thinking is essential as a tool of inquiry, and it is a resource at the personal and professional level (57). It concerns the process of purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation and inferences, and includes considerations upon which the judgement is based (57). Frequently cited attributes of critical thinking relate to open-mindedness, reflection, knowledge and reasoning (58). The ability to think critically is relevant to decision-making in many circumstances (59) and vital to support EBP (60).

Clinical reasoning is a context-dependent thinking and decision-making process that occurs in professional practice to guide practice in action (47). There is no one single model that adequately reflects clinical reasoning in the context of different health professions and different workplaces (47). In short, clinical reasoning involves the discipline-specific knowledge (derived from theory, research and experience), cognition, meta-cognition (reflective self-awareness) and interactive skills that are used to collect, interpret and combine different types of information from a range of sources while making clinical judgements and decisions (61). Clinical reasoning is required when practitioners integrate research evidence with their clinical experience

and patient preferences into decisions that best address the patient's unique situation (62).

Various tools and resources have been designed to enable the five-step process of EBP (Figure 2). For example, the PICO framework (acronym translates to: Populations/People/Patient/Problem, Intervention, Comparison, Outcome) is developed to facilitate the process of framing a query of uncertainty into a focused, answerable question in a structured format (Step 1) (63). Moreover, evidence pyramids, e.g. the 6S model (64) and EBHC pyramid 5.0 (65), may guide practitioners to effectively search for research evidence at the highest possible level in the hierarchy of evidence (Step 2). The search process is further facilitated by the McMaster+, a web-based information service with a searchable database of high quality journal articles (66). Norway is privileged to have the Norwegian Electronic Health Library (NEHL), which includes the McMaster+ and provides healthcare professionals with free access to guidelines, systematic reviews, scientific journals, and other full-text resources (67). To facilitate the critical appraisal of systematic reviews and research articles (Step 3), the Critical Appraisal Skills Programmes (CASP) have developed eight sets of critical appraisal tools, often referred to as the CASP checklists (68). Equivalent checklists are available in Norwegian (69). Moreover, to facilitate the application of research evidence (Step 4), decision aids that communicate benefits, harms and alternatives in an easily understandable manner have been developed to communicate uncertainty and to support patients in making well considered choices among healthcare options (70). Various frameworks, such as the Knowledge-to-Action (KTA) framework (71) and clinical audits (72, 73), may be used to guide the process of implementing evidence into practice and to evaluate performance (Steps 4-5). Also, self-evaluation questions, such as the one described by Straus et al. (2) may be used as a guide to self-evaluate individual EBP performance (Step 5).

Practitioners may incorporate and apply EBP in different ways, depending on their needs, time constraints, level of responsibility and level of EBP expertise (74). Straus et al. (74) differentiate between the 'doing', 'using' and 'replicating' mode. As

‘doers’, clinicians incorporate evidence by completing at least the first four steps of EBP, ‘users’ eliminate the critical appraisal step by restricting their searches to evidence sources that contain pre-appraised evidence summaries, and ‘replicators’ follow recommendations and decisions of respected guideline developers (2, 74). According to Dawes et al. (1), a minimum requirement to provide ‘best practice’ is that all practitioners understand the principles of EBP, have a critical attitude to their own practice and to evidence, and implement evidence-based policies.

1.2 Teaching and learning evidence-based practice

We must keep pace with a world characterized by rapid demographic and epidemiological transitions and health challenges related to new infectious, environmental and behavioural risks (4). To meet these challenges, healthcare education need to prepare upcoming healthcare professionals for a future characterized by lifelong learning, adaptation and change (18). The Lancet report on Education of Health Professionals for the 21st Century (4) proposes that healthcare training should become transformative, with the purpose to produce enlightened change agents. One of the fundamental shifts in transformative learning is a shift in healthcare training “from fact memorisation to searching, analysis, and synthesis of information for decision making” (4, p. 1924). Lifelong learning and EBP have been proposed as a way forward in healthcare education (4, 18).

1.2.1 Evidence-based practice in curricula

The Sicily statement on EBP recommends curricula for health professions to include the necessary knowledge, skills and attitudes of EBP (1). Skills to find relevant research quickly, critically appraise evidence and apply sound findings in practice are regarded by some as equally essential as other clinical skills (75). Recommendations suggest that curricula should be grounded in the five-step model of EBP (1), and that the basic skills of EBP should be taught early, integrated into curricula across all years, and be assessed before graduation (25, 75). Also, the teaching and learning of EBP should reflect the clinical setting, and in doing so, consider the real-time setting

of practice and the amount of time clinicians have available to search for and appraise evidence (1). By integrating and regularly applying the basic skills of EBP in a clinical setting, students learn how to incorporate these skills with patient care and their own life-long learning (1, 75).

In Norway, the National Curricula for Higher Education sets standards for educational programmes in healthcare by describing overall aim, scope and content, and expected learning outcomes upon completion of programmes. The National Curricula for nursing and allied health educations include health profession-specific content (150 European Credit Transfer and accumulation System (ECTS credits)), and common content (30 ECTS credits) shared by Bachelor programmes in the nursing and allied health disciplines (20-23). Based on the National Curricula and the Norwegian Qualification Framework for Lifelong Learning (76), universities and university colleges develop their own curricula. These local curricula contain information about the course-specific learning outcomes, content, structures, and assignments of individual programmes. As of 2017, one of 12 common learning outcomes in the National Regulations of Common Curricula for the Health and Social Care Education calls for students to acquire new knowledge and make professional judgements, decisions and actions in line with EBP (19). Moreover, National Guidelines for the Health and Social Care Educations (RETHOS) are under development (77).

1.2.2 Teaching strategies for evidence-based practice

Numerous studies have assessed the effect of teaching EBP to students on EBP competencies. Teaching EBP has been offered as stand-alone sessions or integrated into clinical practice (25, 78, 79). Teaching strategies have included bedside teaching, journal clubs, workshops, small group discussions, computer laboratory sessions, tutorials, or lectures offered to students as face-to-face, online or blended learning (79, 80). Teaching approaches have involved directed learning or self-directed, problem- based learning delivered to an individual learner or to a group of learners (55, 79, 81). A number of systematic reviews have commented on the inconsistent

and incomplete reporting of EBP educational interventions (25, 55, 79, 81-84), even after contacting study authors for missing information (83). To improve the lack of transparency and incompleteness in the reporting of EBP educational research, the Guideline for Reporting EBP Educational interventions and Teaching (GREET) statement (85, 86) was developed.

Teaching EBP to undergraduate students is associated with an increase in EBP knowledge, skills, attitudes (55, 79-81, 87) and behaviour (55). It has not been possible to determine which kind of educational intervention is most effective for teaching EBP (55, 81). Still, in an overview of systematic reviews, Young et al. (79) found that multifaceted educational interventions, which included combinations of educational strategies, such as small-group discussions, lectures, computer laboratory sessions and journal clubs, where clinically integrated and applied assessment was included were more likely to improve EBP knowledge, skills and attitudes among undergraduates compared with no interventions or single interventions offered over a short period of time (79). In this overview, Young et al. (79) assessed the quality of the included systematic reviews and found it to be of variable quality. However, due to overlap in the studies included in the 16 systematic reviews, findings for undergraduate students were based on 31 individual studies which were not assessed for methodological quality (79).

The findings of Young et al. (79) support Khan and Coomarasamy's (78) proposed hierarchy of teaching and learning methods in EBP. In this hierarchy, the levels of teaching and learning methods were categorized in terms of decreasing effectiveness by 1) interactive and clinically integrated activities; 2a) interactive but classroom-based activities; 2b) didactic but clinically integrated activities; 3) didactic, classroom or stand-alone teaching. A recent systematic review, which lacked a transparent quality assessment of the included studies, supported the previous findings of using multifaceted approaches to teach EBP to undergraduate healthcare students (88). Also, a thematic literature review identified interactive and clinically integrated teaching strategies as a theme for teaching EBP to undergraduate nursing students (89). However, due to low quality evidence, Ahmadi et al. (81) found insufficient

evidence supporting clinically integrated methods and short stand-alone instructions, while high-quality evidence indicated that e-learning strategies were as effective as traditional educational strategies in improving EBP knowledge and skills.

1.2.3 Outcomes of evidence-based practice learning

There are various frameworks for evaluating EBP teaching methods and classifying outcomes of EBP teaching and learning (74, 90, 91). In an early conceptual framework, Straus et al. (74) pointed out that different levels of educational outcomes, i.e. knowledge, attitudes, skills, behaviour and clinical outcomes, should be considered in relation to the learners' needs and learning styles ('doers', 'users' or 'replicators'), and the steps of the EBP model reflected in the teaching and learning.

A later framework classified outcomes of EBP learning from previous research into three categories: 1) learner outcomes, 2) patient outcomes (e.g. patient satisfaction, health-related quality of life and improved patient care) and 3) system outcomes (e.g. population health and cost-effectiveness) (90). In this framework, the learner outcomes were further divided into three domains: 1) affective, which included satisfaction with teaching, attitudes, beliefs and intentions to use EBP, 2) cognitive, which included knowledge acquisition and skills development, and 3) behavioural, which involved the use of evidence in clinical practice (90).

In the Sicily statement on classification and development of EBP tools, the Classification Rubric for EBP Assessment Tools in Education (CREATE) provides seven categories for classifying EBP learner assessment tools: 1) reaction to the EBP educational experience, 2) attitudes about EBP, 3) self-efficacy for conducting EBP, 4) knowledge about the EBP principles, 5) skills for performing EBP, 6) behaviour congruent with EBP as part of patient care, and 7) benefits to patients associated with EBP (91). In this framework, the seven outcome categories are further characterized in relation to the five-step model of EBP, type and level of educational assessment, learners' characteristics, and learning and assessment aims.

Typically reported outcomes of EBP learning relate to attitudes, self-efficacy, knowledge, skills and behaviour. These outcomes are also relevant for this PhD project.

Attitudes refer to the values the learner ascribes to the importance and usefulness of EBP to inform clinical decision-making (91). As a learner outcome in the affective domain, it has variously been assessed as attitudes towards medical literature, use of research information, perceived importance for clinical practice and perceived skills and confidence (90).

Self-efficacy refers to peoples' belief in their own ability to perform a certain activity (91). Self-efficacy has been assessed as beliefs about EBP and confidence in one's ability to use EBP (92), capability beliefs regarding EBP (93) and beliefs in one's ability to implement EBP (94).

Knowledge refers to the retention of facts and concepts about EBP, such as the ability to define EBP concepts, list basic principles of EBP or describe levels of evidence (91). Others relate knowledge to remembering materials as well as grasping the meaning, such as defining and understanding concepts like Numbers Needed to Treat (NNT) (78). Knowledge as a learner outcome in the cognitive domain has been assessed as knowledge about information sources, concepts in critical appraisal, statistics and epidemiological concepts (90).

Skills refer to the application of knowledge, preferably in a practice setting (91). Skills have also been regarded as participants' ability to apply their knowledge by performing the steps of EBP (95), and to applying their knowledge accurately to given problems (78).

Behaviour refers to what learners actually do in practice, and includes all the processes that are used in the application of EBP (91). It is viewed as the actual performance of EBP in practice, and relates to actually enacting the EBP steps in patient care activities, performing evidence-based clinical manoeuvers in practice, and affecting patient outcomes (95). As a learner outcome in the behavioural domain,

it has been evaluated as frequency of question formulation, evidence retrieval and critical appraisal (90). Others refer to solving an issue in practice by seeking the necessary information and applying the knowledge and skills needed to solve it (78).

The objective of an assessment can be formative or summative. With formative assessments, a student's performance is typically assessed during a programme, by lecturers giving feedback and comments on the student's work, concurrent with the learning process (96). Formative assessment provides information about competency development, and is used to guide and facilitate the educational process (91). Summative assessment evaluates achievement at the end of programmes, and is usually described in grades (96). Summative assessment is often used to determine competence or qualifications for advancement (91).

1.2.4 Evidence-based practice in undergraduate health disciplines

Previous studies assessing EBP educational outcomes have been predominantly conducted among medical students and postgraduate healthcare professionals. Most studies assessed advancement in EBP performance before and after EBP exposure, or evaluated educational interventions or strategies. Based on a systematic literature search (Appendix 1), we found ten surveys published by 2014 that assessed EBP knowledge, skills, attitudes, behaviour and perceptions among undergraduate students in nursing and the allied health disciplines of occupational therapy, physiotherapy and radiography (Appendix II). The studies were performed in different countries, and all but one (31) used samples from one individual health discipline. The applied self-reported questionnaires were either developed, validated and applied in a discipline-specific sample of undergraduate students (31-33, 36), modified from a nursing or medical setting, but not validated for the applied samples (28-30, 34, 35), or purposely designed, but not validated (27). Thus, the studies were heterogeneous with regard to study population, applied measurement instruments, reporting of findings and methodological quality.

From a Norwegian perspective there was a lack of studies that had assessed EBP attitudes, knowledge, skills and behaviour in Bachelor programmes across health disciplines. Other designs have been used, but no studies investigating outcomes of EBP learning among Norwegian Bachelor students have used instruments validated for a Norwegian context (27, 97-99). Moreover, no studies have compared outcomes of EBP learning among Bachelor students in nursing, occupational therapy, physiotherapy and radiography.

1.2.5 Evidence-based practice measurement instruments

Tools for assessing outcomes of EBP related to EBP teaching and learning have been examined in several systematic reviews (95, 100-106). These reviews have described instruments that assess EBP knowledge, skills, attitudes and/or behaviour among healthcare professionals (95, 100-102), occupational therapists (103, 104), physiotherapists (105) and nurses (106). Findings from these systematic reviews show that most instruments have limited consideration of measurement properties, and few were recommended for evaluating outcomes of EBP learning among clinicians. Shaneyfelt et al. (95) highlighted the Fresno Test (107) and the Berlin Questionnaire (108) as the only tools with robust measurement properties for evaluating EBP competencies within the medical field. Based on scenarios and objectively measured outcomes, the Fresno Test measures knowledge and skills across four steps of EBP, while the Berlin questionnaire primarily assesses critical appraisal skills (101). For nurses, Leung et al. (106) identified the revised version of the Evidence-Based Practice Questionnaire (EBPQ) (109) as the only instrument with adequate validity for measuring EBP knowledge, skills and attitudes among nurses. The measurement properties of this instrument have later been confirmed across countries and professional groups (110). Within allied health, Glegg and Holsti (103) found the Adapted Fresno Test of Competence in EBP (111) and the EBP Survey (112) adequate for measuring EBP knowledge and skills with occupational therapists. For use in physiotherapy, Fernandez-Dominguez (105) described the Evidence-Based Practice Profile (EBP^2) (113) as the instrument with the most complete reporting of measurement properties.

To our knowledge, no systematic reviews have reported on instruments used for assessing outcomes of EBP learning among undergraduate students across health disciplines. A protocol for a systematic review to identify and assess measurement properties of instruments measuring EBP attitudes, knowledge and skills among undergraduate nursing students was recently published (114), but, so far, the systematic review has not been published. We performed a systematic literature search (Appendix I) to find a relevant measurement instrument, underpinned by transparent evaluation of measurement properties, which could be used to assess outcomes of EBP learning across health disciplines and educational institutions. Studies that evaluated measurement properties of instruments developed to assess outcomes of EBP learning among undergraduate students across health disciplines were included. Measurement instruments developed for healthcare professionals were only considered if they were adapted and tailored to undergraduate students.

By 2014, measurement instruments that assessed outcomes of EBP learning had been developed and validated for students in medicine (108, 115-117), dentistry (118), nursing (93, 119), physiotherapy (120), healthcare disciplines (113), and speech-language therapy (121) (Table 1). Moreover, the Fresno Test had been adapted to students in physiotherapy (122) and speech-language therapy (123). The Evidence-Based Practice Profile (EBP^2) was the only tool with acceptable measurement properties that was described to be trans-professional, to assess the five steps of EBP and to incorporate elements of EBP likely to change as a result of education, training and exposure to EBP (113).

Table 1. EBP tools validated for undergraduate students in healthcare disciplines, in chronological order. Studies published by 2014 informed this thesis.

Instrument Source	Students Country	Instrument construction	Study variable(s) EBP steps	Reliability, Validity and Responsiveness
Berlin Questionnaire Fritsche et al. 2002 (108)	Medical Germany	Scenario, 15 questions Correct/wrong	Knowledge and skills Steps: appraise	**Reliability:** Cronbach's alpha, Internal consistency **Validity:** Discriminative, **Responsiveness:** Pre/post
Knowledge, Attitude and Behaviour Questionnaire (KAB) Johnston et al. 2003 (115)	Medical Hong Kong	Self-report 31 items Likert scale	Knowledge, Attitude Behavior, Perceptions Steps: not reported	**Reliability:** Cronbach's alpha **Validity:** Construct: PCA **Responsiveness:** Pre/post
EBM Competency Questionnaire (EBM-CQ) Park et al. 2009 (116)	Medical Korea	Self-report 32 items Likert scale	Knowledge, Attitude, Practice Steps: not reported	**Reliability:** Cronbach's alpha **Validity:** Construct: EFA/CFA Discriminative
Evidence Based Practice Profile (EBP^2) McEvoy et al. 2010 (113)	Healthcare Australia	Self-report 58 items Likert scale	Knowledge, Attitude Practice Steps: all	**Reliability:** Cronbach's alpha Test-retest **Validity:** Construct: EFA Discriminative, Convergent
Modified Fresno Test Tilson et al. 2010 (122)	Physical therapy USA	Scenario 12 questions Scoring rubric	Knowledge and skills Steps: ask, acquire, appraise and apply (added patient perspective)	**Reliability:** Cronbach's alpha Intra-rater, Inter-rater Item-total correlation **Validity:** Content, Discriminative, Item difficulty, Item discrimination index
Knowledge, Attitudes, Access and Confidence Evaluation (KACE) Hendricson et al. 2011 (118)	Dental USA	Self-report 35 items Correct/wrong Likert scale	Knowledge, Attitude Accessing evidence, Confidence Steps: ask, acquire, appraise	**Reliability:** Cronbach's alpha Test-retest **Validity:** Discriminative **Responsiveness: P**re/post
Knowledge of Research Evidence Competencies' instrument (K-REC) Lewis et al. 2011 (120)	Physiotherapy Australia	Scenario 9 items Scoring rubric Correct/wrong	Cognitive skills Steps: ask, acquire, appraise	**Reliability:** Test-retest Inter-rater **Validity:** Discriminative Item difficulty
Capability beliefs on EBP Wallin et al. 2012 (93)	Nursing Sweden	Self-report 6 items	Capability beliefs, self-efficacy Steps: all	**Rasch analysis**
EBP Evaluation Competence Questionnaire (EBP-COQ) Ruzafa-Martinez et al. 2013 (119)	Nursing Spain	Self-report 25 items 10-point visual analogue scale	Knowledge, Attitude Skills Steps: not reported	**Reliability**: Cronbach's alpha **Validity:** Content. Construct: PCA Discriminative
The Dutch Modified Fresno Spek et al. 2012 (123)	Speech-language therapy Netherlands	Scenario 12 questions Scoring rubric True/false	Knowledge and skills Steps: ask, acquire, aappraise	**Reliability:** Cronbach's alpha Inter-rater, Inter-item and Item-total correlation **Validity:** Content Construct: Discriminative **Responsiveness:** Pre/post
Competent in EBP Spek et al. 2013 (121)	Speech-language therapy Netherlands	Self-report 20 items Likert scale	Self-efficacy and EBP task value Steps: not reported	**Reliability:** Cronbach's alpha **Validity:** Face Construct: PCA Discriminative
Assessing Competence in EBM (ACE) Ilic et al. 2014 (117)	Medical trainees Australia	Scenario 15 questions Yes/no	Knowledge, Attitudes Skills Steps: ask, acquire, appraise and apply	**Reliability:** Cronbach's alpha Item-total correlation **Validity:** Face and content Construct: Discriminative Item discrimination index Item difficulty

Instrument **Source**	**Students** **Country**	**Instrument** **construction**	**Study variable(s)** **EBP steps**	**Reliability, Validity and** **Responsiveness**
Self-report Evidence-Based Practice Tool Blackman et al. 2015 (124)	Nursing students Australia	Self-report 27 items Likert scale	Self-efficacy Steps: not reported	**Rasch analysis**
Evidence-Based practice Knowledge Assessment in Nursing (EKAN) Spurlock and Hagedorn Wonder, 2015 (125)	Nursing students USA	Multiple-choice 20 items	EBP knowledge Steps not reported	**Rasch analysis**
Effectiveness of EBP course and Competence in EBP skills Zelenikova et al. 2015 (126)	Nursing USA	Self-report 13 + 14 items Likert scale	Effectiveness course, Competence in EBP Steps: ask, acquire, appraise	**Reliability**: Cronbach's alpha Inter-item correlation **Validity:** Construct: PCA
Student EBP Questionnaire (S-EBPQ) Upton et al. 2016 (127)	Nursing England	Self-report 21 items Likert and semantic scale	Knowledge and skills Attitudes, Practice 4 subscales Steps: all	**Reliability:** Cronbach's alpha Item-total correlation **Validity:** Construct: PCA Convergent: Discriminative Item discrimination
EBP instrument based on the Theory of Planned Behaviour Watters et al. 2016 (128)	Nursing USA	Self-report	Attitudes, Perceived support, Self-efficacy and Behaviour	Not available in full text
EBP-COQ Turkish version Yildiz et al. 2016 (129)	Nursing Turkey	Self-report Same items as original scale	Same as EBP-COQ	**Reliability**: Cronbach's alpha **Validity:** Content Construct: EFA
Slovak and Czech version of the Evidence-Based Practice Beliefs and Implementation Scales Zelenikova et al. 2016 (130)	Nursing Czech Republic and Slovakia	Self-report scale 16 + 18 items 5-point Likert and frequency scale	Beliefs Behaviour	**Reliability:** Cronbach's alpha **Validity:** Construct: PCA, Criterion
EBP^2 - Polish version Panczyk et al. 2017 (131)	Nursing and midwifery Poland	Self-report Same items as original scale	Same as EBP^2	**Reliability:** Cronbach's alpha Test-retest **Validity:** Construct: EFA Discriminative
EBP^2 - Norwegian version Titlestad et al. 2017 (132)	Nursing and social educators Norway	Self-report Same items as original scale	Same as EBP^2	**Reliability: Cronbach's alpha** Test-retest, SEM **Validity:** Construct: CFA Discriminative **Responsiveness:** Pre/post
S-EBPQ Australian sample Beccaria et al. 2018 (133)	Nursing Australia	Self-report Revised to 20 items tool	Same as S-EBPQ	**Reliability:** Cronbach's alpha **Validity:** Construct: CFA

2. Aims

The overall aim of this project was to contribute to the understanding of measurement and outcomes of EBP learning among healthcare students at the Bachelor level.

The specific aims of the studies in the three papers were:

Paper I

To translate and cross-culturally adapt the Evidence-Based Practice Profile into Norwegian and to evaluate the reliability, validity and responsiveness of the Norwegian version.

Paper II

To assess EBP profiles among Bachelor students in health disciplines, and explore differences between health disciplines and between educational institutions, and further, to investigate associations between EBP profiles and students' assessment of EBP teaching and expectations of EBP performance from teachers.

Paper III

To examine agreement between self-reported and objectively assessed knowledge of EBP terminology among healthcare students, and further, to explore the level of agreement among students with different degrees of EBP exposure.

3. Materials and methods

3.1 Study designs, setting and participants

3.1.1 Study design

This project consisted of one translation and validation study and two cross-sectional studies (Table 2). The studies were sequential, as the first study (hereafter referred to as the measurement study; or Paper I) reported on the translation and validation of the questionnaire used in the second study to survey Bachelor students across health disciplines (the survey; Paper II), and finally the results from this study led to the third study comparing students' self-reported and objectively assessed knowledge of EBP terminology (the agreement study; Paper III).

Table 2. Overview of study designs and materials

	Measurement study Paper I	**Survey Paper II**	**Agreement study Paper III**
Design	Test-retest; pre-post	Cross sectional	Cross sectional
Sample	*Pilot translation:* Bachelor students (n=5), health and social workers (n=13) *Measurement evaluation:* 2nd year Bachelor students in nursing (n=96) and social education (n=27) from one University College and health and social workers (n=26) from a local hospital	3rd year Bachelor students in occupational therapy (n=129), physiotherapy (n=92), radiography (n=56) and nursing (n=430) from three University Colleges and one University in Norway	*Pilot scoring rubric:* 3rd year Norwegian Bachelor students (n=49) and clinicians with Masters degree in EBP (n=19) *Agreement:* 3rd year Bachelor students and Master students from one University College in Norway (n=234) and one University in Canada (n=57)
Data collection	Questionnaire Self-report Interview Year of data collection: Winter 2013 - 2014	Questionnaire Self-report Content analysis Year of data collection: May - June 2015	Questionnaire Self-report Open-ended questions Scoring rubric Year of data collection: Winter 2016 - 2017

3.1.2 Setting

The main setting for this project was Norwegian higher educational institutions with Bachelor programmes in nursing, occupational therapy, physiotherapy and radiography. In Norway, three-year Bachelor programmes in nursing and allied health consist of 180 ECTS credits (20-23). Programmes in these disciplines were offered at 21 university colleges and four universities across the country (nursing (n=25), occupational therapy (n=5), physiotherapy (n=4), and radiography (n=6)).

Specifically, the measurement study was set up in Bachelor programmes in nursing and social education at a university college, and in a ward at a local hospital. During the second study year, the nursing programme offered a stand-alone course in EBP (5 ECTS credits), while the social education programme only briefly introduced EBP early in the first semester and then did not expose students to EBP until the end of the second year. The local hospital ward did not emphasize EBP in clinical work.

The survey was set up in Bachelor programmes in nursing, occupational therapy, physiotherapy and radiography located at three university colleges and one university across Norway. The programmes integrated EBP differently into curricula and into teaching. One nursing programme offered a stand-alone course in EBP during the second year. The other programmes introduced EBP in various teaching and learning sessions throughout the three-year Bachelor programmes. The frequency, level and extent of EBP exposure differed between programmes.

The setting for the agreement study included Bachelor and Master programmes across health disciplines at a university college in Norway, and a Bachelor and a Master programme in nursing at a Canadian university. The Canadian four-year Bachelor of Science in nursing programme integrated EBP systematically into theory and clinical courses through all years, supported with e-learning resources and summative assessments. At the Master level, the Norwegian and Canadian programmes offered stand-alone courses in EBP, and all but one recently established Norwegian Master programme in nursing performed summative assessments of EBP performance.

3.1.3 Participants

In short, the 1233 participants included in this project were 1121 Bachelor students and 54 Master students from Norway and Canada, and 58 healthcare professionals from Norway. The majority (87%) were Norwegian Bachelor students in nursing, occupational therapy, physiotherapy and radiography.

In the measurement study, we included a total of 167 participants to 1) pilot the translated questionnaire and 2) evaluate the measurement properties of the Norwegian version. In the pilot, we used a purposive sample of 18 Bachelor students and clinicians from five different health and social disciplines. The participants' EBP knowledge and skill level varied from novice to experts, and nine (50%) were considered experts in EBP. To evaluate the measurement properties, we used a convenience sample of second year Bachelor students and clinical health and social workers (Table 2). Second year students in nursing and social education were included as they had been systematically exposed and not exposed to EBP, respectively. The health and social workers were included to supplement the sample of non-exposed participants and compose a more heterogeneous sample.

In the survey, we used a convenience sample of 707 final year Norwegian Bachelor students in nursing, occupational therapy, physiotherapy and radiography (Table 2). These students were recruited from the four Norwegian educational institutions that offered all four Bachelor programmes fulltime. In total, the participants were enrolled in 15 educational programmes.

In the agreement study, we included a total of 359 Norwegian and Canadian participants. The study consisted of two parts: 1) a pilot, in which the applied questionnaire and scoring rubric were developed and tested, and 2) a survey with closed and open-ended questions related to EBP terminology. In the pilot, we used a convenience sample of final year Norwegian Bachelor students across health disciplines, and a purposive sample of Norwegian healthcare professionals with a Master degree in EBP (Table 2). The healthcare professionals were included to incorporate answers from experts in EBP. In the survey, we applied a convenience

sample of 291 students from a university college in Norway and a university in Canada. The students were Norwegian Bachelor students in health disciplines (nursing, occupational therapy, physiotherapy and radiography) (n=237) and Canadian Bachelor students in nursing (n=50). We also included Master students from Norway (n=54) and Canada (n=7). In this study, we considered the EBP exposure lower among Norwegian Bachelor students than among Canadian Bachelor students and all (Norwegian and Canadian) Master students.

3.2 Measurement tools and methods

The EBP^2 was used in all studies in this project. In addition, a content analysis of EBP in curricula was performed in the survey. In the agreement study, we also applied open-ended questions on terminology with a supplementary scoring rubric.

3.2.1 Evidence-Based Practice Profile

The EBP^2 is a self-reported questionnaire that measures EBP profiles by collating responses in domains commonly associated with EBP (113). The questionnaire consists of 74 items, of which 58 items relate to five domains (Relevance, Sympathy, Terminology, Practice and Confidence), each using a five-point Likert scale (Table 3, and Appendix III). The items are equally weighted, and domain scores calculated as the sum of all items within the specific domain (113). The domain of Sympathy consists of negatively worded items (113).

Table 3. EBP^2 domains, definitions and Likert scale label values

EBP^2 domains	Item description	No of items	Likert scale labels (1 – 5) Lowest – Highest
Relevance	The value, emphasis and importance placed upon EBP	4	Not at all true – Very true
		4	No intention at all – Absolutely intend to do it
		6	Strongly disagree – Strongly agree
Sympathy	A sense of compatibility of EBP with professional work	7	Strongly disagree – Strongly agree
Terminology	An understanding of common research terms	17	Never heard the term – Understand and could explain to others
Practice	The use of EBP	9	Never – Daily
Confidence	A perception of abilities with EBP skills	11	Not at all confident – Very confident

In the development of the EBP^2, McEvoy et al. (113) extracted 66 items with characteristics which might contribute to an EBP profile from self-reports identified by a systematic review of the literature. The questionnaire was developed and tested among Australian students and professionals across health disciplines (113).

EBP^2 is described with a five-factor structure, acceptable internal consistency and test-retest reliability for all domains (113). Convergent validity is described for three domains, as compared with 19 items on the Upton and Upton questionnaire (109). The instrument distinguishes between levels of exposure to EBP for three domains (Table 4). By 2014, EBP^2 had been applied in three studies. These studies compared self-reported EBP profiles between five allied health disciplines (31), investigated changes in EBP profiles for entry-level physiotherapy students transitioning into the workforce (32), and explored changes in entry-level physiotherapy students' self-reported EBP profiles after an EBP educational intervention (134).

Table 4. Measurement properties of EBP[2] (113)

	Measurement properties	Description	Analysis	Results
RELIABILITY	**Test-retest**	Responses from two occasions, separated by 2 weeks	ICC	Range domains ICC 0.77 – 0.94
	Internal consistency	Overall and for each domain	Cronbach's alpha	Overall α 0.96 Range domains α 0.76 – 0.94
VALIDITY	**Structural**	Number of domains, determined by scree plot	PCA with oblique rotation	Five-factor structure
	Convergent	Compared to Upton & Upton questionnaire	Pearson's r	Confidence r=0.80 Practice r=0.66 Sympathy r=0.54
	Discriminative	Distinguished between EBP exposure groups	ANOVA, p-value	Relevance p≤0.001 Terminology p≤0.001 Confidence p= 0.004

3.2.2 Translation and adaptation to Evidence-Based Practice Profile-Norwegian version

In the measurement study, the EBP[2] was translated and culturally adapted into Norwegian informed by recommendations from WHO (135), Beaton et al. (136) and de Vet et al. (137, p. 182-184). Two bilingual translators, with Norwegian as their native language and expertise in EBP, translated the questionnaire independently, aiming for a conceptual and cultural equivalence. An expert committee, consisting of an EBP researcher, a teacher and a Master student, synthesized the two translated versions into one draft. A professional translator, with English as the native language and no previous knowledge of the original instrument, translated the Norwegian draft back into English. Discrepancies between the back-translation and the original version were discussed between the original author, the expert committee and the translators. The forward-backward process was repeated three times, until the original author, the expert committee and translators agreed upon an acceptable version (Figure 3).

Figure 3: Translation process of the EBP[2]-Norwegian version

The translated draft was pre-tested in a pilot. Cognitive interviews, which included the think aloud method and taxonomy of the Respondent Problem Matrix, were used to identify and classify possible respondent problems (138). In this process, participants were asked to read aloud all items and answers while they answered the questionnaire, and underline words or terms they did not understand and items they had to read more than once. They were also requested to give their understanding of 15 items the expert group found challenging to translate. The individual interviews followed a structured interview guide and were performed by a Master student in EBP with experience in cognitive interviewing. The expert group reviewed the outcomes from the pilot, and unclear terms and phrases were redrafted in collaboration with the original author. Before printing, a lecturer in Norwegian language proof read the questionnaire. The questionnaire was designed as the original tool, with the Norwegian definition of EBP added to the front page.

As a consequence of evaluating the measurement properties of the translated questionnaire in the measurement study, minor modifications were performed before we applied the translated version in the survey. An expert panel (n=4) reviewed all items described with low test-retest reliability values (ICC <0.5). In agreement with

the translators, 12 imprecise items were reworded (Appendix IV). In addition, we added non-domain questions and background variables relevant to our context to the applied Evidence-Based Practice Profile - Norwegian version (EBP^2-N) (Appendix V).

3.2.3 Document review of curricula

In the survey, we performed a document review of curricula to obtain an overview of how the 15 included educational programmes addressed EBP in curricula. We applied an enumeration approach (139, p. 80), in which the occurrence of terms related to EBP in curricula were categorized. Two people (a PhD candidate and a Master student in EBP) read all curricula and searched learning outcomes and content descriptions for the words 'evidence-based practice' (kunnskapsbasert praksis) and terms related to the five-step model of EBP (ask, search, critically appraise, apply and evaluate). The occurrence of EBP and terms related to EBP were reported by semester and course and described as explicit or implicit. EBP was categorized as 'explicit' if EBP was explicitly mentioned in learning outcomes or course content, and if the terms related to EBP specifically reflected the five-step model of EBP. Terms were categorized as 'implicit' if elements of the EBP steps were mentioned, but it was uncertain whether the terms related to EBP specifically or to research in general.

3.2.4 Terminology questionnaire

To assess agreement between self-reported and objectively assessed knowledge of EBP terminology, we applied a questionnaire with self-report questions from the EBP^2 Terminology domain and related open-ended questions in the agreement study. Specifically, the questionnaire consisted of the EBP^2 Terminology domain items (n=17) (113), one self-report question on how to understand the term 'evidence-based practice', and six open-ended questions formulated as "What does [this term] mean, in your own words, AND how would you describe it to a fellow student?". The open-ended questions were related to the 18 self-reported items. To limit the time needed to complete the questionnaire, each participant was asked a subset of six open-ended

questions. To ensure equal distribution, the 18 items were divided into three subsets (Figure 1, Paper III), and each student received a subset chosen at random. The questionnaire was developed in Norwegian (Appendix VI) and English (Appendix VII) both as paper-based and electronic versions.

3.2.5 Scoring rubric

In the agreement study, we developed and applied a five-level scoring rubric to the open-ended answers. The scoring rubric related to the 1-5 levels in the self-rating section of the questionnaire, with values from 1 “never heard the term” to 5 “understand and could explain to others” (Appendix VIII).

The scoring rubric was developed in close collaboration with two experts in EBP from the McMaster University. The development followed a pragmatic and stepwise process. Two Canadian experts developed a draft and co-authors of Paper III discussed and modified it for a Norwegian context. Consistency was explored by two raters (one Canadian and one Norwegian) who individually scored open-ended answers derived from a pilot of Norwegian Bachelor students and former Master students in EBP. The raters met on two occasions to discuss differences in scorings, clarify distinctions in wording and levels of grading, adjust the rubric into a Norwegian and Canadian setting, and add overriding decision rules (Figure 4). For the final scoring rubric, linear weighted kappa was used to estimate interrater agreement.

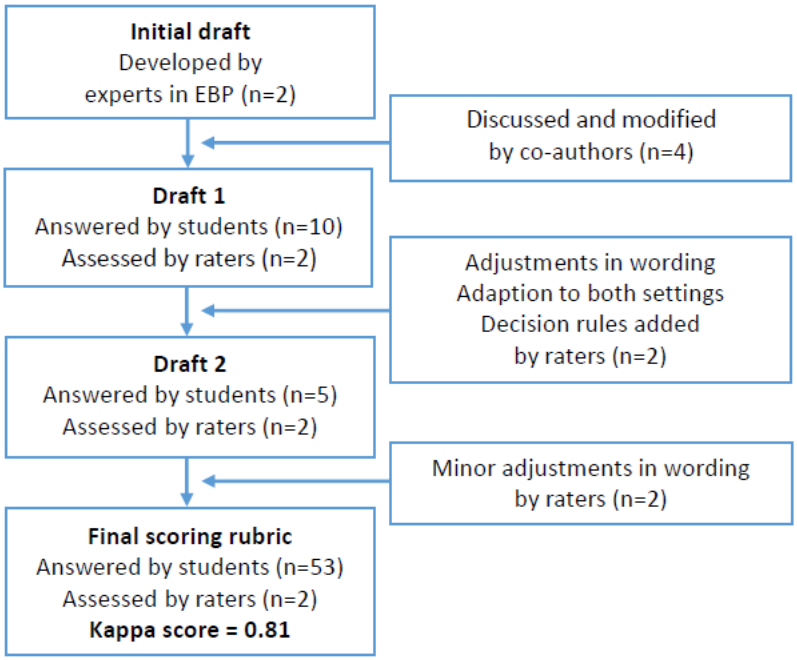

Figure 4. The development process of the scoring rubric of short open-ended answers

3.3 Data collection procedures

In all studies, we collected data in classrooms on days with expected high student attendance. In the measurement study, data were additionally collected at a shift handover in clinical practice. Data were collected on two occasions in this study, with an interval of 3 (test-retest) and 4 weeks (pre-post EBP exposure). In the survey and agreement study, data were collected at one point in time (Table 2). Paper-based questionnaires were used in all studies, with an electronic alternative in the agreement study.

In each study, we collaborated differently with the staff running the educational programmes to perform the data collection. In the measurement study, we had a contact person at each site for data collection. In the survey, we established a collaboration with the deans at the included educational institutions. They informed their faculty and educational leaders, who conveyed information to program teachers, who, in turn, suggested appropriate teaching sessions for data collection. In the agreement study, we established a similar collaboration with the Norwegian

institution. In addition, the data collection was informed by findings from the pilot regarding applicable days for data collection and potential ways to increase student participation. In Canada, a co-researcher found appropriate days and performed the data collections.

All participants received oral and written information about the purpose of the studies during data collection. In addition, students in the survey and the Norwegian students in the agreement study received information about the studies on their learning platform prior to data collection. In all studies, we invited the eligible participants present at the time of data collection to participate, and included the participants who answered and returned the questionnaires. To be included in the measurement study, participants had to answer the questionnaire on both occasions. In the agreement study, the Norwegian Bachelor students received a food voucher as a token of appreciation.

3.4 Data analyses

We used a variety of methods for statistical analyses (Table 5). The statistical software IBM SPSS Statistics version 22 (140) and *R* (141) were used in all studies. Sample size was calculated for each study before any data were collected to ensure adequate statistical power. In the measurement study, sample size was informed by the standards for good methodological quality, as described in the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist (142, 143). In the survey and the agreement study, we calculated sample size with the pwr.anova.tst function in the pwr.package (144), and the CI5Cats function in the kappa Size package in R (145), respectively.

Table 5. Statistical analyses included in Papers I-III

Applied statistical analyses	Paper I	Paper II	Paper III
Descriptive statistics	X	X	X
Cronbach's alpha	X	X	
Confirmative factor analysis (CFA)	X	X	
Standard error of measurement (SEM)	X		
Intraclass correlation coefficient (ICC)	X		X
Linear weighted kappa	X		X
Quadratic weighted kappa			X
Chi-square test		X	
Analysis of variance (ANOVA)		X	
Linear regression analysis		X	
Coefficient of determination (R^2)		X	
Independent sample t-test	X	X	X
Paired t-test	X		X
Spearman's rho		X	
Cohen's d	X	X	
Omega squared		X	

Descriptive statistics were applied in all studies. Mean values with standard deviations and range were used to describe continuous variables. Absolute numbers and proportions were applied to describe nominal variables. For inferential statistics, p-values less than 0.05 indicated statistical significance in all papers.

3.4.1 The measurement study (Paper I)

The international consensus-based COSMIN taxonomy of measurement properties (137, 146, 147) was used as a conceptual framework in the evaluation of measurement properties (Figure 5). We applied the 'COSMIN checklist with 4-point scale' (142, 143) to guide our choices of relevant measurement properties and parameters.

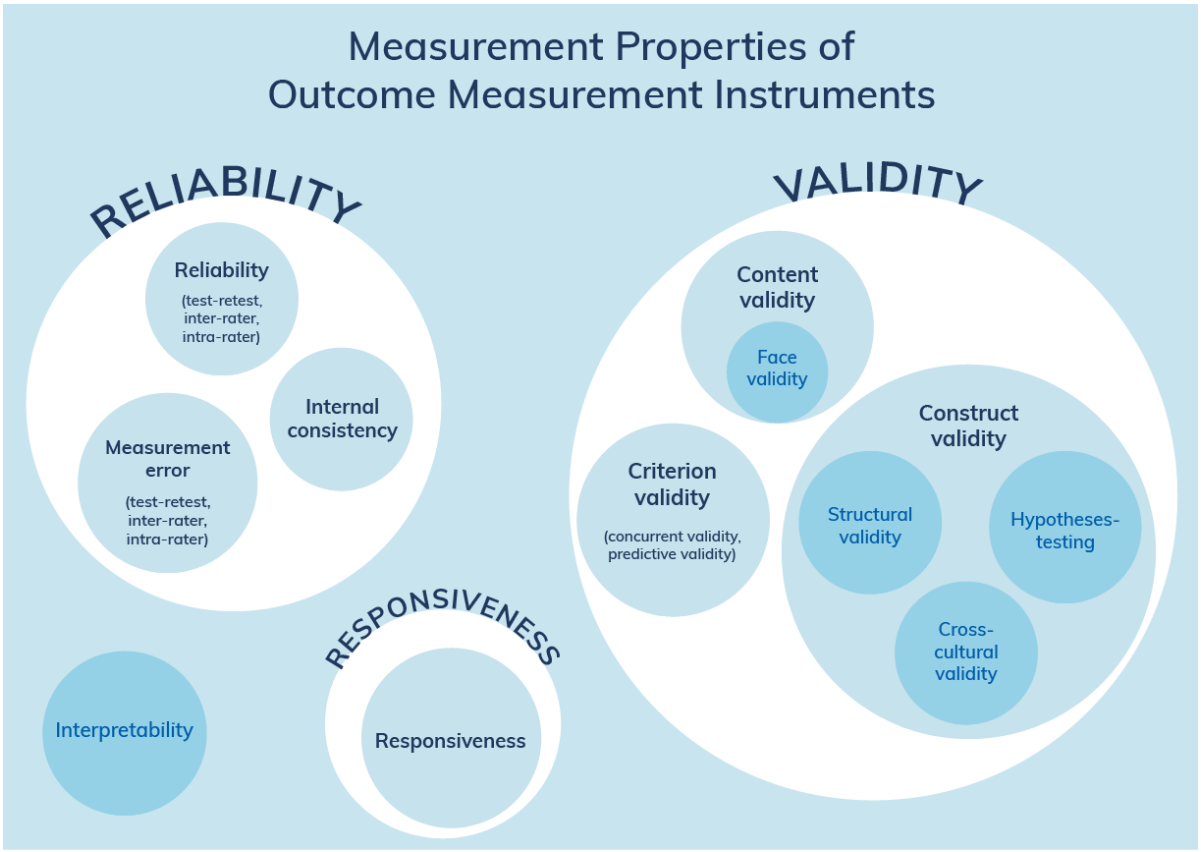

Figure 5. The COSMIN taxonomy of measurement properties, used with permission from COSMIN (148)

As in the original EBP[2], we applied statistical methods related to Classical Test Theory. Table 6 gives an overview of the examined measurement properties, applied analyses and threshold values.

Table 6. Evaluated measurement properties, applied analyses and threshold values

	Measurement properties	Analyses	Threshold values
RELIABILITY	**Internal consistency**	Cronbach's alpha (α)	α 0.70 - 0.90 is well-accepted (137, p. 83)
	Test-retest reliability	Intraclass correlation coefficient (ICC) Linear weighted kappa	ICC acceptable if > 0.70 (149, p. 265) Kappa acceptable if 0.60, good if > 0.75 (44, p. 306)
	Measurement error	Standard Error of Measurement (SEM)	Lower SEM gives higher reliability (137, p. 243)
VALIDITY	**Face validity**	Subjective assessment of overall view, first impression	Approved or not by users of instrument (137, p. 155)
	Content validity	Subjective assessment of items for relevance and comprehensiveness	Approved or not by expert panel (137, p. 156)
	Structural validity	Confirmative factor analysis (CFA) Comparative fit index (CFI) Root mean square error of approximation (RMSEA) Standardized root mean square residual (SRMR)	Good fitting models: CFI close to 0.95 or higher RMSEA close to 0.06 or lower SRMR close to 0.08 or lower (137, p. 170)
	Discriminative validity	Independent sample t-test Effect size (ES)	$p < 0.05$ ES large if 0.8, moderate if 0.5, small if 0.2 (150, p. 25-26)
	Cross-cultural validity	Assessment of translation procedures Comparison of results	Equivalence in scores (137, p. 184-185)
RESPONSIVE	**Responsiveness**	A priori hypotheses Effect size (ES) Paired t-test (P value)	ES large if 0.8, moderate if 0.5, small if 0.2 (150, p. 25-26) $p < 0.05$

Reliability

Reliability relates to the consistency of a measurement tool, meaning whether the tool produces stable and consistent results (44, p. 303). More formally, reliability is defined as "the degree to which a measurement is free from measurement errors" (147, p. 743). Relevant measurement properties include internal consistency, test-retest reliability and measurement error (147).

Internal consistency is defined as "the degree of interrelatedness among items" (147, p. 743). It is thus a measure of the extent to which items of a multi-item scale assess the same construct (137, p. 81). We applied Cronbach's alpha to examine the degree of intercorrelations among the items within each of the five EBP^2-N domains. The statistics were calculated on the basis of the total sample in this study (n=149).

Test-retest reliability is defined as "the extent to which scores from participants who have not changed are the same for repeated measurement over time" (147, p. 743). It is an assessment of a measure's stability, and examines the reproducibility of scores on repeated administrations (44, p. 304). To assess test-retest reliability, we applied EBP^2-N scores measured on two occasions among participants who were not exposed to EBP during the study period (n=53). The EBP^2-N domain scores were considered numerical variables at an interval level, and the intraclass correlation coefficient (ICC) for absolute agreement (two-way random model) was used to assess test-retest reliability. ICC is the preferred test-retest reliability parameter for continuous measures (44, p. 304). Item-level reliability was investigated with ICC and, due to the ordinal measurement level, also with Cohen's linear weighted kappa.

Measurement error is defined as "the systematic and random error of a participant's score that is not attributed to true changes in the construct to be measured" (147, p. 743). It reflects the difference between a measured score and its true value, and includes both random, naturally occurring errors and systematic errors (44, p. 298-299). To assess measurement error, we estimated the standard error of measurement (SEM) as recommended by deVet et al. (137, p. 111). In these analyses, we included EBP^2-N domain measures from both measurement times for non-exposed participants (n=53).

Validity

Validity is defined as "the degree to which the instrument measures the construct it purports to measure" (147, p. 743). Relevant measurement properties include content validity, construct validity and criterion validity (147). We evaluated content validity (including face validity) and construct validity (including structural validity, discriminative validity and cross-cultural validity). Criterion validity was not evaluated as we did not have a reliable and valid criterion, a 'gold standard', we could use as an ideal measure of the construct. Content validity was understood as the degree to which the content of the instrument adequately reflected the construct to be measured (147). Construct validity was defined as the degree to which the scores of the instrument were consistent with hypotheses, i.e with regard to internal relationships and differences between groups (147).

Content validity and face validity were evaluated in the pilot, based on subjective judgements from participants and experts. Face validity, whether the instrument looked as if it was measuring EBP, was assessed by pilot participants (n=18) who described their overall impression of the instrument. Content validity was assessed by the expert group (n=3) who made a judgement about the relevance and comprehensiveness of EBP^2-N items. In line with recommended methodology (137, 146), the expert group considered if the EBP^2-N items were relevant to EBP, the target population of Bachelor students across health disciplines, and for measuring EBP profiles. The comprehensiveness included judgements of the content coverage of items (i.e. the five steps of EBP) and the description of EBP^2-N domains.

Structural validity is defined as "the degree to which scores of an instrument are an adequate reflection of the dimensionality of the construct to be measured" (147, p. 743). It reflects the hypothesized dimensions underlying the broader construct being measured. We applied confirmatory factor analysis (CFA) to test whether data fitted the predetermined five-factor structure. CFA is more appropriate for examining factor structure when hypotheses about dimensions are based on theory or previous analyses, while exploratory factor analysis (EFA) is best when there are no clear-cut ideas about the number of dimensions, as in the development of an instrument (137,

p. 72). To evaluate model fit, we used the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the standard root mean square residual (SRMR). Measures from all participants (n=149) were included in these analyses.

Discriminative validity is defined as "the degree to which the scores of the instrument are consistent with differences between relevant groups, based on the assumption that the instrument validly measures the construct to be measured" (147, p. 743). It is also referred to as known-group validity, and concerns the measure's capability to discriminate between groups that are known (or expected) to differ with regard to the construct of interest (44, p. 317). Based on findings from previous studies (31, 113), we hypothesized that students exposed to EBP would display higher mean scores for the EBP^2-N domains than non-exposed students. Independent sample t-test was applied to assess differences in post-test mean scores between the groups of EBP exposed (n=96) and non-exposed participants (n=53).

Cross-cultural validity is defined as "the degree to which the performance of the items on the translated or culturally adapted instrument are an adequate reflection of the performance of the items of the original version of the instrument" (147, p. 743). It concerns both the conceptual, content and semantic equivalence of the translated and original questionnaire, and the comparability of measurement properties (151). Data from the original EBP^2 were not available, and we could not assess measurement invariance. Differences in measures were therefore assessed by comparing results from our evaluation of measurement properties with the results from the original study. In addition, we assessed the evaluated measurement properties in light of the translational process.

Responsiveness

Responsiveness is defined as "the ability of an instrument to detect change over time in the construct to be measured" (147, p. 743). It concerns whether a change score truly captures an actual change over time (44, p. 321). Since we had no reliable criterion with which we could correlate and compare change scores, we tested hypotheses about changes in scores relative to EBP exposure. Based on a cohort study by Long et al. (134), we formulated an a priori hypothesis of expected

magnitude in change scores (effect size) due to a three-week intensive course in EBP. The effect sizes (ES) were estimated with Cohen's d. A paired t-test was applied to determine changes in pre and post mean EBP^2-N domain scores for participants who attended the course in EBP (n=97).

3.4.2 The survey (Paper II)

We applied Cronbach's alpha to evaluate internal consistency for the five EBP^2-N domains. CFA was performed to examine model fit of the five-factor structure in this sample of final year Bachelor students across health disciplines (n=707).

To analyse distributional differences in demographic characteristics between health disciplines, we used the Chi-square test to test differences in proportions and one-way analysis of variance (ANOVA) to test for mean differences. The independent sample t-test and ANOVA was applied to analyse group differences in mean EBP^2-N domain scores.

To examine the extent to which health discipline was associated with EBP^2-N domain scores, we performed linear regression analyses where we controlled for possible confounding by the following variables: educational institution, gender, age, previous Bachelor education and paid work. The choice of confounding variables was based on a review of the literature (30, 31, 33) and judgement of authors. In the model, nursing was defined as the reference category. The estimated regression coefficients (beta) represent mean differences in scores for the allied health professions compared with nursing. We used the adjusted coefficient of determination (R2) to evaluate overall fit of the predictive model.

The magnitude of the largest difference within each EBP^2-N domain was assessed using Cohen's d. To describe the proportion of variance that could be explained by health discipline, we calculated the Omega squared ($\omega 2$) for each domain.

Due to the ordinal-level measurement, we used Spearman's rho (r_s) to investigate correlations between students' assessment of EBP teaching, students' assumed expectations of EBP performance from teachers and the EBP^2-N domains.

3.4.3 The agreement study (Paper III)

Weighted kappa was used to estimate interrater agreement between self-reported and assessed open-ended answers for each item. We chose this statistic because weighted kappa is advised for ordinal scales and allows similar categories to be in partial agreement, as compared to Cohen's kappa which only considers total agreement or disagreement between categories (152). By assigning weights to categories, weighted kappa considers misclassifications between adjacent categories as less serious than misclassifications between more distant categories (137, p. 118). To provide complementary information on the distribution of disagreement, we calculated both linear weighted kappa (K_{lw}) (linear distance in the number of categories separating the classifications made by raters) and quadratic weighted kappa (K_{qw}) (quadratic distance between classifications, in which disagreement was weighted by the squared number of categories separating raters) (152, 153).

ICC for absolute agreement was used to estimate overall agreement between self-reported and objectively assessed knowledge of EBP terminology for the 17 items included in the EBP^2 Terminology domain.

Paired t-test was used to analyse mean difference between participants' self-reported and assessed open-ended items. Independent sample t-test was used to analyse differences in mean self-reported EBP^2 Terminology domain scores by EBP exposure.

3.5 User participation

A user panel of four Norwegian Bachelor students constituted the user involvement in this project. The users were recruited in their second year, during autumn 2016. They were enrolled after the data collection of the survey, and their involvement in this study was confined to the interpretation and discussion of results. In the agreement study, the users engaged in the data collection, by suggesting suitable times and encouraging peer students to participate in the study. They also contributed to the interpretation and discussion of the results.

The user panel met on five occasions; twice for information, once to plan the data collection of the agreement study, and twice to discuss the results of the survey and the agreement study. Also, e-mail correspondence was used between meetings to clarify inputs from users.

3.6 Ethical and legal issues

The surveys were voluntary, and the participants received oral and written information (Appendix IX). Return of the questionnaire was considered consent for participation in Norway. The Canadian students signed a consent for participation (Appendix X). All data were analysed and stored on the research server at the Bergen University College (later Western Norway University of Applied Sciences). The Norwegian Social Science Data Services (NSD) approved the Norwegian studies. In addition, the Hamilton Integrated Research Ethics Board (HiREB) approved the agreement study in Canada.

The measurement study (Paper I)

The project number at NSD is 36988 (Appendix XI).

We received permission to translate and use the EBP^2 from Dr. Maureen Patricia McEvoy, on behalf of the developers of the EBP^2.

The survey (Paper II)

The project number at NSD is 42653 (Appendix XII).

The Centre for Evidence-Based Practice at the Bergen University College supported the travel expenses for the data collection.

The agreement study (Paper III)

The project number at NSD is 49132 (Appendix XIII). The project number at HiREB is 2463 (Appendix XIV).

A data sharing agreement was signed between McMaster University and Bergen University College (Appendix XV). Also, a data processor agreement was signed between the Center for Evidence-Based Practice and Andrè Thoresen, who developed and administered the electronic version of the applied questionnaire (Appendix XVI).

4. Summary of results

The measurement study

In this study, we translated the EBP^2 into Norwegian and investigated reliability, validity and responsiveness of the EBP^2-N. The study included 18 participants in a pilot to test the translated version and 149 to evaluate the measurement properties of the final Norwegian version.

Terms related to 'evidence' (i.e. evidence, research evidence and evidence findings) were challenging to translate, and all terms were translated into 'forskningsbasert kunnskap' (research-based knowledge). Also, the negatively worded items in the Sympathy domain were difficult to translate into Norwegian. In the pilot, all but one participant found the questionnaire feasible to answer. Of the 58 domain items, 28 items were reported as unclear or challenging to understand. Modifications of 11 of these items were performed in close collaboration with the original authors. Respondents with no knowledge of EBP (n=2) found the questionnaire more challenging to answer than the other participants. Participants with knowledge of EBP found the items to be an adequate reflection of EBP and approved face validity. The expert group found the items relevant and comprehensive for the construct and approved content validity.

The evaluation of measurement properties revealed adequate reliability measures for three of the five EBP^2-N domains (Relevance, Terminology and Confidence). The CFA did not confirm a five-factor model fit (CFI = 0.69, RMSEA = 0.09 (95% CI 0.084 – 0.094), SRMR = 0.095). There was a significant difference between EBP exposure and non-exposure for three domains (Relevance, Terminology and Confidence), ($p \leq 0.001$). Also, responsiveness was found to be as expected or better for all domains, except Sympathy.

In the examination of cross-cultural validity, determined by comparing results from the evaluated EBP^2-N measurement properties with the original EBP^2, we found discrepancies in the results of test-retest reliability and structural validity.

The survey

In this study, we examined EBP profiles among final year Bachelor students attending four different educational institutions. The study included 707 final year students in nursing (61%), occupational therapy (18%), physiotherapy (13%), and radiography (8%).

There were large variations in how often, how specific and how explicit EBP was mentioned in curricula across programmes and educational institutions. All but one programme included EBP in their overall learning outcomes (Table 2, Paper II).

The evaluation of internal consistency and CFA demonstrated that the measurement had adequate Cronbach's alpha measures (0.69 – 0.90), but did not fit a five-factor model (CFI = 0.67, RMSEA = 0.07 (95% CI 0.069 – 0.072), SRMR = 0.07).

Overall, final year Bachelor students found EBP relevant, but revealed limited understanding of EBP terminology, limited confidence with EBP skills, and infrequent use of EBP. Small but statistically significant differences in EBP^2-N domain scores were observed between health disciplines for all domains ($p \leq 0.03$), and between educational institutions for three domains (Relevance, Terminology, and Sympathy) ($p \leq 0.001$). For health disciplines and educational institutions, the largest difference was found for Relevance. Students from one health discipline (radiography) reported a mean standard summary score (Z-score) below the average for all EBP^2-N domains. One educational institution (the one with the least components of EBP in its curricula) reported z-scores below average for all domains except Confidence.

Students with positive assessments of EBP teaching perceived EBP as more relevant, and they were more confident with EBP skills. Also, students with perceived high expectations of EBP performance from teachers reported EBP to be more relevant.

The agreement study

The aim of this study was to examine agreement between self-reported and objectively assessed knowledge of EBP terminology, and explore if this agreement differed among students with different levels of EBP exposure. The sample consisted of Bachelor and Master students across health disciplines from Norway, and Bachelor and Master students in nursing from Canada.

Overall agreement between the self-reported and objectively assessed open-ended items of the EBP^2 Terminology domain was low (ICC=0.29, 95% CI -0.09 – 0.62). For all research terms, self-reported scores were higher than objectively assessed scores ($p < 0.001$) (Figure 6). Large variations were observed in agreement values between self-reported and objectively assessed open-ended items. We found substantial agreement for two items (K_{qw} 0.69 – 0.67), moderate agreement for two items (K_{qw} 0.60 – 0.50), fair agreement for five items (K_{qw} 0.39 – 0.21), and slight agreement for nine items (K_{qw} 0.18 – 0.04).

Equal agreement measures were observed for high and low exposure to EBP. For the self-reported EBP^2 Terminology domain, we found a significantly higher mean score for high EBP exposed students compared with that of low EBP exposed students.

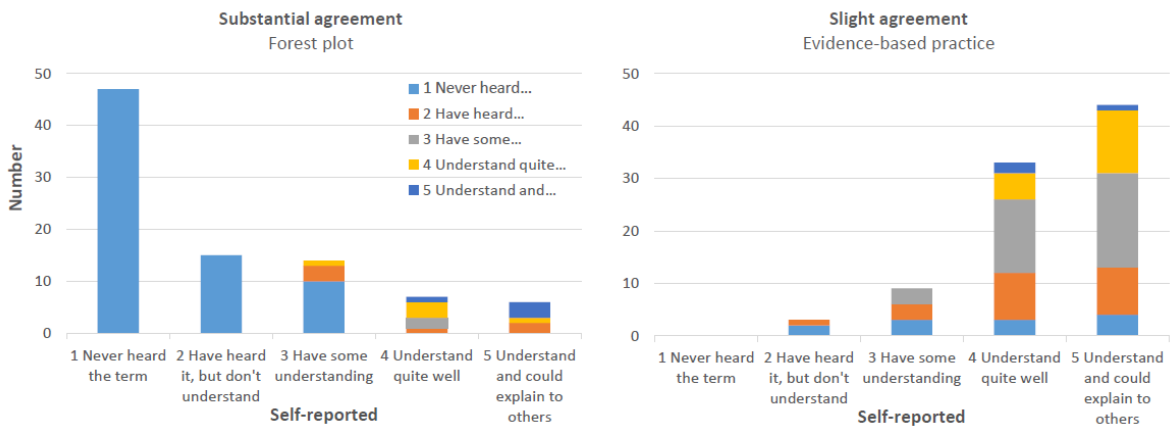

Figure 6. Distribution of assessed objective answers by self-reported answers for example items with substantial and slight agreement

5. Discussion

5.1 Methodological considerations

Validity, “the approximate truth of an inference” (154, p. 34), is a property that can be strongly affected by research design elements (44, p. 216). Validity is commonly divided into internal validity and external validity. In the following sections, methodological strengths and limitations will be discussed in relation to study design, internal validity and external validity.

5.1.1 Study design

To assess measurement properties of the translated instrument in the measurement study, we used test-retest and a pre-post design. The survey and the agreement study were designed as cross-sectional studies, in which respondents were contacted once and information collected at one point in time. Cross-sectional studies are not applicable for casual inferences, but are well-suited to describe and explore associations at a fixed point in time (44, p. 168).

5.1.2 Internal validity

Internal validity concerns validity of the inferences drawn as they relate to the participants of the source population (155, p. 128). Violations of internal validity are often classified into three categories: selection bias, information bias and confounding (155, p. 129). In the following sections, biases (i.e. systematic errors in estimates (155, p. 128)) will be addressed in relation to the way subjects were selected (selection bias), the way subject variables were measured (information bias), and confounding factors that were not completely controlled. In addition, influences that may have affected responses (response bias) and concerns regarding sample size will be discussed.

Selection bias

Selection bias is a systematic error that comes from the procedures used to select subjects and from factors that influence study participation (156, p. 126). It occurs

when the relationship between exposure and outcome is different for those who participated and the eligible participants who did not participate (155, p. 134).

Due to our convenience (nonprobability) sampling procedures, selection bias should be considered. Ideally, a random selection of students could have been performed to minimize the possibility of selecting students atypical of the target population (44, p. 251-252). However, efforts were made to reduce selection bias. In all studies, data were collected on days with expected high student attendance, and a food voucher was given as a token of appreciation to enhance response rates in the agreement study. Moreover, varied content of teaching sessions on the days of data collection enriched diversity among students.

Not all eligible students had teaching sessions on campus during the data collection period and we lacked information about non-responders. Still, we do not suspect that the relationships investigated are different for those who participated and the population at large. High response rates among participants present during data collection indicated low non-response bias.

Information bias

Information bias is a systematic error that can arise when the information collected from or about study subjects is erroneous (156, p. 133). It includes measurement bias and classification bias (157).

Measurement bias

A concern regarding internal validity in this project is the applied measurement instruments in the survey and the agreement study.

In the measurement study, we found adequate measurement properties for the EBP^2-N domains of Relevance, Terminology and Confidence, and inadequate measures for Practice and Sympathy. Content validity was examined with the COSMIN checklist (142, 143), and the relevance and comprehensiveness of items were found acceptable. Nevertheless, results regarding construct validity may indicate that content validity was not satisfactory. It is possible that comprehensibility could have been improved

by including a professional translator who was naive about the topic in the forward translation, and that relevance better could have been enhanced by including representatives from the Bachelor education in the expert panel. Also, to fully capture how items and constructs were understood by Norwegian Bachelor students across health disciplines, we could have included a larger and more heterogeneous sample in the pilot and conducted a qualitative analysis that also contained an elaboration of constructs. Our close collaboration with the developer to ensure conceptual equivalency is a strength of this study. However, with the emphasis on the importance of content validity in the recently published 'COSMIN methodology for assessing content validity' (158) and 'COSMIN risk of bias checklist' (159, 160), we realize that closer considerations should have been made in the translation and adaptation phase.

At the time of the second study, the EBP^2-N was the only Norwegian questionnaire with evaluated measurement properties available to assess outcomes of EBP learning among Norwegian Bachelor students across health disciplines. Aware of the limitations in measurement properties, we made some modifications to the wording of items with low test-retest values before we applied the translated version in the survey. Still, new analyses with an adequately larger sample size (n=707) showed only small improvements in structural validity (Paper II). Hence, results from this profile must be interpreted with these limitations in mind.

In the agreement study, we developed a questionnaire based on the EBP^2 Terminology domain and an associated scoring rubric. To examine the objectively measured knowledge, we considered the use of previously validated tools, such as the Modified Fresno Test (122) or K-Rec (120). However, these tools covered only a few of the research terms in question and were therefore not suitable for our purpose. We assessed face validity for the applied questionnaire and evaluated interrater agreement for the scoring, but a full-scale evaluation of measurement properties was not performed.

Classification bias

We did not consider classification bias to be a threat to internal validity in the measurement study and the survey. This is because information on exposure variables (independent variables) were collected by class level. In addition, we do not find it likely that self-reported age, gender, previous Bachelor education and paid work would be systematically misclassified.

In the agreement study, there might be a risk of misclassification in relation to EBP exposure. This exposure variable was classified by the curriculum's coverage of critical appraisal and research methodology in teaching and assessment, and not by the individual student's actual exposure to EBP topics. Possible misclassification could occur if, for example, students from the recently established Master programme (without summative assessment of EBP performance) were wrongly classified into the higher exposure level. Such nondifferential misclassification of exposure would bias an association towards the null value (155, p. 140).

Moreover, we cannot exclude the possibility of misclassifications in the scored open-ended response variable (dependent variable). Quantitative scorings of open-ended answers could have been biased by raters' subjectivity in determining classifications. However, the scoring rubric was comprehensively developed and the raters obtained high inter-rater agreement. Thus, we find it unlikely that scorings were systematically biased in one direction.

Confounding

Confounding variables are extraneous, contaminating factors that muddle the understanding of the relationship between the independent and dependent variables (44, pp. 162, 723). Potential factors that may produce biases, distortions or errors should be considered in planning the study and, if possible, adjusted for with appropriate statistical analysis (44, p. 161).

In the survey, possible confounding variables were identified a priori in a literature review (30, 31, 33). As a consequence, we retrieved information on and adjusted for five potential confounding variables (i.e. age, gender, previous Bachelor education,

educational institution, and paid work) in the linear regression analysis. Ideally, we should also have adjusted for EBP exposure, but we did not retrieve direct information on previous EBP exposure suspecting a high degree of information bias. Instead, efforts were made to provide information about EBP exposure through a document review of curricula. However, learning outcomes related to EBP were imprecisely and implicitly formulated, and did not reflect students' true EBP exposure and experience. Thus, we could not adjust for confounding regarding EBP exposure in the regression analysis.

We recognize that information on more context specific factors related to students' actual EBP exposure during the educational courses and in clinical placements could have strengthened inferences. The level of EBP exposure through all study years could be defined by, for example, specific information on the content of EBP teaching and assessment during educational courses and in clinical placements, hours of stand-alone EBP teaching sessions, number of assignments including elements of EBP, and types of assessment methods (27, 31, 161). Confounding could also relate to programme specific information, such as educational levels for faculty at the Bachelor level (i.e. Master, PhD, Professor or Senior lecturer), applied teaching materials (i.e. textbooks, NEHL, e-learning resources), and number of faculty, librarians and clinical instructors with competence in EBP.

Response bias

Self-reported responses are vulnerable to the risk of being biased by an influence that leads a person to select a response option which do not truly reflect their 'true score' (44, pp. 282, 743). A general problem is social desirability response bias, in which respondents answer in a manner consistent with positive social values (44, p. 282). In the agreement study, self-reported knowledge was higher than objectively assessed, and respondents might have misrepresented themselves, consciously or unconsciously.

Test-retest results for Practice and Sympathy showed considerable inconsistency. These domains refer to an individuals' use of EBP and their perception of EBP being

compatible with professional work (113). We cannot exclude the possibility that participants did not hold the necessary knowledge of EBP to fully understand the questions, and that responses might have been biased by unfamiliarity with the content. Moreover, responses in the Practice domain could be biased by respondents' ability to remember and recall details regarding EBP behaviour during the past year. Possibly, the retrospective element may have induced unreliable answers. A better way to explore performance could have been to, for example, monitor activity, observe or audiotape EBP behaviour (91, 95, 162).

Sample size

Sample size is an important factor to ensure statistical power. Statistical power refers to the ability to detect a true relationship between variables (44, p. 394). With low statistical power, effect size estimates will be less precise and a Type II error (a false negative conclusion) may occur (154, p. 45). Power analysis is often used to estimate the needed sample size, with the intention to reduce the risk of Type II errors and strengthen statistical conclusion validity (44, p. 394).

Sample sizes were considered a priori for each study, informed by the COSMIN checklist (Paper I) and power analysis (Papers II and III). In the measurement study, we did not recruit enough participants to adequately perform CFA. For an adequate CFA, sample size should be at least five times the number of items (159). Our sample size of 149 was possibly too small for valid fit measures in the CFA analysis. Still, with an adequately large sample size in the survey, we observed similar findings for CFA.

According to the power analysis, sample sizes were too small for subgroup analyses in the survey and the agreement study. While we recruited 56 radiography students in the survey, the power analysis indicated that we had to include at least 64 students from each health discipline. Still, despite the small sample size of radiography students, we observed precise, but small mean differences in EBP^2-N domain scores between health disciplines.

Based on an even distribution of (true) answers, sample size calculations for the agreement study indicated that 78 participants were required for each question set to estimate agreement between self-perceived and assessed open-ended answers. Overall, we recruited enough participants to analyse agreement for items in each question set. However, the number of participants in the subgroups varied from 25 (high exposure) to 64 (low exposure) participants. Thus, due to the low sample size in subgroups, we did not examine agreement for items by EBP exposure.

5.1.3 External validity

External validity or generalizability concerns validity of the inferences as they relate to people outside the source population (155, p. 128). It involves the extent to which study results can be generalized to other situations and people (44, pp. 229, 728).

The EBP^2 was developed for students across health disciplines in Australia, and EBP^2-N was intended to be used for an equivalent population in Norway. The generalizability of the measurement study might be questioned, as we did not include a more heterogeneous sample of students in allied health disciplines. Ideally, the translated measurement instrument could have been validated again when applied in another target population (137, p. 152, 160). In the survey, we examined internal consistency and structural validity in a large sample of Bachelor students in nursing and allied health disciplines. In this sample, drawn from the target population, we observed equivalent findings for the assessed measurement properties.

The target population in the survey were Norwegian Bachelor students in nursing and the allied health disciplines of occupational therapy, physiotherapy and radiography. In total, the four disciplines were offered at 21 university colleges and four universities across the country. While all 25 educational institutions had programmes in nursing, programmes in occupational therapy were delivered at five, physiotherapy at four, and radiography at six educational institutions (163). The sample of nursing students was only drawn from four large educational institutions, and we cannot exclude the possibility that students from private or smaller educational institutions could differ on key characteristics. Students in occupational therapy and radiography

were also drawn from four institutions, while physiotherapy students were included from three educational institutions. Thus, students in allied health disciplines were likely to be represented, while nursing was under-represented.

In the agreement study, we included a convenience sample of Bachelor and Master students from two educational institutions in two different countries. This may limit the extent to which the findings may be generalized to others.

5.2 Discussion of results

The EBP^2-N instrument

In this project, the intention was to assess EBP attitudes, knowledge, skills and behaviour among undergraduates across different health disciplines. From several instruments considered, EBP^2 most closely met our criteria. Classified within the CREATE framework (91), the EBP^2 domains relate to self-reported attitudes (Relevance), knowledge (Terminology), self-efficacy (Confidence) and behaviour (Practice). Alternatively, we could have considered instruments developed for healthcare professionals, but these would need to be adapted and further validated into a context of Norwegian Bachelor students. Examples of this from other settings are the modified Fresno Tests (122, 123), the Student EBP Questionnaire (127, 133), the Slovak and Czech version of the EBP Beliefs and Implementation Scales (130), and the recently published 23-item EBP-KAP (164).

A challenge in the translation process was the word ‘evidence’. There is no consensus about the definition of evidence (44, p. 24). We translated evidence into ‘forskningsbasert kunnskap’ (research-based knowledge), in line with the Norwegian understanding of EBP (kunnskapsbasert praksis). In a recent textbook, however, Guyatt et al. (46, p. 16) suggested a broad definition of evidence: “any empirical observation or report of a symptom or mental state constitutes potential evidence, whether systematically collected or not”. This implies that unsystematic observations by individual healthcare professionals, a patient’s description of a clinical condition, physiological experiments, and clinical trial results all constitute different sources of

evidence (46). By restricting evidence to research, we might have limited the meaning and understanding of evidence. However, this applied only to a few items and the impact on overall results should be minor.

To the best of our knowledge, the EBP^2 has been translated into one other language than Norwegian, namely Polish (131). Some differences in methodology and measurement properties were evident between our study and the Polish version. In contrast to our study, acceptable test-retest reliability was found for *all* domains for the Polish version (131). This may be related to the translation and cultural adaptation of the original EBP^2, but other factors may also be important. For test-retest reliability, it is a challenge to decide on the appropriate time interval between measurements, as there are no standard rules (137, p. 125). While we had a three-week interval, the other studies had 2 weeks between measurements which may have led to higher reliability coefficients. Cronbach's alpha values on the other hand were more similar between the studies.

Although CFA is recommended when prior hypotheses about factor structures exist, it is not uncommon to apply EFA (165). Using EFA, Panczyk et al. (131) initially established eight factors, but chose to impose a five-factor solution in accordance with findings from the original EBP^2 (113). In comparison, our assessment using CFA did not indicate a five-factor structure. Discriminative validity was reported for Relevance and Terminology in the Polish version of EBP^2 (131), while our findings indicated discriminative validity for three domains, in line with that of the original EBP^2 (113). Responsiveness was not evaluated neither for the original EBP^2 (113) nor for the Polish version (131).

Positive EBP attitudes, but limited knowledge, confidence and behaviour

Positive attitudes towards EBP have been reported in surveys among undergraduate students in nursing and allied health across many countries (29-32, 34, 166-169) and among healthcare professionals across disciplines (170-174). Research have also shown that nursing students struggle to see the relevance of evidence to nursing practice (175). The high overall mean score we observed for Relevance indicates that

the Norwegian Bachelor students placed high value, emphasis and importance on EBP. In fact, compared to studies using the same measurement instrument, our findings for Relevance were in line with findings from Australian students who had been exposed to EBP for more than 20 hours (31) or undertaken formal EBP training (32, 134, 176). Only one study, assessing EBP profiles at completion of all EBP training in a four-year entry-level physiotherapy programme, reported higher mean scores for Relevance (161).

Despite overall positive attitudes, we observed limited understanding of research terms used within EBP, limited perceptions of ability with EBP skills, and infrequent use of EBP. Compared with studies using the EBP[2], our overall findings for Terminology, Confidence and Practice were in line with findings from undergraduates that had been exposed to EBP for less than 20 hours (31). Thus, for these domains our findings were lower than findings from undergraduates with formal EBP training (32, 134, 161, 176), except for Practice where our findings were similar to those observed by Lewis et al. (176). For Sympathy, our findings were in line with previous findings, and did not depend on the level of EBP exposure or training (31, 32, 134, 161, 176).

Surveys using other instruments to assess self-reported EBP knowledge, self-efficacy and behaviour among undergraduates in nursing and allied health, have reported low to high levels of EBP knowledge (29, 30, 34-36, 166-168, 177), high capability beliefs in EBP (28, 33, 178) and lack of EBP utilization (28, 30, 35, 36, 168). These studies are heterogeneous with regard to study population, applied measurement instruments and reporting of findings. Differences in samples, countries, educational systems, EBP exposure and EBP training imply that comparisons of results are challenging and should be performed with caution. Still, similar tendencies of positive attitudes and lack of EBP utilization are described among practising nurses and allied health professionals (171-174). Moreover, healthcare professionals frequently report lack of knowledge in critically appraising research evidence and in ability to understand statistical data as barriers towards implementing EBP (174, 179).

To our knowledge, EBP profiles have not been directly compared for Bachelor students in nursing, occupational therapy, physiotherapy and radiography. However, EBP profiles among undergraduates in allied health have been compared in one study (31). The results from this study indicate that the differences we observed in EBP^2-N domain scores are not unique for our sample of allied health students. Consistent with our findings, McEvoy et al. (31) found that students in medical radiation reported lower mean scores for Relevance than undergraduates in physiotherapy and occupational therapy, physiotherapy students scored higher for Terminology than all other, and similarly occupational therapy students scored higher for Practice. For Confidence, the students in allied health reported similar scores while we observed higher mean scores for nursing students.

Although differences in domain scores were small, we found the largest difference between health disciplines and between educational institutions for Relevance. Moreover, students who perceived higher expectations of EBP performance from teachers and students with positive assessments of EBP teaching also placed higher value, emphasis and importance on EBP. Interestingly, the health discipline (radiography) and the educational institution with lowest mean scores for Relevance also reported mean scores below average for most of the other EBP^2-N domains. In focus groups, undergraduates have recounted that the inability to see the relevance of EBP to future work impacted negatively on their learning strategies towards EBP (161). Also, experienced teachers in EBP have emphasised the importance of EBP teaching being relevant to students, as it increases their interest and facilitates learning (180). Overall, our participants perceived EBP positively, possibly influenced by increased attention to EBP in the academic environment, in the literature and at policy levels (170). One way to further motivate Bachelor students to learn and subsequently apply EBP might be to highlight the relevance of EBP to clinical work from the outset of educational programmes and continuously develop positive attitudes towards EBP.

Despite variations of EBP descriptions in curricula, we found small differences in EBP profiles between educational institutions. While mean EBP^2-N domain scores differed statistically significant between educational institutions for Relevance, Terminology and Sympathy, there were no significant differences for Confidence and Practice. To our knowledge, no previous studies have examined EBP profiles across educational institutions. However, in a national survey, Florin et al. (33) observed differences in nursing students' capability beliefs regarding EBP skills between 26 universities in Sweden. The authors explained differences with variations between universities in regard to how prepared students were for EBP.

Previous research indicates that EBP capability beliefs may influence undergraduates' intention to use EBP after graduation (181), and EBP readiness (perceived confidence in ability to perform EBP competencies) might be a mediator between undergraduates' knowledge and engagement in behaviour related to EBP (36). We found that students with positive assessments of EBP teaching were also more confident with EBP skills. However, our Bachelor students reported overall limited confidence with EBP skills in their final semester. Content and delivery of EBP teaching may affect how students perceive their own ability to perform EBP (182). Thus, it might be of interest to identify how the teaching and learning of EBP is performed across programs and institutions. To build confidence with EBP skills, teaching and learning strategies should, preferably, include EBP curricula that build on the five-step process of EBP (1), be multifaceted and clinically integrated (79, 183), be relevant to the stage of the learner (91, 183), increase in complexity while building on previously acquired skills (25, 183, 184), and include feedback on performance (185).

For Terminology, we found that self-reported scores were higher than objectively assessed scores, indicating that our students over-estimated their understanding of quantitative research terms used within EBP. Similar findings have been observed in a recent mixed methods study, where undergraduates declared poorer understanding of statistical terminology in focus groups than self-reported on the EBP^2 Terminology domain (161). Over-estimation of EBP competence has also been observed among

medical students and healthcare professionals (186-188). While these and other studies investigating the relationship between perceived and objectively measured competence in EBP (186-190) did not examine agreement, their findings of small to medium correlations correspond with the low agreement observed in our study. Similar to Lai et al. (187) and Aguirre-Raya et al. (188), we scored the open-ended answers based on a scoring rubric. In addition, or alternatively, we could for example have used multiple-choice questions related to a clinical scenario, for students to demonstrate knowledge regarding interpretation of research.

The scored open-ended answers for the term 'evidence-based practice' indicated that many students thought of EBP as knowledge from research evidence, but they did not include the aspects of clinical expertise or patient preferences. This may point to a limited understanding of the concept of EBP and possibly reflect the programmes' focus on EBP teaching. A recent systematic review found that content related to all five EBP steps only was taught in 12% of educational interventions, while the most frequently taught step was critical appraisal of evidence (74%), followed by acquiring evidence (63%) and asking a clinical question (61%) (83). It is recommended that the teaching and learning of EBP should be clinically integrated (79, 183), and EBP curricular models describe various approaches to teaching EBP decision-making skills, such as simulated learning activities (191), finding and incorporating evidence in care plans (192), or performing the EBP steps and sharing the evidence with a mentor and tutor in clinical practice (193). As bachelor students are novices, role modelling in the clinical and academic environments, for students to see the principles of EBP in actual use, might be essential to consolidate their understanding of the EBP process (161, 180, 194, 195).

In our review of EBP in curricula, we observed large variations with regard to how often, how specific and how explicit learning outcomes related to EBP were described in programmes' curricula spanning 3 years. While most curricula included an overall learning outcome related to EBP performance, learning outcomes involving the core EBP competencies (i.e. five steps of EBP) were rarely addressed explicitly. In discipline-specific courses it was often unclear if learning outcomes

related to EBP referred to EBP specifically or to research in general. Consistent with our findings, previous document reviews of medical and allied health curricula observed fragmented EBP teaching and learning outcomes that mainly referred to enabling EBP competencies, including the philosophy of critical enquiry, basic searching skills, and understanding of epidemiology and biostatistics (196-198).

Unclear descriptions of EBP in Norwegian curricula might indicate that EBP was not fully integrated into teaching and learning. The tradition of teaching research to Bachelor students has centered on basic methods and how to conduct research, instead of teaching the EBP process of how to interpret research and translate evidence into clinical practice (192, 199, 200). From previous research we know that faculty may encounter barriers when teaching EBP related to lack of knowledge in epidemiological and summarized research (201), limited skills in appraising and applying evidence in practice (202, 203), and aspects related to organizational culture and readiness for EBP, such as lack of EBP champions, time, and support for EBP (204-206). Thus, to enhance purposeful teaching of EBP competencies, we might need to upskill faculty in the five-step process of EBP, evaluate the teaching of research methods, statistics and EBP, and renew EBP learning outcomes in curricula. In this process, continuity of EBP in curricula models across educational levels (i.e. Bachelor, Master and Doctoral) could help to ensure EBP teaching and learning at the appropriate competency level and further advance progression of EBP competencies (191, 207, 208). The international consensus of core competencies in EBP for healthcare professionals was recently published and may be used as a guide to inform curriculum development of entry-level programmes and determine appropriate standards for each level of EBP teaching (56). With the development of RETHOS and the upcoming renewal of discipline-specific curricula (77), Norwegian educational institutions have a unique opportunity to enhance EBP teaching and learning in Bachelor healthcare education.

6. Conclusions and implications

We found that the measurement properties of the EBP^2-N were valid and reliable for the domains of Relevance, Terminology and Confidence, and responsive to change for all domains, except Sympathy. For future use, the EBP^2-N should be further developed to enhance structural validity and ensure adequate reliability for all domains.

Bachelor students in nursing, occupational therapy, physiotherapy and radiography found EBP relevant, but revealed limited understanding of EBP terminology, limited confidence with EBP skills, and infrequent use of EBP. We found that there were statistically significant, but small differences between health disciplines for all EBP^2-N domains, and between educational institutions for three domains. There was a moderate association between students' perceived expectations of EBP from teachers and perception of EBP relevance. Students with positive assessments of EBP teaching found EBP more relevant, and perceived higher abilities with EBP skills in themselves. Efforts are needed to further develop the understanding of EBP and to explore strategies for enhancing EBP in curricula and in teaching across healthcare programmes at the Bachelor level.

We found that students across health disciplines had higher self-reported understanding of research terms than objectively assessed by a scoring rubric. There was an overall low agreement between students' self-reported and objectively assessed knowledge of EBP terminology. The self-reported Terminology scale discriminated between levels of EBP exposure. The Terminology scale may be used to differentiate between levels of EBP exposure. For the purpose of educational assessment, users should be aware that self-ratings would be higher than objectively assessed knowledge.

7. Further research

For future use, the structural validity of EBP^2-N should be further developed. Preferably, an instrument that objectively measures competencies across the five-step process of EBP should be developed for Bachelor students across health disciplines.

As of today we have limited knowledge of how the teaching and learning of EBP is carried out in Norway. Some unanswered questions that need to be assessed are:

- How is the concept of EBP understood among students across educational levels (Bachelor and Master), faculty and healthcare professionals in Norway?
- How is the five-step EBP process taught across educational programmes and levels?
- How is the organizational readiness for implementing EBP?
- What are the barriers and facilitators for faculty to apply EBP in teaching and to teach the EBP process to Norwegian students across educational levels?
- Which strategies are needed to fully integrate the needed EBP competencies into a three-year Bachelor programme?
- How do Norwegian faculty teach the five-step process of EBP, and how do they apply EBP in their teaching of students across educational levels?
- What are the actual EBP competencies among Norwegian faculty and students?
- How are EBP competencies assessed during a three-year Bachelor programme?
- What expectations do faculty have regarding Bachelor students' utilization of EBP in theoretical assignments and in clinical placement?
- Which strategies do Bachelor students use to learn and apply the EBP process?

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Paper I

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RESEARCH ARTICLE

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Translation, cross-cultural adaption and measurement properties of the evidence-based practice profile

Kristine Berg Titlestad[1*], Anne Kristin Snibsoer[2], Hilde Stromme[3], Monica Wammen Nortvedt[2], Birgitte Graverholt[2] and Birgitte Espehaug[2]

Abstract

Background: The evidence-based practice profile (EBP^2) questionnaire assesses students' self-reported knowledge, behaviour and attitudes related to evidence-based practice. The aim of this study was to translate and cross-culturally adapt EBP^2 into Norwegian and to evaluate the reliability, validity and responsiveness of the Norwegian version.

Methods: EBP^2 was translated and cross-culturally adapted using recommended methodology. Face validity and feasibility were evaluated in a pilot on bachelor students and health and social workers ($n = 18$). Content validity was evaluated by an expert panel. Nursing students ($n = 96$), social educator students ($n = 27$), and health and social workers ($n = 26$) evaluated the instrument's measurement properties. Cronbach's alpha was calculated to determine internal consistency. Test–retest reliability was evaluated using the intra-class correlation coefficient (ICC) and standard error of measurement (SEM). Discriminative validity was assessed by independent sample *t* test. A confirmatory factor analysis (CFA) was performed to assess the structural validity of a five-factor model (*Relevance*, *Sympathy*, *Terminology*, *Practice* and *Confidence*) using the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). A priori hypotheses on effect sizes and *P* values were formulated to evaluate the instrument's responsiveness.

Results: The forward–backward translation was repeated three times before arriving at an acceptable version. Eleven of 58 items were re-worded. Face validity and content validity were confirmed. Cronbach's alpha was 0.90 or higher for all domains except *Sympathy* (0.66). ICC ranged from 0.45 (*Practice*) to 0.79 (*Terminology*) and SEM from 0.29 (*Relevance*) to 0.44 (*Practice*). There was a significant mean difference between exposure and no exposure to EBP for the domains *Relevance*, *Terminology* and *Confidence*. The CFA did not indicate an acceptable five-factor model fit (CFI = 0.69, RMSEA = 0.09). Responsiveness was as expected or better for all domains except *Sympathy*.

Conclusions: The cross-culturally adapted EBP^2-Norwegian version was valid and reliable for the domains *Relevance*, *Terminology* and *Confidence*, and responsive to change for all domains, except *Sympathy*. Further development of the instrument's items are needed to enhance the instruments reliability for the domains *Practice* and *Sympathy*.

Keywords: Evidence-based practice, Students, Questionnaires, Reliability, Validity, Responsiveness, Psychometrics

Background

Evidence-based practice (EBP) is embedded in health policy and healthcare professionals are increasingly expected to inform their practice by evidence [1]. EBP is a systematic approach for making clinical decisions where current best available research evidence is integrated with clinical experience and patient preferences, within a context of available resources [2]. This involves the five steps model of EBP: asking clinical questions, searching for and appraising research evidence, integrating the evidence into clinical practice and evaluating performance

*Correspondence: kristine.berg.titlestad@hvl.no
[1] Institute of Social Work and Social Education, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway
Full list of author information is available at the end of the article

[3]. However, the implementation of EBP is deficient and there is a gap between best practice and delivered health care [4]. Lack of training is one barrier for implementing EBP [4–6].

EBP training was initially focused on upskilling healthcare professionals within the health workplace [7, 8]. Increasingly, the awareness of EBP teaching among undergraduate students has grown [9, 10]. An international curriculum framework for EBP and recommendations for EBP teaching and education have been described in the Sicily consensus statement on EBP [2]. This consensus statement recommends that teaching in EBP should be grounded in the five step model of EBP. Another recommendation is that EBP should be a basic and essential component of healthcare curricula [2, 11].

The integration of EBP in undergraduate healthcare education requires instruments to assess EBP competence and performance [12]. However, systematic reviews over such tools have mostly identified instruments developed for healthcare professionals and medical students [9, 12–14]. In addition, a limited number of instruments have established measurement properties [12, 13, 15] and few measure all five steps of EBP [12, 14, 15].

The evidence-based practice profile (EBP^2) questionnaire, is a tool that assesses EBP knowledge, attitudes and behaviour among healthcare students [7]. It was developed in Australia by McEvoy et al. [7] and validated for students and healthcare professionals in different healthcare disciplines. The EBP^2 is a self-reported instrument with acceptable measurement properties. It was the only identified tool that examined the principles of EBP and the five steps of EBP, and suitable for measuring EBP across health professions. The aim of this study was to translate and cross-culturally adapt EBP^2 into Norwegian and to evaluate the reliability, validity and responsiveness of the Norwegian version.

Methods

We translated and cross-culturally adapted the EBP^2 questionnaire into Norwegian following recommended methodology [16–18]. The consensus-based standards for the selection of health measurement instruments (COSMIN) checklist was used as a framework to guide our choices of measurement properties and parameters [19, 20].

The original instrument

EBP^2 was originally composed by collating characteristics of EBP from previous existing self-report questionnaires, identified by a systematic review of the literature [7]. The measurement properties were tested across a range of health professionals, academics, and students within health or non-health background. The questionnaire consists of 74 items, 58 domain items and 16 non-domain items. In addition, 13 items address the respondents' demographic characteristics. The respondents indicate their scores on a 5-point Likert scale, and the questionnaire takes 10–12 min to complete.

An exploratory factor analysis (EFA) revealed the presence of the five domains *Relevance, Sympathy, Terminology, Practice* and *Confidence* [7]. *Relevance* (14 items) refers to the value, emphasis and importance placed on EBP, *Sympathy* (7 items) refers to the individual's perception of the compatibility of EBP with professional work, *Terminology* (17 items) refers to the understanding of common research terms, *Practice* (9 items) refers to the use of EBP in clinical situations and *Confidence* (11 items) refers to the perception of an individual's ability with EBP skills [7, 21]. The instrument is multidimensional with each domain score calculated as the sum of all items in each domain, and each item weighted equally. The domain of Sympathy is negatively keyed [7].

The EBP^2 measurement properties confirmed good internal consistency and test–retest reliability [7]. Convergent validity was tested by comparing EBP^2 to the 24-item Upton & Upton questionnaire [22]. The Upton & Upton questionnaire covered three of the five factors in EBP^2 (*Practice*, *Confidence* and *Sympathy*) and the EBP^2 questionnaire demonstrated good convergent validity for the three comparable factors [7]. The EBP^2 distinguished between groups exposed to EBP and unexposed groups for three of the domains (*Relevance, Terminology* and *Confidence*) [7].

Translation and cross-cultural adaption process

Permission to translate the EBP^2 into Norwegian was granted from the copyright holder. Following recommended methodology [16–18], two bilingual translators (KBT, HS), with expertise in the construct measured and whose native language was Norwegian, translated the questionnaire independently of each other. The translators aimed at a conceptual and cultural equivalence, rather than a word-for-word translation. The forward translations were reviewed and discussed by an expert panel that consisted of a professor in EBP (MWN), an assistant professor (AKS) and a master student (KBT). Translators and members of the expert panel were fluent in both Norwegian and English.

The expert panel agreed on a version for back-translation. A professional translator (SG), whose native language was English, performed the back-translation. SG had no knowledge about the original instrument. Discrepancies between the back-translation and the original version were discussed with the copyright holder. The forward–backward translation process was repeated three times until an acceptable version was agreed upon by the expert panel and the copyright holder.

We pilot tested the comprehension of the translated version of EBP[2] on 18 participants from five different health and social professions (Table 1). Nine of these participants were considered experts in EBP. All participants completed the questionnaire while they read aloud the item response options and their own choice of answer. After completion, the participants were interviewed by KBT to elaborate on items or response options that were unclear. The data from the interviews were organised and summarised using "The Problem Respond Matrix" [23]. The Problem Respond Matrix was developed to standardise the analysis of cognitive data and can be used to identify items that are unclear to respondents.

Evaluation of measurement properties

Participants and data collection

The total number of eligible participants was 247, representing bachelor students in nursing ($n = 152$) and social education ($n = 63$) from a large University College in Norway, and health and social workers from a local hospital ($n = 32$). Second year nursing students attending an EBP course, were recruited to evaluate the questionnaire's responsiveness. The EBP course was equivalent to 5 ECTS credits (The European Credit Transfer and Accumulation System) [24] and emphasised the acquisition of knowledge and skills in the principles of EBP and the five-step EBP model. The 3-week course was clinically integrated and students were formally assessed at the end of the course. Second year social educator students attending a course without EBP exposure and clinical health and social workers from a dayshift were enrolled to evaluate test–retest reliability.

The bachelor students were recruited at the start of a classroom session and the health and social workers at a shift handover. Data were collected from January to April 2014. The questionnaire was answered twice by all participants with a time interval of 3 weeks for the test–retest evaluation among social educator students and health and social workers, and with a time interval of 4 weeks for the responsiveness evaluation among nursing students. The test conditions were similar at both measurement times. The questionnaires were administered independently of each other. Participants who answered the questionnaire twice and had less than 25% missing items were included.

Statistical analysis

Statistical analyses were performed using *IBM SPSS Statistics* version 22 [25] and *R* [26]. As in the evaluation of the original EBP[2] only domain items were included in the analyses [7]. The level of significance was set at 0.05. Respondents with more than 25% missing values were excluded from all analyses, following the procedure reported by McEvoy et al. [7]. Respondents with more than 20% missing values in one domain were excluded from analysis of that specific domain.

Reliability was assessed by internal consistency, test–retest reliability and measurement error. For internal consistency, Cronbach's alpha was applied for every domain and was considered good between 0.70 and 0.90 [17].

Table 1 Characteristics of participants in the pilot test ($n = 18$)

	n	%
Gender		
Male	1	6
Female	17	94
EBP training		
None	2	11
3–10 h	2	11
10–20 h	5	28
More than 20 h	9	50

Profession	Students		Professional	
	n	%	n	%
Nurse	3	17	4	22
Social educator	2	11	4	22
Physiotherapist	0	0	3	17
Occupational therapist	0	0	1	5.6
Social worker	0	0	1	5.6

n number of cases

Intraclass correlation coefficient (ICC) determined the test–retest reliability (intra-rater reliability), using a two-way random model, absolute agreement. ICC was calculated for each item and each domain, and ICC > 0.70 was deemed acceptable [27]. Cohen's linear-weighted kappa was calculated for each item. Minimum acceptable kappa value was 0.60, while values of 0.75 or higher were considered good [24, 28]. Measurement error was expressed as standard error of measurement (SEM) using the formula $SEM = SD/\sqrt{2}$. The larger the SEM, the lower the test reliability and the less precision in the measures taken and scores obtained [17].

Discriminative validity for levels of EBP exposure was assessed by independent sample *t* test. Measurements obtained from the nursing students after participation in a course in EBP (5 ECTS) were compared to re-test measurements among social educator students and health and social workers without this course. Structural validity was assessed by factor analysis. Confirmatory factor analysis (CFA) was performed to test whether the data fit the original five-factor structure. To evaluate model fit we used the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). Guidelines suggest that models with CFI close to 0.95 or higher, RMSEA close to 0.06 or lower and SRMR close to 0.08 or lower represent a good-fitting model [29].

We formulated a priori hypotheses on Effect Size (ES) and Paired *t* test results (*P* value) to measure the questionnaire's responsiveness. Based on the cohort of Long et al. [30], we hypothesized a smaller ES in our study due to our 3-week course as opposed to 13-weeks in Long et al. Thus, we hypothesized ES to be larger than moderate at *Relevance*, larger than small at *Sympathy*, larger than moderate at *Terminology*, less than small at *Practice* and larger than small at *Confidence*. ES was considered large if 0.8, moderate if 0.5 or small if 0.2 [31]. We expected no change in the ES for the domain *Practice,* as participants were asked about EBP activities in the past year.

Results

Translation and cross-cultural adaption

The forward–backward translation was repeated three times before arriving at an acceptable version. "The Problem Respond Matrix" showed that eleven items were unclear or challenging to understand (the matrix is available on request). These items were re-worded after consulting the copyright holder.

The pilot participants with expertise in EBP ($n = 9$) confirmed face validity. The expert panel assessed content validity and found the questionnaire, questions and rating scale clinically reasonable and relevant to the area of applicability. The layout of the EBP^2-Norwegian version is similar to the original with the same number of items and demographic questions.

Evaluation of measurement properties

A total of 247 individuals were eligible for participation. Among the eligible students ($n = 215$), 188 (87%) met for the first teaching session and answered the questionnaire. The study included 149 participants responding at both measurements: 96 nursing students testing the questionnaire's responsiveness, and 27 social educator students and 26 health and social workers testing test–retest reliability (Fig. 1). We excluded participants who did not meet for the retest ($n = 38$) and respondents with more than 25% missing items ($n = 1$).

Most of the participants were females (87%). The mean age was 28.2 years (range 20–61) (Table 2). The average number of items with missing values was 0.7 (SD = 0.9) per participant. No items had more than 2.7% missing values.

Cronbach's alpha for the five domains ranged from 0.49 (*Sympathy*) to 0.92 (*Terminology*) on the first test. On the second test, Cronbach's alpha ranged from 0.66 (*Sympathy*) to 0.94 (*Terminology* and *Confidence*) (Table 3).

Table 4 shows the results from the analyses of test–retest reliability. ICC ranged from 0.45 (*Practice*) to 0.79 (*Terminology*). Linear-weighted kappa for single items ranged from −0.02 (*Sympathy*) to 0.68 (*Terminology*) and SEM values varied from 0.29 (*Relevance*) to 0.44 (*Practice*).

There was a significant mean difference between exposure and no exposure to EBP for the domains *Relevance*, *Terminology* and *Confidence* (Table 5). The CFA showed that the CFI of the entire model was 0.59 on the first test and 0.69 on the second test. Its RMSEA was 0.090 (95% CI 0.085–0.094) and 0.089 (95% CI 0.084–0.094) while the SRMR was 0.098 and 0.095.

Statistically significant mean differences comparing pre- and post-EBP course measurements were observed for all domains except *Sympathy*. ES values were as expected or better for the domains *Relevance*, *Terminology*, *Practice* and *Confidence*, but lower for *Sympathy* (Table 6).

Discussion

The EBP^2 was translated and cross-culturally validated into Norwegian, using acknowledged standards. The EBP^2-Norwegian version was found to be a reliable tool for measuring three of the five domains, namely *Relevance*, *Terminology* and *Confidence.* Further, the EBP^2-Norwegian version was able to detect a change after EBP exposure in all domains, except for *Sympathy*. Content validity was established. Discriminative validity was

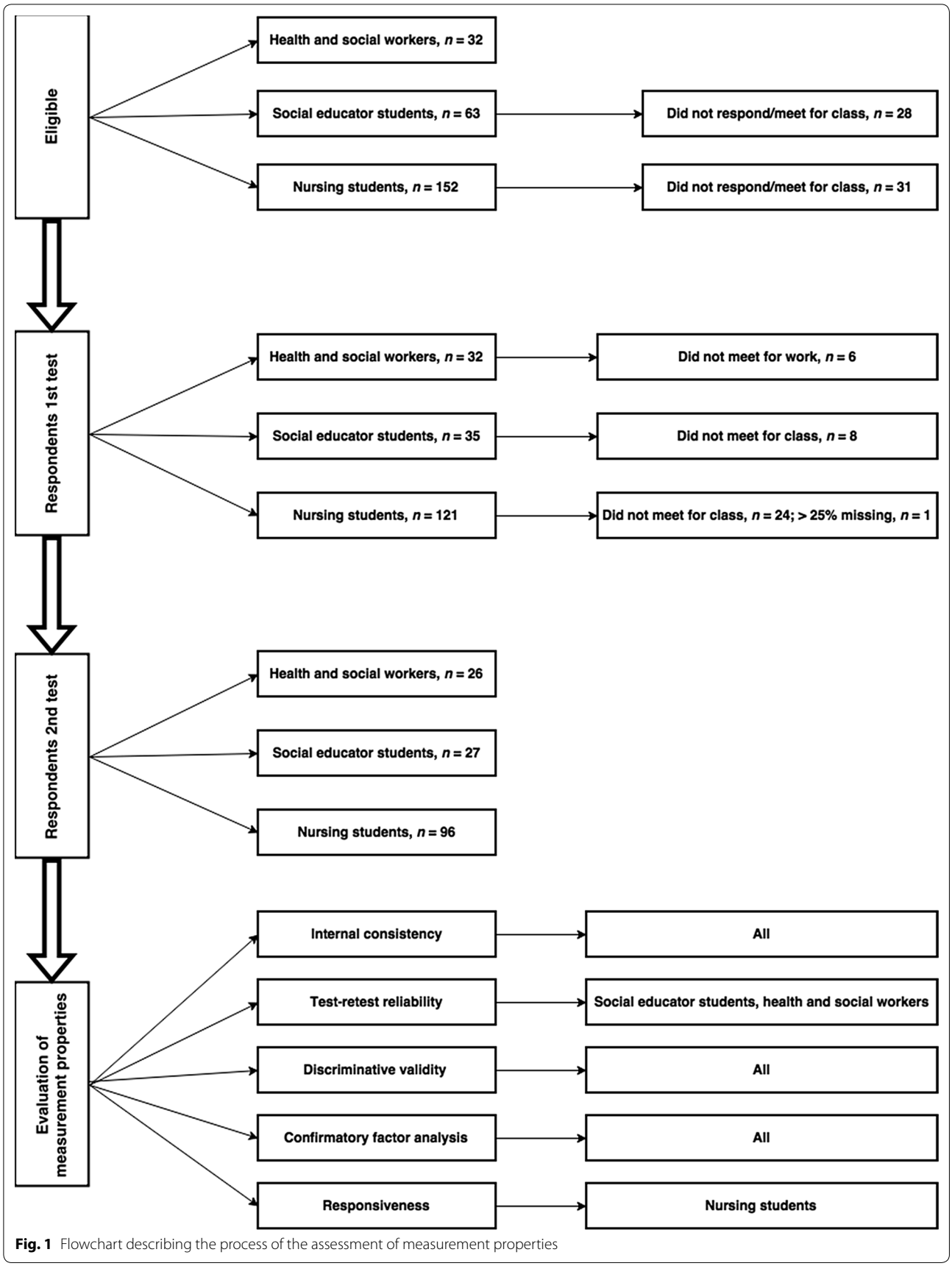

Fig. 1 Flowchart describing the process of the assessment of measurement properties

Table 2 Characteristics of participants

Characteristics	All (n = 149)		Test–retest reliability (n = 53)		Responsiveness (n = 96)	
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
Age	148 (99)	28.2 (10.5)	53 (100)	35 (12.7)	95 (99)	24.4 (6.4)
Gender						
Male	19 (13)		6 (11)		13 (14)	
Female	130 (87)		47 (89)		83 (87)	
English						
Easy	71 (48)		23 (43)		48 (50)	
Neither hard nor easy	62 (42)		22 (42)		40 (42)	
Hard	11 (7)		5 (9.4)		6 (6)	
Very hard	1 (0.7)		1 (1.9)		0 (0)	
Missing	4 (2.7)		2 (3.8)		2 (2)	
Profession[a]						
Nurse			23 (88)			
Occupational therapist			1 (4)			
Social educator			2 (7.7)			
EBP training[a]						
None			17 (65)			
3–10 h			3 (12)			
10–20 h			2 (7.7)			
More than 20 h			2 (7.7)			
Missing			2 (7.7)			

n number of cases, *SD* standard deviation

[a] Among the included health and social workers ($n = 26$)

Table 3 Internal consistency ($n = 149$)

Domain	*N* of items	1st test		2nd test	
		n	Cronbach's alpha	n	Cronbach's alpha
Relevance	14	145	0.88	144	0.91
Sympathy	7	144	0.49	145	0.66
Terminology	17	139	0.92	135	0.94
Practice	9	144	0.82	142	0.90
Confidence	11	147	0.91	143	0.94

n number of cases

verified for *Relevance*, *Terminology* and *Confidence*, but structural validity did not confirm the original five-factor model.

In our study, the domain *Sympathy* revealed low reliability and poor responsiveness. In the evaluation of the original EBP[2] the measurement properties were also poorest for *Sympathy*, although with better results [7]. While this domain consists of the smallest number of items, a likely explanation for inadequate internal consistency may be poor interrelatedness among the items for this domain. Furthermore, *Sympath*y consists of

Table 4 Test–retest reliability of the questionnaire ($n = 53$)

Domain	Range items weighted kappa's	Range items ICC	n	Domain ICC (95% CI)	Mean difference	SEM
Relevance	0.25 to 0.54	0.32–0.70	53	0.69 (0.47–0.82)	0.19	0.29
Sympathy	−0.02 to 0.40	0.01–0.50	52	0.47 (0.19–0.63)	0.13	0.32
Terminology	0.28 to 0.68	0.27–0.84	52	0.79 (0.66–0.87)	−0.04	0.36
Practice	0.09 to 0.47	0.02–0.54	53	0.45 (0.21–0.64)	−0.15	0.44
Confidence	0.31 to 0.57	0.41–0.74	53	0.76 (0.62–0.85)	0.00	0.38

n number of cases, *CI* confidence interval

Table 5 Discriminative validity for participants with ($n = 96$) and without ($n = 53$) EBP course (5 ECTS points)

Domain	EBP course		No EBP course					
	n	Mean (SD)	n	Mean (SD)	Mean difference	95% CI	*P* value	Effect size (Cohen's d)
Relevance	96	58.7 (6.5)	53	53.3 (7.5)	5.39	3.05 to 7.73	<0.001	0.76
Sympathy	96	20.3 (3.0)	53	20.3 (3.1)	0.02	−1.06 to 1.07	1.0	0.01
Terminology	96	51.6 (11.9)	53	39.1 (13.3)	12.51	8.32 to 16.71	<0.001	0.99
Practice	96	21.2 (5.8)	53	21.4 (5.3)	−0.19	−2.10 to 1.70	0.84	0.04
Confidence	96	33.8 (8.3)	53	28.8 (8.4)	4.97	2.14 to 7.80	0.001	0.59

n number of cases, *SD* standard deviation, *CI* confidence interval

Table 6 Responsiveness of the domain scores of EBP^2-Norwegian version ($n = 96$)

Domain	*n*	Pre	Post	Pre-post			
		mean (SD)	mean (SD)	mean difference	95% CI	*P* value	Effect size (Cohen's d)
Relevance	95	54.1 (7.0)	58.6 (6.5)	4.53	3.15 to 5.92	<0.001	0.67
Sympathy	93	20.2 (2.1)	20.2 (3.0)	0.09	−0.73 to 0.56	0.79	0.03
Terminology	96	41.8 (11.9)	51.6 (11.9)	9.81	7.87 to 11.76	<0.001	0.82
Practice	96	19.7 (5.7)	21.2 (5.8)	1.53	0.43 to 2.64	0.007	0.27
Confidence	96	27.0 (8.1)	33.8 (8.3)	6.77	5.36 to 8.19	<0.001	0.83

n number of cases, *SD* standard deviation

negatively worded items with reversed scores. Although reversed score items serve the useful function to disrupt undesirable response sets, they may confuse respondents if the altered direction of the wording goes unnoticed [32]. In addition, the negatively worded items were more challenging to translate than the others, and it might be that the Norwegian translation did not fully capture the English phrasing.

Test–retest reliability was low for the domains *Sympathy* and *Practice*. It is possible that the inconsistency we observed relates to raised EBP consciousness between the measurement periods, through exposure to questions, reflection and better understanding [33]. However, both domains refer to the use of EBP in clinical situations and the compatibility of EBP with professional work [7]. They rely on an understanding of EBP concepts and day-to-day practical incorporation of EBP, and it may be that the inconsistency we found reflects the homogeneity in our sample and its diverse familiarity with EBP concepts. A further exploration with a larger and more heterogeneous sample could determine if prerequisite EBP acquaintance is essential to fully understand the questions. Nonetheless, the results from the test–retest reliability analyses may be used to shape item-retention decisions, by performing analyses of the items' ICC values, refining item wording with the target population through cognitive interviews and asking an expert panel to consider content validity [33]. A review for potential cultural, contextual, translational and interpretational limitations of the items on the EBP^2-Norwegian version, with emphasis on the domains *Sympathy* and *Practice* is essential.

Norwegian health and social workers with experience in EBP confirmed face and content validity on the EBP^2-Norwegian version. As the original scale, the EBP^2-Norwegian version discriminated between low and high exposure of EBP for *Relevance*, *Terminology* and *Confidence*. Moreover, the number of missing items was low and did not indicate problems with the instrument, like incomprehension or a poor fit between answers and response options [17]. This suggests that the participants found the EBP^2-Norwegian version feasible. Still, the CFA did not confirm the original five-factor model.

As hypothesized, the domains most likely to be affected by the 3 week EBP course were *Relevance* and *Terminology*. For these domains, ES was larger than expected. In addition, we observed a larger change in ES for *Confidence* than predicted. We hypothesized a smaller ES than observed by Long et al. [30], since our students participated in a 3-week EBP course and the students in the previous study received a 13-week EBP course. Interestingly, the EBP course in our study fulfills the recommendations for EBP teaching, like clinical integration, multifaceted teaching strategies and formal assessment [34]. It is possible that we underestimated the value of these important aspects when we formulated the a priori hypotheses on ES.

One strength of this study is the application of recommended frameworks [16, 35] to guide a transparent translation, cross-cultural adaption, evaluation and reporting of measurement properties. Our sample size was adequate for evaluation of internal consistency, test–retest reliability, discriminative validity and responsiveness. Still, according to de Vet [17] there should be a minimum of 100 participants, but preferably four to ten participants per item to perform a satisfactory CFA [36]. Our sample size of 149 participants may therefore be too small for valid fit measures in the CFA analysis. Furthermore, bachelor students from two different health and social studies programmes were included in the Norwegian study, compared to students from five different health programs in the Australian study [7]. A larger, more heterogeneous sample could have improved the methodological information of the five-factor model.

To assess EBP competence in all five EBP steps with one instrument is a challenge [15, 37]. Self-reported competence in EBP may cause respondents to over-estimate their actual competence [38], and the most common way to measure EBP learning has been to evaluate attitudes and self-efficacy with self-reported instruments [15]. According to the CREATE framework (classification rubric for EBP assessment tools in education) actual EBP knowledge, skills and behaviour need to be assessed through cognitive testing, performance assessment and activity monitoring [15]. Hence, the limitations of the EBP^2 tool should ideally be triangulated with additional information gained from instruments assessing actual knowledge and skills.

EBP education is increasingly common across clinical settings and higher educational programmes. Still, the possibility to measure the impact of EBP education has been limited to a few validated tools. With the cross-cultural adaption and measurement evaluation of the EBP^2-Norwegian version our study adds knowledge to this subject.

Conclusions

The measurement properties of EBP^2-Norwegian version was reliable and valid for the domains *Relevance, Terminology* and *Confidence.* Further research is needed to appraise the domains *Sympathy* and *Practice.* We recommend further studies of EBP^2-Norwegian version with a larger and more heterogeneous sample. We also recommend further linguistic improvement of the questionnaire by using the results from testing test–retest reliability to shape the item-retention decisions.

Abbreviations

EBP: evidence-based practice; EBP^2: the evidence-based practice profile; COSMIN: the consensus-based standards for the selection of health measurement instruments; EFA: exploratory factor analysis; KBT: Kristine Berg Titlestad; HS: Hilde Stromme; MWN: Monica Wammen Nortvedt; AKS: Anne Kristin Snibsoer; SG: Simon Goudie; ECTS: the European credit transfer and accumulation system; ICC: intraclass correlation coefficient; SEM: standard error of measurement; CFA: confirmatory factor analysis; CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual; ES: effect size; NSD: the Norwegian social science data services; CREATE: the classification rubric for EBP assessment tools in education.

Authors' contributions

KBT, AKS, BE, BG and MWN made contribution to the conception and the design of the study. HS constructed the search strategies used to identify relevant instruments. HS and KBT translated the instrument into Norwegian. KBT conducted the survey and acquired the data. KBT, AKS and BE conducted the data analysis. All authors participated in the interpretation of results. KBT drafted the manuscript. All authors read, critically revised, and approved the final manuscript. All authors' have agreed to be accountable for all aspects of the work. All authors read and approved the final manuscript.

Authors' information

Kristine Berg Titlestad (KBT), M.Sc., is an Assistant Professor at the Institute of Social Work and Social Education, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway. Anne Kristin Snibsoer (AKS), M.Sc., RN, is an Assistant Professor at Centre for Evidence-Based Practice, Western Norway University of Applied Sciences, Bergen, Norway. Hilde Stromme (HS), M.Sc., Librarian, is a Senior Adviser at The Norwegian Institute of Public Health, Oslo, Norway. Monica Wammen Nortvedt (MWN), Ph.D., RN, Professor, Dean, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway. Birgitte Graverholt (BG), RN, Ph.D., is the Head of Centre for Evidence-based Practice, Western Norway University of Applied Sciences, Bergen Norway. Birgitte Espehaug (BE), Ph.D., Statistician, is a Professor at Centre for Evidence-Based Practice, Western Norway University of Applied Sciences, Bergen, Norway.

Author details

[1] Institute of Social Work and Social Education, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway. [2] Centre for Evidence-Based Practice, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway. [3] The Norwegian Institute of Public Health, Oslo, Norway.

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Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

The data supporting the conclusions of this article are available for authorized researchers upon request from the corresponding author.

Ethics approval and consent to participate

The participants were informed verbally and in writing about the purpose of the study. The survey was voluntary, and return of the questionnaires was considered consent of participation. Data were treated confidentially and stored in the research server at the University College. The Norwegian Social Science Data Services (NSD) granted approval of the study in January 2014 (reference number 36988).

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Paper II

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Evidence-based practice profiles among bachelor students in four health disciplines: a cross-sectional study

Anne Kristin Snibsøer[1*], Birgitte Graverholt[1], Monica Wammen Nortvedt[1,2], Trond Riise[3] and Birgitte Espehaug[1]

Abstract

Background: Despite the recognition of integrating evidence-based practice (EBP) in educational programs, there is limited research about bachelor students' EBP profiles (EBP knowledge, attitudes and behaviour) in the health disciplines nursing, occupational therapy, physiotherapy and radiography. The aim of this study was to assess EBP profiles among bachelor students in health disciplines, and explore differences between health disciplines, educational institutions, students' assessment of EBP teaching and expectations of EBP performance.

Methods: A survey using the 'Evidence-Based Practice Profile - Norwegian version' (EBP^2-N) was conducted among final year bachelor students in health disciplines from four educational institutions. The questionnaire consisted of five domains (Relevance, Terminology, Confidence, Practice and Sympathy) and assessed the five steps of EBP. We performed regression analyses to analyse mean differences in domain scores between health disciplines, Cohen's *d* to illustrate the magnitude of the largest difference in each domain, Omega squared to describe portion of variance in domain scores, and Spearman's rho (r_s) to assess the monotonic relationship between EBP^2-N domains and assessment of EBP teaching and expectations of EBP performance, respectively.

Results: Students reported highest overall mean score for Relevance, with an estimated standardized mean of 81.2 (CI 95% = 80.4–82.0). The other EBP^2–N domains had estimated standardized means of 54 and less. Statistically significant differences ($p < 0.03$) between health disciplines were observed for all domains. The largest mean difference was found for Relevance with highest score for occupational therapy and lowest for radiography, with an estimated Cohen's *d* of 1.11. Moderate positive associations were observed between Relevance scores and students' assessment of EBP teaching ($r_s = 0.31$), and expectations of EBP performance from teachers ($r_s = 0.36$). We also observed a moderate positive correlation between Confidence and students' assessment of EBP teaching ($r_s = 0.46$).

Conclusion: Bachelor students in health disciplines found EBP relevant, but revealed low understanding of EBP terminology, low confidence with EBP skills, and low use of EBP in clinical situations. We observed differences in EBP profiles between health disciplines and between educational institutions. The differences in scores raise questions about the understanding of EBP within disciplines, and the complexity of EBP in educational settings.

Keywords: Evidence-based practice, Students, Nursing, Occupational therapy, Physiotherapy, Radiography, Attitude, Knowledge, Behaviour

* Correspondence: Anne.Kristin.Snibsoer@hvl.no
[1]Centre for Evidence-Based Practice, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Postbox 7030, 5020 Bergen, Norway
Full list of author information is available at the end of the article

Background

Evidence-based practice (EBP) is a systematic approach to clinical decision-making which incorporates the current best available evidence from research and clinical expertise with the values and preferences of health service users, within a context of available resources [1]. There is an expectation that health professionals apply knowledge and skills in their professional work that is based on the best available evidence, use evidence to inform practice, and constantly strive to use evidence-based approaches to improve health system performance [2–4]. However, studies have demonstrated that even though health professionals hold positive attitudes towards EBP there is a lack of EBP utilization in practice [5, 6]. A number of barriers towards EBP have been described, including lack of time, lack of availability and accessibility of research, lack of cultures that recognize EBP performance, and lack of EBP knowledge and skills among health professionals [6–9].

New demands in healthcare impose changes in healthcare education and training. International federations of healthcare acknowledge that the teaching of EBP skills and research methodology should be integrated in healthcare educations [10–12]. Moreover, the Lancet commission report *Education of health professionals for the twenty-first century* propose a shift in healthcare training towards producing enlightened change agents [13]. By emphasizing the importance of lifelong learning, and recommending transformative learning that embraces the transfer from facts memorization to searching, analysis and synthesis of information for decision-making, the report supports the need for EBP knowledge and skills. The progressive focus on EBP is also included in Norwegian healthcare educational policies, which recommend mandatory teaching in EBP for all bachelor students in health disciplines [14].

An international curriculum framework for EBP, with recommendations for EBP teaching and education, was first described in the Sicily statement on EBP [1]. According to this consensus statement, EBP should be a basic and essential component of curricula. The EBP teaching should be based on the five step model of EBP, which typically involves the ability to formulate a research question, conduct a systematic search for literature, critically appraise the evidence, apply the evidence into clinical practice and evaluate performance [1]. To promote lifelong learning, the basic skills of EBP should be taught early and integrated in curricula through all study years [15]. In addition, it is recommended that the teaching and learning strategies are multifaceted, clinically integrated and include knowledge and skills assessment [16].

Despite the recognition of integrating EBP in healthcare educational programs, there is diversity in how bachelor students in health disciplines perceive EBP. Results of previous surveys assessing EBP knowledge, attitude and behaviour among healthcare students have been inconsistent [17–24]. The studies have applied different instruments, mainly to students within a single profession. Only one instrument has been explicitly developed to cover the range of EBP domains likely to change as a result of education and training across health professions [25]. Moreover, one study has used this instrument to compared EBP profiles (EBP knowledge, attitude and behaviour) between students in the allied health professions [22]. No previous studies have compared EBP profiles between bachelor students in nursing and the allied health professions. The aim of this study was to assess EBP profiles among bachelor students in health disciplines, and explore differences between health disciplines, educational institutions, students' assessment of EBP teaching and expectations of EBP performance.

Methods

We conducted an analytic cross-sectional study among Norwegian final year bachelor students in health disciplines during spring 2015.

Setting

In Norway, a bachelor's degree is the entry-level to practice as a nurse, occupational therapist, physiotherapist or radiographer. The 3 year bachelor programs constitute 180 European Credit Transfer and accumulation System (ECTS), distributed on theoretical and clinical studies [26] (Table 1). At the time of data collection, full-time education in healthcare were offered at 21 University Colleges and four Universities distributed across the country (Table 1).

Norwegian National Curricula set standards for healthcare bachelor programs by describing overall aims, content and required competences upon completion of programs [26]. The National Curricula for all healthcare programs consists of a profession-specific content (150 ECTS) and a common content (30 ECTS). The common content includes core competences that are shared by all bachelor programs in healthcare [26], and are often taught interdisciplinary. Based on the National Curricula, higher educational institutions develop their own curricula, which includes information about their programs' aims, core competences, learning outcomes and contents, as well as the organization, progression and facilitation of programs [27]. A National Agency for Higher Education (NOKUT) accredits and monitors the quality of these programs [28].

All bachelor programs represented in this study addressed EBP in their curricula. A document review was performed to indicate when EBP was stated in the curricula learning outcomes and content (Table 2). Two people (first author and a research assistant) carried out

Table 1 Distribution of ECTS in National Curricula and educational institutions for Norwegian bachelor programs in healthcare

Health discipline	Distribution of 180 ECTS			Bachelor programs at
	Theoretical studies	Skills training at school	Placement in clinical practice	University (U) University College (UC)
Occupational therapy	105	15	60	1 U + 5 UC
Physiotherapy	105	30	45	1 U + 3 UC
Radiography	111	9	60	1 U + 5 UC
Nursing	90	15	75	4 U + 21 UC

the document review. They searched all curricula for the word *evidence-based practice* and terms related to the five-step model of EBP (ask, acquire, appraise, apply and assess). To determine if the terms were related to EBP training, we judged whether the use of each term within the sentence was specific to EBP and not to research in general.

Participants

The participants in our study consisted of final year bachelor students in nursing, occupational therapy, physiotherapy and radiography. The convenience sample was recruited from the four Norwegian educational institutions that, at the time of data collection, offered all of these bachelor programs fulltime.

Students enrolled in 16 programs at four educational institutions were eligible to participate ($n = 1346$). We collected data at teaching sessions with expected high student attendance during spring term 2015. One program in physiotherapy and two classes of nursing were excluded as they had no teaching sessions at campus during the data collection period ($n = 249$). Students absent during the sessions ($n = 322$) were not included. Thus, 775 students were invited to participate (Fig. 1).

Data were collected from March – June 2015. The students received information about the study on the students' online learning platform 2 days before data collection. During the teaching session, a researcher handed out and collected the paper-based questionnaire. The teaching sessions varied in content and included a range of topics.

Table 2 EBP explicit (E), implicit (I) or not mentioned (–) in curricula (2012–2015)

School	Health discipline	EBP in programs' curricula						
			Semester					
		Overall aim	1	2	3	4	5	6
A	Occupational	E	E	E	E	E	E	E[a]
	Physiotherapy	E	E	–	E	E	–	I[b]
	Radiography	E	E	E	I	E	E	I
	Nursing	E	–	–	–	E	–	I
B	Occupational	E	–	–	E	I	E	E
	Radiography	E	E	–	I	–	I	E
	Nursing	E	E	E	E	E	E	E
C	Occupational	E	–	–	–	I	E	E
	Physiotherapy	E	–	–	–	I	I	E
	Radiography	E	–	I	E	–	E	I
	Nursing	E	I	I	E	–	E	E
D	Occupational	E	I	–	–	E	–	E
	Physiotherapy	E	I	–	–	–	I	–
	Radiography	I	I	–	–	–	–	I
	Nursing	E	I	–	I	E	I	I

[a] E = EBP explicitly mentioned by word

[b] I = EBP implicitly mentioned by elements of the EBP steps (ask, acquire, appraise, apply or assess), but indefinite if curricula reflected EBP or research in general

Measurement

We used the Norwegian version of the Evidence-Based Practice Profile (EBP[2]) questionnaire [25, 29], a self-reported questionnaire that examines self-perceived EBP knowledge, attitude and behaviour. The questionnaire is trans-professional, assesses the five steps of EBP and incorporates elements of EBP that are likely to change as a result of education, training and exposure over time. It consists of 73 items, whereof 58 items relate to the five domains of Relevance, Terminology, Confidence, Practice and Sympathy. The domains explore the value, emphasis and importance participants place on EBP (Relevance, 14 items), the understanding of common research terms (Terminology, 17 items), the perception of ability with EBP skills (Confidence, 11 items), the use of EBP in clinical situations (Practice, 9 items), and the perception of compatibility of EBP with professional work (Sympathy, 7 items) [25]. The domain of Sympathy has negatively phrased items, which need to be reversed before analysis. Each item was weighted equally within the domain.

The non-domain items included 15 educational items and six demographic characteristics, including gender, age, health discipline, educational institution, previous bachelor education and percentage of paid work besides studies. A subset of the educational items assessed the participants' assessment of EBP teaching (4 items) and assumed expectations of EBP performance from teachers and clinical instructors (2 items).

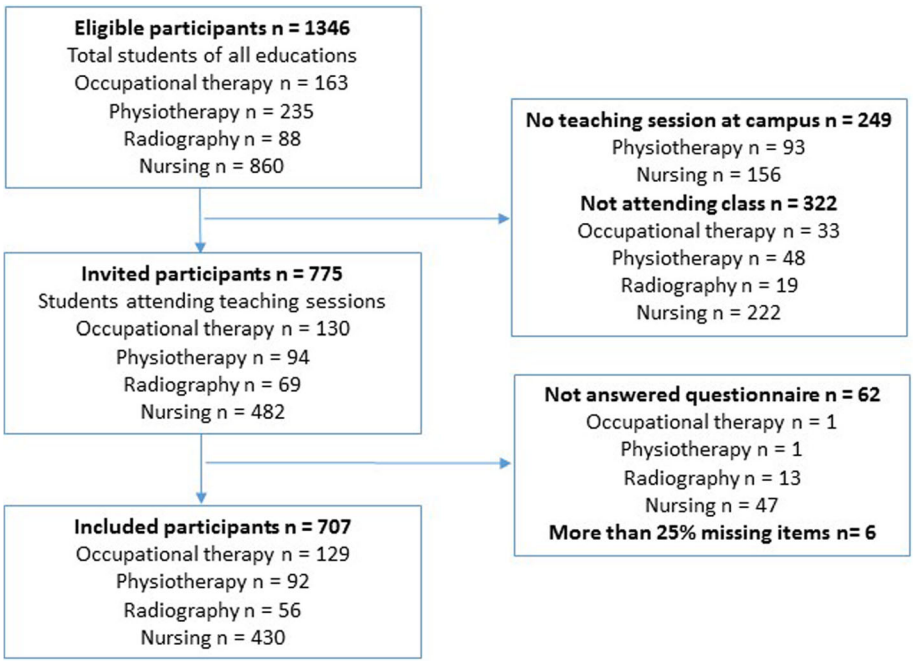

Fig. 1 Flow diagram of included participants

All items were scored on a 5-point Likert scale, with a minimum score of 1 and a maximum score of 5 per item. A summary score for each domain was calculated by summing the scores of the items within the domain. In addition, we calculated standardized summary scores on a scale from 0 to 100 and standard summary scores (Z-scores). Respondents with more than 25% missing items on non-demographic items were excluded from further analysis. Respondents with more than 20% missing values on one domain were excluded from analysis of that specific domain. For respondents with missing items of 20% or less within a domain we substituted the missing scores with the mean of the other items in the domain.

The Evidence-Based Practice Profile – Norwegian version (EBP^2-N) has been translated, culturally adapted and psychometric tested [29]. EBP^2-N was found valid and reliable for the domains Relevance, Terminology and Confidence, and responsive to change for all domains, except Sympathy. The authors recommended further linguistic improvement. Thus, before the questionnaire was used in our survey, the EBP^2-N was reviewed and imprecise items (n = 12) were revised by an expert panel. The confirmatory factor analysis (CFA) showed the same results as in the validation study [29]. Cronbach's alpha for the five domains ranged from 0.69 (Sympathy) to 0.90 (Confidence) (Additional file 1).

Statistical analysis

A power analysis informed that at least 64 students should be included from each health discipline to detect a standardized mean difference (effect size) of 0.5 as statistically significant (two-sided hypothesis test; $\alpha = 0.05$) with a power of 80%. We chose to include all available students to ensure adequate numbers for multiple regression analyses and for subgroup analyses.

Descriptive analyses were applied for demographic characteristics. The Chi-square test and one-way analysis of variance (ANOVA) were performed to test for distributional differences among the four health disciplines (nursing, occupational therapy, physiotherapy and radiography), gender, educational institutions (school A, B, C and D), previous bachelor education (yes, no), paid work in addition to studies (0%, 1–20%, 21–50% and > 50% of a full time employment of 37.5 h per week) and age (in years).

Differences in mean domain scores between health disciplines and between educational institutions were analysed by ANOVA. Linear regression analyses were performed to examine the extent health discipline predicted domain scores. In the model, we controlled for possible confounding by the variables educational institution, gender, age, previous bachelor education and paid work. We used the original scores as outcome variables for these analyses. Nursing was defined as the reference category, and the estimated regression coefficients (beta) represent mean differences in scores for the allied health professions compared to nursing. Goodness-of-fit was assessed by the adjusted coefficient of determination (R^2).

To illustrate the magnitude of the difference we calculated Cohen's d (standard deviation units) as the difference

between the highest and lowest mean within each domain divided by the pooled standard deviation. In addition, we calculated Omega squared (ω^2) to describe the proportion of variance in domain scores that could be explained by health discipline. Spearman's rho (r_s) was used to assess the monotonic relationship between the EBP^2-N domains, and students' assessment of EBP teaching and students' assumed expectations from teachers of EBP performance, respectively.

Cohen's *d* (standard deviation units) was considered small if 0.2, medium if 0.50 and large if 0.80 [30]. Spearman's rho was interpreted as small if < 0.30, medium if 0.31–0.49 and large if ≥0.50 [30].

p-values less than 0.05 indicated statistical significance. The statistical software IBM SPSS Statistics version 22 [31] and *R* [32] were used for the statistical analyses.

Results

Of the 775 students who attended the teaching sessions, 713 (92%) answered the questionnaire. Six respondents had more than 25% missing items, allowing 707 responses to be included in the analysis (Fig. 1).

The respondents were students in occupational therapy (18%), physiotherapy (13%), radiography (8%) and nursing (61%) (Table 3). The mean age was 25.1 (SD ± 4.8) years (range 20–56 years). The proportion of men was highest among radiography students (32%) and lowest among nursing students (9%). Most participants (91%) had no previous bachelor education and the majority (84%) had paid work besides their studies.

The highest overall mean score was observed for Relevance, with an estimated standardized mean of 81.2 (CI 95% = 80.4–82.0). The other EBP^2-N domains had estimated standardized means of 54 and less (Table 4).

Differences in mean scores among health disciplines were small, but statistically significant for all domains ($p \leq 0.03$) (Table 4 and Additional file 2). The largest difference was found for Relevance, with highest score for occupational therapy and lowest for radiography, with an estimated Cohen's d of 1.11 (Table 4). Students in radiography consistently reported low mean domain scores, with mean Z-scores below the average for all EBP^2-N domains (Fig. 2). Domain Z-scores among health disciplines varied from – 0.77 (95% CI -1.04 – -0.5) (Relevance) for radiograph students to 0.43 (95% CI 0.25–0.62) (Terminology) for physiotherapy students (Fig. 2). The difference between health disciplines persisted after adjustment for educational institution, gender, age, previous

Table 3 Characteristics of participants for the total sample and for each health discipline

	Total (*n* = 707)	Occupat therapy (*n* = 129)	Physio-therapy (*n* = 92)	Radio-graphy (*n* = 56)	Nurse (*n* = 430)	*p*-value
	n (%)	n (%)	n (%)	n (%)	n (%)	
Gender[a]						$p < 0.001$[b]
Female	599 (85)	101 (78)	71 (77)	38 (68)	389 (91)	
Male	106 (15)	28 (22)	21 (23)	18 (32)	40 (9)	
Educational institution						$p < 0.001$[b]
School A	162 (23)	29 (23)	37 (40)	13 (23)	83 (19)	
School B	197 (28)	38 (30)	0	11 (20)	148 (34)	
School C	244 (35)	52 (40)	40 (44)	22 (39)	130 (30)	
School D	104 (15)	10 (8)	15 (16)	10 (18)	69 (16)	
Previous bachelor education[a]						$p = 0.2$[b]
Yes	56 (8)	5 (4)	10 (11)	5 (9)	36 (9)	
No	643 (91)	124 (96)	82 (89)	50 (91)	387 (91)	
Work in addition to studies[a]						$p < 0.001$[b]
0%	103 (15)	28 (22)	20 (22)	10 (18)	45 (11)	
1–20%	399 (56)	62 (48)	55 (60)	23 (41)	259 (61)	
21–50%	179 (25)	38 (30)	15 (17)	18 (32)	108 (25)	
> 50%	23 (3)	1 (1)	1 (1)	5 (9)	16 (4)	
Age						$p = 0.06$[c]
N	701	129	92	55	425	
Mean (SD)	25.1 (4.8)	25.7 (5.2)	24.0 (2.6)	25.2 (4.5)	25.2 (5.0)	
Min - Max	20–56	21–50	21–38	20–43	21–56	

[a]Number of missing values was 5 for gender, 10 for previous bachelor education and 5 for work in addition to studies
[b]analyzed by Chi-square
[c]analyzed by one-way ANOVA

Table 4 Mean level of bachelor students' ($n = 707$) EBP^2-N scores and test of mean differences across four health disciplines

EBP^2-N domains (max value)	Total sample		Health disciplines			
	Original scale	Standardized[a]	*F*	P	Cohen's *d*	ω^2
	Mean (95% CI)	Mean (95% CI)				
Relevance (70)	59.5 (59.0–59.9)	81.2 (80.4–82.0)	15.14	< 0.001	1.11	0.06
Terminology (85)	47.0 (46.2–47.9)	44.1 (42.9–45.4)	8.60	< 0.001	0.69	0.03
Confidence (55)	34.8 (34.3–35.3)	54.1 (52.9–55.3)	8.95	< 0.001	0.44	0.03
Practice (45)	23.8 (23.4–24.2)	41.0 (39.9–42.1)	5.08	0.002	0.60	0.02
Sympathy (35)	21.8 (21.5–22.0)	52.7 (51.8–53.7)	3.03	0.03	0.43	0.01

[a]0–100 scale, calculated as (observed score – min domain score)*100 / (max domain score – min domain score)

bachelor education and work in addition to studies (Additional file 3).

The mean EBP^2-N scores differed significantly between educational institutions for three domains (Relevance $p < 0.001$, Terminology $p < 0.001$ and Sympathy $p = 0.001$). The largest difference was found for Relevance, with an estimated Cohen's d of 0.86. Among educational institutions, school D reported mean Z-scores below the average for all domains, except Confidence. Domain Z-scores among educational institutions varied from –0.66 (95% CI -0.87 – -0.45) (Relevance) for school D to 0.27 (95% CI 0.10–0.43) (Terminology) for school A (Fig. 2).

A medium positive correlation was observed between Relevance and students' assessment of EBP teaching ($r_s = 0.31$, $n = 693$, $p < 0.001$), between Relevance and students' assumed expectations from teachers of EBP performance ($r_s = 0.36$, $n = 696$, $p < 0.001$), and between Confidence and assessment of EBP teaching ($r_s = 0.46$, $n = 691$, $p < 0.001$) (Additional file 4).

Discussion

This is the first study to assess EBP profiles among bachelor students in nursing and allied health professions. We found that bachelor students across health disciplines found EBP relevant, but revealed low understanding of EBP terminology, low confidence with EBP skills, and low use of EBP in clinical situations. Differences in domain specific results were observed between health disciplines and between educational institutions. In addition, we found that students with positive assessments of EBP teaching also perceived EBP as more relevant, and they were more confident with their EBP skills. Moreover, students who perceived high EBP expectations from teachers found EBP more relevant.

The high overall mean score for Relevance indicates that the respondents placed high values, emphasis and importance on EBP. Our findings for this domain was equivalent to and slightly higher than findings from previous studies using the same instrument [20, 22, 33, 34]. Although we did not examine EBP exposure specifically, our results for Relevance corresponded to findings among Australian students with more than 20 hours of EBP exposure and to Australian students who had undertaken formal EBP training, including stand-alone courses and integration of EBP in professional theoretical courses and supervised clinical practice [20, 22, 33, 34].

Our students' positive perception of Relevance did not translate into the other EBP^2-N domains. Our findings for Terminology and Confidence were lower than previously reported for students undertaking EBP training [20, 33, 34]. For these domains, our results were in line

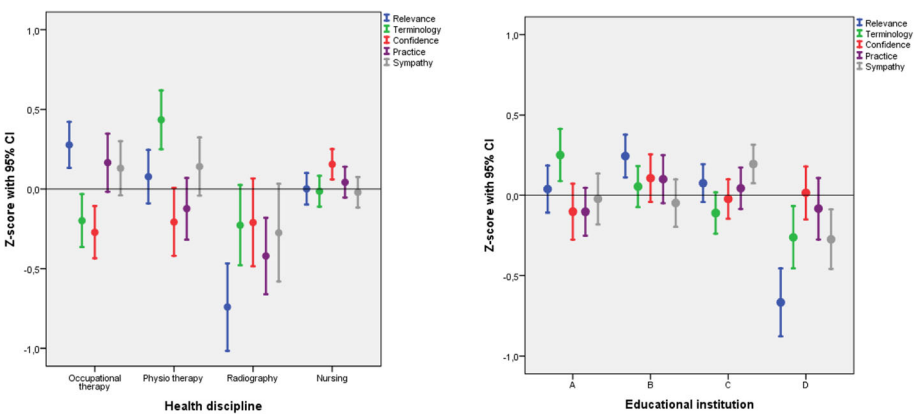

Fig. 2 Z-score values for the EBP^2-N domains by health discipline and educational institution

with findings from students with less than 20 hours of EBP exposure [22]. For the domains of Practice and Sympathy, our findings were more consistent with previous studies [20, 22, 33, 34], although we for Practice also observed lower mean values as compared to Australian students with formal EBP training [20, 34]. However, taken into account the differences in samples, educational systems, EBP exposure and training, our comparisons of findings should be interpreted with caution. Nevertheless, it is of interest to observe the EBP profiles in our sample in light of the findings from students in different contexts.

One explanation for our positive result of Relevance may be the progressive focus on EBP in Norwegian higher education, healthcare policies and media. We observed that students who perceived higher expectations of EBP from teachers also placed higher value, emphasis and importance on EBP. Media, referring governmental policies and national discussions focusing on an evidence-based society, may have functioned as reinforcement of the students' academic exposure and added value to how relevant they viewed EBP. With external expectations and self-reported measurements there is always a risk of providing socially desirable responses rather than actual attitudes. However, we found a moderate association between perceived EBP expectations and Relevance, and this was not evident for the other EBP^2-N domains. It is therefore likely that multiple exposures to EBP may have influenced our participants' positive attitudes towards EBP.

The students in our study reported low scores for Terminology and Confidence. These findings might indicate that a three-year bachelor program is too short to incorporate EBP knowledge and skills in healthcare educational programs. Another plausible explanation could be lack of competence in teaching EBP among faculty at the bachelor's level. Although the teaching and learning of EBP in Norwegian higher education is upcoming, the tradition of teaching has centred on how to conduct research rather than how to use the best evidence to inform practice. Faculty may hold positive attitudes towards EBP and be knowledgeable in basic methodology, but lack knowledge and skills in the EBP process of appraising and applying evidence in practice [35–37]. However, knowledge and skills in research methodology does not necessarily translate into supportive attitudes towards EBP, knowledge of the EBP process, or skills in acquiring and appraising evidence [36, 38]. We found that students with positive assessments of EBP teaching found EBP more relevant and were more confident with EBP skills. Hence, to enhance educational cultures that ensure students' competences and appreciation of EBP it is essential to understand faculty's knowledge, attitudes, and practice of teaching EBP, and to upskill faculty in the EBP process [36–38].

Our results revealed small, but statistically significant differences in domain scores between disciplines. We did not identify any systematic patterns in the EBP profiles, and it is challenging to find plausible explanations for the physiotherapy students' higher Terminology scores, the nursing students' higher Confidence scores and the radiography students' lower Relevance scores. In line with our results, McEvoy et al. [22] also observed higher scores for Terminology among physiotherapy students and lower EBP^2 domain scores for students in medical radiation.

A possible explanation for the physiotherapy students' higher Terminology scores might be that the physiotherapy program has a stronger focus on research and methodology, as physiotherapists frequently use tests based on quantitative studies for diagnosis and treatment. It is also plausible that our nursing programs' extensive clinical placement periods may explain the nursing students' higher Confidence scores. The nursing profession in Norway has been highly representative in postgraduate EBP programs [39], and there is a possibility that clinical nurses engaged in EBP may have encouraged their students' confidence in EBP.

One can only speculate why the radiography students reported lower scores for Relevance, and mean scores below the average for all other EBP^2-N domains. It may be argued that, compared to the other included health disciplines, radiographers are more involved in diagnosis than treatment, they participate less in the daily care of patients and their job entails technical tests ordered by other health professionals. Upton et al. [40] have previously illuminated that EBP might be perceived as less relevant for professionals engaged in diagnosis rather than treatment, and in workplace cultures that expect adherence to sets of rules rather than questioning of practice. Thus, one might question if less independency in clinical decisions might be a reason for lower EBP perceptions.

During our curriculum review, we found fragmented, imprecisely and implicitly formulated learning outcomes related to EBP across all programs. Interestingly, students attending the educational institution (school D) with less integration of EBP in curricula reported lower scores for Relevance, and mean standard scores below the average for most of the other domains. We are aware that our document review does not truly reflect our students EBP exposure and experience, and our study was not designed to capture EBP teaching and learning approaches. Still, inadequate descriptions of EBP learning outcomes in curricula have been observed in other studies [41], and McEvoy et al. [42] have argued that accreditation bodies should recognize EBP in accreditation documents to prioritize the integration of EBP into entry-level programs. Thus, to ensure explicit EBP

competences upon completion of bachelor programs, regular reviews of EBP learning outcomes in programs' curricula is needed. In line with findings from systematic reviews [16] and recommendations from experienced educators in EBP [1], educational institutions should develop comprehensive curricula where EBP teaching and learning is integrated throughout entire study programs, allowing repetition, consolidation and application of EBP knowledge and skills.

Strengths and limitations

Some limitations to this study have already been presented throughout the discussion, including lack of information about the students' actual EBP teaching and learning. In addition, analysis of structural validity of the EBP^2-N did not confirm the original five-factor model. Subsequently, the results of Sympathy and Practice should be interpreted with caution, as structural validity was not confirmed for these domains.

The response rate was high among students attending teaching sessions. Still, the smaller sample size of radiography students is a limitation to this study. Additionally, a large proportion of eligible students was not included in the study, and we lacked information to analyse non-responders. The allied health programs were well represented in the study. This was not the case for nursing students, where a limited proportion of educational institutions were included. Still, we considered diversity by including educational institutions located throughout the country, and by collecting data during teaching sessions with various topics. By including students from four health disciplines, attending various teaching sessions at four different educational institutions, we have provided insight into differences in EBP profiles at one point of time across a variety of Norwegian bachelor students in health disciplines.

In the analyses we adjusted for a range of possible confounders. A substantial amount of variability in the outcome measures was unaccounted for indicating that other, possible context specific, factors could have resulted in a better model fit.

Conclusion

Bachelor students in health disciplines found EBP relevant, but revealed low understanding of EBP terminology, low confidence with EBP skills, and low use of EBP in clinical situations. We observed differences in EBP profiles between health disciplines and between educational institutions. The differences in scores raise questions about the understanding of EBP within disciplines, and the complexity of EBP in educational settings. Our findings underline that bachelor students in health disciplines are not equally prepared for EBP.

Additional files

Additional file 1: Cronbach's Alpha for the EBP^2-N domains. The table provides Cronbach's Alpha results as a measure of the reliability for the five EBP^2-N domains. (PDF 398 kb)

Additional file 2: Descriptive statistics for EBP^2-N domains by participants' characteristics ($n = 707$). The table provides the mean score values for the five EBP^2-N domains by health disciplines, educational institutions, gender, previous bachelor education, work in addition to studies and age. Group differences were analysed by ANOVA and t-tests. (PDF 575 kb)

Additional file 3: Estimated differences in mean EBP^2-N domain scores between health disciplines (n = 707). The table provides differences in mean EBP^2-N domain scores estimated by simple and multiple linear regression for health disciplines with nurses as the reference group. Goodness-of-fit was assessed by the adjusted coefficient of determination (R^2). (PDF 74 kb)

Additional file 4: The relationship between EBP^2-N domains, assessment of EBP teaching and expectation of EBP performance. The table provides the results of the relationship of the five EBP^2-N domains, and students' assessment of EBP teaching and students' assumed expectations from teachers of EBP performance, respectively, estimated by Spearman's rho (r_S). (PDF 314 kb)

Additional file 5: Dataset. The file provides the non-identifying data used in the current study (all data except gender and age). (XLSX 196 kb)

Abbreviations

ANOVA: Analysis of variance; CFA: Confirmatory factor analysis; CI: Confidence intervals; EBP: Evidence based practice; EBP^2: Evidence-based practice profile; EBP^2-N: Evidence-based practice profile – Norwegian version; ECTS: European credit transfer and accumulation system; r_s: Spearman's rho; Z-scores: Mean standard score

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Availability of data and material

The non-identifying data used during the current study are included in Additional file 5 (all data except gender and age).

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Authors' contributions

AKS, BG, MWN and BE contributed in designing the study. AKS, MWN and BE collected the data. AKS and BE performed the data analysis. AKS, BG, MWN, BE and TR interpreted the data. AKS drafted the manuscript. All authors have contributed to and approved the final manuscript.

Ethics approval and consent to participate

Data were analysed and stored in the research server at the Western Norway University of Applied Sciences. The Norwegian Social Science Data Services (NSD) approved the study (Reference number 42653). The survey was voluntary, and consent for participation was completion and return of the questionnaire. We treated the data confidentially.

Consent for publication

Not applicable.

Competing interests
The authors declare that they have no competing interests.

Publisher's Note

Author details
[1]Centre for Evidence-Based Practice, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Postbox 7030, 5020 Bergen, Norway. [2]Accident and Emergency Department, Bergen Municipality, Postbox 7700, 5020 Bergen, Norway. [3]Department of Global Public Health and Primary Care, University of Bergen, Postbox 7804, 5020 Bergen, Norway.

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Additional file 1. Cronbach's Alpha for the EBP^2-N domains.

Domain	N of items	N	Cronbach's Alpha
Relevance	14	677	0.86
Terminology	17	657	0.89
Confidence	11	682	0.90
Practice	9	659	0.83
Sympathy	7	675	0.69

Additional file 2. Descriptive statistics for EBP^2-N domains by participants' characteristics (n=707).

	EBP^2-N domains				
	Relevance (70)	**Terminology (85)**	**Confidence (55)**	**Practice (45)**	**Sympathy (35)**
	mean (SD)	**mean (SD)**	**mean (SD)**	**mean (SD)**	**mean (SD)**
Health discipline (n)					
Occupational (129)	61 (5)[a]	45 (11) [a]	33 (7) [a]	25 (6) [a]	22 (3) [a]
Physiotherapy (92)	60 (5)[b]	52 (10) [abc]	33 (7) [b]	23 (5)	22 (3)
Radiography (56)	55 (6) [abc]	45 (10)[b]	33 (7)[c]	22 (5) [ab]	21 (4) [a]
Nursing (430)	59 (6) [ac]	47 (11)[c]	36 (7) [abc]	24 (5)[b]	22 (3)
p value*	<0.001	<0.001	<0.001	0.002	0.03
Educational institution (n)					
School A (162)	60 (6) [a]	50 (12) [a]	34 (8)	23 (5)	22 (3)
School B (197)	61 (6) [b]	48 (10)[b]	35 (7)	24 (6)	22 (4)
School C (244)	60 (6) [c]	46 (11) [a]	35 (7)	24 (5)	22 (3) [a]
School D (104)	55 (7) [abc]	44 (11) [ab]	35 (6)	23 (5)	21 (3) [a]
p value*	<0.001	<0.001	0.4	0.3	0.001
Gender (n)					
Female (599)	59 (6)	46 (11)	35 (7)	24 (5)	22 (3)
Male (106)	60 (6)	52 (10)	36 (7)	24 (5)	23 (4)
p value**	0.8	<0.001	0.06	0.8	0.01
Previous bachelor education (n)					
Yes (56)	60 (6)	52 (10)	37 (6)	25 (5)	22 (4)
No (643)	59 (6)	47 (11)	35 (7)	24 (5)	22 (3)
p value**	0.4	<0.001	0.06	0.1	0.7
Work in addition to studies (n)					
0 % (103)	59 (6)	46 (13)	34 (7)	24 (6)	22 (4)
1 – 20 % (399)	60 (6)	46 (11)	35 (7)	24 (5)	22 (3)
21 – 50 % (179)	59 (6)	48 (10)	35 (7)	24 (5)	22 (4)
> 50 % (23)	58 (7)	49 (15)	37 (8)	26 (8)	22 (3)
p value*	0.4	0.2	0.5	0.3	0.9
Age (n)* **					
<24 years (354)	59 (6)	46 (11)	35 (7)	24 (5)	22 (3)
≥24 years (358)	60 (6)	48 (12)	35 (7)	24 (6)	22 (4)
p value**	0.3	0.002	0.6	1	0.3

**Analysed by factorial ANOVA*

*** Analysed by independent t-test*

****Median value of 24 years defined the middle value for the age groups*

[abc] Groups with the same subscript are significantly different to each other within the same domain. For example, occupational therapists scored significantly higher than radiographers and nurses for Relevance, while physiotherapy scored significantly higher than the radiographers did.

Additional file 3. Estimated differences in mean EBP^2-N domain scores between health disciplines (n=707).

	Relevance		Terminology		Confidence		Practice		Sympathy	
	Univariate	**Multivariate***	**Univariate**	**Multivariate***	**Univariate**	**Multivariate***	**Univariate**	**Multivariate***	**Univariate**	**Multivariate***
	B (CI 95%)	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**	**B (CI 95%)**
	P	**p**	**p**	**p**	**p**	**p**	**p**	**p**	**p**	**p**
Occupational therapy	1.6 (0.4 - 2.8) 0.008	1.3 (0.1 – 2.4) 0.04	-2.1 (-4.3 - 0.1) 0.06	-2.8 (-4.9 - -0.7) 0.01	-3.1 (-4.5- -1.7) <0.001	-3.3 (-4.7 - -1.8) <0.001	0.7 (-0.4 – 1.7) 0.2	0.7 (-0.3 – 1.8) 0.2	0.5 (-0.1 – 1.2) 0.1	0.1 (-0.4 - 0.9) 0.5
Physiotherapy	0.4 (-1.0 -1.8) 0.6	0.8 (-0.6-2.2) 0.3	5.1 (2.5 – 7.6) <0.001	5.0 (2.5 – 7.5) <0.001	-2.5 (-4.1 - -1.0) 0.002	-2.6 (-4.3 - -0.9) 0.003	-0.8 (-2.0 - 0.4) 0.2	-0.6 (-1.9 – 0.7) 0.4	0.6 (-0.2 – 1.3) 0.2	0.4 (-0.4 – 1.2) 0.3
Radiography	-4.9 (-6.6 - -3.1) <0.001	-4.7 (-6.4 - -3.0) <0.001	-1.8 (-4.9 – 1.4) 0.3	-2.9 (-6.0 – 0.2) 0.06	-2.7 (-4.7 - -0.7) 0.009	-3.2 (-5.2 - -1.2) 0.002	-2.5 (-4.0 - -0,9) 0.002	-2.5 (-4.1 - -1.0 0.001	-1.0 (-1.9 – 0.0) 0.05	-1.3 (-2.3 - -0.3) 0.01
Nurse	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]	0[a]
Adjusted R^2	0.057	0.122		0.119		0.042		0.021		0.041

*adjusted for educational institution, gender, age, previous bachelor education, and work in addition to studies.

Additional file 4. The relationship between EBP^2-N domains, assessment of EBP teaching and expectation of EBP performance.

Domain	Assessment of EBP teaching			Expectation of EBP performance		
	r_s	n	p	r_s	n	p
Relevance	0.307	693	<0.001	0.356	696	<0.001
Terminology	0.257	693	<0.001	0.111	695	0.003
Confidence	0.460	691	<0.001	0.192	694	<0.001
Practice	0.269	690	<0.001	0.278	692	<0.001
Sympathy	0.211	688	<0.001	0.183	691	<0.001

Paper III

PLOS ONE

RESEARCH ARTICLE

Self-reported and objectively assessed knowledge of evidence-based practice terminology among healthcare students: A cross-sectional study

Anne Kristin Snibsøer[1]*, Donna Ciliska[1,2], Jennifer Yost[2,3], Birgitte Graverholt[1], Monica Wammen Nortvedt[1,4], Trond Riise[5], Birgitte Espehaug[1]

1 Centre for Evidence-Based Practice, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway, **2** School of Nursing, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada, **3** College of Nursing, Villanova University College of Nursing, Villanova, Pennsylvania, United States of America, **4** Accident & Emergency Department, Bergen Municipality, Bergen, Norway, **5** Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway

* Anne.Kristin.Snibsoer@hvl.no

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Abstract

Background

Self-reported scales and objective measurement tools are used to evaluate self-perceived and objective knowledge of evidence-based practice (EBP). Agreement between self-perceived and objective knowledge of EBP terminology has not been widely investigated among healthcare students.

Aim

The aim of this study was to examine agreement between self-reported and objectively assessed knowledge of EBP terminology among healthcare students. A secondary objective was to explore this agreement between students with different levels of EBP exposure.

Methods

Students in various healthcare disciplines and at different academic levels from Norway (n = 336) and Canada (n = 154) were invited to answer the Terminology domain items of the Evidence-Based Practice Profile (EBP^2) questionnaire (self-reported), an additional item of 'evidence based practice' and six random open-ended questions (objective). The open-ended questions were scored on a five-level scoring rubric. Interrater agreement between self-reported and objective items was investigated with weighted kappa (K_w). Intraclass correlation coefficient (ICC) was used to estimate overall agreement.

Results

Mean self-reported scores varied across items from 1.99 ('forest plot') to 4.33 ('evidence-based practice'). Mean assessed open-ended answers varied from 1.23 ('publication bias') to 2.74 ('evidence-based practice'). For all items, mean self-reported knowledge was higher

than that assessed from open-ended answers ($p<0.001$). Interrater agreement between self-reported and assessed open-ended items varied ($K_w = 0.04–0.69$). The overall agreement for the EBP^2 Terminology domain was poor (ICC = 0.29). The self-reported EBP^2 Terminology domain discriminated between levels of EBP exposure.

Conclusion

An overall low agreement was found between healthcare students' self-reported and objectively assessed knowledge of EBP terminology. As a measurement tool, the EBP^2 Terminology scale may be useful to differentiate between levels of EBP exposure. When using the scale as a discriminatory tool, for the purpose of academic promotion or clinical certification, users should be aware that self-ratings would be higher than objectively assessed knowledge.

Introduction

Evidence-based practice (EBP) is a systematic approach where the current best available evidence from research is combined with clinical experience and patient preferences to make clinical decisions within a context and available resources [1]. As healthcare professionals are increasingly expected to use evidence from various sources to improve healthcare outcomes, there is a growing responsibility for educational programs to enhance students' knowledge and skills in the EBP process and research methodology [1–4]. Knowledge of EBP terminology and research methodology are prerequisites to understand the concept of EBP, critically appraise research evidence, and integrate and apply evidence in clinical practice.

As educators implement EBP in curricula, they need reliable instruments to assess student knowledge, both formatively and summatively. In the second Sicily statement, Tilson et al. [5] presented the Classification Rubric for EBP Assessment Tools in Education (CREATE) framework, recommending a common taxonomy for tools assessing EBP learning. The framework refers to knowledge as "learner's retention of facts and concepts about EBP", and suggests assessments of EBP knowledge that evaluate a learner's ability to define EBP concepts, describe level of evidence, or list basic principles of EBP [5].

Various instruments have been used to assess EBP knowledge among healthcare professionals [6–9]. Few tools have been validated for use among undergraduate students. Cardoso et al. [10] have published a protocol for a systematic review that aims to identify and assess properties of instruments for measuring knowledge, attitudes and skills in EBP among undergraduate nursing students. However, at the present time there are no systematic reviews of instruments used to assess EBP knowledge among healthcare students across disciplines. Typically, self-report scales that assess the steps of the EBP model (ask, acquire, appraise and apply) [11–13] or the understanding of common research terms [14] have been used to evaluate self-perceived (i.e. subjective) EBP knowledge. Objective knowledge has been evaluated with questionnaires including multiple-choice questions [15–17], or clinical scenario tasks with subsequent dichotomous [18, 19] or open-ended [20, 21] questions. Self-report instruments have advantages such as simple administration, low costs and greater feasibility. Evidence from other fields shows that self-report of skills and abilities correspond poorly to objective performance [22, 23].

Agreement between self-reported and objectively measured knowledge of EBP has not been widely investigated. Few studies report correlations between self-reported and objectively

measured competence in critical appraisal and EBP terminology among undergraduate medical students [24], physicians [25], allied healthcare professionals [26] and nurses [27]. Other studies report only on separate results for the two outcome measures [28–32]. Whether self-rating scales in the field of EBP accurately reflect objective knowledge levels is largely unstudied, particularly among healthcare students. The aim of this study was to examine agreement between self-reported and objectively assessed knowledge of EBP terminology among healthcare students. A secondary objective was to explore agreement among students with different levels of EBP exposure.

Materials and methods

We performed a cross-sectional study among students from various healthcare disciplines in one Norwegian University College and nursing students from one Canadian University, during winter 2016/2017.

Setting

EBP is a national priority in Norwegian educational healthcare programs [33, 34] and there has been an increase in teaching and learning of EBP during the past decade. Nonetheless, at the time of data collection, EBP was not fully integrated in the curricula of the Norwegian University College and EBP exposure varied between programs. At the bachelor's and master's level all programs pursued competencies in EBP and research methodology, but the level and extent differed between programs (Table 1).

In Canada, the consideration of research evidence in practice decisions is an increasingly part of individual standards of practice [35]. The curriculum of the Canadian University had included the teaching and learning of EBP for two decades. As of 2014, the bachelor's of science in nursing program had EBP integrated through all four years in theory and clinical courses, supported with e-learning resources and summative assessments. At the master's level, the students took a stand-alone one-semester course in EBP and research methodology, with reinforcement of this content in a subsequent course.

In Norway, the exposure of EBP terminology, critical appraisal skills and research methodology in teaching and learning was in general less for students at the bachelor's as compared to the master's level. In Canada, the exposure throughout the bachelor's program may be similar to the exposure of the master's students, but the master's student experience was much more concentrated in one course. In this study, we have considered EBP exposure as higher among Norwegian master's students and all Canadian students than among Norwegian bachelor's students.

Participants and data collection

Eligible participants from Norway (n = 336) were students at one University College and comprised final (3rd) year bachelor in nursing, occupational therapy, physiotherapy and radiography, as well as 2nd year master of clinical nursing specializing in anesthetics, surgical or intensive care nursing, 3rd year master of clinical nursing specializing in diabetes, cardiac or public health nursing, and 2nd and 4th year master of EBP in healthcare (Table 1). Eligible participants from Canada (n = 154) were 3rd year bachelor of science in nursing and 1st year master of science in nursing course based primary health care nurse practitioner students from one University.

We collected data in classrooms after teaching sessions. The class sessions varied in content and did not necessarily include teaching of EBP or research methodology. The Norwegian students received information about the study on their online learning platform two days before data collection, while the Canadian students were informed in the classrooms. The students

Table 1. Teaching of EBP critical appraisal skills and research methodology for bachelor and master students.

	Length of programs		Stand-alone course in EBP and/or research methodology	Teaching of EBP critical appraisal skills and/or research methodology	Evaluation in EBP critical appraisal skills and/or research methodology
	Semesters (Years)	Full/ Part-time	Courses (No. courses, total credit points, semester taught)	Semester	Formative (F), Summative (S)
NORWAY					
Bachelor in Nursing	6 (3)	F	EBP (1, 5 ECTS*, 4)	2, 4, 6	F
Bachelor in Occupational Therapy	6 (3)	F	No	3, 5, 6	F
Bachelor in Physiotherapy	6 (3)	F	No	1, 3, 4, 5, 6	F
Bachelor in Radiography	6 (3)	F	Research methodology (1, 5 ECTS, 5)	4, 5, 6	F
Master in Clinical Nursing specializing in anesthetics, surgical, intensive care, pediatric nursing	5 (2.5)	F/P**	EBP and research methodology (1, 15 ECTS, 3)	3, 4, 5	F
Master in Clinical Nursing specializing in diabetes, cardiac, public health nurse	6 (4)	P	EBP and research methodology (2, 25 ECTS, 1, 4)	1, 4, 5, 6	F, S
Master in EBP in Healthcare	8 (4)	P	EBP and research methodology (5, 75 ECTS, 1–5)	1, 2, 3, 5–8	F, S
CANADA					
Bachelor of Science in Nursing	8 (4)	F	Research methodology (1, 3 credits***, 8)	1–8	F, S
Master of Science in Nursing Course Based Primary Health Care Nurse Practitioner	6 (2)	F/P	EBP and research methodology (1, 3 credits, 1)	1, 2	F, S

*ECTS = European Credit Transfer and accumulation System. One credit corresponds to 25–30 hours of work.

**First 3 semesters (90 ECTS) were full-time and last two semesters (30 ECTS) were part-time studies.

***A credit is roughly equivalent to one lecture-hour per week for one term or two hours of laboratories or seminars per week for one term

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were asked to complete a paper-based or electronic questionnaire that contained 18 questions related to their understanding of terms associated with EBP and research, and six open-ended questions where they were to elaborate on their understanding of a subset of the terms. Students answered and returned the self-reported part of the questionnaire before they received the open-ended questions. Students who preferred the electronic version used a link to the questionnaire from their online learning platform. The Norwegian students received a food voucher for dinner in the school cafeteria, as a token of appreciation.

Measurement

The questionnaire consisted of demographic characteristics, 17 self-report questions from the Evidence-Based Practice Profile (EBP^2) Terminology domain [14], one self-report question of how to understand the term 'evidence-based practice' and six open-ended questions formulated as "What does XX mean, in your own words, AND how would you describe it to a fellow student?".

The EBP^2 is a self-report trans-professional questionnaire that examines self-perceived EBP knowledge, attitude and behaviour. It consists of five domains (Relevance, Terminology, Confidence, Practice and Sympathy), where the EBP^2 Terminology domain (17 items) examines knowledge related to the understanding of common research terms. EBP^2 has previously been described with acceptable reliability and validity measures among Australian students and

professionals across health disciplines [14]. The questionnaire has been translated into Norwegian, cross-culturally adapted and validated among Norwegian bachelor students and healthcare professionals from various disciplines. In the Norwegian version, the EBP^2 Terminology domain was found reliable, valid and responsive to change [36].

Specifically, the applied questionnaire consisted of three parts. Part 1 assessed demographic characteristics, including gender, age, educational program and educational institution. Part 2 examined self-reported knowledge and contained 18 items, whereof 17 originated from the EBP^2 Terminology domain. In this part, participants rated their self-perceived understanding on a 5-point Likert scale, where 1 = "never heard the term", 2 = "have heard it, but don't understand", 3 = "have some understanding", 4 = "understand quite well" and 5 = "understand and could explain to others". Part 3 examined objective knowledge, as assessed and rated by a rubric, and contained open-ended short answer questions derived from Part 2. To limit the time needed to complete the questionnaire, each participant was asked a subset of six open-ended questions. Thus, all 18 items were divided into three subsets (Fig 1), and each student received a subset chosen at random. There were a total of three question subsets, therefore agreement measures for each question were calculated on approximately a third of the total number of participants.

To assess the answers of the open-ended questions, we developed a five-level scoring rubric in close collaboration with experts in EBP from McMaster University (DC and JY). The scoring of the open-ended answers related to the 1–5 levels in the self-rating section of Part 2, with values from 1 "never heard the term" to 5 "understand and could explain to others".

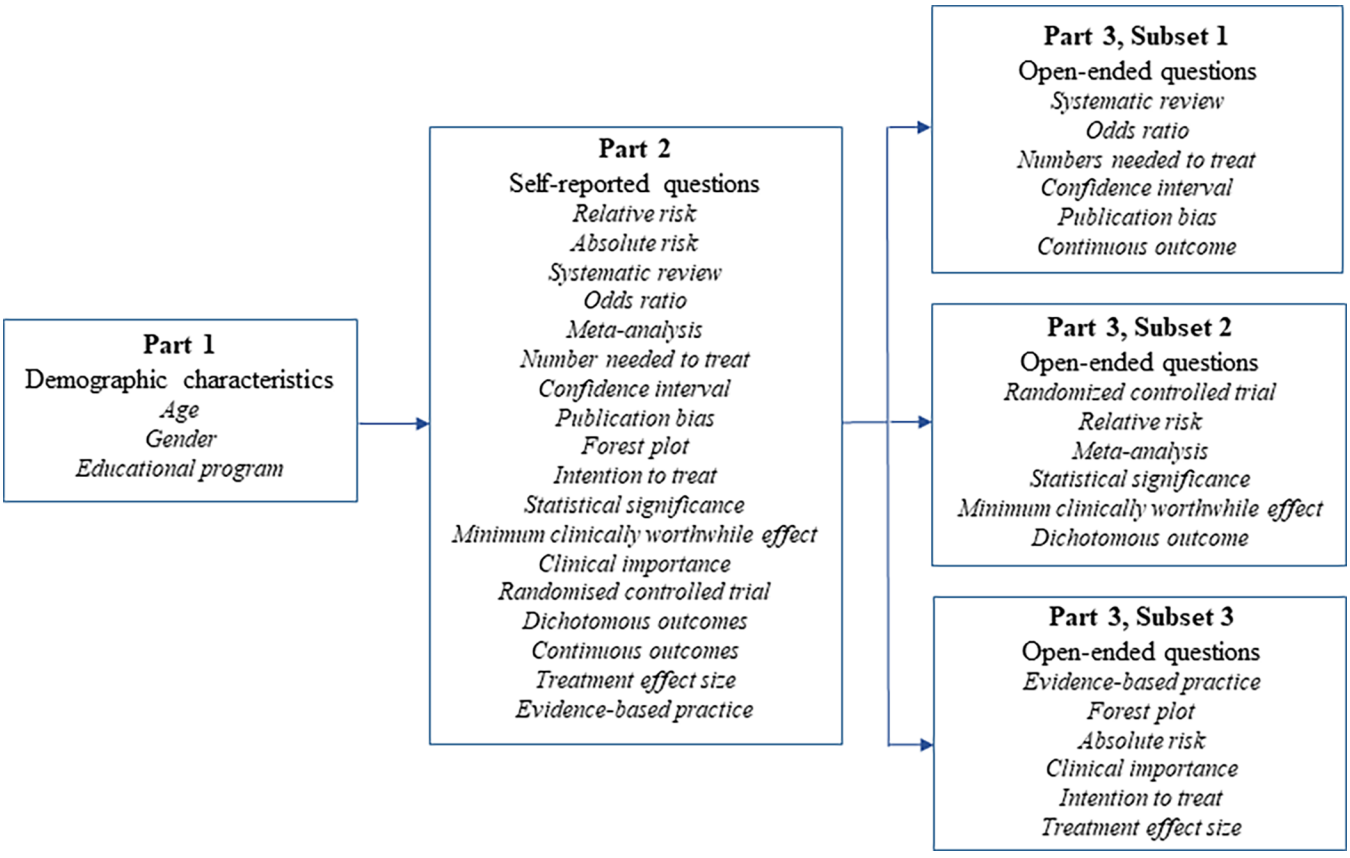

Fig 1. Questionnaire items, self-report and subsets of open-ended questions.

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We performed a pilot study during spring term 2016 to test the understanding and interpretation of the scoring rubric, as well as the administration of the paper-based and the electronic version of the questionnaire. The pilot was performed among final-year Norwegian bachelor's students in nursing and allied healthcare (n = 49) and recently graduated master's students in EBP (n = 19). Two raters (AKS and DC) individually scored the answers, met at two occasions and discussed differences in scorings between raters. Adjustments in the scoring rubric to clarify wording and distinctions between levels of grading were made, and two decision rules to the final scoring rubric (available upon request from first author) were added. Finally, the two raters individually scored the remaining pilot questionnaires (n = 53). Interrater agreement with linear weighted kappa (K_{lw}) demonstrated an almost perfect agreement between raters ($K_{lw} = 0.81$).

In the current study, one rater (AKS) scored the Norwegian questionnaires and one rater (DC) scored the Canadian questionnaires. All open-ended questions that were left blank (not answered) were scored as 1 "never heard the term". Respondents who did not answer any questions in part three were excluded from analysis.

Statistical analysis

A power analysis informed that 78 students were needed to estimate agreement between self-perceived and assessed open-ended answers (kappa value of 0.8 with a lower confidence limit of 0.7). Since a student would give open-ended answers to a third of the items only, a total of 234 students needed to be enrolled. The significance level was set to 0.05. The sample size calculations were performed using the CI5Cats function in the kappaSize package in R [37].

Descriptive analyses were applied for demographic characteristics. Mean (M) and standard deviation (SD) were reported to describe the scores of the self-reported and assessed open-ended items. Due to the ordinal measurement level, weighted kappa was used to estimate interrater agreement between self-reported knowledge and assessed open-ended answers for each research term. To provide complementary information on the distribution of disagreement, we calculated both quadratic (K_{qw}) and linear weighted kappa (K_{lw}). Furthermore, overall summary score was calculated for the EBP^2 Terminology domain by summing the scores of the 17 items within the domain. We used the intraclass correlation coefficient for absolute agreement (ICC) to estimate overall agreement for the EBP^2 Terminology domain.

Mean differences between self-reported and assessed open-ended items were estimated with paired t-test. We used independent sample t-test to analyze differences in mean self-reported EBP^2 Terminology domain scores by EBP exposure.

P-values less than 0.05 indicated statistical significance. Kappa values were considered poor if < 0, slight if 0–0.20, fair if 0.21–0.40, moderate if 0.41–0.60, substantial if 0.61–0.80 and almost perfect if 0.81–1.0 [38].

The statistical software IBM SPSS Statistics version 22 [39] and *R* [40] were used for the statistical analyses.

Ethics

The Norwegian Social Science Data Services (NSD) (Reference number 49132), and The Hamilton Integrated Research Ethics Board (Project number 2463) approved the study.

The survey was voluntary. In Norway, consent for participation was completion and return of the questionnaire. In Canada, the students signed a consent for participation. Data was analysed and stored in the research server at the Western Norway University of Applied Sciences.

Table 2. Characteristics of participants.

	Total (n = 291)	Norway (n = 234)	Canada (n = 57)
	n (%)	n (%)	n (%)
Gender			
Female	253 (87)	201 (86)	52 (91)
Male	33 (11)	28 (12)	5 (9)
Missing	5 (2)	5 (2)	0
Educational program			
Bachelor in nursing	155 (53)	105 (45)	50 (88)
Bachelor in occupational therapy	23 (8)	23 (10)	
Bachelor in physiotherapy	43 (15)	43 (18)	
Bachelor in radiography	16 (6)	16 (7)	
Master in nursing	30 (10)	23 (10)	7 (12)
Master in evidence-based practice	24 (8)	24 (10)	
Age			
N	252	195	57
Mean (SD)	26.4 (8.4)	27.8 (8.8)	21.6 (4.4)
Min–Max	19–56	21–56	19–51

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User involvement

A user panel of four Norwegian bachelor students, one from each health discipline, constituted the user involvement in this study. The users assisted in the collection of data by finding appropriate times for data collection and encouraging peer students to participate in the study. They also participated in the interpretation and discussion of the results. The user panel met on three occasions, to receive information about the study, plan the data collection and discuss results. E-mail correspondence was used between meetings.

Results

Of all eligible students, 291 (59%) answered the questionnaire. The response rate was higher in Norway (70%) than in Canada (37%). Four students were excluded, as they had not answered part three of the questionnaire, allowing 287 respondents to be included in the analysis.

Our sample included bachelor students in nursing (53%) and allied health professions (29%), and master students in nursing (10%) and in evidence-based practice (8%) (Table 2). The mean age was 26.4 (SD = 8.4) years and the majority were females (87%). The sample consisted of a higher proportion of Norwegian (80%) than Canadian (20%) students.

The mean self-reported scores for the terms included in the EBP^2 Terminology domain varied from 1.99 ('forest plot') to 4.20 ('systematic review') (Table 3). The self-reported mean score for the item 'evidence-based practice' was 4.33, (SD = 0.8). The overall self-reported mean EBP^2 Terminology score was 3.02 (SD = 0.87).

The assessed open-ended mean scores for the terms included in the EBP^2 Terminology domain varied from 1.23 ('publication bias') to 2.31 ('randomized controlled trial') (Table 3). The assessed open-ended mean score for the item 'evidence-based practice' was 2.74 (SD = 1.0). The overall assessed open-ended mean score for EBP^2 Terminology was 1.70 (SD = 0.68).

For all research terms, self-reported knowledge was higher than assessed ($p<0.001$). Still, we observed large variations in agreement values between self-reported and assessed open-ended items (Table 3). We found substantial agreement for the items 'forest plot' ($K_{qw} = 0.69$) and 'dichotomous outcome' ($K_{qw} = 0.67$), and moderate agreement for the items 'numbers

Table 3. Agreement values for the EBP² terminology domain and research terms.

	Mean scores (SD)				Weighted kappa
Items	**n**	**Self-reported**	**n**	**Assessed**	**Quadratic (95% CI)**
EBP² Terminology domain					
Forest plot	89	1.99 (1.28)	89	1.46 (1.09	0.69 (0.55–0.83)
Dichotomous outcome	100	2.23 (1.56)	100	1.64 (1.10)	0.67 (0.55–0.79)
Numbers needed to treat	97	2.62 (1.36)	98	2.00 (1.32)	0.60 (0.46–0.73)
Confidence interval	98	2.87 (1.37)	98	1.86 (1.11)	0.50 (0.39–0.62)
Continuous outcome	98	2.61 (1.41)	98	1.49 (1.02)	0.39 (0.26–0.52)
Meta-analysis	100	3.25 (0.94)	100	1.95 (1.16)	0.30 (0.17–0.43)
Treatment effect size	89	2.88 (1.21)	89	1.80 (0.97)	0.29 (0.17–0.41)
Relative risk	100	3.09 (1.17)	99	1.72 (1.02)	0.22 (0.12–0.32)
Statistical significance	100	3.61 (1.20)	100	2.20 (1.16)	0.21 (0.09–0.33)
Intention to treat	89	2.74 (1.28)	89	1.28 (0.84)	0.18 (0.07–0.30)
Odds ratio	98	2.52 (0.94)	98	1.46 (0.68)	0.17 (0.07–0.27)
Randomized controlled trial	100	4.14 (0.99)	100	2.31 (1.14)	0.16 (0.08–0.24)
Publication bias	98	3.18 (1.42)	98	1.23 (0.73)	0.09 (0.02–0.17)
Systematic review	96	4.20 (0.82)	98	2.12 (0.84)	0.08 (0.03–0.12)
Min clinically worthwhile effect	100	2.57 (1.24)	100	1.29 (0.72)	0.07 (-0.02–0.17)
Clinical importance	89	3.89 (1.07)	89	1.63 (0.68)	0.06 (0.01–0.11)
Absolute risk	89	3.01 (1.07)	89	1.46 (0.88)	0.04 (-0.03–0.11)
Evidence-based practice	89	4.33 (0.80)	89	2.74 (1.03)	0.13 (0.04–0.22)

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needed to treat' (K_{qw} = 0.60) and 'confidence interval' (K_{qw} = 0.50). Moreover, we observed fair agreement for five items, and slight agreement for the remaining nine. Analysed with linear weighted kappa, agreement values were lower for all items. We found low overall agreement between the self-reported and objectively assessed open-ended items of the EBP² Terminology domain (ICC = 0.29; 95% CI: -0.09–0.62).

Agreement measures were equal for high (ICC = 0.11; 95% CI: -0.07–0.33) and low (ICC = 0.11; 95% CI: -0.07–0.32) exposure of EBP. These findings were consistent with analyses performed for each question subset S1 Table. High exposed students had a significantly higher self-reported mean EBP² Terminology score compared to that of low exposed students (MD = 1.19, $p < 0.001$) S2 Table.

Discussion

In this study, we found overall low agreement between healthcare students' self-reported and objectively assessed knowledge of EBP terminology, as rated by a rubric. However, agreement varied by research terms. We found substantial agreement for the research terms with the lowest self-reported mean scores and slight agreement for the research terms with highest self-reported mean scores. We observed no difference in agreement values for students with high or low EBP exposure. However, self-reported scores were on average higher for students with high EBP exposure than with low exposure.

To the best of our knowledge, few studies have previously made comparisons between self-reported and objectively assessed knowledge in the field of EBP knowledge. Previous studies assessing the relationship between self-reported and objective measured EBP knowledge have reported small to medium correlations between self-reported and objectively measured competence in critical appraisal among senior medical students [24] and health professionals [26].

Others have reported small, non-significant correlations between self-reported and objective measures of EBP knowledge among nurses [27] and physicians [25]. However, by reporting correlation coefficients, previous studies have reported the strength of a linear association between two variables, and not the agreement between them [41]. Direct comparisons of results should therefore be performed with caution.

Consistent with previous studies [24, 25, 32], our participants over-estimated their self-reported EBP knowledge. One factor influencing self-ratings may be social desirability bias. This mechanism, where respondents answer in a manner that would be viewed favorably, has also been seen in other fields of research, such as when self-reporting physical activity [23] and self-reporting height, weight and body mass index [42]. Another explanation may be that the students lacked the ability to judge their own knowledge and skills, maybe due to lack of internal yardstick or understanding of expectations. In a study of performance on social and intellectual tasks, Ehrlinger et al. [43] found that poor performers overestimated performance, and argue that incompetence may deprive us of insight regarding our deficits.

The students' responses and the poor agreement we observed may also have a simpler explanation. Context and motivations for using EBP may influence assessments [5], and there is no reason to believe that this study is different. For instance, the motivation to recall knowledge and write down answers to the open-ended questions is a demanding task. Perhaps the students lacked motivation to write out the answers during the data collection period. As such, we have no way of telling whether the respondents could have demonstrated higher levels of understanding in their open-ended answers if they were able to verbally respond to the short answer questions, if their motivation was different, or if they were allowed to use the resources that they can use in real-life situations. Also, Zell and Krizan [22] argue that self-assessment for tasks that are familiar and have low complexity corresponds better than unfamiliar and high-complexity tasks.

We found overall low agreement between self-reported and objectively assessed knowledge in EBP terminology, but with large variations in agreement values between items. Highest agreement was found for the research terms with lowest self-reported mean scores. For example, for 'forest plot' most students answered 1 ("never heard the term") on the self-report and "I don't know" for the corresponding open-ended question. Conversely, for terms that students reported higher levels of knowledge, such as 'evidence-based practice', 'systematic review', and 'randomized controlled trial', we found high self-reported scores and slight agreement values. For these items, we observed large differences between responders and raters' classifications, indicating that our responders may not have been as knowledgeable as they reported. However, it could also be argued that the higher agreement found for items with the lowest self-reported scores may not reflect a better understanding of own knowledge, but rather be ascribed to a floor effect limiting variation in self-reported and objectively assessed answers. Still, with additional evidence from other disciplines revealing poor correspondence between self-evaluations of abilities and objective performance measures [22, 23], we question whether self-reported knowledge of EBP terminology, as measured in the EBP^2 Terminology domain, is a good proxy for objective knowledge of EBP.

Blanch-Hartigan [44] described that medical students' ability to self-assess performance was more accurate later in medical school as compared to earlier in medical school. In our study, we conjectured that students with higher exposures of EBP would rate themselves higher on the self-reported EBP^2 Terminology domain, obtain higher assessed scores on their open-ended answers, and have better agreement values than students with lower exposures of EBP. As hypothesized and previously described [14, 37], we found that the self-reported EBP^2 Terminology domain discriminated between levels of EBP exposure. However, we found no differences in agreement values for students with different exposures of EBP.

Limitations

The main limitation of this study was that the open-ended questions and scoring rubric had not been evaluated for reliability and validity. We attempted to overcome this limitation by ensuring that experts in EBP developed the rubric and adapted it to both settings before use. In addition, we performed a pilot in which we found an almost perfect agreement between raters.

At the time of data collection, EBP^2 was the only questionnaire that examined knowledge related to EBP terminology among students across health disciplines. By applying the EBP^2 Terminology domain, we have only assessed one part of the EBP^2 questionnaire. Furthermore, EBP terminology is only one facet of EBP. By not assessing knowledge related to all steps of the EBP model (ask, acquire, appraise, apply or assess), we have examined a limited dimension of knowledge related to EBP.

We have no further information of our responders' confidence and competence in EBP, apart from the knowledge of EBP terminology we assessed at this one point of time. We recognize that a convenience sample of students from two educational institutions in two different countries may have hampered generalizability of the study. Furthermore, there was heterogeneity among the Norwegian master students regarding EBP exposure, as a newly started master program had not integrated EBP to the same extent as the two other programs.

We included sufficient participants to analyze agreement between self-reported and objectively assessed knowledge. Due to the smaller sample size of master students and Canadian students, agreement values between levels of EBP exposure should be interpreted with caution. We did not want variations in resources to influence the answers, and our participants answered the questionnaire under similar conditions. By administering the questionnaire anonymously in classrooms, we excluded a large proportion of eligible students.

Conclusion

We found overall low agreement between healthcare students self-reported and objectively assessed knowledge of EBP terminology. The self-reported EBP^2 Terminology domain discriminated between levels of EBP exposure. As a measurement tool, the EBP^2 Terminology scale may be useful to discriminate between levels of EBP exposure.

As a discriminatory tool for the purpose of academic promotion or clinical certification, users should be aware that self-ratings would be higher than objectively assessed knowledge.

Supporting information

S1 Table. Agreement values for EBP exposure, analyzed for subsets of open-ended questions.
(DOCX)

S2 Table. Self-reported EBP^2 terminology domain scores and EBP exposure.
(DOCX)

S1 File. Data set.
(ZIP)

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Author Contributions

Conceptualization: Anne Kristin Snibsøer, Donna Ciliska, Birgitte Graverholt, Monica Wammen Nortvedt, Trond Riise, Birgitte Espehaug.

Data curation: Anne Kristin Snibsøer.

Formal analysis: Anne Kristin Snibsøer, Birgitte Espehaug.

Funding acquisition: Birgitte Graverholt.

Investigation: Anne Kristin Snibsøer, Jennifer Yost.

Methodology: Anne Kristin Snibsøer, Donna Ciliska, Jennifer Yost, Birgitte Espehaug.

Project administration: Anne Kristin Snibsøer.

Resources: Anne Kristin Snibsøer, Jennifer Yost.

Supervision: Donna Ciliska, Birgitte Graverholt, Monica Wammen Nortvedt, Trond Riise, Birgitte Espehaug.

Validation: Anne Kristin Snibsøer, Donna Ciliska, Birgitte Espehaug.

Visualization: Anne Kristin Snibsøer, Birgitte Espehaug.

Writing – original draft: Anne Kristin Snibsøer.

Writing – review & editing: Anne Kristin Snibsøer, Donna Ciliska, Jennifer Yost, Birgitte Graverholt, Monica Wammen Nortvedt, Trond Riise, Birgitte Espehaug.

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Supporting Information

S1 Table. Agreement values for EBP exposure, analyzed for subsets of open-ended questions.

Subset	Exposure*	n	ICC** (95% CI).
1	All	95	0.28 (-0.09 – 0.62)
	Low	60	0.15 (-0.07 – 0.43)
	High	35	0.16 (-0.07 – 0.46)
2	All	98	0.27 (-0.09 – 0.60)
	Low	64	0.11 (-0.07 – 0.34)
	High	34	0.07 (-0.07 – 0.26)
3	All	87	0.17 (-0.07 – 0.47)
	Low	62	0.05 (-0.05 – 0.20)
	High	25	0.06 (-0.05 – 0.26)

**Low exposure = Bachelor's students from Norway; High exposure = Master's students from Norway and undergraduate and master's students from Canada*

***ICC for absolute agreement*

S2 Table. Self-reported EBP[2] Terminology domain scores and EBP exposure.

	EBP[2] Terminology domain			
EBP exposure*	**n**	**Mean (SD)**	**Mean Difference (95%CI)**	**P value**
Low	187	2.58 (0.60)		
High	104	3.77 (0.58)	1.19 (1.04 – 1.33)	<0.001

**Low exposure = Bachelor's students from Norway; High exposure = Master's students from Norway and undergraduate and master's students from Canada*

Appendix I

Search strategies for literature searches

MEDLINE

Search date: October 05, 2018

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to October 05, 2018>

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1 exp Evidence-Based Practice/ (81759)
2 (evidence based occupational therapy or evidence based physical therapy or evidence based physiotherapy or evidence based radiography or evidence based nursing or evidence based medicine or evidence informed health care or evidence informed healthcare or (evidence based adj4 allied health)).tw. (12905)
3 1 or 2 (87690)
4 students/ or students, health occupations/ or students, medical/ or students, nursing/ (103105)
5 (occupational therapy student* or physical therapy student* or physiotherapy student* or radiography student* or nursing student* or allied health student' or medical student*).tw. (48762)
6 undergraduate*.tw. (34388)
7 bachelor student*.tw. (44)
8 student*.tw. (245069)
9 4 or 5 or 6 or 7 or 8 (284196)
10 3 and 9 (2081)

Embase

Search date: October 05, 2018

Database: Embase <1974 to 2018 Week 41>

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1 evidence based medicine/ or evidence based nursing/ or evidence based practice/ (159523)
2 (evidence based occupational therapy or evidence based physical therapy or evidence based physiotherapy or evidence based radiography or evidence based nursing or evidence based medicine or evidence informed health care or evidence informed health care or (evidence based adj4 allied health)).tw. (16455)
3 evidence informed decision making.tw. (147)
4 1 or 2 or 3 (164362)
5 university student/ or baccalaureate nursing student/ or male nursing student/ or graduate student/ or occupational therapy student/ or undergraduate student/ or allied health student/ or physical therapy student/ or nursing student/ or graduate nursing student/ or medical student/ or student/ (182329)
6 (radiography student* or occupational therapy student* or physical therapy student* or physiotherapy student* or nursing student* or allied health student* or medical student*).tw. (57370)
7 student*.tw. (309997)
8 bachelor student*.tw. (56)
9 undergraduate*.tw. (39695)
10 baccalaureate student*.tw. (257)
11 5 or 6 or 7 or 8 or 9 or 10 (373739)
12 4 and 11 (2887)

Cinahl
Search date: October 05, 2018

S1 (MH "Professional Practice, Evidence-Based") OR (MH "Nursing Practice, Evidence-Based") OR (MH "Occupational Therapy Practice, Evidence-Based") OR (MH "Physical Therapy Practice, Evidence-Based") (30511)

S2 (evidence based occupational therapy or evidence based physical therapy or evidence based physiotherapy or evidence based radiography or evidence based nursing or evidence based medicine or evidence informed healthcare or evidence informed health care or (evidence based N4 allied health)) (18246)

S3 S1 OR S2 (35273)

S4 (MH "Students, Allied Health") OR (MH "Students, Occupational Therapy") OR (MH "Students, Physical Therapy") OR (MH "Students, Radiologic Technology") OR (MH "Students, Medical Technology") OR (MH "Students, Medical") OR (MH "Students, Nursing") OR (MH "Students, Nursing, Baccalaureate+") OR (MH "Students, Nursing, Graduate+") (40017)

S5 (occupational therapy student* or physical therapy student* or physiotherapy student* or radiography student* or nursing student* or allied health student* or medical student*) (52050)

S6 S4 OR S5 (52633)

S7 S3 AND S6 (797)

SweMed+
Search date: October 05, 2018

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1 exp: "evidence-based practice" (2857)
2 exp: "evidence-based medicine" (2401)
3 exp:"evidence-based physiotherapy" (33)
4 exp:"evidence-based nursing" (151)
5 exp:"evidence-based occupational therapy" (1542)
6 exp:"evidence-based radiography" (4836)
7 #1 OR #2 OR #3 OR #4 OR #5 OR #6 (9051)
8 students AND exp:"Students" (1501)
9 exp:"Students, Health Occupations" (1028)
10 exp:"Students, Nursing" (569)
11 exp:"Students, Medical" (338)
12 #8 OR #9 OR #10 #11 (1501)
13 #7 AND #12 (92)

Appendix II

Literature table of previous surveys assessing outcomes of EBP learning

Inclusion: P: Bachelor students in nursing, occupational therapy, physiotherapy, radiography

O: Outcomes of EBP learning related to knowledge, skills, attitudes, behaviour and perceptions of EBP

Exclusion: Evaluations of EBP educational interventions or EBP learning strategies

Table. Surveys assessing EBP knowledge, skills, attitudes, behaviour and perceptions among undergraduate students in nursing, occupational therapy, physiotherapy, radiography in chronological order. Studies published by 2014 informed this thesis.

Source	Aim	Design Sample	Measurement instrument	Response rate	Result	Comments
Leufer & Cleary-Holdforth. 2007 (28)	Examine attitudes and beliefs, knowledge level and utilization of EBP	Cross sectional Nursing students n=217	EBP Belief EBP Implement Scale	n=145 66%	High EBP belief scores, low EBP implementation scores Positive correlation between the beliefs and behaviour	Questionaire developed for nurses. No descriptions of validation
Waters et al. 2009 (29)	Determine current knowledge and attitudes towards EBP	Postal survey Nursing students (n=1134) and nurses (n=677) Australia	Nurses' Perceptions of EBP	n=257 + n=126 (21%)	Positive attitudes towards EBP, with no differences between students and nurses. Low to moderate knowledge and skills	Questionnaires developed for general practitioners trust boards. Adapted to nursing students. Tested for face and content validity
Brown et al. 2010 (30)	Identify predictors of knowledge, attitude, use and future use of EBP	Cross-sectional Nursing students n=689 2 universities USA	KAB Questionnaire Self-report 43 items	n=436 (63.3%)	EBP knowledge, attitude, use and future use increased with advancing academic class level. Confidence in clinical decision-making and clinical preparedness were significant positive predictors for EBP use and future use	Instrument developed for medical school setting. Item modifications in wording to address nursing Cronbach's alpha 0.71 – 0.86 Refers to original study for validity

Source	Aim	Design Sample	Measurement instrument	Response rate	Result	Comments
McEvoy et al. 2010 (31)	Examine relationship between EBP profile and exposure to EBP, stage of training, professional health discipline	Cross-sectional Allied disciplines students n=1676 academic staff n=120 1 university Australia	EBP[2] Self-report	n=898 (54%) n=35 (29%)	EBP profiles differed between degree of prior exposure to EBP and between discipline groups for all domains, but Sympathy Age and exposure affected all domains	Physiotherapy, occupational therapy, podiatry, medical radiation and human movement Refers to original study for validity
McEvoy et al. 2011 (32)	Describe change in EBP knowledge, attitudes, and behaviour in entry level physiotherapy students transitioning into the workforce	Longitudinal, 2 cohorts Physiotherapy students Final semester n=72+32 (2008) n=96+80 (2009) 1 university Australia	EBP[2] Self-report	n=45+29 n=90+76	Small changes in effect size for EBP domains Relevance and Practice declined in first workforce year and improved in second year. Terminology improved in both workforce years. Confidence improved in second year. Sympathy showed little change	Survey answered in the final entry-level year, and after first and second years in workforce Refers to original study for validity
Florin et al. 2012 (33)	Experience of educational support for research utilization and capability beliefs regarding EBP skills	Cross-sectional Nursing students Final semester n=2107 26 universities, Sweden	LANE questionnaire Self-report 12 items (RU support + EBP capability beliefs)	n = 1440 (68%)	High capability beliefs in EBP skills, but large variations between universities for framing question, seeking out relevant knowledge, critically appraise and compiling best knowledge. Perceived support for research utilization varied between universities. Campus education more supportive than clinical education	Cronbach's alpha 0.88 Refers to previous study (personal communication) for validity
Stronge & Cahill. 2012 (34)	Investigate knowledge and attitudes towards EBP of occupational therapy students	Cross-sectional Occupational therapy Final year n=111 4 universities Ireland	KAB Questionnaire Self-report	n=86 (77%)	80% considered themselves to be evidence-based practitioners. High self-reported EBP knowledge, attitudes and behaviour. The majority reported accessing EBP weekly or more often. Barriers: lack of time, fieldwork educator not practicing EBP, difficulties finding evidence	Instrument developed for medical school setting. Item modifications to address occupational therapy Refers to original study for Cronbach's alpha, construct validity and responsiveness

Source	Aim	Design Sample	Measurement instrument	Response rate	Result	Comments
Scholten-Peeters et al. 2013 (35)	Examine attitudes, perceived knowledge and behaviours towards EBM, and participation in scientific research	Cross-sectional Physiotherapy students, teachers, supervisors and clinicians n=814 Netherlands	DOERAK Translated version of Berlin + McColl questionnaires Web-based	n=165 (20%)	60% had some experience with research activities. Lack of EBP knowledge and behaviour among students. Weak positive attitude towards participating in research, with higher scores for teachers than students 71% students could explain SR to others	Questionnaire developed for RCT evaluating effect of educational program among GP's. Modified to physiotherapy in this study Content validity in original study
Llasus, Angosta & Clark. 2014 (36)	Examine relationship between self-reported EBP knowledge and EBP readiness, and extent of EBP implementation	Cross-sectional Nursing students Final semester n=1386 24 programs 4 states, USA	ACE-ERI Knowledge ACE-ERI Basic EBP Implement scale Multiple choice Self-report	n = 174 (13%)	Low EBP knowledge and engagement in EBP implementation behaviours. Moderately confident in EBP readiness. EBP readiness was statistically significant mediator between EBP knowledge and engagement in EBP implementation behaviour	Cronbach's alpha 0.56 – 0.94 Refers to original studies for face, content and discriminative validity Low response rate
Olsen et al. 2014 (27)	Compare self-reported EBP behaviour, abilities and barriers during clinical placements with different EBP exposure across study programmes	Cross-sectional Physiotherapy Final year bachelor n=246 5 cohorts Norway	Self-made questionnaire related to EBP behaviour and barriers	n=180 (73%)	Association between level of EBP exposure and students' EBP behaviour for asking and searching, ability to search for and critically appraise research evidence, and experience of critical appraisal as a barrier. Strongest correlation between level of EBP exposure and ability to critical appraise research evidence	Cronbach's alpha 0.67 – 0.72 Questionnaire developed for study, not validated
Ashktorab et al. 2015 (166)	Investigate nursing students' knowledge, attitude and intention to implement EBP and its related factors	Cross-sectional Nursing students n=170 Two faculties Iran	Rubin and Parrish questionnaire Self-report	n=170 100%	Moderate mean scores for the three subscales. Age was inversely correlated with knowledge, attitude and intention to use EBP. Significant differences between familiarity with research methods and statistics for EBP knowledge and skills, but not intention to implement EBP	Translated and validated instrument by content validity, Cronbach's alpha and ICC. Census sampling method

Source	Aim	Design Sample	Measurement instrument	Response rate	Result	Comments
Karki et al. 2015 (167)	Explore nurses and nursing students perceptions and attitudes towards EBP	Cross sectional Nursing students and nurses n=273 Nepal	Adapted Majid instrument Self-report	n=121 44% (50 stud)	93% had no previous training in EBP Most had positive attitudes towards EBP, but limited EBP knowledge and skills. Barriers for implementing EBP included lack of time and resources, lack of knowledge and limited autonomy to change practice	Content validity described in original study Findings not differentiated for nurses and students
Hagedorn Wonder et al. 2016 (177)	Explore relationship between exposure to statistic and research course and EBP knowledge	Cross sectional Secondary analysis Nursing students n=? 2 programs, USA	EKAN Multiple-choice	?	Exposed to statistical coursework had higher EBP knowledge scores than non-exposed. Exposed to research coursework did not have the same exposure-related increase in EKAN scores as for statistic course	Small, unequally sized subgroups Used same sample as in validation study
*Shaikh et al. 2017 **	*Examine knowledge and practice of EBP*	*Physiotherapy students* *India*	*Questionnaire*	*n=225*	*Poor to fair EBP knowledge. Positive EBP attitude* *Unable to implement EBP in patient care due to lack of knowledge, time and communication skills*	*Request for pdf sent to author on Research Gate*
Bostrom et al. 2018 (178)	Compare self-reported capability beliefs on EBP between health professionals and students	Cross-sectional Students (n=81+88) and clinicians (n=127) in health disciplines Geriatric department Sweden	EBP Capabilities Beliefs Scale	73% students 80% clinicians	High capability beliefs in student group, less in health profession group. Students highest mean value for 'search other sources', lowest for 'implement knowledge'. No significant difference on capability beliefs between student disciplines	Occupational therapy, medical, physiotherapy and nursing. Tool validated for nurses. Refers to original study for validity
Kim et al. 2018 (168)	Examine EBP attitudes, knowledge, behaviour and critical thinking disposition	Nursing students N=300 4 schools Korea	EBP Questionnaire (EBPQ) Critical thinking disposition (CTD)	n=266	Mean EBPQ scores were highest for knowledge, then practice and attitude. Age ≥23 years, male, satisfaction with major demonstrated higher scores for EBP. EBP correlated statistically significant with CTD. CTD was an explanatory factor of EBP	EBPQ was translated, not validated. Cronbach's alpha 0.73 – 0.89 CTD develop in unpublished phd thesis. Cronbach's alpha 0.82

***** Shaikh AA, Gad A: Evidence Based Practice: Knowledge, Attitude and Practice of Physiotherapy Students in Maharashtra. Indian Journal of Physiotherapy & Occupational Therapy. 2017;11(2):53-57.

Appendix III

UNIVERSITY OF SOUTH AUSTRALIA

Evidence-Based Practice Profile Questionnaire

The aim of this questionnaire is to collect data on evidence-based practice (EBP) knowledge, behaviours and attitudes

Survey instructions

We would be very appreciative if you could please take some time to complete this survey.
It will take 10-12 minutes to complete.
Please circle one number in each line or tick/answer as requested.
Comment on your responses as appropriate in the areas provided

Thank you for your time in completing this questionnaire

Rate your RESPONSE to the following statements:

	Not at all true	Not really true	Possibly true	Quite likely true	Very true
1. I understand what is meant by the term evidence-based practice (EBP)	1	2	3	4	5
2. I am aware of EBP in my profession	1	2	3	4	5
3. My profession uses EBP as a framework	1	2	3	4	5
4. I am aware of current developments in EBP in my profession	1	2	3	4	5

Do you have any comments about your responses?

Rate your RESPONSE to the following statements:

	No intention at all	Unlikely to consider doing it	Could consider doing it	Highly likely to consider doing it	Absolutely intend to do it/keep doing it
5. I intend to develop knowledge about EBP	1	2	3	4	5
6. I intend to develop skills in accessing, acquiring and appraising evidence relevant to my area of practice	1	2	3	4	5
7. I intend to read relevant literature to update knowledge	1	2	3	4	5
8. I intend to apply best available evidence findings to improve practice	1	2	3	4	5

Do you have any comments about your responses?

Rate your RESPONSE to the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
9. Application of EBP is necessary in my work	1	2	3	4	5
10. Literature and research findings are useful in my day-to-day work	1	2	3	4	5
11. I need to increase the use of evidence in my daily work	1	2	3	4	5
12. I am interested in learning or improving the skills necessary to incorporate EBP into my work	1	2	3	4	5
13. EBP improves the quality of my work	1	2	3	4	5
14. EBP helps me make decisions about clients in my work	1	2	3	4	5
15. EBP does not take into account the limitations of my day-to-day work	1	2	3	4	5
16. There isn't much point in doing EBP because there is a lack of strong evidence to support most of the work I do	1	2	3	4	5
17. EBP does not take into account my clients' preferences	1	2	3	4	5
18. In making decisions about my professional work, I value clinical/field experience more than scientific studies	1	2	3	4	5
19. Workplace experience is the most reliable way to know what really works	1	2	3	4	5
20. Critical appraisal of the literature and its relevance to the client is not very practical in the real world of my profession	1	2	3	4	5
21. Seeking relevant evidence from scientific studies is not very practical in the real world	1	2	3	4	5

Do you have any comments about your responses?

Rate your UNDERSTANDING of the following terms:

	Never heard the term	Have heard it but don't understand	Have some understanding	Understand quite well	Understand and could explain to others
22. Relative risk	1	2	3	4	5
23. Absolute risk	1	2	3	4	5
24. Systematic review	1	2	3	4	5
25. Odds ratio	1	2	3	4	5
26. Meta analysis	1	2	3	4	5
27. Number needed to treat	1	2	3	4	5
28. Confidence interval	1	2	3	4	5
29. Publication bias	1	2	3	4	5
30. Forest plot	1	2	3	4	5
31. Intention to treat	1	2	3	4	5
32. Statistical significance	1	2	3	4	5
33. Minimum clinically worthwhile effect	1	2	3	4	5
34. Clinical importance	1	2	3	4	5
35. Randomised controlled trial (RCT)	1	2	3	4	5
36. Dichotomous outcomes	1	2	3	4	5
37. Continuous outcomes	1	2	3	4	5
38. Treatment effect size	1	2	3	4	5

Do you have any comments about your responses?

IN THE PAST YEAR HOW OFTEN have you:

	Never	Monthly or less	Fortnightly	Weekly	Daily
39. Formulated a clearly answerable question that defines the client or problem, the intervention and outcome(s) of interest	1	2	3	4	5
40. Tracked down the relevant evidence once you have formulated the question	1	2	3	4	5
41. Searched an electronic database	1	2	3	4	5
42. Critically appraised any literature you have discovered to determine the methodological quality	1	2	3	4	5
43. Integrated research evidence with your expertise	1	2	3	4	5
44. Considered your clients' preferences when making clinical/professional decisions	1	2	3	4	5
45. Read published research reports	1	2	3	4	5
46. Informally shared and discussed literature/research findings with others in your workplace	1	2	3	4	5
47. Formally shared and discussed literature/research findings with others in your department/practice (eg journal club, in-service presentation)	1	2	3	4	5

Do you have any comments about your responses?

Rate your CONFIDENCE in the following EBP activities:

	Not at all confident	A little confident	Reasonably confident	Quite confident	Very confident
48. Research Skills	1	2	3	4	5
49. Computer skills	1	2	3	4	5
50. Ability to identify gaps in your knowledge	1	2	3	4	5
51. Ability to convert your information needs into clearly answerable questions	1	2	3	4	5
52. Awareness of major information types and sources	1	2	3	4	5
53. Ability to search an electronic database	1	2	3	4	5
54. Ability to access evidence (get copies of articles or reports)	1	2	3	4	5
55. Ability to critically analyse evidence against set standards ie quality scoring	1	2	3	4	5
56. Ability to determine how valid (close to the truth) the material is	1	2	3	4	5
57. Ability to determine how useful (clinically applicable) the material is	1	2	3	4	5
58. Ability to apply information to individual cases (ie integrate research evidence with personal preferences, values, concerns, expectations)	1	2	3	4	5

Do you have any comments about your responses?

Rate your RESPONSE to the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
59. I want to learn new information	1	2	3	4	5
60. I critically evaluate new ideas	1	2	3	4	5
61. I have good management skills	1	2	3	4	5
62. I solve problems using a plan	1	2	3	4	5
63. I enjoy studying	1	2	3	4	5
64. In my organisation, leaders continually look for opportunities to learn	1	2	3	4	5
65. I make time to read research	1	2	3	4	5
66. Insufficient time is one of the greatest barriers to the use of EBP in my clinical/professional practice	1	2	3	4	5
67. My workload is too great for me to keep up to date with all the new evidence	1	2	3	4	5
68. The cost of information resources limits my use of EBP in my clinical/professional practice	1	2	3	4	5
69. Easy access to computers dictates whether or not I practise EBP	1	2	3	4	5
70. The resources available to me are adequate to undertake EBP	1	2	3	4	5
71. Collective support amongst my colleagues is one of the greatest facilitators to my use of EBP in clinical/professional practice	1	2	3	4	5
72. Support from management is one of the greatest facilitators to my use of EBP in clinical/professional practice	1	2	3	4	5
73. Senior management/my employer requires me to use EBP	1	2	3	4	5
74. I've just had a gutful of EBP	1	2	3	4	5

Do you have any comments about your responses?

Demographics

75. What is your age? _____
76. When is/was your final year as an undergraduate student?_____
77. Sex: ☐ Female ☐ Male
78. Are you currently working in the profession for which you have trained/are training?
    ☐ YES ☐ F/T ☐ P/T
    ☐ NO
79. What is that profession?_____

80. Which of the following best describes your MAIN work setting: *(Tick one box only)*
    ☐ Public sector ☐ Private sector ☐ Academic
    ☐ Community-based agency (Domiciliary Care, Community Centre, Charitable institution)
    ☐ Other (please specify) _____

81. Type of work: In which area have you mainly worked in the past year?
(Tick one box only)
    ☐ Managers (eg Health/Education Manager)
    ☐ Education (eg teacher or educator at University, School)
    ☐ Health (eg Diagnostic, Promotion, Therapy, Allied Health, Medical, Nursing)
    ☐ Information, Communication, Technology
    ☐ Legal, Social and Welfare
    ☐ Arts and Media
    ☐ Business, Human Resources and Marketing
    ☐ Design, Engineering, Science and Transport
    ☐ Other (please specify) _____

82. Please provide a brief overview of your work experience in the past 12 months:
_____

83. Are you currently studying? ☐ NO
    ☐ YES ☐ F/T ☐ P/T
84. If YES, what are you studying? _____

85. What is your highest qualification attained? *(Tick one box only)*
    ☐ Registered Nurse
    ☐ Post graduate certificate course
    ☐ Bachelor
    ☐ Masters course work /Graduate Entry
    ☐ Masters (Research)
    ☐ Other (Please specify) _____
    ☐ Diploma
    ☐ Graduate Diploma
    ☐ Honours (Bachelor WITH Honours or Bachelor AND Honours degree)
    ☐ PhD

86. Have you formally undertaken any training in EBP? ☐ NO ☐ YES
    If YES: choose longest completed course if you have done more than one
    ☐ EBP course as part of University education (Bachelor, Masters etc) >20 hrs
    ☐ Short course 10 - 20 hours
    ☐ Weekend course 3 - 10 hrs
    ☐ Single lecture 1- 3 hrs
87. Is English your first language? ☐ YES ☐ NO

Appendix IV

Appendix II. Revised and reworded EBP^2-N items

	Item	Original text	Measurement study text	Survey text
Relevance	5	I intend to develop knowledge about EBP	Jeg har til hensikt **å tilegne meg** kunnskap om KBP	Jeg har til hensikt å **utvikle min** kunnskap om KBP
	6	I intend to develop skills in accessing, acquiring and appraising evidence relevant to my area of practice	Jeg har til hensikt å **tilegne meg** ferdigheter i å søke etter, innhente og kritisk vurdere forskningsbasert kunnskap som er relevant for mitt praksisfelt	Jeg har til hensikt å **utvikle mine** ferdigheter i å søke etter, innhente og kritisk vurdere forskningsbasert kunnskap som er relevant for mitt praksisfelt
	14	EBP helps me make decisions about clients in my work	KBP hjelper meg å ta faglige avgjørelser **som omhandler** pasienter/brukere i mitt arbeid	KBP hjelper meg å ta faglige avgjørelser **relatert til** pasienter/brukere
Sympathy	15	EBP does not take into account the limitations of my day-to-day work	KBP tar ikke høyde for **de** begrensninger jeg møter i mitt daglige arbeid**/som student**	KBP tar ikke høyde for begrensninger jeg møter i mitt daglige arbeid
	16	There isn't much point in doing EBP because there is a lack of strong evidence to support most of the work I do	Det **har ingen hensikt** å utøve KBP fordi det er mangel på solid forskningsbasert kunnskap som understøtter det meste av arbeidet jeg gjør	Det **er ikke noe poeng** å utøve KBP fordi det er mangel på solid forskningsbasert kunnskap som understøtter det meste av arbeidet jeg gjør
	17	EBP does not take into account my clients' preferences	**KBP tar ikke hensyn til** mine pasienters/brukeres **preferanser**	Mine pasienters/brukeres **ønsker og behov blir ikke ivaretatt gjennom KBP**
	20	Critical appraisal of the literature and its relevance to the client is not very practical in the real world of my profession	Å kritisk vurdere litteratur og dens relevans for pasient/bruker, er ikke så lett å gjennomføre **i praksis** innen min profesjon	Å kritisk vurdere litteratur og dens relevans for pasient/bruker er ikke så lett å gjennomføre **i virkeligheten** innen min profesjon

	Item	Original text	Measurement study text	Survey text
Practice	39	Formulated a clearly answerable question that defines the client or problem, the intervention and outcome(s) of interest	Formulert et presist spørsmål som definerer pasient/bruker eller problem, intervensjon og utfall av interesse	Formulert et presist spørsmål som definerer pasient/bruker eller problem, intervensjon og utfall av interesse **(PICO)**
	42	Critically appraised any literature you have discovered to determine the methodological quality	Kritisk vurdert litteratur du har funnet, for **å vurdere** metodisk kvalitet	Kritisk vurdert litteratur du har funnet for metodisk kvalitet
	45	Read published research reports	Lest publiserte forsknings**rapporter**	Lest publisert forskning
	46	Informally shared and discussed literature/research findings with others in your workplace	**Uformelt** delt og diskutert litteratur/forskningsfunn med andre på din arbeidsplass	Delt og diskutert litteratur/ forskningsfunn **uformelt** med andre på din arbeidsplass
	47	Formally shared and discussed literature/research findings with others in your department/practice (eg journal club, in-service presentation)	**Formelt** delt og diskutert litteratur/forskningsfunn med andre på din avdeling/praksis (for eksempel i form av journal club, internundervisning)	Delt og diskutert litteratur/ forskningsfunn **formelt** med andre på din avdeling/praksis (for eksempel i form av journal club, internundervisning)

Appendix V

HØGSKOLEN I BERGEN

Kunnskapsbasert praksis profil

Målet med dette spørreskjemaet er å samle inn data om kunnskap, atferd og holdninger til kunnskapsbasert praksis (KBP).

KBP er å ta faglige avgjørelser basert på systematisk innhentet forskningsbasert kunnskap, erfaringsbasert kunnskap og pasientens/brukerens ønsker og behov i en gitt situasjon.

Vennligst besvar spørsmålene i din rolle som student ved Høgskolen/Universitetet

Instruksjoner:

Vi vil være veldig takknemlige hvis du tar deg tid til å besvare dette spørreskjemaet.
Det vil ta ca. 12 minutter å fylle ut skjemaet.
Vennligst sett ring rundt ett tall på hvert spørsmål.
Kommenter dine svar i feltene: “Har du noen kommentarer til svarene dine?".

Takk for at du tar deg tid til å delta i denne undersøkelsen.

Developed by Maureen Patricia McEvoy, Marie T. Williams & Timothy Stephen Olds, 2010.
Oversatt til norsk av Kristine Berg Titlestad, Høgskolen i Bergen, Avdeling for helse- og sosialfag, Senter for kunnskapsbasert praksis, 2014.

Grader ditt SVAR på følgende påstander:

	Stemmer ikke i det hele tatt	Stemmer ikke helt	Stemmer delvis	Stemmer mest sannsynlig	Stemmer helt
1. Jeg forstår hva som menes med begrepet kunnskapsbasert praksis (KBP)	1	2	3	4	5
2. Jeg kjenner til KBP innen min profesjon	1	2	3	4	5
3. KBP brukes som rammeverk innen min profesjon	1	2	3	4	5
4. Jeg kjenner til pågående utvikling av KBP innen min profesjon	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Grader ditt SVAR på følgende påstander:

	Ingen hensikt i det hele tatt	Usannsynlig å vurdere å gjøre det	Kan vurdere å gjøre det	Vil høyst sannsynlig vurdere å gjøre det	Vil absolutt gjøre det/fortsette å gjøre det
5. Jeg har til hensikt å utvikle min kunnskap om KBP	1	2	3	4	5
6. Jeg har til hensikt å utvikle mine ferdigheter i å søke etter, innhente og kritisk vurdere forskningsbasert kunnskap som er relevant for mitt praksisfelt	1	2	3	4	5
7. Jeg har til hensikt å lese relevant litteratur for å oppdatere min kunnskap	1	2	3	4	5
8. Jeg har til hensikt å anvende beste tilgjengelige forskningsbaserte kunnskap for å forbedre praksis	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Grader ditt SVAR på følgende påstander:

	Svært uenig	Uenig	Verken enig eller uenig	Enig	Svært enig
9. Anvendelse av KBP er nødvendig i mitt arbeid	1	2	3	4	5
10. Litteratur og forskningsfunn er nyttige i mitt daglige arbeid	1	2	3	4	5
11. Jeg må øke bruken av forskningsbasert kunnskap i mitt daglige arbeid	1	2	3	4	5
12. Jeg er interessert i å lære eller forbedre ferdigheter som er nødvendig for å kunne integrere KBP i mitt arbeid	1	2	3	4	5
13. KBP forbedrer kvaliteten på mitt arbeid	1	2	3	4	5
14. KBP hjelper meg å ta faglige avgjørelser relatert til pasienter/brukere	1	2	3	4	5
15. KBP tar ikke høyde for begrensninger jeg møter i mitt daglige arbeid	1	2	3	4	5
16. Det er ikke noe poeng å utøve KBP fordi det er mangel på solid forskningsbasert kunnskap som understøtter det meste av arbeidet jeg gjør	1	2	3	4	5
17. Mine pasienters/brukeres ønsker og behov blir ikke ivaretatt gjennom KBP	1	2	3	4	5
18. Når jeg tar faglige avgjørelser legger jeg større vekt på klinisk/praktisk erfaring enn på vitenskapelige studier	1	2	3	4	5
19. Erfaring fra praksis gir den mest pålitelige kunnskapen om hva som virkelig virker	1	2	3	4	5
20. Å kritisk vurdere litteratur og dens relevans for pasient/bruker er ikke så lett å gjennomføre i virkeligheten innen min profesjon	1	2	3	4	5
21. Å søke etter relevant forskningsbasert kunnskap fra vitenskapelige studier er ikke så lett å gjennomføre i praksis	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Grader din FORSTÅELSE av følgende begreper:

	Har aldri hørt begrepet	Har hørt det, men forstår det ikke	Har litt forståelse	Forstår det ganske bra	Forstår det og kan forklare det for andre
22. Relative risk/relativ risiko	1	2	3	4	5
23. Absolute risk/absolutt risiko	1	2	3	4	5
24. Systematic review/systematisk oversikt	1	2	3	4	5
25. Odds ratio	1	2	3	4	5
26. Meta analysis/metaanalyse	1	2	3	4	5
27. Number needed to treat	1	2	3	4	5
28. Confidence interval/Konfidensintervall	1	2	3	4	5
29. Publication bias/Publikasjonsskjevhet	1	2	3	4	5
30. Forest plot	1	2	3	4	5
31. Intention to treat	1	2	3	4	5
32. Statistical significance/Statistisk signifikans	1	2	3	4	5
33. Minimum clinically worthwhile effect/ minste klinisk betydningsfulle effekt	1	2	3	4	5
34. Clinical importance/klinisk relevans	1	2	3	4	5
35. Randomised controlled trial (RCT)/ randomisert kontrollert studie	1	2	3	4	5
36. Dichotomous outcomes/dikotome utfall	1	2	3	4	5
37. Continuous outcomes/kontinuerlige utfall	1	2	3	4	5
38. Treatment effect size/behandlingseffektstørrelse	1	2	3	4	5

Har du noen kommentarer til svarene dine?

I LØPET AV DET SISTE ÅRET, HVOR OFTE har du?

	Aldri	Månedlig eller sjeldnere	Hver 14. dag	Ukentlig	Daglig
39. Formulert et presist spørsmål som definerer pasient/bruker eller problem, intervensjon og utfall av interesse (PICO)	1	2	3	4	5
40. Funnet relevant forskningsbasert kunnskap etter å ha formulert spørsmålet	1	2	3	4	5
41. Søkt i en elektronisk database	1	2	3	4	5
42. Kritisk vurdert litteratur du har funnet for metodisk kvalitet	1	2	3	4	5
43. Integrert forskningsbasert kunnskap med egen erfaring	1	2	3	4	5
44. Tatt hensyn til pasientens/brukerens preferanser når du har tatt kliniske/faglige beslutninger	1	2	3	4	5
45. Lest publisert forskning	1	2	3	4	5
46. Delt og diskutert litteratur/ forskningsfunn uformelt med andre på din arbeidsplass	1	2	3	4	5
47. Delt og diskutert litteratur/ forskningsfunn formelt med andre på din avdeling/praksis (for eksempel i form av journal club, internundervisning)	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Grader HVOR TRYGG DU FØLER DEG på følgende KBP-aktiviteter:

	Ikke trygg i det hele tatt	Litt trygg	Rimelig trygg	Ganske trygg	Veldig trygg
48. Forskningsferdigheter	1	2	3	4	5
49. Dataferdigheter	1	2	3	4	5
50. Evne til å identifisere egne kunnskapshull	1	2	3	4	5
51. Evne til å omsette eget informasjonsbehov til presise spørsmål som lar seg besvare	1	2	3	4	5
52. Kjennskap til viktige informasjonskilder	1	2	3	4	5
53. Evne til å søke i en elektronisk database	1	2	3	4	5
54. Evne til å innhente forskningsbasert kunnskap (skaffe kopier av artikler og rapporter)	1	2	3	4	5
55. Evne til å kritisk vurdere forskningsbasert kunnskap etter fastsatte standarder, som for eksempel sjekklister/kvalitetskåringsverktøy	1	2	3	4	5
56. Evne til å fastsette hvor gyldig (nært opp til sannheten) studien er	1	2	3	4	5
57. Evne til å fastsette hvor nyttig (klinisk anvendbar) studien er	1	2	3	4	5
58. Evne til å anvende generell informasjon til individuell pasient/bruker i en gitt situasjoner (som for eksempel integrere forskningsbasert kunnskap med personlige preferanser, verdier, hensyn og forventninger)	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Grader ditt SVAR på følgende påstander:

	Svært uenig	Uenig	Verken enig eller uenig	Enig	Svært enig
59. Systematiske oversikter er viktige for å holde seg faglig oppdatert	1	2	3	4	5
60. Jeg tar hensyn til S-pyramiden når jeg søker etter forskningslitteratur	1	2	3	4	5
61. Jeg har fått god opplæring i kritisk vurdering av forskningsartikler	1	2	3	4	5
62. Jeg har fått god opplæring i søk etter retningslinjer og systematiske oversikter	1	2	3	4	5
63. Jeg har brukt nettressursen kunnskapsbasertpraksis.no gjennom utdanningen	1	2	3	4	5
64. Jeg har brukt Helsebiblioteket som en ressurs gjennom utdanningen	1	2	3	4	5
65. Jeg syntes det er lett å forstå forskningslitteratur	1	2	3	4	5
66. Jeg liker å studere	1	2	3	4	5
67. Jeg har fått god undervisning i kunnskapsbasert praksis av lærere ved høgskolen/universitetet	1	2	3	4	5
68. Jeg har fått god opplæring i kunnskapsbasert praksis av praksisveiledere i klinisk praksis	1	2	3	4	5
69. Min arbeidsbelastning er for stor til at jeg kan holde meg oppdatert på relevant forskningsbasert kunnskap	1	2	3	4	5
70. Mine lærere forventer at jeg anvender kunnskapsbasert praksis	1	2	3	4	5
71. Mine praksisveiledere forventer at jeg anvender kunnskapsbasert praksis	1	2	3	4	5
72. Jeg ønsker å arbeide kunnskapsbasert når jeg er ferdig utdannet	1	2	3	4	5
73. Jeg ønsker å lære mer om KBP	1	2	3	4	5

Har du noen kommentarer til svarene dine?

Bakgrunnsvariabler

1. Alder: _____

2. Kjønn: ☐ Kvinne ☐ Mann

3. Hvilken profesjonsutdanning går du på?

☐ Ergoterapi ☐ Radiografi

☐ Fysioterapi ☐ Sykepleier

4. Har du en tidligere bachelorutdanning fra høgskole/universitet? ☐ Ja ☐ Nei

5. Hvor mye arbeider du ved siden av studiet?

0%	1 – 20%	21 – 50%	> 50 %
☐	☐	☐	☐

Appendix VI

HØGSKOLEN I BERGEN

Kunnskapsbasert praksis profil

Terminologi

Målet med denne undersøkelsen er

å validere kunnskapsdomenet *terminologi* på spørreskjemaet 'Kunnskapsbasert praksis profil'

Takk for at du tar deg tid til å delta i denne undersøkelsen.

Spørreskjemaet består av tre deler.

Del 1 består av tre bakgrunns spørsmål. I del 2 får du 18 spørsmål, som etterspør din forståelse av begreper forbundet med forskning. Når du har besvart disse spørsmålene vil du få del 3 som består av seks åpne spørsmål. Vi ber deg om å besvare disse spørsmålene med dine egne ord, så presist og utfyllende som mulig.

Det vil ta ca. 20 minutter å besvare skjemaet.

EBP[2] is developed by Maureen P. McEvoy, Marie T. Williams & Timothy Stephen Olds, 2010.
Oversatt til norsk av Kristine Berg Titlestad, Høgskolen i Bergen, Avdeling for helse- og sosialfag, Senter for kunnskapsbasert praksis, 2014.

Disse to spørsmålene vil bli brukt til å fjerne besvarelsen din om du ønsker å trekke deg fra studien ved en senere anledning:

1. Første to bokstaver i din mors pikenavn: _____ _____

2. Måned du ble født (eks Januar skriv Jan): _____ _____ _____

Del 1. Bakgrunns spørsmål

1. Alder (antall år): _____

2. Kjønn: ☐ Kvinne ☐ Mann

3. Hvilken utdanning går du på?

☐ Bachelor i ergoterapi
☐ Bachelor i fysioterapi
☐ Bachelor i radiografi
☐ Bachelor i sykepleie
☐ Master i klinisk sykepleie
☐ Master i kunnskapsbasert praksis i helsefag

Del 2. Grader din FORSTÅELSE av følgende begreper om forskning

	Har aldri hørt begrepet	Har hørt det, men forstår det ikke	Har litt forståelse	Forstår det ganske bra	Forstår det og kan forklare det for andre
1. Relative risk/relativ risiko	1	2	3	4	5
2. Absolute risk/absolutt risiko	1	2	3	4	5
3. Systematic review/systematisk oversikt	1	2	3	4	5
4. Odds ratio	1	2	3	4	5
5. Meta analysis/metaanalyse	1	2	3	4	5
6. Number needed to treat	1	2	3	4	5
7. Confidence interval/Konfidensintervall	1	2	3	4	5
8. Publication bias/Publikasjonsskjevhet	1	2	3	4	5
9. Forest plot	1	2	3	4	5
10. Intention to treat	1	2	3	4	5
11. Statistical significance/Statistisk signifikans	1	2	3	4	5
12. Minimum clinically worthwhile effect/ minste klinisk betydningsfulle effekt	1	2	3	4	5
13. Clinical importance/klinisk relevans	1	2	3	4	5
14. Randomised controlled trial (RCT)/ randomisert kontrollert studie	1	2	3	4	5
15. Dichotomous outcomes/dikotome utfall	1	2	3	4	5
16. Continuous outcomes/kontinuerlige utfall	1	2	3	4	5
17. Treatment effect size/behandlingseffektstørrelse	1	2	3	4	5
18. Kunnskapsbasert praksis	1	2	3	4	5

Du vil nå få seks spørsmål. Vi ber deg besvare hvert spørsmål så utfyllende du kan med egne ord.

1. Hva er en systematisk oversikt og hvordan vil du forklare det til en medstudent?

2. Hva er odds ratio (OR) og hvordan vil du forklare det til en medstudent?

3. Hva er et konfidensintervall og hvordan vil du forklare det til en medstudent?

4. Hva er publikasjonsskjevhet og hvordan vil du forklare det til en medstudent?

5. Hva er number needed to treat (NNT) og hvordan vil du forklare det til en medstudent?

6. Hva er kontinuerlige utfall og hvordan vil du forklare det til en medstudent?

Du vil nå få seks spørsmål. Vi ber deg besvare hvert spørsmål så utfyllende du kan med egne ord.

1. Hva er en randomisert kontrollert studie (RCT)) og hvordan vil du forklare det til en medstudent?

2. Hva er en metaanalyse og hvordan vil du forklare det til en medstudent?

3. Hva er relativ risiko (RR) og hvordan vil du forklare det til en medstudent?

4. Hva er statistisk signifikans og hvordan vil du forklare det til en medstudent?

5. Hva er dikotome utfall og hvordan vil du forklare det til en medstudent?

6. Hva er minste klinisk betydningsfulle effekt («Minimum clinically worthwhile effect») og hvordan vil du forklare det til en medstudent?

Du vil nå få seks spørsmål. Vi ber deg besvare hvert spørsmål så utfyllende du kan med egne ord.

1. Hva er kunnskapsbasert praksis og hvordan vil du forklare det til en medstudent?

2. Hva er absolutt risiko (AR) og hvordan vil du forklare det til en medstudent?

3. Hva er klinisk relevans og hvordan vil du forklare det til en medstudent?

4. Hva er et forest plot og hvordan vil du forklare det til en medstudent?

5. Hva er intention to treat og hvordan vil du forklare det til en medstudent?

6. Hva er behandlingseffektstørrelse («Treatment effect size») og hvordan vil du forklare det til en medstudent?

Appendix VII

Evidence-Based Practice Profile

Terminology

The aim of this survey is to validate the *terminology* domain of the Evidence-Based Practice Profile questionnaire

EBP^2 was developed by Maureen P. McEvoy, Marie T. Williams & Timothy Stephen Olds, 2010.

Thank you for participating in this survey.

The survey consists of three parts.

Part 1 will ask you four demographic questions. Part 2 then asks you to respond to 18 questions about your understanding of terms associated with research. Finally, Part 3 consists of six questions asking you to describe, in your own words as precisely and detailed as possible, terms associated with research.

It takes about 20 minutes to answer the survey.

These first two questions will be used to remove your responses should you wish to withdraw from the study at any time:

1. First two letters of your mother's maiden name: _____ _____

2. Month you were born (i.e. for January type "Jan"): _____ _____ _____

Part 1: Demographic Questions

Age (number in years): _____

Gender:

☐ Female

☐ Male

What educational program are you attending?

☐ Bachelor in Nursing

☐ Master in Nursing

☐ Master in Nursing/Nurse Practitioner

At which university?

☐ Ryerson University

☐ McMaster University

Part 2: Rate your UNDERSTANDING of the following terms about research

	Never heard the term	Have heard it, but don't understand	Have some under-standing	Under-stand quite well	Understand and could explain to others
1. Relative risk	1	2	3	4	5
2. Absolute risk	1	2	3	4	5
3. Systematic review	1	2	3	4	5
4. Odds ratio	1	2	3	4	5
5. Meta analysis	1	2	3	4	5
6. Number needed to treat	1	2	3	4	5
7. Confidence interval	1	2	3	4	5
8. Publication bias	1	2	3	4	5
9. Forest plot	1	2	3	4	5
10. Intention to treat	1	2	3	4	5
11. Statistical significance	1	2	3	4	5
12. Minimum clinically worthwhile effect	1	2	3	4	5
13. Clinical importance	1	2	3	4	5
14. Randomised controlled trial (RCT)	1	2	3	4	5
15. Dichotomous outcomes	1	2	3	4	5
16. Continuous outcomes	1	2	3	4	5
17. Treatment effect size	1	2	3	4	5
18. Evidence-based practice	1	2	3	4	5

Part 3: You will now be asked to describe six terms about research. The terms have been chosen at random. We ask that you answer each question as thoroughly as you can with your own words.

Open-Ended Questions:

1. What does *systematic review* mean, in your own words; and how would you describe it to a fellow student.

2. What does *odds ratio* mean, in your own words; and how would you describe it to a fellow student.

3. What does *confidence interval* mean, in your own words; and how would you describe it to a fellow student.

4. What does *publication bias* mean, in your own words; and how would you describe it to a fellow student.

5. What does *number needed to treat (NNT)* mean, in your own words; and how would you describe it to a fellow student.

6. What does *continuous outcomes* mean, in your own words; and how would you describe it to a fellow student.

Part 3: You will now be asked to describe six terms about research. The terms have been chosen at random. We ask that you answer each question as thoroughly as you can with your own words.

Open-Ended Questions:

1. What does *randomised controlled trial (RCT)* mean, in your own words; and how would you describe it to a fellow student.

2. What does *meta analysis* mean, in your own words; and how would you describe it to a fellow student.

3. What does *relative risk* mean, in your own words; and how would you describe it to a fellow student.

4. What does *statistical significance* mean, in your own words; and how would you describe it to a fellow student.

5. What does *dichotomous outcomes* mean, in your own words; and how would you describe it to a fellow student.

6. What does *minimum clinically worthwhile effect* mean, in your own words; and how would you describe it to a fellow student.

Part 3: You will now be asked to describe six terms about research. The terms have been chosen at random. We ask that you answer each question as thoroughly as you can with your own words.

Open-Ended Questions:

1. What does *evidence-based practice* mean, in your own words; and how would you describe it to a fellow student.

2. What does *absolute risk* mean, in your own words; and how would you describe it to a fellow student.

3. What does *clinical importance* mean, in your own words; and how would you describe it to a fellow student.

4. What does *forest plot* mean, in your own words; and how would you describe it to a fellow student.

5. What does *intention to treat* mean, in your own words; and how would you describe it to a fellow student.

6. What does *treatment effect size* mean, in your own words; and how would you describe it to a fellow student.

Appendix VIII

Scoring rubric of short open-ended answers

Decision rules:

1. Give score based on correct part of answer. Ignore incorrect aspects, no deductions of incorrect from correct.
2. If there are pieces of answers from a higher score, the judgement can be made for awarding the higher score, even if not totally complete answer.

Score 1 for wrong answer or if left blank or if they answer "don't know".

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
1. Relative risk	Some kind of statistical result *OR* Some kind of result mentioned in a study	Tells us risk/chance/ rate/probability of an event or outcome occurring *OR* Comparison of outcomes in two groups of people or the same group over time	Tells us the risk/chance/ rate/probability of an event or outcome occurring in one group compared to another group	Tells us the proportion/percentage risk/chance/ rate/probability of an event or outcome occurring in one group divided by the proportion/percentage risk/chance/rate/probability experiencing the event or outcome in the other group *OR* RR=(Events or outcome in one group ÷ N in that group) **/** (events or outcomes in the other group ÷ total N in that group) *OR* Showing some understanding of RR of 1 = no difference
2. Absolute risk	Some kind of statistical result Some kind of result mentioned in a study	Risk/chance/probability of an event or outcome	Risk/chance/probability of an event or outcome within *one* group	Proportion/percentage/probability of people/patients who experience an event or outcome *OR* AR = Events/outcomes in a group/ Total N in the group

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
3. Systematic review	Literature review *OR* review of studies/articles; higher levels of evidence pyramid	Compiling/synthesizing all the studies on a topic	Rigorous, transparent method to compile/synthesize all the studies on one topic/question ***Can get some of these points:*** - involves clear question; search for published and unpublished studies; quality assessment; data extraction; and quantitative (meta-analysis) or narrative synthesis; generates overall result/conclusion High level of search and evidence pyramids	Rigorous, transparent method to compile/synthesize all the studies in one topic/question ***Need all points to get 5:*** - involves clear question; search for published and unpublished studies; quality assessment; data extraction; and quantitative (meta-analysis) or narrative synthesis; generates overall result/conclusion Uses 2 people acting independently at each stage (to reduce potential for bias) High level of evidence pyramid
4. Odds ratio	Some kind of statistical result *OR* Some kind of result mentioned in a study	Comparison of outcomes in two groups of people	Odds, rate/probability of an event versus non-event occurring in one group compared to another group	Odds, rate/probability of an event versus non-event in one group divided by the odds of the event or outcome in another group *OR* OR = (Events ÷ non events in one group) / Events ÷ non events in another group) *OR* Showing some understanding of OR of 1 = no difference
5. Meta analysis	Some kind of statistical analysis	Statistical combination of the results of several studies	Statistical method for combining the results of the same outcome or event for ≥ 2 studies	In a systematic review, a statistical method for combining the results of the same outcome/event for ≥ 2 studies in one overall summary statistic or treatment effect This can be explained as a diamond, representing the summary statistic, where the horizontal lines reflect the confidence interval and the vertical points reflect the point estimate

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
6. Number needed to treat	Some kind of statistical analysis *OR* Some kind of result mentioned in a study	Number of patients who need to be treated to get a desired outcome or event	Is the number of patients who must be treated to prevent 1 additional negative event or to promote 1 additional positive event	Is the number of patients who must be treated to prevent 1 additional negative event or to promote 1 additional positive event. Useful to assess clinical significance NNT is calculated as 1 / absolute risk difference (rounded to the next whole number).
7. Confidence interval	Some kind of statistical analysis	Provide a range of values of outcome, result or event	Provides the likely range of the true values of outcome, result or event of interest *OR* A measure of range of the treatment effect *OR* X% of the time (often 95%) the true value (effect/outcome/event) for the population lies within the given range of values *OR* Width of the CI is related to our certainty (or precision) of results	Provides the likely range of the estimate of true value for the outcome, result or event of interest *OR* X% of the time (often 95%) the true value (effect/outcome/event) for the population lies within the given range of values ***AND the answer has to include one of the following:*** It can be interpreted for statistical and clinical significance *OR* If CI does not cross the line of no difference (O or 1, depending on continuous or dichotomous outcomes), it tells us statistical significance *OR* Width of the CI tells us precision and helps with decision about clinical significance
8. Publication bias	Type of bias as to what research gets published	Studies with negative or non-statistically/in-significant results are less likely to be published	The possibility of a systematic bias in published research in a field due to over-reporting of positive results or under-reporting of negative or non-statistically significant results	The possibility of a systemic bias in published research in a field due to over-reporting of positive results. Studies with negative results are less likely to be written, submitted and accepted for publication. Should be assessed in a systematic review ***Answer might include:*** Can be assessed graphically with a funnel plot, and/or statistically with Egger test

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
9. Forest plot	Visual depiction, picture, plot	Visual depiction/display of a meta-analysis	A graphical/visual depiction/display of results of the same outcome/event/result from studies	Is a graphical/visual depiction/display of results of studies of the same outcome/event/result, along with the overall results. It was developed for use in medical research as a means of graphically representing a meta-analysis ***Answer might include:*** Each horizontal line and point estimate represents one study. The final part of the figure represents the meta-analysis, where the vertical lines are the point estimate, and the horizontal points give the confidence interval
10. Intention to treat	Number of people who researchers were expecting in each group	All participants are analyzed in the groups to which they were randomized	All participants are analyzed in the groups to which they were randomized, even if they failed to receive/complete the intervention	All participants are analyzed in the groups to which they were randomized, even if they failed to receive/complete the intervention. *Intention-to-treat analysis* helps prevent bias caused by the loss of participants, and the resulting imbalance between groups ***Answer might include:*** Strategies include substituting missing data with baseline data, last observation, or mean of all other observations for that participant. Gives more conservative treatment effect
11. Statistical significance	Some kind of statistical analysis	Statistically, there is a difference within or between groups	The difference/result did not happen by chance Can also say results are big enough to show a difference	The extent to which difference/result did not occur by chance indicating a true difference/result in outcome within or between groups ***Answer must include:*** When statistically significant, the probability of finding the result by chance falls below a specified level of probability (usually $p<0.05$, or CI does not include 1 for rates, or 0 for differences) ***Answer might include***: Rejecting null hypothesis

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
12. Minimum clinically worthwhile effect	Difference in result in clinical studies	Smallest effect that would be considered worthwhile	At minimum, it is the difference in treatment effect (score, rate of an outcome) that would be considered worthwhile in order to justify doing or receiving an intervention in terms of the benefits	At minimum, what is the difference in treatment effect (score, rate of an outcome) that would be considered worthwhile to do or receive an intervention in terms of the benefits - If data exists, consider based on previous research (for example, what % of body weight needs to be reduced in order to reduce cardiovascular risk factors) - Based on confidence intervals, consider where the minimum clinically worthwhile effect falls in relation to the confidence interval
13. Clinical importance	How important is the result of intervention	Whether the difference/result of a study should influence a change in practice	Whether the smallest (or largest) difference/result of an outcome/event should influence a change in practice	Use confidence interval (or NNT/NNH) to help determine whether the smallest (or largest) difference/result of an outcome/event should influence a change in practice
Clinical relevance	*How relevant applicable is the result of the intervention*	*Whether the difference/result of a study should influence a change in practice*	*Is the result of the study large enough to warrant a change in practice?*	*Need all 3:* 1. *Is the result of the study large enough to warrant a change in practice?* 2. *How close are important characteristics of the study population to your patients? – similarity of study population to yours* 3. *Can the intervention be done in your setting (you have the resources and the trained staff)*

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
14. Randomised controlled trial (RCT)	Quantitative study design; Two groups	A quantitative study where patients are randomized. If only talk about random sampling, then it scores a 1 Needs to be clear that it is random allocation (way to get the participants into groups)	A quantitative study in which participants or populations are randomly allocated to ≥ different 2 groups and then followed up over time to determine if differences between groups occurs on the outcome of interest	A quantitative study in which participants or populations are randomly allocated (by chance) to ≥ 2 different groups and then followed up over time to determine differences between groups occurs on the outcome/events of interest ***Answer must include*:** This is the best way to control for bias in a study *OR* Show some indication that they are relating to bias in their answer ***Answer might include:*** The only expected difference between the control and experimental groups is the outcome variable being studied *OR* Highest quality study design for interventions (where ethically possible) Ideally allocation is concealed
15. Dichotomous outcomes	Data that can have only one of two values	Data that have two categories or levels	Data have only two categories or levels of outcome; either/or	Data that can take one of two categories or levels (eg, dead or alive, symptoms present or absent). Also known as binary data Distinct from continuous outcomes that are on a measurement scale (eg, weight, BMI, blood glucose, etc)
16. Continuous outcomes	Data that can be measured continuously	Data measured with a scale that has a 0 value	Data with a potentially infinite number of values along a measurement continuum (weight, blood pressure, temperature)	Data with a potentially infinite number of values along a measurement continuum (weight, blood pressure, temperature). **Answer must include:** Distinct from dichotomous (binary) or data classified in categories

Item	2 Have heard it but don't understand	3 Have some understanding	4 Understand quite well	5 Understand and could explain to others
17. Treatment effect	statistical analysis *OR* Result of a study	Measurement or analysis of the outcome/result of intervention/treatment	The difference in the outcome between different study groups (interventions/treatments, control/comparison)	A comparison of the difference in the outcome *OR* Results of analysis which tells you if there is a difference in outcomes between groups *Treatment Effect* is a generic term for the estimate of the true value of the effect (i.e. the amount of change) from a given intervention compared to not receiving the treatment/intervention or receiving another intervention Effect size may be expressed as a mean difference, relative risk, odds ratio, relative risk reduction, etc…
18. Evidence-based practice	Using research (knowledge) in clinical practice	Using (knowledge) from research evidence in clinical practice Must include practice	Using research evidence (knowledge) combined with experience, and consideration of patient preferences, in the context (optional to make decisions about patient care)	The consideration of the best available (acceptable to instead say *systematic*) knowledge from research evidence, clinical expertise, patient preferences, in the context for making decisions about patient care Can also describe that it is a 5/7 step process instead of saying it is applied to patient care

Appendix IX

Informasjon og forespørsel om deltakelse i forskningsprosjektet:

"Psykometrisk testing av et spørreskjema om kunnskap, atferd og holdninger til kunnskapsbasert praksis"

Med dette skrivet vil vi informere deg og samtidig be deg om å delta i en studie som skal vurdere gyldigheten av et spørreskjema og kartlegge kunnskap, atferd og holdninger til kunnskapsbasert praksis (KBP).

Bakgrunn og formål
Nasjonalt og internasjonalt er det bred enighet om at helse- og omsorgsarbeidere skal utøve KBP. Internasjonal forskning har økende fokus på å kartlegge kunnskap, atferd og holdninger til KBP blant studenter og klinikere innen helse- og sosialfagene. I Norge foreligger ingen studier om helsefagstudenters forhold til KBP. Det foreligger heller ingen spørreskjema som kan kartlegge kunnskap, atferd og holdninger til KBP for både studenter og klinikere innen helse- og sosialfagene.

Hensikt
Vi ønsker å:

- vurdere gyldigheten av spørreskjemaet "The Evidence-Based Practice Profile Questionnaire" for norske forhold
- kartlegge kunnskap, atferd og holdninger knyttet til KBP blant helsefagstudenter
- publisere resultatene i vitenskapelige tidsskrifter og presentere dem på forskningskonferanser

Hva innebærer deltakelse i studien?
Bachelorstudenter ved vernepleier- og sykepleierutdanningen ved Høgskolen i Bergen samt helse- og sosialarbeidere ved Olaviken alderspsykiatriske sykehus vil bli bedt om å besvare og returnere et spørreskjema to ganger med ca. 14 dagers mellomrom. Bachelorstudentene vil også bli bedt om å besvare spørreskjemaet på nytt etter ett år. Spørreskjemaet etterspør kunnskap, atferd og holdninger til KBP samt generelle bakgrunnsopplysninger om deg og din utdannings- og arbeidssituasjon. Det tar ca. 10-12 minutter å fylle ut skjemaet.

Innsamlete data fra spørreskjemaene vil bli lagret på et lukket lagringsområde på forskningsserveren til Høgskolen i Bergen. Dataene vil bli brukt til å til å vurdere spørreskjemaets gyldighet og bachelorstudenter sin kunnskap, atferd og holdninger til KBP. Resultatene vil gjøres kjent som rapporter, masteroppgaver, og bli publisert i nasjonale og internasjonale tidsskrift. Ved publisering vil det ikke fremgå opplysninger som kan tilbakeføres til deg som person.

Hva skjer med informasjonen om deg?
Professor Monica Wammen Nortvedt er ansvarlig for prosjektet og datamaterialet, men vil kunne inkludere masterstudenter eller andre ansatte ved institusjonen i prosjektet i løpet av prosjektperioden. Disse vil bruke datamaterialet mer eller mindre selvstendig til egne kartleggingsprosjekter. Prosjektmedarbeiderne har taushetsplikt og alle opplysninger som fremkommer fra deg vil bli behandlet konfidensielt.

Senest ved prosjektslutt 15.12.2019 vil navnelisten bli slettet, mens indirekte personidentifiserende opplysninger vil bli slettet eller grovkategorisert på en slik måte at ingen enkeltpersoner kan gjenkjennes.

Prosjektet er meldt til Norsk samfunnsvitenskapelig datatjeneste AS, Personvernombudet for forskning (NSD).

Frivillig deltakelse
Det er frivillig å delta i studien. Du kan trekke deg fra studien når som helst uten å oppgi grunn, og du kan kreve at opplysningene som er fremkommet slettes eller anonymiseres. Ved å returnere spørreskjemaene gir du samtykke til å delta i undersøkelsen. Dersom du senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte Kristine Berg Titlestad på telefon 926 01 400, eventuelt e-post kristine.titlestad@me.com.
Vi håper du har anledning til å sette av tid til å besvare dette spørreskjemaet.

Med vennlig hilsen

Kristine Berg Titlestad
Mastergradsstudent
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

Anne Kristin Snibsøer
Veileder/Høgskolelektor
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

Monica Wammen Nortvedt
Prosjektleder/Professor
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

HØGSKOLEN I BERGEN

Bergen, våren 2015

Forespørsel om å delta i kartlegging av kunnskap, atferd og holdninger til kunnskapsbasert praksis

Med dette skrivet vil vi informere deg og samtidig spørre om du kan delta i en studie som skal kartlegge kunnskap, atferd og holdninger til kunnskapsbasert praksis blant bachelorstudenter i helsefag.

Bakgrunn

Kunnskapsbasert praksis har vært på den helsepolitiske agendaen det siste tiåret. Som et ledd i satsningen på kunnskapsbasert praksis har HelseOmsorg21 fremmet forslag om at opplæring i kunnskapshåndtering og kunnskapsbasert praksis må bli obligatorisk i alle helsefagutdanningene. Det er hittil ikke gjort noen systematiske undersøkelser som viser hvilket forhold bachelorstudenter i helsefag har til kunnskapsbasert praksis.

Hensikt
Vi ønsker å kartlegge kunnskap, atferd og holdninger knyttet til kunnskapsbasert praksis blant tredje års bachelorstudenter i ergoterapi, fysioterapi, radiografi og sykepleie.

Hva studien innebærer
Tredje års bachelorstudenter i ergoterapi, fysioterapi, radiografi og sykepleie ved Høgskolen i Bergen, Høgskolen i Oslo, Høgskolen i Sør-Trøndelag og Universitetet i Tromsø vil bli bedt om å besvare og returnere et spørreskjema. Spørreskjemaet etterspør kunnskap, atferd og holdninger til kunnskapsbasert praksis samt generelle bakgrunnsopplysninger om deg og din utdanningssituasjon. Det tar ca. 10-12 minutter å besvare skjemaet.

Innsamlete data fra spørreskjemaene vil bli lagret på et lukket lagringsområde på forskningsserveren til Høgskolen i Bergen. Dataene vil bli brukt til å vurdere bachelorstudenter sin kunnskap, atferd og holdninger til kunnskapsbasert praksis. Resultatene vil gjøres kjent som rapporter og bli publisert i nasjonale og internasjonale tidsskrift. Ved publisering vil det ikke fremgå opplysninger som kan tilbakeføres til deg som person.

Monica Wammen Nortvedt er ansvarlig for prosjektet og datamaterialet, men vil kunne inkludere masterstudenter eller andre ansatte ved institusjonen i prosjektet i løpet av prosjektperioden. Prosjektmedarbeiderne har taushetsplikt og alle opplysninger som fremkommer fra deg vil bli behandlet konfidensielt. Spørreskjemaet er ikke kodet, og kan ikke knyttes direkte til deg. Senest 02.03.2030 vil indirekte personidentifiserende opplysninger bli slettet eller grovkategorisert på en slik måte at ingen enkeltpersoner kan gjenkjennes. Prosjektet er meldt til Norsk samfunnsvitenskapelig datatjeneste AS, Personvernombudet for forskning (NSD).

Det er frivillig å delta i undersøkelsen. Ved å returnere spørreskjemaene gir du samtykke til å delta i undersøkelsen. Dersom du har spørsmål til studien kan du kontakte Anne Kristin Snibsøer på tel. 55587878, evt e-post aksn@hib.no.

Vi håper du har anledning til å sette av tid til å besvare og returnere dette spørreskjemaet.

Med vennlig hilsen

Anne Kristin Snibsøer
Ph.d student
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

Monica Wammen Nortvedt (sign)
Prosjektleder/Professor
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

HØGSKOLEN I BERGEN

Bergen, vinteren 2017

Forespørsel om deltagelse i et forskningsprosjekt

Med dette skrivet vil vi informere deg og samtidig spørre om du kan delta i en studie som skal evaluere spørreskjemaet *Kunnskapsbasert Praksis Profil* sitt kunnskapsdomene *terminologi.*

Bakgrunn
Kunnskapsbasert praksis profil er et spørreskjema med fem domener som måler selvrapportert kunnskap, holdning og atferd knyttet til kunnskaps-basert praksis (KBP). I dette prosjektet ønsker vi å utforske om kunnskapsdomenet *terminologi* måler det vi ønsker at det skal måle.

Hensikt
Hensikten med prosjektet er å validere kunnskapsdomenet *terminologi*

Hva studien innebærer
Tredje års bachelorstudenter i ergoterapi, fysioterapi, radiografi og sykepleie samt mastergradsstudenter i klinisk fysioterapi, klinisk sykepleie og kunnskapsbasert praksis ved Høgskolen i Bergen vil bli bedt om å besvare og returnere et spørreskjema. I tillegg vil bachelor og mastergradsstudenter ved McMaster University i Canada bli spurt om å besvare et tilsvarende spørreskjema på engelsk. Spørreskjemaet etterspør kunnskap relatert til kunnskapsbasert praksis samt generelle bakgrunnsopplysninger om deg. Det tar ca. 20 minutter å besvare skjemaet.

Innsamlete opplysninger vil bli behandlet konfidensielt. Det vil ikke være mulig å spore din IP-adresse eller brukeridentitet. Innsamlete data vil bli lagret på et lukket lagringsområde på forskningsserveren til Høgskolen i Bergen. Prosjektet vil ikke ha noen innvirkning for ditt øvrig studieopplegg da dataene kun skal anvendes i forskningsprosjektet. Dataene vil bli brukt til å validere kunnskapsdomenet terminologi. I studien vil det også inngå data fra utdanningsinstitusjoner i Canada. Resultatene vil gjøres kjent som rapporter og bli publisert i nasjonale og internasjonale tidsskrift. Ved publisering vil det ikke fremgå opplysninger som kan tilbakeføres til deg som person.

Birgitte Espehaug er ansvarlig for prosjektet og datamaterialet, men vil kunne inkludere masterstudenter eller andre ansatte ved institusjonen i prosjektet i løpet av prosjektperioden. Prosjektmedarbeiderne har taushetsplikt og alle opplysninger som fremkommer fra deg vil bli behandlet konfidensielt. Spørreskjemaet er ikke kodet, og kan ikke knyttes direkte til deg. Senest 02.03.2030 vil indirekte personidentifiserende opplysninger bli slettet eller grovkategorisert på en slik måte at ingen enkeltpersoner kan gjenkjennes. Prosjektet er meldt til Norsk samfunnsvitenskapelig datatjeneste AS, Personvernombudet for forskning (NSD).

Det er frivillig å delta i undersøkelsen. Ved å returnere spørreskjemaet gir du samtykke til å delta i undersøkelsen. Dersom du har spørsmål til studien kan du kontakte Anne Kristin Snibsøer på tel. 55587878, evt e-post aksn@hib.no.

Vi håper du har anledning til å sette av tid til å besvare og returnere dette spørreskjemaet.

Med vennlig hilsen

Anne Kristin Snibsøer
Ph.d student
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

Birgitte Espehaug (sign)
Prosjektleder/Professor
Høgskolen i Bergen
Senter for kunnskapsbasert praksis

Appendix X

McMaster University
Faculty of Health Sciences
School of Nursing
1200 Main Street West
Hamilton, Ontario, Canada
L8N 3Z5
Phone 905.525.9140
Fax 905.524.5228
http://www.fhs.mcmaster.ca/nursing

PARTICIPANT INFORMATION SHEET

Study Title: Perceived and actual evidence-based practice knowledge: A validation of the EBP2 Terminology domain.

Locally Responsible Principal Investigator:
Dr. Jennifer Yost
School of Nursing, McMaster University
1280 Main St West, HSC 2J24H
Hamilton, Ontario, Canada
905 525-9140 ext. 21927
E-mail: jyost@mcmaster.ca

Principal Investigator:
Ann Kristen Snibsøer
Centre for Evidence Based Practice
Bergen University College
Postboks 7030
5020 Bergen, Norway
011 + 47 55587878
Email: Anne.Kristin.Snibsoer@hib.no

Co-Investigators:
Dr. Birgitte Espehaug
Centre of Evidence-Based Practice
Bergen University College
Postboks 7030
5020 Bergen, Norway
Email: Birgitte.Espehaug@hib.no

Dr. Cristina Catallo
Daphne Cockwell School of Nursing, Ryerson University
350 Victoria Street, Toronto Ontario M5B 2K3, POD 470b
416 979-5000 ext.2019
Email: ccatallo@ryerson.ca

Research Coordinator:
Olivia Marquez
McMaster University
175 Longwood Road South, Suite 210a,
Hamilton, ON, L8P 0A1
905 525-9140, ext. 20464
Email: omarquez@healthevidence.org

Funding Source: This study is supported by the Research Council of Norway, which is funding the Principal Investigator's PhD studies.

You are being invited to participate in a research study conducted by Dr Yost and her team because you are an undergraduate or graduate student in the School of Nursing at McMaster University.

In order to decide whether or not you want to be a part of this research study, you should understand what is involved and the potential risks and benefits. This following gives detailed information about the research study, which will be discussed with you. Once you understand the study, you will be asked to indicate that you wish to participate.

WHY IS THIS RESEARCH BEING DONE?
This research is being done to improve a questionnaire that measures evidence-based practice. Evidence based practice is defined as a systematic approach where the current best available evidence from research is combined with clinical experience and patient preferences to make clinical decisions within a context of available resources.

WHAT IS THE PURPOSE OF THIS STUDY?
The purpose of this study is to to determine how well a questionnaire, the Evidence-Based Practice Profile or EBP^2, measures what it is supposed to be measuring – perceptions of knowledge about evidence-based practice and actual knowledge about evidence-based practice.

WHAT WILL MY RESPONSIBILITIES BE IF I TAKE PART IN THE STUDY?

If you volunteer to participate in this study, we will ask you to do the following things:
Complete an electronic or paper-based questionnaire at one point in time (January, 2017). This survey will ask about demographic information, your understanding of terms associated with research, and to describe, in your own words, terms associated with research. It takes about 20 minutes to answer the questionnaire.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?
There are no foreseeable risks or discomforts associated with this study. However, you may feel inconvenienced by the time and effort to complete the questionnaire. You can decline to answer questions on the electronic survey.

HOW MANY PEOPLE WILL BE IN THIS STUDY?
It is expected that a minimum of 150 undergraduate and graduate students at McMaster University (Canada), Ryerson University (Canada), and Bergen University College will participate in this study.

WHAT ARE THE POSSIBLE BENEFITS FOR ME AND/OR FOR SOCIETY?
We cannot promise any personal benefits to you from your participation in this study.

IF I DO NOT WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?
It is important for you to know that you can choose not to take part in the study.

WHAT INFORMATION WILL BE KEPT PRIVATE?
Your data will not be shared with anyone except with your consent or as required by law. No identifying will be collected and your responses to the questionnaire will be replaced by a unique

code for which only you will know the answer.), Only Principal Investigator (Ms. Snibsøer) and the Supervisor and Co-Investigator (Dr. Espehaug) will have access to your responses. De-identified electronic files can be accessed by Co-Investigators (Drs. Yost and Catallo). Electronic files will be maintained on a research server at Bergen University College and treated confidentially. Paper files will be kept in a locked cabinet in Dr. Yost's office. If the results of the study are published, no information that discloses your identity will be released or published without your specific consent to the disclosure. All study data will be destroyed after 10 years.

CAN PARTICIPATION IN THE STUDY END EARLY?
If you volunteer to be in this study, you may withdraw at any time and have the option of removing your data from the study. Should you wish to withdraw from the study, contact the Local Principal Investigator (Dr. Yost) by phone (905-525-9140 x 21927) or email (jyost@mcmaster.ca). You may also refuse to answer any questions you do not want to answer and still remain in the study.

WILL I BE PAID TO PARTICIPATE IN THIS STUDY?
You will not be paid to participate in this study.

WILL THERE BE ANY COSTS?
There are no costs associated with this this study.

IF I HAVE ANY QUESTIONS OR PROBLEMS, WHOM CAN I CALL?
If you have any questions about the research now or later**,** contact the Local Principal Investigator (Dr. Yost) or the any of the Co-Investigators listed above.

CONSENT STATEMENT

Participant:

I have read the preceding information thoroughly. I have had an opportunity to ask questions and all of my questions have been answered to my satisfaction. I agree to participate in this study. I understand that I will receive a signed copy of this form.

Name	**Signature**	**Date**

Person obtaining consent:

I have discussed this study in detail with the participant. I believe the participant understands what is involved in this study.

Name, Role in Study	**Signature**	**Date**

This study has been reviewed by the Hamilton Integrated Research Ethics Board (HIREB). The HIREB is responsible for ensuring that participants are informed of the risks associated with the research, and that participants are free to decide if participation is right for them. If you have any questions about your rights as a research participant, please call the Office of the Chair, Hamilton Integrated Research Ethics Board at 905.521.2100 x 42013.

Appendix XI

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Monica Wammen Nortvedt
Avdeling for helse- og sosialfag Høgskolen i Bergen
Postboks 7030
5020 BERGEN

Vår dato: 23.01.2014 Vår ref: 36988 / 2 / MSS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 09.01.2014. Meldingen gjelder prosjektet:

36988	*Psykometrisk testing av et spørreskjema og kartlegging av kunnskap, atferd og holdninger til kunnskapsbasert praksis*
Behandlingsansvarlig	*Høgskolen i Bergen, ved institusjonens øverste leder*
Daglig ansvarlig	*Monica Wammen Nortvedt*
Student	*Kristine Berg Titlestad*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 15.12.2019, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Marie Strand Schildmann

Kontaktperson: Marie Strand Schildmann tlf: 55 58 31 52
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Kopi: Kristine Berg Titlestad kristine.titlestad@me.com

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 36988

Formålet med prosjektet er psykometrisk testing av et spørreskjema og kartlegging av kunnskap, atferd og holdninger til kunnskapsbasert praksis (KBP).

Utvalget består av andre års bachelorstudenter i vernepleie og sykepleie ved en høgskole og et utvalg helse- og sosialarbeidere ved et alderspsykiatrisk sykehus.

Den psykometriske testingen vil bestå av en test, og en retest av spørreskjemaet etter ca. 14 dager. Det gjennomføres en oppfølging av studentenes kunnskap, atferd og holdninger til KBP ved å sende et nytt skjema etter 1 år.

Ifølge prosjektmeldingen skal det innhentes skriftlig samtykke basert på muntlig og skriftlig informasjon om prosjektet og behandling av personopplysninger. Personvernombudet finner informasjonsskrivet tilfredsstillende utformet i henhold til personopplysningslovens vilkår.

Innsamlede opplysninger registreres på privat pc. Personvernombudet legger til grunn at veileder og student setter seg inn i og etterfølger Høgskolen i Bergen sine interne rutiner for datasikkerhet, spesielt med tanke på bruk av privat pc til oppbevaring av personidentifiserende data.

Prosjektet skal avsluttes 15.12.2019 og innsamlede opplysninger skal da anonymiseres. Anonymisering innebærer at direkte personidentifiserende opplysninger som navn/koblingsnøkkel slettes, og at indirekte personidentifiserende opplysninger (sammenstilling av bakgrunnsopplysninger som f.eks. yrke, alder, kjønn) fjernes eller grovkategoriseres slik at ingen enkeltpersoner kan gjenkjennes i materialet.

Appendix XII

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Monica Nortvedt
Senter for kunnskapsbasert praksis Høgskolen i Bergen
Postboks 7030
5020 BERGEN

Vår dato: 10.03.2015 Vår ref: 42653 / 3 / MSS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 09.03.2015. Meldingen gjelder prosjektet:

42653	*Kunnskapsbasert praksis blant bachelorstudenter i helsefag*
Behandlingsansvarlig	*Høgskolen i Bergen, ved institusjonens øverste leder*
Daglig ansvarlig	*Monica Nortvedt*
Student	*Anne Kristin Snibsøer*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 02.03.2030, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Marie Strand Schildmann

Kontaktperson: Marie Strand Schildmann tlf: 55 58 31 52
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Kopi: Anne Kristin Snibsøer aksn@hib.no

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 42653

Prosjektet gjennomføres i samarbeid med Høgskolen i Oslo og Akershus, Høgskolen i Sør-Trøndelag og Universitetet i Tromsø. Høgskolen i Bergen er behandlingsansvarlig institusjon. Personvernombudet forutsetter at ansvaret for behandlingen av personopplysninger er avklart mellom institusjonene. Vi anbefaler at det inngås en avtale som omfatter ansvarsfordeling, ansvarsstruktur, hvem som initierer prosjektet, bruk av data og eventuelt eierskap.

Utvalget informeres skriftlig og muntlig om prosjektet og samtykker til deltakelse. Informasjonsskrivet er godt utformet.

Datamaterialet innhentes via manuelle spørreskjema som så overføres til PC. Spørreskjemaene vil kunne være indirekte personidentifiserende.

Personvernombudet legger til grunn at forsker etterfølger Høgskolen i Bergen sine interne rutiner for datasikkerhet. Dersom personopplysninger skal lagres på mobile enheter, bør opplysningene krypteres tilstrekkelig.

Forventet prosjektslutt er 02.03.2030. Ifølge prosjektmeldingen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltpersoner kan gjenkjennes. Det gjøres ved å:
- slette direkte personopplysninger (som navn/koblingsnøkkel)
- slette/omskrive indirekte personopplysninger (identifiserende sammenstilling av bakgrunnsopplysninger som f.eks. bosted/arbeidssted, alder og kjønn)

Appendix XIII

Anne Kristin Snibsøer
Senter for kunnskapsbasert praksis Høgskolen i Bergen
Postboks 7030
5020 BERGEN

Vår dato: 23.08.2016 Vår ref: 49132 / 3 / ASF Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 01.07.2016. Meldingen gjelder prosjektet:

49132	*Perceived and actual evidence-based practice knowledge – a validation of the EBP2 Terminology domain*
Behandlingsansvarlig	*Høgskolen i Bergen, ved institusjonens øverste leder*
Daglig ansvarlig	*Anne Kristin Snibsøer*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 01.09.2017, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Kjersti Haugstvedt

Amalie Statland Fantoft

Kontaktperson: Amalie Statland Fantoft tlf: 55 58 36 41
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 49132

INFORMASJON OG SAMTYKKE
I følge meldeskjemaet skal deltakerne i studien informeres skriftlig og muntlig om prosjektet og samtykke til deltakelse. Informasjonsskrivet mottatt 15.08.2016, er godt utformet.

INFORMASJONSSIKKERHET
Personvernombudet legger til grunn at dere behandler alle data og personopplysninger i tråd med Høgskolen i Bergen sine retningslinjer for innsamling og videre behandling av forskningsdata og personopplysninger.

PUBLISERING
I meldeskjemaet har dere krysset av for at det skal publiseres personopplysninger i oppgaven. Dersom personopplysninger skal publiseres, må det innhentes et eksplisitt samtykke til dette. Vi kan ikke imidlertid ikke finne informasjon om dette i informasjonsskrivet. Personvernombudet legger derfor til grunn at dette er feil, og har endret dette punktet til at dere skal publisere anonymt og at ingen informanter vil kunne gjenkjennes i publikasjonen.

OPPBEVARING AV PERSONOPPLYSNINGER
Datamaterialet skal oppbevares på Høyskolen i Bergen sin forskningsserver til 31.08.2026. Prosjektet er en del av et større NFR-prosjekt, og datamaterialet oppbevares med personidentifikasjon for videre forskning.

Personvernombudet gjør oppmerksom på at dersom data fra prosjektet skal benyttes i andre forskningsprosjekter, vil dette kreve ny melding til ombudet.

Appendix XIV

HiREB

Hamilton Integrated Research Ethics Board

Date: 3 January 2017

Project Number: 2463

Project Title: Perceived and actual evidence-based practice knowledge: A validation of the EBP2 Terminology domain.

Principal Investigator: Dr. Jennifer Yost

As you are aware your study was presented at the December 07-2016 Hamilton Integrated Research Ethics Board meeting where it received ***provisional*** approval from the full Research Ethics Board. The HiREB has identified the following issues/revisions:

1. Consent page 3, para1, line 2: Please remove reference to Dr. Catallo.

All documents submitted must have a version number and version date that correlates with the version number and version date of the uploaded documents indicated in the sections in the application form.

Your revised submission should include a cover letter, which addresses each of the bullets identified in this letter, and the revisions should be clearly highlighted in each revised documents (include tracked and clean copies). A response to HiREB is required within 60 days from the date of this letter or the project will be considered abandoned unless the researcher has requested an extension.

PLEASE NOTE: you may not begin this study until you have responded to these issues and received Final approval status from HiREB.

Documents to assist you with your response to provisional approval are located on our website: http://www.hireb.ca/forms-downloads/

PLEASE QUOTE THE ABOVE REFERENCE PROJECT NUMBER ON ALL FUTURE CORRESPONDENCE

Sincerely,

Raelene Rathbone

Dr. Raelene Rathbone, MB BS, MD, PhD
Chair, Hamilton Integrated Research Ethics Board

The Hamilton Integrated Research Ethics Board operates in compliance with and is constituted in accordance with the requirements of: The Tri-Council Policy Statement on Ethical Conduct of Research Involving Humans; The International Conference on Harmonization of Good Clinical Practices; Part C Division 5 of the Food and Drug Regulations of Health Canada, and the provisions of the Ontario Personal Health Information Protection Act 2004 and its applicable Regulations;**for studies conducted at St. Joseph's Hospital, HIREB complies with the health ethics guide of the Catholic Alliance of Canada**

Appendix XV

DTA17-021

DATA SHARING AGREEMENT ("Agreement")
Research Use of Survey Information

BETWEEN: McMaster University **('Provider')**
1280 Main Street West, Hamilton Ontario L8S 4L8

Dr. Jennifer Yost (**'Provider Investigator'**)

AND

Bergen University College **('Recipient')**
Postboks 7030
5020 Bergen, Norway

Anne Kristin Snibsøer (**'Recipient Investigator'**)

Date: October 10, 2016 (**'Effective Date'**)

Name of Study/Provider REB File Number: [Perceived and actual evidence-based practice knowledge: A validation of the EBP2 Terminology domain, HiREB Project 2463.] ("Study")

Data to be provided (Survey Data): As per the REB approved Study Protocol, incorporated herein by reference.

1. This Agreement effective as of the Effective Date, is entered into between the parties to govern the transfer of the Data from Provider to Recipient for use in the Study, in compliance with applicable laws. Provider retains the right to refuse transfer of the Data requested.

2. Provider will prepare and furnish to Recipient the Data in accordance with Ontario's *Personal Health Information Protection Act (PHIPA)*, and specifically warrants that transfer of the Data by Provider will be in compliance with REB approved subject informed consent forms ("ICFs") provided by the individuals from whom the Data was collected, or terms of an REB Waiver of Consent, as applicable. Data will not be transferred until each party's REB provides written approval for the Study.

3. Recipient shall use the Data in compliance with all applicable laws; and shall specifically only use or disclose the Data for the conduct of the Study in accordance with the permitted uses of the Data specified in the applicable ICFs or REB Waiver of Consent, or otherwise as required by law. No right, title or interest in and to the Data is granted or implied to the Receiving Party hereunder.

4. Recipient shall have the right to use (1) the analyzed, de-identified data derived from the use of the Data, and (2) de-identified information and results arising out of analysis of the Data, as part of a publication or presentation of the results of the Study, and shall own such de-identified, analyzed data and results. Recipient shall not include any personally identifying information in any publication or presentation. Provider Investigator's contribution to the Study shall be appropriately acknowledged in any such publication or presentation in accordance with academic standards.

5. Recipient shall use appropriate safeguards to prevent any unauthorized use of disclosures of the Data and shall report to the Provider any unauthorized use or disclosure of which Recipient becomes aware, or of any breach of this Agreement. Recipient shall not use the Data to identify or contact the individuals from whom such Data were collected. Recipient shall securely destroy the Data as

required by the Protocol or Provider and provide a written confirmation of the manner of destruction in a form acceptable to Provider. Provider may conduct audits of the Recipient concerning the maintenance of appropriate security safeguards to ensure compliance with this Agreement.

6. Recipient shall give access to the Data only to its staff with a need to know for the purpose of conducting the Study, and who are bound by Recipient to comply with the terms of this Agreement.

7. General Terms and Conditions:

   (a) No party shall be entitled to assign or transfer this Agreement or the rights and obligations hereunder to any third party without the prior written approval of other party.

   (b) This Agreement, including the attached Schedules, represents the entire understanding between or among the parties related to the Study and supersedes all previously or contemporaneously executed agreements related to the Study.

   (c) This Agreement shall not be amended, modified, varied or supplemented except in writing signed by each of the parties.

   (d) No failure or delay on the part of any party hereto to exercise any right or remedy under this Agreement shall be construed or operate as a waiver thereof.

   (e) The parties hereto are independent contractors. Nothing contained herein shall be deemed or construed to create between the parties hereto a partnership or joint venture or employment or principal-agent relationship. No party shall have the authority to act on behalf of any other party or to bind another party in any manner.

   (f) Each party to this Agreement assumes responsibility for its own obligations under this Agreement.

   (g) No party shall use, or authorize others to use, the names, symbols or marks of another party hereto or its staff for any endorsement purposes without prior written approval from the party whose name, symbols or marks are to be used.

   (h) This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the federal laws of Canada applicable therein.

   (i) This Agreement may be executed by the Parties in counterparts and may be executed and delivered by facsimile or electronically by PDF and all such counterparts, facsimiles and PDF copies shall together constitute one agreement. The parties agree that facsimile or PDF copies of signatures have the same effect as original signatures.

PROVIDER

Gay Yuyiting
Executive Director
McMaster Industry Liaison Office
McMaster University

January 9, 2017
Date

RECIPIENT

Marjolein Memelink Iversen
Vice Dean of Research
Faculty of Health and Social Sciences
Bergen University College

26 October 2016
Date

ACKNOWLEDGMENT BY PROVIDER SCIENTIST & RECIPIENT SCIENTIST

I have read and understood this Agreement and agree to act in accordance with all the terms and conditions of the Agreement. I further agree to ensure that all participants working under my supervision or otherwise involved in working with the Data are aware of and abide by the terms of this Agreement.

Jennifer Yost

30 October 2016
Date

Anne Kristin Snibsøer
Anne Kristin Snibsøer

26. October 2016
Date

Appendix XVI

Databehandleravtale

I henhold til personopplysningslovens § 13, jf. § 15 og personopplysningsforskriftens kapittel 2.

mellom

Senter for kunnskapsbasert praksis

Behandlingsansvarlig

og

Andrè Thoresen

Databehandler

1. Avtalens hensikt

Avtalens hensikt er å regulere rettigheter og plikter etter Lov av 14. april 2000 nr. 31 om behandling av personopplysninger (personopplysningsloven) og forskrift av 15. desember 2000 nr. 1265 (personopplysningsforskriften). Avtalen skal sikre at personopplysninger om de registrerte ikke brukes urettmessig eller kommer uberettigede i hende.

Avtalen regulerer databehandlers bruk av personopplysninger på vegne av den behandlingsansvarlige, herunder innsamling, registrering, sammenstilling, lagring, utlevering eller kombinasjoner av disse.

2. Formål

Formålet med databehandleravtalen er å regulere og sikre behandling av persondata.

2.1 Konkrete rutiner for bruk av personopplysningene

I undersøkelse skal det samles indirekte personidentifiserende opplysninger, som kjønn, alder og utdanning. Databehandler skal samle og midlertidig lagre data på egen lukket server. Databehandler har ikke råderett over personopplysningene, og kan dermed ikke bearbeide eller behandle disse til egne formål.

Følgende behandlinger omfattes av avtalen:

- Databehandler lager et elektroniske spørreskjema i FileMaker Pro.
- Informantene får tilgang til og besvarer skjemaet via en felles webløsning.
- Informantenes IP adresse og brukeridentitet vil ikke være sporbar.
- Når data er samlet skal databehandler, i samarbeid med forsker, overføre data til Høgskolen i Bergen sin forskningsserver og slette data fra lukket server.

2.2 Regler for utlevering av personopplysningene

Databehandler skal kun forholde seg til avtalen. Databehandler skal ikke utlevere personopplysninger til andre eksterne parter.

3. Databehandlers plikter

Databehandler skal følge de rutiner og instrukser for behandlingen som behandlingsansvarlig til enhver tid har bestemt skal gjelde.

Databehandler plikter å gi behandlingsansvarlig tilgang til sin sikkerhetsdokumentasjon, og bistå, slik at behandlingsansvarlig kan ivareta sitt eget ansvar etter lov og forskrift.

Behandlingsansvarlig har, med mindre annet er avtale eller følger av lov, rett til tilgang til og innsyn i personopplysningene som behandles og systemene som benyttes til dette formål. Databehandler plikter å gi nødvendig bistand til dette.

Databehandler har taushetsplikt om dokumentasjon og personopplysninger som vedkommende får tilgang til iht. denne avtalen. Denne bestemmelsen gjelder også etter avtalens opphør.

4. Bruk av underleverandør

Dersom databehandler benytter seg av underleverandør eller andre som ikke normalt er ansatt hos databehandler skal dette avtales skriftlig med behandlingsansvarlige før behandlingen av personopplysninger starter.

Samtlige som på vegne av databehandler utfører oppdrag der bruk av de aktuelle personopplysningene inngår, skal være kjent med databehandlers avtalemessige og lovmessige forpliktelser og oppfylle vilkårene etter disse.

5. Sikkerhet

Databehandler skal oppfylle de krav til sikkerhetstiltak som stilles etter personopplysningsloven og personopplysningsforskriften, herunder særlig personopplysningslovens §§ 13 – 15 med forskrifter. Databehandler skal dokumentere rutiner og andre tiltak for å oppfylle disse kravene. Dokumentasjonen skal være tilgjengelig på behandlingsansvarliges forespørsel.

Avviksmelding etter personopplysningsforskriftens § 2-6 skal skje ved at databehandler melder avviket til behandlingsansvarlig. Behandlingsansvarlig har ansvaret for at avviksmelding sendes Datatilsynet.

6. Sikkerhetsrevisjoner

Behandlingsansvarlig skal avtale med databehandler at det kan gjennomføres sikkerhetsrevisjoner jevnlig for systemer og lignende som omfattes av denne avtalen.

7. Avtalens varighet

Avtalen gjelder så lenge databehandler behandler personopplysninger på vegne av behandlingsansvarlig.

Ved brudd på denne avtale eller personopplysningsloven kan behandlingsansvarlig pålegge databehandler å stoppe den videre behandlingen av opplysningene med øyeblikkelig virkning.

Avtalen kan sies opp av begge parter med en gjensidig frist på 1 måned, jfr. pkt 8 i denne avtalen.

8. Ved opphør

Ved opphør av denne avtalen plikter databehandler å tilbakelevere alle personopplysninger som er mottatt på vegne av den behandlingsansvarlige og som omfattes av denne avtalen.

Databehandler skal slette alle data fra serveren som inneholder opplysninger som omfattes av avtalen. Dette gjelder også for eventuelle sikkerhetskopier.

Databehandler skal skriftlig dokumentere at sletting og eller destruksjon er foretatt i henhold til avtalen innen rimelig tid etter avtalens opphør.

Denne avtale er i 2 – to eksemplarer, hvorav partene har hvert sitt.

Bergen, 30.06.2016

Behandlingsansvarlig

Birgitte Graverholt

Birgitte Graverholt
Leder, Senter for kunnskapsbasert praksis
Høgskolen i Bergen

Databehandler

Andrè Thoresen