Benchmarking the strategies for assessing clinical reasoning in osteopathic curricula

Moore, Keri, Grace, Sandra, Orrock, Paul, Coutts, Rosanne, Blaich, Raymond and Vaughan, Brett (2014) Benchmarking the strategies for assessing clinical reasoning in osteopathic curricula. International Journal of Osteopathic Medicine, 17 (3). pp. 187-198. ISSN 1746-0689

Benchmarking the strategies for assessing clinical reasoning in osteopathic curricula

Keri Moore[a,b]
Sandra Grace[a]
Paul Orrock[a,b]
Rosanne Coutts[a]
Raymond Blaich[a,b]
Brett Vaughan[a,b,c]

[a] School of Health and Human Science, Southern Cross University, New South Wales, Australia
[b] College of Health & Biomedicine, Victoria University, Melbourne, Australia
[c] Institute for Sport, Exercise & Active Living, Victoria University, Melbourne, Australia

Corresponding author:
Dr Keri Moore
School of Health and Human Sciences
Southern Cross University
PO Box 157
Lismore, NSW
Australia
p) (02) 6626 9300
e) keri.moore@scu.edu.au

Benchmarking the strategies for assessing clinical reasoning in osteopathic curricula

INTRODUCTION

In the current climate of standards-driven quality review and improvement, universities across Australia are benchmarking their assessment practices to ensure that the standards set down are being achieved.[1] Benchmarking may be a one-off event, but is often treated as a continuous process in which organizations continually seek to improve their practices. Benchmarking has many different styles, including conducting the process with external (e.g. legislative), internal and/or collaborative agencies. Internal and collaborative benchmarking within teams and between collegial groups is well established.[2] Within education, the Quality Assurance Agency (QAA) in the UK supports the external reference point type of benchmarking,[3, 4] but the equivalent Australian, the Tertiary Education Quality Standards Agency (TEQSA) has been reported to favour a wider range of styles.[5] The current paper reports on a functional benchmarking activity – a process that compares similar processes within an industry. We compared assessment in pre-professional osteopathic curricula in four higher education institutions.

Benchmarking provides an opportunity for educators to learn from their own experiences, and from others,[1] and the very sharing of information and associated experiences contributes to the likelihood of its success.[6] Benchmarking between educational institutions is a vital component of quality assurance[7] and engaging in such a process contributes to greater consistency in

assessment and improved quality of graduates. To date, there have been no published reports of benchmarking between osteopathy teaching institutions.

Osteopathy curricula in higher education are designed to develop knowledge, skills and dispositions in line with the Threshold Learning Outcomes for Health, Medicine and Veterinary Science,[8] Accreditation Policy of the Australian and New Zealand Osteopathic Council[9] and the statutory body, the Osteopathy Board of Australia (OBA).[10] The OBA requires that accredited programs produce graduates with a number of capabilities in key domains, including the foundation skill of clinical reasoning. Moreover, clinical reasoning skills are described as Core Competencies in the World Health Organization's Benchmarks for Training in Osteopathy.[11] The competences required of graduate osteopaths are described in the various accreditation policies and documents which can be summarised as the ability to:

- gather and record an accurate, organised and problem-focused patient history, including psycho-social factors, using appropriate perspective, tact and judgment**;**
- arrive at an appropriate diagnosis based on the objective evaluation of all available evidence; and;
- interpret relevant literature in a critical and scientific manner and apply these skills to ongoing learning and patient management.[9, 11, 12]

Speaking more broadly, the core definitions of clinical reasoning have been described by Higgs and Jones:[13]

> *Clinical reasoning (or practice decision-making) is a context-dependent way of thinking and decision making on professional practice to guide practice actions (p. 4).*

Further,

> *Decision making within clinical reasoning occurs at micro, macro and meta levels and may be individually or collaboratively conducted. It involves metaskills of critical conversations, knowledge generation, practice model authenticity and reflexivity (p.4).*

Qualitative approaches have identified clinical reasoning as: applying knowledge and experience to the problem, patient or situation; **analysing and reanalysing** to deduce the problem and treatment; **rationalising or justifying** what and why; **combining knowledge** to reach a conclusion; and **problem solving** and **pattern building**.[14]

The concepts embedded in the various aforementioned documents related to the development of osteopathic clinical skills in the pre-professional curricula include:

- knowledge application;
- knowledge generation;
- problem-solving;

- analysis; and
- justification of clinical decisions/ judgment.

Clearly, developing a complex capability such as clinical reasoning requires careful scaffolding throughout the curriculum. Health curricula, such as those designed to educate osteopaths are typically informed by the identified 'stages of learning' which begin at the novice stage then advanced beginner, competent and proficient practitioner and finally the expert stage.[15] Comprehension of such stages inform the design of any clinical assessment strategy used throughout the experiential learning component of the curriculum. Further, Bloom's taxonomy,[16] a well-established instrument for generating learning objectives, is useful for establishing consistency and appropriateness when constructing learning objectives or performance criteria for clinical assessments, including those relating to clinical reasoning.[17, 18]

Although there are some detractors of Bloom's, this framework is consistent with the Australian Qualifications Framework (AQF). The AQF provide the standards for Australian qualifications including learning objectives for each AQF level and qualification type.[19] Bloom's classifications progress from early tasks such as acquiring knowledge, comprehension and application of knowledge to the more complex and abstract tasks of analysis, synthesis and evaluation.[20] Even though Bloom's framework permits it, the current study did not explore the development of the student's affective and psychomotor skills instead focusing only on the

cognitive domain.

Notwithstanding the value of verbs used to depict Bloom's hierarchical taxonomy, an additional indicator of students progression against any set of learning objectives can be demonstrated by a comparison of the curricula with Miller's triangle.[21] Miller proposed a classification for assessment in medical education that is applicable to all health science students as well as those in other disciplines. Miller's four-levelled pyramid conceptually represents skill building in a graded fashion. Consideration of both Bloom's and Miller's ranked frameworks helps understand any overarching assessment strategy.

In any osteopathic curriculum it is expected that students will demonstrable progression in knowledge, skills and ability as they develop their clinical reasoning and judgment from the early clinical experience to pre-graduation. A fusion of Bloom's taxonomy, Miller's Pyramid and the expected osteopathic capabilities is presented in Figure 1.

INSERT Figure 1 here

In short, the assessment strategy ought to be constructed in such a way as to allow the student to demonstrate their progression from mere knowledge to higher order application of knowledge and skills in complex situations. For the

literature presents some examples of assessment tools used to assess clinical reasoning abilities in student osteopaths as well as other disciplines. They are:

A **Portfolio assessment** is widely used in medicine and nursing[22] and its use in osteopathic education has been described.[23, 24] It is valued for its authenticity[25] and potential for encouraging reflective practice.[26]

The use of **written assessments** of clinical reasoning permits the generation of descriptive statistics to determine reliability and construct validity.[27] Questions are typically structured using the extended matching question,[28, 29] key features question[30] or script concordance test formats.[31, 32] These types of assessment provide a standardised, reliable method for the assessment of clinical reasoning.

Abbey[33] analysed the outcomes of two assessment strategies for clinical competencies: **clinical tutor reports and oral reports**. Clinical tutors' reports are commonly used because they assess the development of students' clinical reasoning over time. Oral reports of case studies are 'snap-shot' assessments that are used to explore student's problem solving and decision-making skills and their value as self-directed learning exercises is highlighted.[34] Abbey[33] found that clinic tutors tended to award higher marks than examiners of oral exams. The author reports the variance in marking was thought to be related to the different purposes of

> these assessments. Oral exams may be well suited to assessing baseline competence (e.g. public safety), functional abilities, behavioural knowledge and skills, whereas clinical tutor reports are appropriate for assessing consistent performance over time in matters such as professional attitudes toward self-monitoring, ethical practice as well as the tacit and implicit aspects' of clinical competence. Non-technical competencies have been described as essential to success in health care practice and the challenges inherent in educating health professionals to develop biomedical competence and 'bedside' manner.[35]

In summing up, whilst clinical reasoning has been investigated and described for many health professions, Thomson et al.[36] wrote that it:

> *…remains poorly understood in the profession of osteopathy and that in order for the profession to progress, clinical reasoning according to osteopathic values needs to be defined and developed through critique.*

The purpose of the present study was to benchmark the assessment strategy used to assess osteopathic clinical reasoning in a number of teaching programs. For the purposes of this study our team considered that,

> 'clinical reasoning in osteopathy was understood to be demonstrated by students when gathering evidence about cases, formulating

working diagnoses, and thinking through all the stages of typical consultations that lead to decision-making about treatment and management of osteopathic patients.'

METHOD

The study was approved by the Southern Cross University Human Research Ethics Committee (ECN-12-270). Clinical education academics from Southern Cross University (Australia), Victoria University (Australia), Unitec (New Zealand) and the British School of Osteopathy (United Kingdom) agreed to participate in the study. The study was undertaken in five stages.

Stage 1 – Gathering documents

Participating osteopathic educators submitted unit/subject outlines that included learning objectives and clinical assessments, examiner and student guides, and marking criteria that demonstrated the institutions' approaches to assessment of clinical reasoning in the final two years of the osteopathic programs. Each subject/unit guide was critiqued by one team member to determine how each assessment was related to the teaching activities, a process Biggs[37] recommends to strengthen the curricula. Data from curricula at each institution were collated and reviewed using comparative content analysis, a method for determining the relative merit of educational process.[38]

A data collection template was developed and piloted three times using a random selection of documents from the four institutions. Four members of the research team reviewed a sample of the subject/unit guides from one institution each. The data analysis team met to evaluate, discuss and amend the template as required

before it was populated with information from each subject/unit guide at each institution. Each member of the data analysis team contacted the academic representative(s) from the participating institution when further information or clarification was required. The descriptors for each type of assessment were generated from the data in a similar methodology to that was used in a previous study by one of the research team.[39] The participating osteopathic programs were de-identified and referred to as Institutions A, B, C and D.

Stage 2 – Verifying data

'Member checking' is the process by which the researcher tests the categories, interpretations and conclusions generated from the data provided by participants.[40] Member checking in this study involved academic representatives from each participating institution checking the templates that had been compiled with their own data, verifying that they accurately represented the learning objectives and assessment strategies in their clinical curricula.

Stage 3 - Focus Groups

Representatives from the participating institutions attended in person or by online teleconferencing (Skype Inc.) to discuss the information generated on the templates, the overarching assessment strategy and results. This is further explained in the next section.

Although not reported on in this paper at the same teleconferencing events, focus groups were also used to explore the current views of osteopathic educators about what constitutes 'osteopathic clinical reasoning'. Results from the focus groups about what constitutes osteopathic clinical reasoning will be reported in a subsequent paper.

Stage 4 - Analysing content

Data were analysed using three strategies:

1) Types of assessment tools were collated and compared across all osteopathic programs;

2) The learning objectives related to each tool were reviewed to determine how they were used in each program as well as for alignment with Bloom's taxonomy; and

3) The overarching assessment strategy was compared to Miller's hierarchy.

Verbs contained in each 'learning outcome' related to each assessment tool, were used as the indicator of the level of cognitive skill required to achieve the learning outcome.[20] *Level 1, Knowledge* was nominated if the assessment item involving the recall of information. *Level 2, Comprehension* was assigned to those items and statements asking students to show understanding or interpretation. *Level 3, Application* was assigned to assessments where students were asked to apply learning to a novel situation. *Level 4, Analysis* was applied

to assessments where a level of analysis was required, such as distinguishing between fact and inference. *Level 5, Synthesis* was assigned to tasks involving the creation of new meaning or structure. *Level 6, Evaluation*, the most abstract level, was assigned to those items where students needed to make independent judgments about a course of action.

Stage 5 – Generation of Report

The final stage included further member checking. Academics from participating institutions were invited on two separate occasions to review the report and provided feedback to ensure that the findings were accurate and supported by all participants.

RESULTS

Type of assessment

Across all four programs there are six assessment strategies used to assess student's osteopathic clinical reasoning. In five of these approaches the students is assessed by clinical educator who works for the university or who is seconded. Only one approach involves assessment by a peer - another student.

They are:

1. **Assessment of Actual Performance** - the Long Case is an assessment of student's actual performance when applying their knowledge, skills and clinical capabilities with patients in a clinical setting;
2. **Assessment of Simulated Performance**: For example the Objective Structured Clinical Examination, OSCE, viva voce;
3. **Global Reports:** Supervisors reports on a student's performance over time that typically assess students' knowledge, in general, skills and professionalism over several weeks of time;
4. **Oral or written Assessments**: Reports or oral presentations on real and or simulated case studies;
5. **Portfolio:** a presentation of achievement – evidence to support a claim that a student has learned something in particular; and

6. **Peer review**: Assessment of one student by another student which can include a report on simulated performance of skills and report on actual performance real-time, in-situ.

The types of assessments tools used by the participating institutions are presented in Table 1 that shows the strategy across each institution. Assessment of student's actual performance, the Supervisor's Report and some peer assessments are implemented during clinic whereas assessment of simulated performance, oral and written case study presentations and portfolios are conducted outside the clinic, away from patients.

INSERT Table 1 here

Alignment of learning objectives with Bloom's taxonomy

Across the four programs a variety of learning objectives were used to describe competencies for clinical reasoning in clinical assessments in the final two years of the osteopathic programs. Tables 2-5 show the Bloom's Level (BL), objectives and assessment tools (AT) in each of the four semesters of the final two-years of each program. Each institution used higher order learning objectives (Bloom's *Level 3 Application* and above). In the first semester of the two-year practicum component of each degree the BL ranged from

INSERT Table 2 here

INSERT Table 3 here

INSERT Table 4 here

INSERT Table 5 here

Table 6 demonstrates the alignment of the learning objectives for the four participating institutions at Bloom's *Level 4 Analysis* and above.

Insert Table 6 here

Table 6 shows the emphasis on Miller's level 'Does' which is most appropriate given that clinical education concerns applying theory to practice. None of the learning objectives used at the institutions in this study align with BL 2. Institution A used verbs consistent with BL 4 and 6 with not much alteration over time. The learning objectives emphasised identifying the patient's concerns and selecting appropriate treatment, ethical, practical and pragmatic concerns, management plan and short, medium and long-term goals including preventative care strategies.

Institution B used verbs consistent with BL 5 in the earlier stages and with BL 1 and 4 emerging in the later two stages. The learning objectives focused on

diagnosis and treatment with some focus on the development of management plans. The learning outcome: ‘Gather and use information in clinical reasoning’ suggests that clinical reasoning may be different from the thinking involved in the development of diagnosis.

Institution C used verbs consistent with Bloom’s levels 1, 3, 4, 5 & 6 and shows a different expectation of students in the final two stages of the two-year curriculum. The learning objectives emphasised words such as ‘recognise, interpret and evaluate symptoms to develop reasoned diagnostic hypothesis,’ and had a greater use of words such as ‘critically analyses conflicting evidence, judge and set priorities in management.’ Such words suggest a more critical examination of the students’ thinking processes.

Institution D used verbs consistent with BL 5 exclusively at all four stages of the two-year curriculum. The learning objectives explore a students’ demonstration and explanation of the development of a diagnosis and a management plan.

DISCUSSION

Underlying any benchmarking process is the assumption that the programs and available resources are similar.[7] The present study compared documents containing learning objectives and assessment tasks, and used Bloom's taxonomy and Miller's pyramid concept to investigate the scaffolding and appropriateness of learning objectives with the development of clinical reasoning skills in the clinical component of osteopathic programs. With that in mind, it is important to acknowledge that the process of assessing learning objectives against a taxonomy can be flawed, especially when categorising using key words. The language used in curriculum documents (for example, inaccurate or inappropriate descriptors of learning objectives or assessment criteria) may not be a true reflection of the overall or implicit intent of the learning objectives or the reality of assessment practices. This potential issue highlights the importance of gathering information using multiple sources, and an open discourse, to ensure that conclusions about learning objectives and assessment tools are authentic and meaningful.

This benchmarking review of particular curricula documents found that a wide range of assessment types were used to assess clinical reasoning in the final two years of an osteopathic teaching program. A review of the assessments showed that students were required to apply knowlegde to real life situations, develop analytical skills and work with problem solving and abstract concepts. Assessment of students' actual performance (real-time in situ) constitutes

practical assessment of workplace performance. This allows for the exploration of students' understanding of systems, roles, ethics, and responsibilities, processes and lateral thinking, proficiency in basic clinical skills, communication and core disciplinary knowledge. There is a tradition in osteopathic education to assess student's real-time in-situ performance using the long case assessment of an entire consultation and one institution in the present study used student peer-review in this style of assessment. While there have been questions raised about the reliability of this type of assessment,[41-44] evidence would suggest that osteopathic educators are keen to continue using it as they regard it as the highest form of authentic assessment in any assessment strategy for students.[23]

It is noteworthy that several assessment types were not used by any educational institution in this study, including industry-based case studies, inter professional case studies, self-evaluation of actual performance of skills (real-time in-situ), short written reflection on practice (e.g. reflective diary or blogs), research proposals and online discussions and tasks related to clinical experiences. There was no evidence of assessment of student's knowledge and ability to work autonomously in any of the participating institutions. There was no evidence of assessment of osteopathic student's knowledge and ability to work autonomously in any of the participating institutions' documents.

All institutions predominantly employed higher order learning objectives however the current strategy for assessing osteopathic clinical reasoning has gaps in relation to testing student's 'know how', their comprehension however it may be assessed outside clinic. The consequences of clustering learning outcomes across two whole years is worthy of further discussion. It could be argued that there does not appear to be an expected increase in difficulty – an assessment of student's 'progression' when looking at the overall assessment strategies at each participating institution.

The verbs used to describe osteopathic learning objectives in the participating institutions are not directly comparable with the language of the WHO Benchmarks for Training in Osteopathy[11] which uses terms such as: 'ability to form an appropriate differential diagnosis and treatment plan' and 'proficiency in physical examination and the interpretation of relevant tests and data'. (p.8). The terms 'appropriate' and 'proficiency' in the aforementioned sentence are open to broad interpretation by academics and is unhelpful in setting standards. Clearly, much more work needs to be done to align these statements to those routinely used in health professional education.

The assessment strategies in all four participating institutions were consistent with the four levels of Miller's pyramid model of competency assessment which visually conceptualizes skill development from lowest order 'knows' to the more complex 'does'.[21]

Further research is required to assess the validity and reliability of the overarching assessment strategy and the individual assessment tools used to assess osteopathic clinical reasoning. This could potentially be achieved through a more robust 'systems approach' to assessment such as that described by Van der Vleuten et al.[25] who advocate a move from assessment *of* learning, to optimise "…assessment *for* learning and assessment for decision making about learner progress."

CONCLUSION

This study investigated the assessment strategies used to explore student's clinical reasoning development in each institution in relation to osteopathic clinical reasoning. The results show osteopathic teaching institutions employ a range of six assessments tools when they assess clinical reasoning. The assessment of student's actual performance during real-time, in-situ clinical consultation with patients; simulated performance; the clinical supervisors report and; oral or written reports on simulated case studies. There was some variance in the scaffolding of teaching/learning and assessments when compared to Bloom's taxonomy, and Miller's pyramid. The results show that in the osteopathy teaching institutions in the present study do not scaffold the expected learning objectives to reflect an increase in difficulty as the student's progress; the learning objectives tend to be clustered and relatively stable. However, this may be a reflection of only investigating the final years of an osteopathy teaching program. This opens the field for future research.

The benefits of this benchmarking exercise were that it encouraged collaboration across osteopathic educational institutions about assessment practices, highlighted consistencies and inconsistencies in assessment of clinical reasoning in osteopathic students, and was a catalyst for dialogues about best practice.

It would be worthwhile if future studies benchmarked the criteria used in clinical assessments and made explicit the key professional values related to assessing clinical competencies.

REFERENCES

1. Achim MI, Căbulea L, Popa M, Mihalache S-Ş. On The Role Of Benchmarking In The Higher Education Quality Assessment. *Annales Universitatis Apulensis Series Oeconomica* 2009;**2**:850-7.

2. Jackson N. Benchmarking in UK HE: an overview. *Quality Assurance in Education* 2001;**9**:218-35.

3. Burquel N, van Vught F. Benchmarking in European Higher Education: A step beyond current quality models. *Tertiary Education and Management* 2010;**16**:243-55.

4. Pidcock S. What is the impact of subject benchmarking? *Active Learning in Higher Education* 2006;**7**:111-28.

5. Stella A, Woodhouse D. *Benchmarking in Australian higher education: A thematic analysis of AUQA audit reports*: Australian Universities Quality Agency Melbourne, VIC; 2007.

6. Kettunen J. Cross-evaluation of degree programmes in higher education. *Quality Assurance in Education* 2010;**18**:34-46.

7. Pressler JL, Kenner CA. Benchmarking: with whom? How often? *Nurse Educ* 2013;**38**:87-8.

8. Australian Learning & Teaching Council. Health, Medicine and Veterinary Science Learning and Teaching Academic Standards Statement. 2011; http://www.olt.gov.au/system/files/resources/altc_standards_HMVS_210611.pdf. Accessed June 3, 2012.

9. Australian & New Zealand Osteopathic Council. Accreditation Policy: Standards and procedures for the accreditation of osteopathic courses in Australia. 2010; http://anzoc.org.au/pdf/apaus.pdf?phpMyAdmin=c59ffb7e59b6bb5b540b7e1b6586926e.

10. Osteopathy Board of Australia. About the Osteopathy Board of Australia. 2013; http://www.osteopathyboard.gov.au/About.aspx. Accessed July 14, 2013.

11. World Health Organisation. Benchmarks for training in osteopathy. 2010; http://www.who.int/medicines/areas/traditional/BenchmarksforTraininginOsteopathy.pdf. Accessed July 20, 2013.

12. Hager P, Boud D, Stone CF.Capabilites for Osteopathic Practice. Sydney, Australia. University of Technology Sydney. 2009.

13. Higgs J, Jones M, Loftus S, Christensen N, eds. *Clinical reasoning in the health professions*. Sydney: Butterworth Heinemann; 2008.

14. Hendrick P, Bond C, Duncan E, Hale L. Clinical reasoning in musculoskeletal practice: students' conceptualizations. *Phys Ther* 2009;**89**:430-42.

15. Dreyfus SE, Dreyfus HL.A five-stage model of the mental activities involved in directed skill acquisition. DTIC Document. 1980.

16. Bloom BS, Engelhart M, Furst EJ, Hill WH, Krathwohl DR. Taxonomy of educational objectives: Handbook I: Cognitive domain. *New York: David McKay* 1956;**19**:56.

17. Hurt RL. Advising as Teaching: Establishing Outcomes, Developing Tools, and Assessing Student Learning. *NACADA Journal* 2007;**27**:36-40.

18. Spring H. Theories of learning: models of good practice for evidence-based information skills teaching Learning and teaching in action. *Health Info Libr J* 2010;**27**:327-31.

19. Australian Qualifications Framework Council. AQF Qualifications. 2013. http://aqf.edu.au/AbouttheAQF/TheAQF/tabid/108/Default.aspx. Accessed 17 Aug 2009.

20. Nevid JS, McClelland N. Using Action Verbs as Learning Outcomes: Applying Bloom's Taxonomy in Measuring Instructional Objectives in Introductory Psychology. *Journal of Education and Training Studies* 2013;**1**:p19-24.

21. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med* 1990;**65**:910-7.

22. Thome G, Hovenburg H, Edgren G. Portfolio as a method of continuous assessment in an undergraduate health education programme. *Med Teach* 2006;**28**:e171-e6.

23. Vaughan B, Sullivan V, Gosling C, McLaughlin P, Fryer G, Wolff M, et al. Methods of assessment used by osteopathic educational institutions. *Int J Osteopath Med* 2012;**15**:134-51.

24. Vaughan B, Florentine P, Carter A. Introducing a portfolio assessment in a pre-professional osteopathy program. *Int J Osteopath Med* 2013; doi: 10.1016/j.ijosm.2013.06.003

25. Van der Vleuten C, Schuwirth L, Driessen E, Dijkstra J, Tigelaar D, Baartman L, et al. A model for programmatic assessment fit for purpose. *Med Teach* 2012;**34**:205-14.

26. O'Sullivan A, Howe A, Miles S, Harris P, Hughes C, Jones P, et al. Does a summative portfolio foster the development of capabilities such as reflective practice and undertstanding ethics? An evaluation from two medical schools. *Med Teach* 2012;**34**:e21-e8.

27. Groves M, Scott I, Alexander H. Assessing clinical reasoning: a method to monitor its development in a PBL curriculum. *Med Teach* 2002;**24**:507-15.

28. Samuels A. Extended Matching Questions and the Royal Australian and New Zealand College of Psychiatrists written examination: an overview. *Australas Psychiatry* Mar 2006;**14**:63-6.

29. Beullens J, Struyf E, Van Damme B. Do extended matching multiple-choice questions measure clinical reasoning? *Med Educ* 2005;**39**:410-7.

30. Farmer EA, Page G. A practical guide to assessing clinical decision-making skills using the key features approach. *Med Educ* 2005;**39**:1188-94.

31. Brailovsky CA, Charlin B, Beausoleil S, Cote S, van der Vleuten CPM. Measurement of clinical reflective capacity early in training as a predictor of clinical reasoning performance at the end of residency: An experimental study on the script concordance test. *Med Educ* 2001;**35**:430-6.

32. Esteves JE, Bennison M, Thomson OP. Script concordance test: Insights from the literature and early stages of its implementation in osteopathy. *Int J Osteopath Med* 2013: doi: 10.1016/j.ijosm.2013.05.001.

33. Abbey H. Assessing clinical competence in osteopathic education: Analysis of outcomes of different assessment strategies at the British School of Osteopathy. *Int J Osteopath Med* 2008;**11**:125-31.

34. Chapman J, Westmorland M, Norman G, Durrell K, Hall A. The structured oral self-directed learning evaluation: one method of evaluating the clinical reasoning skills of occupational therapy and physiotherapy students. *Med Teach* 1993;**15**:223-35.

35. Lane I. Professional competencies in health sciences education: from multiple intelligences to the clinic floor. *Adv Health Sci Educ* 2010;**15**:129-46.

36. Thomson OP, Petty NJ, Moore AP. Clinical reasoning in osteopathy. More than just principles? *Int J Osteopath Med* 2011;**14**:71.

37. Biggs J. Aligning teaching for constructing learning. *Higher Education Academy* 2003.

38. Charles C, Mertler C. *Introduction to educational research*. Boston, US: Allyn and Bacon; 2002.

39. Ferns S, Moore K. Assessing student outcomes in fieldwork placements: an overview of current practise. *Asia-Pacific Journal of Cooperative Education* 2012;**13**:207-24.

40. Bryman A. The nature of qualitative research. In: Bryman A, ed. *Social research methods*. 3rd ed. Oxford: Oxford University Press; 2008:365-99.

41. Benning T, Broadhurst M. The long case is dead — long live the long case: Loss of the MRCPsych long case and holism in psychiatry *Psychiatr Bull R Coll Psychiatr* 2007;**31**:441-2.

42. Epstein RM. Assessment in medical education. *N Engl J Med* 2007;**356**:387-96.

43. McKinley RK, Hastings AM, Petersen S. The long case revisited. *Med Educ* 2005;**39**:442-3.

44. Benning T, Broadhurst M. The long case is dead--Long live the long case. *Psychiatr Bull R Coll Psychiatr* 2007;**31**:441-2.

Table 1. Assessment tools used at participating institutions**.**

	Institution			
Category of Assessment Tool	**A**	**B**	**C**	**D**
1. **Assessment of Performance - real-time, in-situ:** Practical assessment of work place performance - detailed understanding of disciplinary systems, roles, ethics, and responsibilities, systems, processes and lateral thinking, proficiency in basic disciplinary skills, communication and core disciplinary knowledge.	✓	✓	✓	✓
2. **Assessment of simulated performance:** Institutional based assessment intended to replicate the work place environment, for example role play including OSCE – peer and self-assessment and staff internal and external.	✓	✓	✓	×
3. **Clinical Supervisors Report:** assessment of professional behaviour, adherence to relevant disciplinary code of practice and general demeanour in the practice-based setting.	✓	×	✓	✓
4. **Case Studies:** understanding of disciplinary knowledge etc, roles, ethics, and responsibilities, systems, processes and lateral and higher order thinking, debates. Can be inter professional or discipline specific and may be brief cases or vignettes. **Oral or written report on simulated case study:** Typical work place scenarios- written responses.	✓	✓	×	✓
5. **Peer review** a. Report on simulated performance of skills	×	×	×	×
b. Report on actual performance, real-time, in-situ	×	✓	✓	×
6. **Portfolio of evidence of achievement**: Reflection of workplace experience and collection of evidence.	✓	×	×	×

Table 2. The alignment of learning outcomes, Bloom's taxonomy levels and assessment tools in Phase 1.

Institution A	Institution B	Institution C	Institution D
Manage a patient consultation in co-operation with the clinical supervisor, identifying the presenting problem, developing a basic working diagnosis and selecting a treatment regime that considers the presenting problem with some consideration for ethical, practical and pragmatic concerns. **BL:** 4. **AT:** Mini OCE/CEX, Osteopathic Clinical Practice Assessment and Case Study.	Formulate diagnosis and execute an appropriate range of treatment plans. **BL:** 5 **AT:** Observed Long Case and Observed Short Case. OSCE Formulate diagnostic hypothesis relating to a range of patients and situations. **BL:** 5 **AT:** Observed Short Case	Recognise, interpret and evaluate the multi-factorial nature of presenting patients so as to develop reasoned diagnostic and conceptual hypotheses appropriate to the individual with minimal supervision. **BL:** 1. **AT**: Peer Review, Tutors Report, OSCE, Patient Management Problem. Demonstrate, in a reasoned and logical fashion, the ability to examine a patient using a range of appropriate examination processes and techniques and critically analyze your findings in relation to other data available to you. **BL:** 4. **AT**: Tutors Report, OSCE and written exam. Demonstrate, with minimal supervision, the ability to engage in clinical reasoning using a range of evidence to help formulate an osteopathic evaluation for your patients, and to justify your reasoning by calling on a broad knowledge base. **BL**:4. **AT**: Tutors Report, OSCE and Patient Management Problem.	Demonstrate and explain the diagnostic process in a specific case context. **BL** 5. **AT:**Observed long case , Record of progress, Clinical Supervisors Report, Viva voce Develop and explain a management Plan. **BL** 5. **AT:** Observed long case, Record of progress, Clinical Supervisors Report, Viva voce
		Identify, prioritize and manage patients with minimal supervision who present with a combination of factors, and devise an appropriate range of management strategies, which may then be explored with the patient. **BL:** 4. **AT:** Tutor's Report and Patient Management Problem. Identify, manage and take responsibility as a professional for the clinical decision making process within agreed guidelines and with minimal supervision. **BL:** 3. **AT**: Tutor Report.	

Table 3. The alignment of learning outcomes, Bloom's taxonomy levels and assessment tools in Semester 2.

Institution A	Institution B	Institution C	Institution D
Manage a patient consultation identifying the problem, developing a working diagnosis and selecting a treatment regime that considers the presenting problem in the entirely with consideration for ethical, practical and pragmatic concerns. **BL:** 4. **AT:** Mini OCE/CEX, Osteopathic Clinical Practice Assessment.	Formulate treatment and management plans that demonstrate an awareness of the uncertainty and ambiguity inherent in professional and clinical life **BL:** 5. **AT:** Observed Short Case	Same as Semester 1	Same as Semester 1

Table 4. The alignment of learning outcomes, Bloom's taxonomy levels and assessment tools in Semester 3.

Institution A	**Institution B**	**Institution C**	**Institution D**
Manage a patient consultation identifying the problem, developing a working diagnosis and selecting a treatment regime that considers the presenting problem in the entirety with consideration for ethical, practical and pragmatic concerns. **BL:** 4. **AT:** OSCE, Portfolio and Mini OCE/CEX. Develop a management plan and prognosis that sets short, medium and long term goals, and takes into account all aspects of the patient's problem including lifestyle factors. **BL:** 4.**AT:** OSCE and Portfolio. Evaluate and use evidence in clinical practice including evidence-based practice, evidence to support clinical decision making and justify the use of evidence in contemporary practice. **BL:** 6. **AT:** OSCE and Practicum Report.	Gather and use information in clinical reasoning. **BL:** 1. **AT:** Observed Long Case and Observed Short Case. Effectively use structured analysis and decision making in patient management plans. **BT:** 4. **AT:** Case Study. Synthesize solutions to a range of clinical problems using existing knowledge. **BL:** 5. **AT:** Case Study.	Critically evaluate complex, and any conflicting, clinical evidence encountered during the evaluation of your patient confidently and independently. Demonstrate the ability to judge its meaning with respect to hypothesis generation and diagnosis of your patient. **BL:** 6. **AT**: Tutor Report, Clinical Competency Assessment and Case Report. Confidently develop appropriate patient management strategies with an awareness of the complexity and unpredictability inherent in clinical decision-making. **BL:** 3. **AT:** Tutor Report, Clinical Competency Assessment and Case Report. Exercise initiative to select and apply appropriate diagnostic and therapeutic techniques from a comprehensive range in order to meet patient's needs. **BL:** 3. **AT** Tutor Report, Clinical Competency Assessment and Case Report. Take full responsibility for professional judgements and clinical decision-making in all aspects of patient care including communication with outside agencies and defend them appropriately. **BL:** 6. **AT** Tutor Report and Clinical Competency Assessment	Same as Semester 1

Table 5. The alignment of learning outcomes, Bloom's taxonomy levels and assessment tools in Semester 4**.**

Institution A	**Institution B**	**Institution C**	**Institution D**
Devise integrated case management plans for patients, incorporating preventive care strategies. **BL:** 4. **AT** Mini OCE/CEX, Portfolio and Case study.	Formulate diagnosis and execute an appropriate range of treatment plans. **BL:** 5. **AT** OSCE Gather and use information in clinical reasoning. **BL:** 1. **AT** OSCE	Same as Phase 3	Same as Semester 1

Table 6. Alignment of learning outcomes with Bloom's taxonomy and Miller's hierarchy.

		Knows	**Knows how**	**Shows how**	**Does**		
Bloom's Taxonomy		Level 1 Knowledge	Level 2 Comprehension	Level 3 Application	Level 4 Analysis	Level 5 Synthesis	Level 6 Evaluation
S1	A				*		
	B					**	
	C	*		*	***		
	D					**	
S 2	A				*		
	B					*	
	C	*		*	***		
	D					**	
S3	A				**		*
	B	*			*	*	
	C			**			**
	D					**	
S4	A				*		
	B	*				*	
	C			**			**
	D					**	

AUTHORSHIP STATEMENT

KM developed the idea for the study. All authors undertook the literature review. KM, SG, RC, PO and RB collected and analysed the data. KM developed the first draft of the manuscript. All authors contributed to revisions of the manuscript. All authors approved the final version of the manuscript.