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Large-scale online education programmes and their potential to effect change in behaviour and practice of health and social care professionals

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3 **Large-scale online education programmes and their potential to effect change in**
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5 **behaviour and practice of health and social care professionals: A rapid systematic**
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7 **review.**
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11
12 **Abstract**
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14 This rapid systematic review examined the reported effects of large-scale online
15 education on the behaviour and, ultimately, practice of health and social care
16 professionals. Electronic databases of health and education literature were searched,
17 193 unique records were screened against inclusion and exclusion criteria, 31 papers
18 were accessed for full text reading and six were included. Identified studies reported
19 primarily qualitative results, which were synthesised according to outcomes. Factors
20 that contributed to the results were also identified. All papers reported that
21 participation in e-learning programmes resulted in changes in behaviour and practice,
22 including: increased awareness, changes in attitudes, improved communication,
23 increased confidence and the actual changes applied in a workplace. Observed benefits
24 of these programmes ranged from gaining new insights into own practice, through
25 feeling empowered to apply changes, to eventually being able to provide more person-
26 centred services and willing to adopt and spread a more humane evidence-based
27 practice. While the current study is an early indication of the potential of large-scale
28 online education to effect practice change, further research is recommended as is
29 further in-depth investigation into how these changes are achieved and what factors
30 contribute to success.
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52 **Keywords**
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54 online education; MOOCs; health and social care professionals; practice change; behaviour
55 change
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Introduction

With rapidly growing knowledge the demands of professional development necessitate ongoing learning by health and social care staff. To fit modern lifestyles, commonly requiring multitasking and flexibility, education opportunities need to offer comparative responsiveness to the learners' personal needs and varying work patterns. With constantly growing access to the Internet, increasing numbers of higher education institutions are exploring the possibilities of offering short subject-specific courses to large online communities of learners. Massive Open Online Courses (MOOCs) in the field of health and wellbeing have been offered to learners worldwide (Milligan & Littlejohn, 2016). Freely available to anyone with reliable internet access, this form of education may potentially be utilised in health and social care professionals' training, ultimately bringing benefits to staff, carers, service users and their families (Sandars, 2013). The inclusiveness and wide reaching nature of MOOCs present unique opportunities for continuous professional development and a means of understanding of both professionals' and service users' experiences.

Forms of online learning have been successfully used with medical and health students in higher education institutions (HEIs) globally, with widely reported positive impacts on students' knowledge and clinical skills (Hunter, 2014; McCutcheon et al., 2014; Weiner et al., 2014). The potential of large-scale online education to influence or change behaviour is of particular significance as it might have a widespread impact on clinical practice and health attitudes. However, little is known about the contribution of large-scale online education to translating understanding into action and changing practice. To our knowledge, research evidence for the potential of large-scale education to change behaviour and ultimately influence practice of health and social care practitioners, although constantly growing, has not yet been synthesised in a systematic way.

Aims

This rapid review examined the potential of large scale online education programmes in the field of health and wellbeing to change behaviour and practice of health and social care professionals. Specifically, this work addressed the following research questions:

1. Does participation in MOOCs in the field of health and wellbeing change behaviour, influence attitudes and/or perceptions, and/or change practice?
2. If so, how are these changes achieved?
3. Does participation in MOOCs by health and social care professionals impact on patient outcomes?

Methods

A rapid systematic review was conducted to inform the development and evaluation of health-related MOOCs. Electronic databases relevant to education and the subject of health and social care (Medline, CINAHL Plus, PsycARTICLES, British Education Index, ERIC, ASSIA, SCOPUS and the Cochrane Library) were searched for articles and reports initially in June 2016 with the search updated in September 2017. A search string was developed to include terms relevant to: 1) large scale online education, 2) health and wellbeing, and 3) behaviour change (see Appendix). In recognition of the rapid nature of this review, only titles were searched for the above terms. In addition to database searches, the authors' own repositories of MOOC-related literature were scanned. A Google Scholar search was also performed using the same search string.

Articles were included in the review if they:

- concerned a health or wellbeing-related MOOC (or a similar large scale online course)
- reported outcomes observed through empirical study
- concerned evaluation and/or measuring impact
- included outcomes related to the change of behaviour, attitudes or perceptions
- were published in or after 2000
- were available online and in English

Articles were excluded when they:

- pertained to measuring attitudes towards e-learning in general or a specific online educational technique or materials
- reported only examination performance, knowledge or skills and not impact on behaviour, attitudes or perceptions
- reported on design and/or development of e-learning programmes
- reported on an e-learning module within a single organisation directed at specific cohorts of students undertaking formal clinical, undergraduate or postgraduate education
- concerned online health education (OHE) and not education of health or social care professionals
- pertained to spaced education (SE), mobile or blended learning
- were PhD theses or study protocols

The combined searches yielded 245 records, leaving 193 records after deduplication. Titles and abstracts were screened, 162 records were immediately excluded for not meeting the

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2
3 inclusion criteria, and 31 articles were retrieved for full-text reading. Two authors (AZ and
4
5 KL) independently assessed these papers for inclusion, resolving any disagreements through
6
7 discussion and eventually excluding 25 articles with reasons (see Figure 1). Six papers were
8
9 included in this review.
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13 [Figure 1 near here]
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16 A data extraction tool was developed and data were collected on the following:
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18 characteristics of e-learning programmes, methods and theoretical basis for evaluations
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20 undertaken, outcomes related to behaviour change, and methods/approaches identified by the
21
22 authors as contributing to successful change in practice, behaviour or attitudes (see Table 1).
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29 **Results**

30 31 32 *Characteristics of included studies* 33

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35 Of the six included studies, four used qualitative approaches (Cottrell & Donaldson, 2013;
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37 Lahti et al., 2016; Marks et al., 2014; Paliadelis et al., 2015) and two used a mixed methods
38
39 design (Sim & Radloff, 2008; Tchernegovski et al., 2015). However, in all studies data
40
41 pertaining to behaviour change or impact on practice were of a purely qualitative nature.
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46 [Table 1 near here]
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49 All studies reported on e-learning courses directed at health professionals and concerned
50
51 improvement of practice in a number of health and clinical skills areas, including: blood
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53 transfusion (Cottrell & Donaldson, 2013), mental health (Lahti et al., 2016; Tchernegovski et
54
55 al., 2015), medicines management (Marks et al., 2014) and radiation therapy (Sim & Radloff,
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3 2008). One course did not focus on a specific health issue and was directed at students and
4
5 their clinical supervisors (Paliadelis et al., 2015).
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9 The e-learning programmes were conceived, commissioned and/or developed by healthcare
10 workforce education organisations and governmental bodies in Australia (Paliadelis et al.,
11 2015; Tchernegovski et al., 2015), Scotland (Cottrell & Donaldson, 2013), Finland (Lahti et
12 al., 2016) and Canada (Marks et al., 2014). One e-learning programme was developed in
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14 Australia, but also included participants from New Zealand and Canada (Sim & Radloff,
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16 2008).
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24 *Participants*

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28 In all studies participants volunteered to take part in the research; their participation in online
29 education programmes was also on a voluntary basis. Not all course participants took part in
30 a research study; they were most often a group within the total population of learners.
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36 The number of participants in studies was generally small and varied from 7 to 28. In two
37 studies this number was unknown, but a total number of learners was stated (Marks et al.,
38 2014; Paliadelis et al., 2015). Overall, three studies reported a total number of learners which
39 ranged between 86 and 284.
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46 In four studies the participants were qualified and practising health professionals: nurses in
47 Scotland (Cottrell & Donaldson, 2013), pharmacists in Canada (Marks et al., 2014), radiation
48 therapists in Australia, New Zealand and Canada (Sim & Radloff, 2008), and mental health
49 staff (primarily nurses, social workers and psychologists) in Australia (Tchernegovski et al.,
50 2015). In a study from Finland the course was undertaken by all levels of nursing staff, but
51
52 the research focused on nursing managers (Lahti et al., 2016) and a study from Australia
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3 included students in nursing, medicine, social work and pharmacy and their clinical
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5 supervisors (Paliadelis et al., 2015).
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10 *Evaluation of E-learning for Behaviour Change Potential*

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14 Only two studies mentioned theoretical frameworks which guided their evaluations (Lahti et
15 al., 2016; Sim & Radloff, 2008) and both employed the Kirkpatrick's evaluation model
16
17 (Kirkpatrick, 1998), which describes four levels of evaluation, among them behavioural
18
19 changes after training and the impacts of the training on the working environment. One study
20
21 (Sim & Radloff, 2008) additionally reported on Boud's reflective model (Boud et al., 1985)
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23 which describes seven levels of reflection processes that learners might experience, with the
24
25 sixth level pertaining to changes in behaviour, the learner's affective state and/or
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27 perspectives.
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33 Questionnaires were the most commonly used source of data, employed in all studies with the
34
35 exception of one (Cottrell & Donaldson, 2013). As the studies were primarily qualitative, the
36
37 questionnaires were commonly used as a method of collecting free text responses to open-
38
39 ended questions. Only one study (Sim & Radloff, 2008) mentioned the use of quantitative
40
41 methods alongside the predominating qualitative approach; in this study one questionnaire
42
43 pertaining to workplace change was completed by managers or supervisors and not the
44
45 learners themselves. Similarly, nursing managers, who were the participants in another study
46
47 (Lahti et al., 2016) were asked to report both personal outcomes and changes which they
48
49 noticed in the practice of other nurses - fellow learners on the course. Semi-structured
50
51 interviews were undertaken in three studies (Cottrell & Donaldson, 2013; Marks et al., 2014;
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53 Tchernegovski et al., 2015), two papers presented analysis of data collected from discussion
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55 forums (Sim & Radloff, 2008; Tchernegovski et al., 2015) and two studies reported on using
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3 participants' learning portfolios (Sim & Radloff, 2008) or action plans (Marks et al., 2014) as
4
5 data sources. In one study (Marks et al., 2014) focus groups were conducted immediately
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7 after the course.
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10 Forms of thematic content analysis were a popular method of choice for data analysis, and
11
12 some papers provided more specific details of methods applied (see Table 1). Most of the
13
14 included studies reported on multiple outcomes including learners' experience of e-learning
15
16 and the actual knowledge gained through the course; these outcomes were excluded from the
17
18 current review which focuses primarily on changes in behaviour and direct, or less direct,
19
20 impacts on practice. All studies reported collecting data immediately after the course. In three
21
22 studies longer term outcomes were also examined (Marks et al., 2014; Sim & Radloff, 2008;
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24 Tchernegovski et al., 2015) - the authors reported that at least some of the effects observed
25
26 were sustained two months, three months and one year respectively after the course
27
28 completion.
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36 *Outcomes related to Changes in Behaviour and Practice*

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39 All six papers reported that participation in e-learning programmes resulted in certain
40
41 changes in practice. Outcomes were also described in areas likely to lead to behaviour
42
43 change. For this report, common factors were identified and outcomes were grouped
44
45 according to changes observed in: awareness, attitudes, communication, confidence and,
46
47 ultimately, practice (see Table 2). The order of these concepts is aimed at illustrating the
48
49 potential path to behaviour change, beginning with increased awareness and culminating in
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51 changes to daily clinical practice.
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55 [Table 2 near here]
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Increased Awareness

Four articles reported that the courses resulted in learners gaining awareness of the importance of certain aspects crucial to their practice, e.g. patient safety (Cottrell & Donaldson, 2013), their own attitudes (Lahti et al., 2016), relationships in patients' families (Tchernegovski et al., 2015), and the role of reflecting in the workplace (Sim & Radloff, 2008). Increased appreciation of the complexities of own clinical practice was mentioned in one study (Sim & Radloff, 2008) and two studies reported on learners gaining a better understanding of patients' needs (Lahti et al., 2016; Tchernegovski et al., 2015), including the importance of empowering parents of children who are patients (Tchernegovski et al., 2015).

Change in Attitudes

Changes in attitudes were reported in three studies (Lahti et al., 2016; Paliadelis et al., 2015; Sim & Radloff, 2008). Some authors observed that participants gained new ideas and insights into their own practice (Paliadelis et al., 2015) while others described increased positive attitude towards work and learning (Sim & Radloff, 2008) and reported on developing and maintaining an internal clinical work ethic (Lahti et al., 2016). In the latter study positive changes in learners' attitudes towards aggressive patients and a shift towards more collaborative and individualistic patient care were also observed (Lahti et al., 2016).

Enhanced Communication and Collaboration

Improved communication was mentioned in three studies and concerned better cooperation between practitioners and patients (Lahti et al., 2016), improved teamwork (Lahti et al., 2016) and enhanced collaboration with other health professionals (Marks et al., 2014). Other authors observed positive effects of the course on the wider team and workplace, and

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2
3 reported that on completion of their educational programme participants were more willing to
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5 share new ideas and solutions, engage colleagues in collaborative reflections and contribute
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7 towards departmental projects (Sim & Radloff, 2008).
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10 *Increased confidence, empowerment*

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13 Four papers reported increased confidence among course participants (Cottrell & Donaldson,
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15 2013; Marks et al., 2014; Sim & Radloff, 2008; Tchernegovski et al., 2015). One study found
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17 that the learners felt more reassured and well informed (Cottrell & Donaldson, 2013) and
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19 another mentioned empowerment and increased enthusiasm (Sim & Radloff, 2008). Some
20
21 findings highlighted how confidence translated to improved practice in offering
22
23 recommendations to patients (Marks et al., 2014), family-focused practice (Tchernegovski et
24
25 al., 2015) or safe transfusion practice (Cottrell & Donaldson, 2013). Two papers observed the
26
27 impact of increased confidence on willingness to try new roles, teach newly acquired skills to
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29 others (Marks et al., 2014), attempt new initiatives and actively seek new challenges at work
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31 (Sim & Radloff, 2008).
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37 *Change in practice*

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40 All papers reported on outcomes directly linked to change in practice (Cottrell & Donaldson,
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42 2013; Lahti et al., 2016; Marks et al., 2014; Sim & Radloff, 2008; Tchernegovski et al., 2015)
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44 or participants' expectation that their practice would improve following the course (Paliadelis
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46 et al., 2015). Some findings indicate more general improvements in the quality of work and a
47
48 more ethically advanced clinical approach, e.g. increased vigilance in practice (Cottrell &
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50 Donaldson, 2013), readiness to accept responsibility for outcomes (Marks et al., 2014) and
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52 take on a more proactive role with increased clinical responsibilities (Sim & Radloff, 2008),
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54 engaging in reflective practice (Sim & Radloff, 2008), and adopting evidence-based
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56 approaches to inform clinical decisions (Marks et al., 2014; Sim & Radloff, 2008).
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3 Other outcomes concerned more specific aspects of clinical practice, relevant in particular
4 health environments and communities of learners. In one study these effects included more
5 humane treatment of patients in psychiatric hospitals meaning reduction in the use of physical
6 restraints, more outdoor activities and involving patients in decision making (Lahti et al.,
7 2016). In another mental health-related study, participants were reported to have become
8 more family responsive, better equipped to assess the impact of mental illness on parenting
9 and child development and more willing to provide information and resources to families
10 (Tchernegovski et al., 2015). Another study reported improved patient-centred care and direct
11 benefits to patients in the form of more skilful interviews and medication reviews undertaken
12 by pharmacists (Marks et al., 2014).
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28 *Aspects of E-learning Programmes that contributed to Improvements in Practice*

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31 Authors of some of the included articles made attempts to establish what worked particularly
32 well in the programmes and identified factors that potentially led to the observed positive
33 outcomes. It should be acknowledged that, with one notable exception (Marks et al., 2014),
34 these recommendations were not direct responses to intended research questions but
35 originated in authors' reflections following the study.
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44 One study found that the course content stimulated deeper thinking and reflection, and that
45 these qualities led to practitioners being ready to take responsibility for driving their own
46 personal learning (Cottrell & Donaldson, 2013), while another concluded that enhanced
47 awareness of own attitudes was enabled by self-reflection exercises incorporated in the
48 course (Lahti et al., 2016). The benefits of using elements of storytelling in educational
49 materials were highlighted in one study (Paliadelis et al., 2015) which explained that the
50 learners not only enjoyed the programme and gained new insights, but also connected with
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3 the characters in the stories which presumably enhanced emotional involvement in the
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5 course.
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9 Just over half of the participants in one study (Sim & Radloff, 2008) continued reflecting on
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11 the literature and engaging in reflective practice in the workplace three months after the
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13 course. The authors attribute this effect to ‘transformative learning’ through the successful
14
15 use of online discussion forums and activities focused on evidence-based practice, which
16
17 encouraged participants to reflect on their own practice, contributed to the learners claiming
18
19 ownership of their development and led to their empowerment in the process. This enhanced
20
21 the learners’ confidence, enabled more critical reflection and allowed for new perspectives to
22
23 unfold, leading to exploration of professional boundaries and a more proactive role in the
24
25 workplace. The authors conclude that online learning can “bring about empowerment,
26
27 transformative learning and reflection outcomes that go beyond just mere acquisition of
28
29 clinical knowledge online” (Sim & Radloff, 2008: 12).
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34 The only study purposely designed to examine aspects of large-scale e-learning that
35
36 contributed to implementing changes in practice was a study looking at improving the skills
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38 of pharmacists in Canada (Marks et al., 2014). The paper reported that the changes observed
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40 were sustained one year after the course completion and the authors attributed these effects to
41
42 “internal motivation, a supportive work environment, and the practicality of the concepts
43
44 learned” (Marks et al., 2014: 7) rather than the course content or design alone. However, the
45
46 programme itself clearly facilitated the transfer of learning to practice. The authors describe
47
48 three factors emerging as most important to learners: 1) acquiring a vision of the targeted
49
50 outcomes and skills and ways of practicing, 2) support for transfer of learning and building
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52 confidence, 3) preparation for action and opportunities to reflect on practice. The paper
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54 concludes that online learning can facilitate practice-oriented outcomes and offers
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3 recommendations to course designers looking to achieve similar effects, reflecting the three
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5 factors mentioned above: supporting learners in developing identity as practitioners and
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7 sharing this experience with peers, providing “real-world tools and ‘how-tos’”, and offering
8
9 opportunities “to reflect on practice, set goals, and participate in low-risk, practice-at-work
10
11 activities” (Marks et al., 2014: 12)
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13 14 15 16 **Discussion**

17
18 In the current review we synthesised outcomes pertaining to behaviour change from six
19
20 studies examining the impact of large-scale online education programmes. This review adds a
21
22 new perspective to the synthesis of online education evidence to date and is an early
23
24 indication that large-scale online education has the potential to influence behaviour change of
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26 health and social care professionals and, consequently, change of practice.
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30 In our investigation we found, in line with another review (Sinclair et al., 2016), that the
31
32 majority of the e-learning-focused studies in the area of health and wellbeing to date
33
34 examined the attitudes of learners towards the online course, their experiences of learning, or
35
36 the acquisition of clinical skills through the course (Weiner et al., 2014; Ossiannilsson et al.,
37
38 2015; Bloomfield & Jones, 2013; Walsh et al., 2010; Fleet et al., 2011; Eaton-Spiva & Day,
39
40 2011). Assessment of the actual changes in practice was not commonly undertaken. A similar
41
42 observation was reported in an earlier review (Curran & Fleet, 2005) and, despite over a
43
44 decade having passed, challenges seem to remain in designing studies that would allow for
45
46 assessment of impact on behaviour and clinical practice.
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51 With a particular focus on large-scale e-learning, as a form of continuing professional
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53 development and not a part of formal undergraduate or postgraduate programmes, the current
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55 review differs from reviews previously undertaken in the area (McCutcheon et al., 2014;
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3 Sinclair et al., 2016; George et al., 2014; Lahti et al., 2014); these were predominantly
4
5 interested in knowledge improvement and learner satisfaction with exception of a recent
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7 review (Sinclair et al., 2016) examining the effectiveness of asynchronous e-learning on
8
9 clinicians' behaviour. This review concluded that e-learning was at least as effective as
10
11 traditional learning, and superior to no instruction at all in improving health care professional
12
13 behaviour. However, the asynchronous character of examined e-learning initiatives did not
14
15 allow for the observation of potential effects linked to social interaction during the course and
16
17 included courses were not necessarily of a large scale.
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21 The variation of the types of e-learning programmes and their focus in identified studies
22
23 meant that we were not able to draw generalisable conclusions or assess with certainty the
24
25 effectiveness of the large-scale online educational programmes for behaviour and practice
26
27 change. However, the included studies seemed to consistently indicate the positive influence
28
29 of online education on awareness, attitudes, communication, and confidence, with some
30
31 reports listing the actual changes in practice. These outcomes are known to be associated with
32
33 behaviour change (Kim & Hunter, 1993), in line with a number of theories of human
34
35 behaviour that recognise the role of multiple interrelated factors, including self-confidence,
36
37 self-efficacy, attitudes, emotions and social interaction (Perry et al., 1990; Godin & Kok,
38
39 1995; Prochaska et al., 1998).
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45 Some of the outcomes explored in our review were examined in other studies of e-learning
46
47 directed at health and social care practitioners, particularly confidence and related self-
48
49 efficacy. A recent PhD thesis confirmed the positive impact of an e-learning module on
50
51 perceptions and self-confidence of nurses in implementing family presence during
52
53 resuscitation of adults (Powers, 2014). In another investigation, an online course
54
55 incorporating asynchronous discussions with peers and a facilitator over a scheduled delivery
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3 period resulted in increased confidence of physicians taking part (Curran et al., 2010). Self-
4 efficacy was reported to have improved in a web-delivered education programme tailored for
5 public health nurses (Larsen & Zahner, 2011) and a facilitated online course was effective in
6 increasing community-based nutrition professionals' self-efficacy and collaboration (Stark et
7 al., 2011) – an outcome related to another of our findings.
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15 Due to infrequent exploration of the factors that led to changes in included papers, we were
16 not able to establish with consistency what particular aspects of large scale online learning
17 were successful in effecting behaviour and practice change. However, there are indications
18 that large-scale online education promotes self-reflection and this, in combination with
19 opportunities for real-life application of the concepts learned, enhances the likelihood of
20 behaviour and practice improvement. This finding is not surprising and in line with the wide-
21 researched and proven benefits of 'reflective practice' (Lowe et al., 2007; Mann et al., 2009;
22 Knight, 2015). What the current study adds, is the indication that these benefits might
23 potentially be achieved on a larger scale through online learning.
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36 We were not able to assess changes in patient outcomes, as the included studies did not
37 measure these. Sinclair et al. (2016) report similar difficulties with identifying research
38 reaching beyond practice change and into assessing the impact of professionals' learning on
39 their patients.
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46 *Strengths and limitations*

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49 This review was undertaken to inform the evaluation of two health-related MOOCs and was
50 therefore rapid in nature (Schunemann & Moja, 2015) and inevitably limited in scope. The
51 rapidity of this work did not, however, compromise its thoroughness and the review was
52 undertaken in a systematic way with constraints transparently reported. Certain methods
53 helped shorten the time needed for completion of the review, for example only one researcher
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3 was involved in the analysis of findings, formal quality assessment of included studies was
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5 not undertaken, and reference lists and grey literature were not consulted.
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9 Owing to small sample sizes and often insufficient information on how participants were
10
11 recruited, a potential selection bias in the included studies may exist, impacting inevitably on
12
13 the synthesis provided in the current report. The volume of empirical literature pertaining to
14
15 behaviour change through large-scale online education is modest and some of the studies
16
17 included in this review lacked the methodological rigour expected in more established areas
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19 of educational research. Given the rapid development of educational technology, and the
20
21 early stage of the corresponding field of research, an increase of quality in-depth research
22
23 projects can be expected.
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27 Despite the above limitations, the current review is, to our best knowledge, the first attempt
28
29 to systematically synthesise behaviour-related outcomes from evaluations of large scale
30
31 online education programmes aimed at health and social care professionals. Careful
32
33 consideration of inclusion/exclusion criteria illustrates the diverse focus of literature in the
34
35 area and may serve as a starting point for further work: for example, aiming to expand the
36
37 understanding of effects on behaviour in blended learning or online modules leading to
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39 academic degrees.
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42 43 ***Recommendations for further research*** 44

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46 The modest number of published studies examining the impacts of large-scale online
47
48 programmes on behaviour outcomes perhaps reflects the nature of this young field of
49
50 research. However, with rapidly growing number of health and wellbeing-related MOOCs,
51
52 more robust investigations into the potential of these courses to impact on clinical practice
53
54 are expected to be undertaken.
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3 The shortage of research in the area is not surprising given the increased difficulties in
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5 measuring behaviour change in large-scale online education in comparison to smaller or
6
7 localised programmes with potential for individual follow-up with learners. MOOCs offer
8
9 only limited opportunities for direct access to the learners' experiences over time. Any
10
11 measurement of behaviour change inevitably needs to be based on self-report and/or indirect
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13 accounts (of managers, for example), increasing the potential for bias. Limited opportunities
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15 for follow-up and typically short duration of online courses result in measurements of the
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17 practitioners' intention to change rather than the actual change of clinical practice (Weston et
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19 al., 2008; Kirkwood & Price, 2014). However, creative methodologies addressing the
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21 learners' personal experience and the collective experience of wider communities of learners,
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23 could allow for meaningful evaluations, which would potentially continue beyond the
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25 duration of the course itself. The NICE guideline for effective behaviour interventions
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27 (NICE, 2007) recognises the multimodality of health related human behaviour and
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29 recommends that researchers employ diverse methods to evaluate behaviour change
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31 interventions and "use embedded process evaluations that include the perspectives of
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33 recipients" (NICE, 2007: 29). Creative evaluation research is much needed for establishing
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35 the role of large-scale online education for practice change.
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41 NICE (2007) additionally highlight the role of support networks and relationships in shaping
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43 public health behaviours. MOOCs, by offering opportunities to interact with a large
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45 community of learners (fellow clinicians, carers and service users), enhance the feeling of
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47 belonging and, consequently, the likelihood of a real practice change. Chan et al. argue that
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49 online discussions enabled through constructivist MOOCs (cMOOCs) have particular
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51 relevance to health and social care professionals as they "might allow online communities to
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53 deal with messy, real-life problems that do not have clear answers" (Chan et al., 2015: 5).
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3 The role of education-focused online networks and communities including patients for
4 improvement of clinical practice should be examined in future research.
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9 In this review perspectives of learners and their managers were explored. Future research
10 could expand these insights by exploring the patient and lay person's perspective in
11 longitudinal qualitative studies. While the analysed studies focused on courses directed
12 specifically at groups of health professionals, there is a growing number of large-scale online
13 courses in the field of health and wellbeing with access open to the wider audience.
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19 Examining the effects of these programmes on the communities of both practitioners and
20 patients, and particularly on mutual understanding and cooperation, would be of particular
21 value to large-scale improvement projects reaching beyond a single health condition or
22 environment. Further research could also look into the area of collaborative learning (Chan et
23 al., 2015; MacNeill et al., 2014; Scales et al., 2011) and the role of networking for
24 strengthening professional identities and appreciating wider collaborations.
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34 Lastly, MOOCs and similar educational opportunities hold a promise of outcomes not yet
35 examined and perhaps not yet anticipated. Pioneering research in the area could explore these
36 emerging possibilities using creative methods and particularly utilising innovative ways of
37 engaging wider communities to establish the nature and scale of those undiscovered potential
38 impacts.
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49 **Conclusions**

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52 This review expands the current knowledge on the potential of large scale online education
53 programmes to effect behaviour change and enhances the growing understanding of how this
54 change may be achieved for health and social care professionals and, indirectly, for their
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3 patients and clients. Our findings suggest that large-scale online education could contribute to
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5 health and social care improvement initiatives and play an increasingly significant role in
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7 translating knowledge into practice. The factors contributing to sustainable practice
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9 improvement include: increased awareness, change in attitudes, improved communication,
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11 increased confidence and the actual changes applied in daily practice. Studies included in the
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13 current review seem to suggest that transformative learning is achievable through online
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15 education and highlight a plethora of observed benefits ranging from the learners gaining new
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17 insights into own practice, through feeling empowered to apply changes, to eventually being
18
19 able to provide more person-centred services to patients and willing to adopt and spread a
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21 more humane evidence-based practice. These insights should result in more conscious
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23 decisions in designing MOOCs aimed to improve health and social care practice.
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Figure 1: Search diagram.

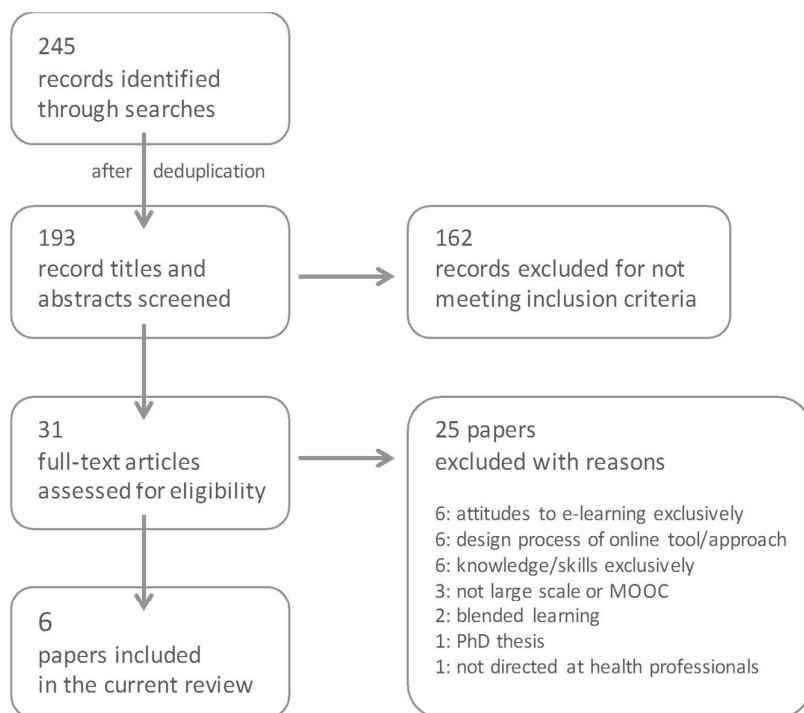


Table 1: Characteristics of included studies.

Reference	Course description	Institution offering the course	Study type	Participants	Setting	Theoretical basis for evaluation	Methods of evaluation / timing	Results reported	Authors' conclusions on what worked
Cottrell 2013	"Safe Transfusion Practice" e-learning programme (self-paced)	NHS Education for Scotland	qualitative phenomenology	<ul style="list-style-type: none"> registered and experienced nurses n=7 (of total population of 89 learners) 	<ul style="list-style-type: none"> Scotland (two District General Hospitals) 	(not reported)	<ul style="list-style-type: none"> semi-structured interviews thematic analysis using Colaizzi's framework timing: post course 	<ul style="list-style-type: none"> Increased awareness of safe transfusion practice, including potential risks to patients (5 participants) Reassurance (5 participants) Increased confidence in safe transfusion practice (1 participant) Higher order thinking and reflection of clinical practice (6 participants) More attention given to own clinical practice resulting in positive patient identification (5 participants) 	The course content stimulated higher order thinking and reflection of clinical practice and encouraged practitioners to take responsibility for driving their own personal learning.
Lahti 2015	e-learning continuing education course (ePsychNurse .Net) intended to enable nurses to manage distressed and disturbed patients in psychiatric hospitals (3–6 months)	(not clear, nationwide in Finland)	qualitative descriptive design	<ul style="list-style-type: none"> nursing managers n=28 	<ul style="list-style-type: none"> Finland (six psychiatric hospital districts and nine psychiatric hospitals) 	Kirkpatrick's four-level evaluation model	<ul style="list-style-type: none"> structured, open-ended questionnaire (completed by nursing managers) inductive content analysis timing: post course 	<ul style="list-style-type: none"> Increased awareness of own attitudes More positive attitudes toward aggressive patients; more individualistic and collaborative attitudes toward patient care Better understanding of patients' needs and more humane treatment: reduction in the use of coercive methods, more willingness to use alternative methods instead of physical restraints and readiness to anticipate aggressive situations Improved cooperation with patients: more outdoor activities and involving patients in decision making Better cooperation among nurses: improved debriefing and teamwork, increased readiness to develop and maintain an internal clinical work ethic 	Awareness of own attitudes was achieved through self-reflection exercises.
Marks 2014	online continuing professional education (CPE) course for practicing pharmacists in Canada: "ADAPT - ADapting pharmacists' skills and Approaches to maximize Patients' drug Therapy effectiveness" (18 weeks)	(not clear, nationwide in Canada)	qualitative case study	<ul style="list-style-type: none"> practicing pharmacists n=? (of total population of 86 learners) 	<ul style="list-style-type: none"> Canada (pharmacists in community pharmacies, clinics, hospitals, and nursing homes) 	(not reported)	<ul style="list-style-type: none"> 1) focus groups (n=12), 2) semi-structured telephone interviews (n=10), 3) pre-interview online survey (n=10); study participants' Action Plans, submitted as part of their course work (n=49) used to verify the themes emerging from the primary sources of data consensus coding process timing: post course (focus groups) and 12 months post course (interviews and survey) 	<ul style="list-style-type: none"> Changes to direct patient care in the areas of: interviewing patients, conducting medication reviews, making evidence-based decisions, conducting patient-centred care, and accepting responsibility for outcomes Enhanced communication skills: more systematic, concise, or frequent communication with other health-care professionals Increased confidence to offer recommendations about patient care, to branch out to new roles and services, to collaborate with other health-care professionals, and to teach newly acquired skills to others Improved interprofessional collaboration skills: better collaboration with other health-care professionals 	Participants reported that the changes they had made in their practice were sustained one year after the course due to internal motivation, a supportive work environment, and the practicality of the concepts learned. Three factors emerged as being important to learners in facilitating transfer of learning to practice: 1) acquiring a vision of the targeted outcomes and skills, 2) support for transfer of learning, and 3) preparation for action.

Paliadelis 2015	interprofessional e-learning program that, via a storytelling model, supports the professional development of students and their clinical supervisors (self-paced)	Health Workforce Australia (HWA)	qualitative	<ul style="list-style-type: none"> students and clinical supervisors (nursing, medicine, social work and pharmacy) n=? (of total population of 284 learners) 	<ul style="list-style-type: none"> Australia (a large rural area of northern New South Wales) 	(not reported)	<ul style="list-style-type: none"> five open-text evaluative questions (including whether what participants learned might improve their practice); reflective and evaluative comments made on the forums (170 postings evaluated) secondary analysis of data timing: post course 	<ul style="list-style-type: none"> Recognition of gaining new insights into practice (80% participants) Expectation that the course would improve practice (74% participants) 	As well as enjoying the programme, the learners really 'connected' with the characters in the stories.
Sim 2008	CPD online module to increase radiation therapists' knowledge in planning for radiation therapy for the breast by engaging in reflective practice (13 weeks)	(not clear)	action research (quantitative and qualitative elements)	<ul style="list-style-type: none"> radiation therapists n=26 	<ul style="list-style-type: none"> Australia, New Zealand and Canada 	Kirkpatrick's four-level evaluation model Boud's reflective model	<ul style="list-style-type: none"> Workplace Survey (completed by supervisors), 3-month post module survey, EBP assignments, postings at discussion forums, participants' learning portfolio Henri's thematic unit of analysis timing: pre, post course and 3 months post course (survey) 	<ul style="list-style-type: none"> Empowerment as a result of participating in the course (24 participants), added confidence in attempting new initiatives in the workplace, assuming a more proactive role and increased clinical responsibilities Changes in practice: appreciation of the complexities of radiation therapy planning, engaging in literature search, actively seeking new challenges at work Positive impact on workplace: increased enthusiasm and displaying a more positive attitude towards learning, willingness to share new ideas and solutions, willingness and ability to contribute towards departmental projects Increased awareness and understanding of the importance of reflecting in the workplace, engaging colleagues in collaborative reflections and adopting evidence-based approaches in advancing clinical practices 	Reflection on the literature and engaging in reflective practice in the workplace was sustained 3 months after the course (53% participants). Providing opportunities for participants to reflect on their workplace contribution and to claim ownership of their learning allows them to be empowered in the process. Armed with newfound confidence and changed perspective, participants began pushing their professional boundary and started to assume a more proactive role in the workplace.
Tchernegovski 2015	"Let's Talk about Children" e-learning resource to provide clinicians with skills to empower parents to support their family (self-paced)	The Australian Children of Parents with a Mental Illness (COPMI) national initiative	sequential mixed-method design	<ul style="list-style-type: none"> mental health clinicians (primarily nurses, social workers, and psychologists) n=21 	<ul style="list-style-type: none"> Australia 	(not reported)	<ul style="list-style-type: none"> Family-Focused Workforce Questionnaire pre- and post-training (n=21), supplemented by post-training interviews (n=8) thematic content analysis timing: pre, post course and 2 months post course (survey and interviews) 	<ul style="list-style-type: none"> Significant changes for subscales measuring Family and Parenting Support, Assessing Impact on the Child, Connectedness and Parenting and Mental Illness Changes in practice: participants becoming more family responsive, willing to assess the impact of mental illness on parenting and child development and provide information and resources to families Increased awareness of the relationships among parent psychopathology, parenting, and the impacts on children Increased confidence in the use of family-focused practices Increased awareness: recognising the importance of empowering parents 	(not reported)

Table 2: Behaviour and practice related outcomes reported in included studies.

Outcomes	Studies	Examples
Increased awareness	Cottrell 2013	<ul style="list-style-type: none"> • awareness of safe transfusion practice, importance of positive patient identification and potential risks to patients
	Lahti 2015	<ul style="list-style-type: none"> • better understanding of patients' needs • awareness of own attitudes
	Sim 2008	<ul style="list-style-type: none"> • awareness and understanding of the importance of reflecting in the workplace • appreciation of the complexities of radiation therapy planning
	Tchernegovski 2015	<ul style="list-style-type: none"> • awareness of the relationships among parent psychopathology, parenting, and the impacts on children • recognising the importance of empowering parents
Change in attitudes	Lahti 2015	<ul style="list-style-type: none"> • attitudes toward aggressive patients became more positive and attitudes toward patient care more individualistic and collaborative • more positive attitude towards developing and maintaining an internal clinical work ethic
	Paliadelis 2015	<ul style="list-style-type: none"> • new ideas and insights into practice
	Sim 2008	<ul style="list-style-type: none"> • increased positive attitude towards work and learning
Enhanced communication and collaboration	Lahti 2015	<ul style="list-style-type: none"> • better cooperation among nurses: more systematic debriefing and improved teamwork • better cooperation between patients and nurses
	Marks 2014	<ul style="list-style-type: none"> • more systematic, concise, or frequent communication and improved collaboration with other health-care professionals
	Sim 2008	<ul style="list-style-type: none"> • impact on the workplace: willingness to share new ideas and solutions, engaging colleagues in collaborative reflections, assisting with online searches • willingness and ability to contribute towards departmental projects
Increased confidence, empowerment	Cottrell 2013	<ul style="list-style-type: none"> • confidence in safe transfusion practice • feeling of being reassured and more informed
	Marks 2014	<ul style="list-style-type: none"> • greater confidence to offer recommendations about patient care, to branch out to new roles and services, to collaborate with other health-care professionals, and to teach newly acquired skills to others
	Sim 2008	<ul style="list-style-type: none"> • empowerment and more enthusiasm • added confidence in attempting new initiatives in a workplace, actively seeking new challenges at work
	Tchernegovski 2015	<ul style="list-style-type: none"> • feeling more confident to use family-focused practices in the future
Change in practice	Cottrell 2013	<ul style="list-style-type: none"> • more vigilance and attention in practice
	Lahti 2015	<ul style="list-style-type: none"> • more humane treatment of patients: reduction in the use of coercive methods, more willingness to use alternative methods instead of physical restraints and readiness to anticipate aggressive situations • improved patient treatment: more outdoor activities and involving patients in decision making
	Marks 2014	<ul style="list-style-type: none"> • changes to direct patient care in areas of: interviewing patients, conducting medication reviews, making evidence-based decisions, conducting patient-centred care, and accepting responsibility for outcomes
	Paliadelis 2015	<ul style="list-style-type: none"> • expectation that the course will improve practice
	Sim 2008	<ul style="list-style-type: none"> • continued reflection on the literature and engaging in reflective practice in the workplace • assuming a more proactive role and increased clinical responsibilities • adopting evidence-based approaches in advancing clinical practices
	Tchernegovski 2015	<ul style="list-style-type: none"> • being more family responsive, better assessing the impact of mental illness on parenting and child development, and providing information and resources to families

Appendix

Search string

S1: large scale education OR MOOC OR massive open online course OR massive course OR open education OR e-learning OR elearning OR online learning OR distant learning OR online education OR distant education

S2: health OR wellbeing OR well being OR well-being OR car* OR compassion OR inequalit* OR medical OR social OR practic* OR clinic*

S3: behaviour* OR behavior* OR chang* OR attitude OR perception OR belie* OR act*OR practic* OR clinic* OR experience

S4: S1 AND S2 AND S3