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REVIEW

Learning Outcomes from Participation in Student-Run Health Clinics: A Systematic Review

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Abstract: Student-run clinics (SRCs) offer unique opportunities for students to engage in healthcare delivery, but the student learning outcomes of such clinics have not yet been systematically examined in a comprehensive manner. The purpose of this review was to appraise and synthesize existing literature pertaining to student learning outcomes associated with participation in SRCs. A systematic review was undertaken using PubMed, CINAHL, and Web of Science databases. The quality of articles that met inclusion criteria articles was appraised using the Mixed Methods Appraisal Tool (MMAT). Study details, such as learning outcomes, were also extracted. Ninety-two studies met inclusion criteria. Most studies were conducted in North America (n = 73, 79.3%), and related to clinics involving solely medical students (n = 35, 38.0%) or multi-professional clinics (n = 34, 37.0%). Demonstrated learning outcomes of SRC participation include clinical skills, interprofessional skills, empathy/compassion for underserved patients, and leadership. SRC participation had little apparent impact on students' future career directions. Quality appraisal via the MMAT found mixed levels of research quality amongst reviewed studies. In summary, while SRC participation appears to offer benefits for student learning, improved study design and research outside of North American contexts would further advance knowledge.

Keywords: healthcare, undergraduate education, interprofessional education, multidisciplinary research, health workforce, student-led clinics, student-run, student-assisted

Introduction

A variety of skills and competencies require development as a part of the formal education of health professionals. Experiences outside the traditional classroom and placement settings in student-run clinics (SRCs), also referred to as student-led and/or student-assisted clinics, offer students the opportunity to gain early clinical and leadership experience via direct engagement in healthcare delivery.[1] Some argue that such student-led service-learning should be a required component of health professional's education.[2]

Understanding the learning outcomes which students achieve from participation is of obvious importance for those involved in SRCs and may have policy and program implications. Previous reviews have focused on students' experiences and perceptions of participating in student-run clinics (SRCs),[3] and the educational or learning outcomes of SRCs have also been the topic of systematic[4] and rapid reviews.[5] While these reviews offer valuable insight, they are dated and focus solely on entry-level students or interprofessional SRCs, respectively. The literature concerning the learning benefits associated with student involvement in all types of SRCs has not previously been systematically assessed.

Thus, the purpose of this systematic review is to systematically appraise and synthesize the literature concerning the learning outcomes of student involvement in SRCs. It seeks to address the following questions. First, what learning

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outcomes can students acquire by participating in SRCs? Second, what is the quality of the existing literature on this topic? To answer these questions, we adopt the broadest possible inclusion criteria to encompass SRCs regardless of geographic location, professions, or level of study.

Methods

This systematic review was undertaken in line with the quality guidance of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol.[6] A comprehensive search strategy and selection process identified original research relating to student participation in SRCs.

Search Process

A systematic search was conducted in October 2022 using queries developed for several databases, including PubMed (MEDLINE), CINAHL (EBSCOHost), and Web of Science (Clarivate). Search strategies were developed in conjunction with a librarian. Three search term groups were included in search strategies. The first used terms concerning college/university/higher education. The second included the term student, and similar terms, along with "run" or "led" to specify the target population in addition to the context. Finally, the third used terms relating to clinics. The search was restricted to English-language studies only. Full search strategies are provided in Appendix A.

Source Selection

Following the database search, sources were aggregated within reference management software (EndNote X9.3.3, Clarivate, London, UK). Next, duplicates were removed using The Systematic Review Assistant-Deduplication Module (SRA-DM), a program shown to reliably remove duplicate records with excellent sensitivity and specificity.[7] Remaining duplicates were removed using the EndNote software de-duplication function,[8] as well as manually during abstract and title screening which was managed through the web application Rayyan QCRI.[9]

Source selection was guided by the inclusion and exclusion criteria detailed in Table 1. Criteria were established to acquire a comprehensive list of sources empirically measuring the learning outcomes of SRCs. Although only research published in English was considered for inclusion, no restrictions were placed on location, discipline, or date of publication.

Data Extraction and Analyses

Data from each source that met inclusion criteria were extracted into Microsoft Excel (Microsoft Corporation, Redmond WA, version 16.60). Three authors (OW, PB, and ET) extracted source characteristics details (author name, year of publication, study location, study design, sample characteristics), and all authors appraised sources independently, with each source appraised by at least two authors. Discrepancies or uncertainties were then discussed and resolved by OW, PB, and ET. Given the heterogeneity in study approaches, sources were appraised using the Mixed Methods Appraisal Tool (MMAT).[10] Educational and learning outcome categories were identified and extracted during the full-text review, and consolidated into broad categories for reporting purposes.

Table 1 Inclusion/Exclusion Criteria

Criterion	Inclusion	Exclusion
Population	Students	Non-students/professionals
Setting	Student-run clinic	Clinic where students were not integrally engaged in leading healthcare delivery
Study design	Empirical	Narrative
Outcome	Assessed student educational outcomes	Did not assess student educational outcomes
Source type	Peer-reviewed publications, dissertations, and theses	Conference abstracts and proceedings, editorials, commentaries, letters to editor, reviews

Descriptive statistics to accompany a narrative analysis of learning outcomes were computed using Microsoft Excel.

Results

Initial searches retrieved 651 sources after deduplication. Sources were screened at the level of title and abstract followed by a full-text review of 266 sources. An additional 23 sources were identified beyond those identified via the database

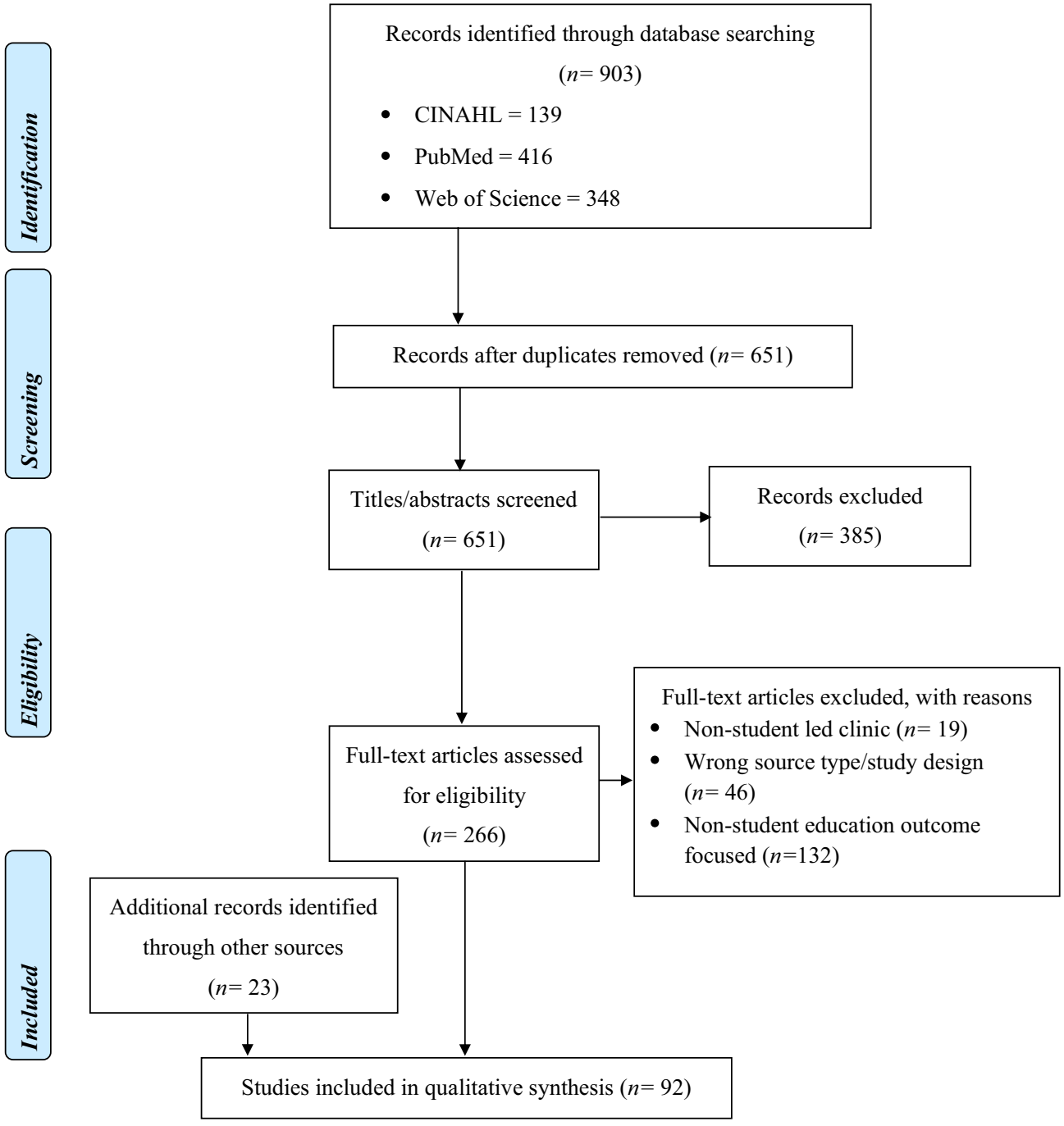

Figure 1 Study Flow Diagram.
Notes: Adapted from Moher D, Liberati A, Tetzlaff J, Altman D. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097. doi:10.1371/journal.pmed.1000097.[6]

searches. Ultimately, 92 sources were underwent data extraction and synthesis. Figure 1 details the flow of sources through the review process, according to PRISMA guidelines.[6]

Study Characteristics

Study characteristics are displayed in Table 2. Most concerned SRCs in the United States (U.S.) (n = 63, 68.5%), with several in Canada (n = 10, 10.9%), a few in Australia (n = 6, 6.5%), three in The Netherlands (n = 3, 3.2%), two each in Ireland (n = 2, 2.2%), South Africa (n = 2, 2.2%), and Sweden (n = 2, 2.2%) and one each in Brazil, New Zealand, Singapore, and the United Kingdom. The most common type of student sampled was medical (n = 35, 38.0%), followed by an interprofessional group (n = 34, 36.9%), pharmacy (n = 8, 8.7%), physical therapy (n = 7, 7.6%), nursing students (n = 3, 3.3%), with single studies involving dentistry, occupational therapy, osteopathy, physician assistant and midwifery students. The most common design was retrospective (n = 61, 66.3%). Prospective studies, including one intervention (n = 25, 27.2%) were the next most common, with the remaining six cross-sectional (6.5%). Quantitative methods were the most common data collection method (n = 39, 42.4%), while 27 studies (29.3%) used mixed-methods, and 27 (28.3%) employed qualitative techniques such as focus groups, one-on-one interviews, and open-ended/free-text response survey questions.

Table 2 Qualitative Study Appraisal

Author	Data Collection Methods	S1	S2	1.1	1.2	1.3	1.4	1.5
Ablinsson et al (2019)[40]	SS group interviews	✓	✓	✓	✓	✓	✓	✓
Abrey et al (2022)[48]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Ambrose et al (2015)[38]	Open-ended questions	✓	✓	✓	✓	✓	?	?
Batra et al (2009)[25]	Written reflections	✓	✓	✓	?	?	✓	?
Bostick (2014)[69]	Focus groups	✓	✓	✓	✓	✓	✓	✓
Campbell et al (2013)[23]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Chen et al (2014)[26]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Frakes et al (2014)[39]	Structured interview	✓	✓	✓	✓	✓	X	?
Frie et al (2021)[62]	Open-ended questions	✓	✓	✓	✓	✓	✓	✓
Guirguis et al (2011)[80]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Hamilton (2020)[41]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Hand et al (2018)[28]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Housely et al (2018)[76]	Reflection statements	✓	✓	✓	✓	✓	✓	✓
Huang et al (2021)[55]	SS Focus groups	✓	✓	✓	✓	✓	✓	✓
Johnston et al (2020)[59]	Focus groups	✓	✓	✓	✓	✓	✓	✓
Ko et al (2019)[83]	Reflective essay	✓	✓	✓	✓	X	X	X
Lamsam (1999)[29]	Open-ended questions	?	?	?	?	?	X	X
Lie et al (2016)[30]	Focus groups	✓	✓	✓	✓	✓	✓	✓
Lysak et al (2018)[64]	Focus groups	✓	✓	✓	✓	?	X	?
Ng et al (2020)[57]	Focus groups	✓	✓	✓	✓	✓	✓	✓
O'Connor et al (2018)[58]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Passmore et al (2016)[72]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Ross et al (2022)[52]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Sakamoto (2022)[53]	SS one-on-one interviews	✓	✓	✓	✓	✓	✓	✓
Scott et al (2015)[96]	Open-ended questions	✓	✓	✓	?	✓	X	✓
Stickler et al (2013)[42]	Focus groups	✓	✓	✓	✓	✓	✓	✓

Notes: SS=Semi-structured; S1=Are research question(s) clear?; S2=Is data collection appropriate to answer research question(s)?; 1.1=Is qualitative approach appropriate to answer research question(s)?; 1.2=Is qualitative data collection approach appropriate to answer research question(s)?; 1.3=Are findings adequately derived from data?; 1.4=Does data interpretation substantiate results?; 1.5=Is there coherence between qualitative data sources, collection, analyses, and interpretation?; ✓=Yes; X=No; ?=Unclear.

Study Quality

The Mixed Methods Appraisal Tool is a critical appraisal tool/checklist intended to be used to assess the quality of studies included in systematic reviews combining qualitative, quantitative and mixed-methods studies. MMAT assessment showed that all but eight included studies had a clear research question and collected relevant data. The 26 located qualitative studies (Table 2) used a range of methodological approaches and analytical techniques in collecting data (10 involved semi-structured one-on-one interviews, 7 focus groups, 3 reflections, 4 open-ended survey questions and 2 structured interviews). Most qualitative studies (n = 22) adequately derived findings from the qualitative data collected, but six did not adequately substantiate results with data interpretation.

There were 39 quantitative studies, of which almost all collected data via survey (n = 34), less often used quantitative methods included reviewing academic records (n = 5) or analyses of medical files (n = 1). Twenty quantitative studies may be characterised as descriptive, whereby data related to student outcomes was measured only within one group. Most such studies (n = 12) lacked one or more MMAT methodological quality criteria for these types of study (Table 3). A further 19 quantitative studies were non-randomised studies, where outcomes in a student cohort participating in SRCs were compared to a non-participating comparator group. When assessed against criteria outlined in the MMAT, non-randomized studies generally used appropriate measurements (n = 12), had complete outcome data (n = 18), and delivered the intervention as intended (n = 19). However, clarity was lacking and several in particular did not account for confounders (factors that may account for both the learning outcomes observed and the relative likelihood of participating in voluntary SRCs).[11–19] It seems apparent that students who participate in such clinics – even within the same program of study – are likely to have somewhat different characteristics from those who do not, and such studies should seek to account for these differences.

Of the 27 mixed-methods studies (ie, those which adopted both quantitative and qualitative data collection methods) all collected quantitative data via survey, but there was greater variation in qualitative data collection, mostly open-ended survey questions (n = 17) but others via interviews (n = 6), focus groups (n = 3), or student reflections (n = 3). In terms of quality, most mixed-methods studies (n = 26) articulated a clear research question and adopted an appropriate approach to collect data, but just two provided a clear rationale for adopting a mixed-methods approach.[20,21] Only one clearly demonstrated all mixed-methods MMAT quality criteria (Table 4).

Student Learning Outcomes

Clinical skills were the most common learning outcome reported to stem from participation in a SRC (n = 52), see Table 5. Participation provided the opportunity to practice, experience, and gain confidence applying clinical skills.[11,22–59] Students improve interpersonal skills, including interpersonal communication skills,[17,27–29,48,50,60–62] patient interaction relationship skills,[19,40,42,43,63,64] team work,[60] and experience and comfort managing language barriers (eg, interacting with patients for whom English is not their first language).[65–67] Professionalism, including professional skills and competency,[29,31,68–70] and autonomy/responsibility (including professional responsibility) are developed too.[22,40,42,59,68,71] Other arguably clinically relevant learning outcomes included awareness of personal strengths and weaknesses,[42] and the importance of self-advocacy.[30]

The next most common reported learning outcome pertained to interprofessional skills (n = 40),[27,36,37,39,44,56] including experience working in an interprofessional/interdisciplinary environment/team,[17,33,35,36,59,64,66,70,72–75] teamwork and interprofessional communication,[16,21,41,42,61,76–79] and improved understanding and appreciation of interprofessional roles.[21,30,55,79–83] Greater confidence collaborating with community organisations was also reported as a learning outcome in one study.[22] Although most relevant studies found SRC participation was associated with improved interprofessional skills, it should be noted that a number[17,35,78,82] found more limited or qualified impacts in this area.

The third most frequently reported learning outcome associated with SRC participation revolved around empathy/compassion for underserved individuals (n = 34),[15,18,25,27–29,42,53,55,57,59,62,75,83–87] in particular improving attitudes towards,[15,18,25,28,34,88] as well as awareness and understanding and of the needs and social reality of, the underserved.[19,22,29,31,35,36,55,57,59,60,62,66,68,70,75,76,82,84,86,89–92] Though one study reported no change in overall attitudes towards homeless patients.[93] Finally, improved skills working with indigenous populations were noted as a learning outcome in one study.[94]

Table 3 Quantitative Study Appraisal

Author	Data collection methods	S1	S2	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5
Non-randomized study													
Brown et al (2017)[13]	Survey	✓	✓	X	✓	✓	X	✓					
Campos-Outcalt (1985)[14]	Analyses of medical files	?	?	✓	✓	✓	X	✓					
Enich et al (2021)[15]	Survey	✓	✓	?	✓	✓	X	✓					
Geelhoed et al (2019)[93]	Survey	✓	✓	✓	✓	✓	✓	✓					
Kersbergen et al (2022)[16]	Survey	✓	✓	?	✓	X	X	✓					
Kovalskiy et al (2017)[17]	Survey	✓	✓	?	✓	✓	X	✓					
Lee et al (2017)[74]	Survey	✓	✓	✓	✓	✓	✓	✓					
Mazori et al (2019)[67]	Survey	?	?	?	✓	✓	✓	✓					
Mercadante et al (2021)[18]	Survey	✓	✓	✓	✓	✓	X	✓					
Modi et al (2017)[85]	Survey	✓	✓	✓	✓	✓	✓	✓					
Morello et al (2010)[19]	Survey	?	?	?	✓	✓	X	✓					
Moseley et al (2022)[11]	Survey	✓	✓	?	✓	✓	X	✓					
Nakamura et al (2014)[45]	Survey	✓	✓	?	✓	✓	✓	✓					
Seif et al (2013)[44]	Survey	✓	X	✓	X	✓	✓	✓					
Sick et al (2014)[37]	Survey	✓	✓	✓	✓	X	✓	✓					
Sick et al (2017)[88]	Survey	✓	✓	✓	✓	✓	✓	✓					
Stoddard et al (2011)[95]	Academic record review	✓	✓	✓	✓	✓	✓	✓					
Tang et al (2022)[12]	Academic record review	✓	✓	✓	✓	✓	X	✓					
Thomson et al (2022)[101]	Academic record review	✓	✓	?	✓	✓	✓	✓					
Descriptive													
Abrão et al (2008)[43]	Survey	X	X						?	?	?	?	?
Adel et al (2021)[49]	Academic record review	✓	✓						✓	✓	✓	✓	✓
Dekker et al (2015)[71]	Survey	✓	✓						?	?	✓	?	✓
Diaz et al (2016)[65]	Survey	✓	✓						✓	✓	✓	✓	✓
Drummond et al (2021)[54]	Survey	✓	✓						?	?	✓	?	✓
Forg et al (2020)[87]	Survey	✓	✓						?	?	✓	✓	✓
Godoshian et al (2019)[92]	Survey	✓	✓						✓	✓	✓	✓	✓
Heller et al (2019)[100]	Survey	✓	✓						?	?	X	?	✓
Mishan et al (2017)[32]	Survey	✓	✓						✓	✓	✓	✓	✓
Mohammed et al (2018)[33]	Survey	✓	✓						✓	?	✓	?	✓
Murzl et al (2017)[90]	Survey	?	?						?	?	✓	?	X
Pozdnyakova et al (2019)[46]	Survey	✓	✓						✓	✓	✓	✓	✓
Schweitzer (2012)[34]	Survey	✓	✓						✓	✓	✓	?	✓
Shrader et al (2010)[81]	Survey	✓	✓						✓	?	✓	?	✓
Simmons et al (2019)[73]	Survey	✓	✓						✓	✓	✓	✓	✓
Simon et al (2019)[82]	Survey	✓	✓						✓	✓	✓	✓	X
Stephens et al (2015)[36]	Survey	✓	✓						✓	?	✓	X	✓
Vaikunth et al (2014)[98]	Academic record review	✓	✓						✓	✓	✓	✓	✓
Wee et al (2010)[60]	Survey	✓	✓						✓	✓	✓	✓	✓
Wees et al (2022)[51]	Survey	✓	✓						?	?	?	?	?

Notes: S1=Are research question(s) clear?; S2=Is data collection appropriate to answer research question(s)?; 3.1=Are participants representative of target population?; 3.2=Are measurements appropriate?; 3.3=Is outcome data complete?; 3.4=Are confounders accounted for in design and analyses?; 3.5=Is intervention delivered as intended?; 4.1=Is sampling strategy relevant?; 4.2=Is sample representative of target population?; 4.3=Are measurements appropriate?; 4.4=Is risk of response bias low?; 4.5=Are statistical analyses appropriate?✓=Yes; X=No; ?=Unclear.

Leadership was another commonly reported outcome (n = 15). In particular, SRC participation was consistently found to benefit student's capacity to lead, including gaining leadership experience and developing leadership skills,[30,33,41,58,60,62,75,95,96] as well as experience and confidence teaching other students (ie, peer teaching).[20,36,56,59,97]

Table 4 Mixed Methods Study Appraisal

Author	Qualitative data collection method/s	S1	S2	1.1	1.2	1.3	1.4	1.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Non-randomized trial																							
Caratelli et al (2020)[77]	Reflective essay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						X	✓	✓	?	?
Chen et al (2021)[86]	OEQ	✓	✓	?	?	✓	✓	✓	?	✓	✓	X	✓						X	X	X	X	X
Feldman et al (2018)[99]	OEQ	✓	✓	?	?	?	?	?	?	✓	✓	?	✓						X	X	X	X	X
Fröberg et al (2018)[47]	Interviews (supervisors)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						X	X	X	X	✓
Schutte et al (2017)[61]	OEQ, written feedback	✓	✓	?	?	?	?	?	✓	✓	✓	✓	✓						X	X	X	X	X
Shabbir et al (2015)[89]	Written feedback	✓	✓	X	X	X	X	X	?	✓	✓	X	✓						X	X	X	X	X
Sheu et al (2012)[102]	OEQ	✓	✓	✓	✓	✓	✓	✓	?	✓	✓	✓	✓						X	✓	✓	✓	✓
Descriptive																							
Bennard et al (2004)[22]	Interviews (students), OEQ	X	?	?	?	?	?	?						?	✓	✓	✓	?	X	?	✓	?	X
Borges et al (2007)[24]	OEQ	✓	✓	X	X	X	✓	X						✓	✓	✓	✓	✓	X	X	X	✓	X
Chopra et al (2020)[20]	Optional one-on-one interview (students)	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Christensen et al (2013)[27]	OEQ	✓	✓	✓	✓	X	X	X						✓	?	✓	?	✓	X	X	X	X	X
Clark et al (2003)[84]	Reflection	✓	✓	✓	✓	✓	X	X						✓	✓	✓	?	✓	X	X	X	X	X
George et al (2017)[68]	OEQ	✓	✓	✓	✓	✓	✓	✓						?	?	✓	?	✓	X	X	X	X	X
Gilkey et al (2006)[78]	OEQ	✓	✓	✓	✓	✓	✓	✓						✓	?	✓	?	✓	X	✓	✓	✓	?
Gustaffson et al (2016)[79]	Semi-structured focus group	✓	✓	✓	✓	✓	✓	?						✓	?	✓	X	✓	X	X	X	✓	X
Hamso et al (2012)[97]	One-on-one interviews, focus groups (students)	✓	✓	✓	✓	✓	✓	✓						✓	?	✓	X	✓	?	✓	✓	✓	?
Hefford et al (2021)[50]	OEQ	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓	X	✓	✓	✓	X

(*Continued*)

Table 4 (Continued).

Author	Qualitative data collection method/s	S1	S2	1.1	1.2	1.3	1.4	1.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Hill et al (2017)[94]	Interviews (students)	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	?	✓	X	✓	✓	✓	✓
Hu et al (2018)[66]	OEQ	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	?	✓	X	✓	✓	✓	✓
Kavannagh et al (2015)[70]	Written reflection	✓	✓	✓	✓	✓	?	✓						?	?	✓	?	X	X	X	X	X	X
McQuillan et al (2017)[31]	OEQ	✓	✓	✓	?	X	?	X						?	?	✓	?	✓	X	✓	X	✓	X
O'Brien et al (2013)[21]	OEQ	✓	✓	✓	✓	✓	X	✓						?	?	✓	?	✓	✓	✓	✓	✓	X
Paparella-Pitzel et al (2021)[56]	OEQ	✓	✓	✓	✓	✓	✓	✓						✓	?	✓	?	✓	X	✓	✓	✓	X
Pennington et al (2016)[63]	OEQ	✓	✓	✓	?	✓	X	X						✓	?	✓	X	✓	X	X	X	X	X
Rockey et al (2021)[75]	Interviews/focus groups	✓	✓	✓	✓	✓	✓	✓						✓	?	✓	?	✓	X	✓	✓	✓	X
Sheu et al (2011)[35]	OEQ	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓	?	✓	X	✓	✓	✓	✓
Simmons et al (2009)[91]	OEQ	✓	✓	✓	✓	X	X	X						✓	✓	✓	?	✓	X	X	X	X	X

Notes: All quantitative data were collected using surveys; OEQ=Open-ended/text questions; S1=Are research question(s) clear?; S2=Is data collection appropriate to answer research question(s)?; 1.1=Is qualitative approach appropriate to answer research question(s)?; 1.2=Is qualitative data collection approach appropriate to answer research question(s)?; 1.3=Are findings adequately derived from data?; 1.4=Does data interpretation substantiate results?; 1.5=Is there coherence between qualitative data sources, collection, analyses, and interpretation?; 3.1=Are participants representative of target population?; 3.2=Are measurements appropriate?; 3.3=Is outcome data complete?; 3.4=Are confounders accounted for in design and analyses?; 3.5=Is intervention delivered as intended?; 4.1=Is sampling strategy relevant?; 4.2=Is sample representative of target population?; 4.3=Are measurements appropriate?; 4.4=Is risk of response bias low?; 4.5=Are statistical analyses appropriate?; 5.1=Is rationale for using mixed-methods approach adequate; 5.2=Is integration of different components to answer research question(s) effective?; 5.3=Is interpretation of integrated components adequate?; 5.4=Are divergences and inconsistencies of components adequately addressed?; 5.5=Do components adhere to respective quality criteria?; ✓=Yes; X=No; ?=Unclear.

Table 5 Study Characteristics and Student Learning Outcomes

Author	Location	Profession	Design	Student Learning Outcomes				
				Clinical Skills	Leadership	Empathy for Underserved	Interprofessional Skills	Career Interest
Qualitative								
Ablinson et al (2019)[40]	Sweden	MED	XS	✓				
Abrey et al (2022)[48]	Australia	OST	RET	✓				
Ambrose et al (2015)[38]	Canada	INT	RET	✓	✓	✓	✓	
Batra et al (2009)[25]	U.S.	NURS	RET	✓		✓		✓ (UND)
Bostick (2014)[69]	Canada	INT	RET	✓				
Campbell et al (2013)[23]	Canada	INT	XS	✓				
Chen et al (2014)[26]	U.S.	MID	RET	✓				
Frakes et al (2014)[39]	Australia	INT	RET				✓	
Frie et al (2021)[62]	U.S.	NURS	REY	✓	✓	✓	✓	
Guirguis et al (2011)[80]	Canada	PHAR	RET				✓	
Hamilton (2020)[41]	Australia	MED	RET	✓	✓			
Hand et al (2018)[28]	U.S.	INT	RET	✓		✓		
Housley et al (2018)[76]	U.S.	PHAR	RET					✓ (UND)
Huang et al (2021)[55]	Canada	INT	PROS	✓		✓	✓	
Johnston et al (2020)[59]	South Africa	INT	RET	✓	✓	✓	✓	
Ko et al (2019)[83]	U.S.	PHAR	RET			✓	✓	✓ (UND)
Lamsam (1999)[29]	U.S.	INT	RET	✓		✓		
Lie et al (2016)[30]	U.S.	PHAR	RET				✓	✓ (UND & PC)
Lysak et al (2018)[64]	Canada	PT	RET	✓			✓	
Ng et al (2020)[57]	Canada	INT	RET	✓		✓	✓	
O'Connor et al (2018)[58]	Ireland	PT	RET	✓	✓		✓	
Passmore et al (2016)[72]	Canada	INT	RET				✓	
Ross et al (2022)[52]	Australia	INT	RET	✓				
Sakamoto (2022)[53]	U.S.	NURS	RET	✓		✓		✓ (UND)
Scott et al (2015)[96]	U.S.	MED	RET		✓		✓	
Stickler et al (2013)[42]	U.S.	PT	RET	✓		✓	✓	
Quantitative								
Non-randomized trial								
Brown et al (2017)[13]	U.S.	INT	RET					✓ (PC)
Campos-Outcalt (1985)[14]	U.S.	MED	RET					✓ (PC)
Enich et al (2021)[15]	U.S.	MED	RET			✓		
Geelhoed et al (2019)[93]	U.S.	PT	PROS			✓		
Kersbergen et al (2022)[16]	Netherlands	DENT	PROS				✓	
Kovalskiy et al (2017)[17]	U.S.	MED	RET				✓	
Lee et al (2017)[74]	U.S.	INT	RET				✓	
Mazori et al (2019)[67]	U.S.	MED	INTV	✓				
Mercadante et al (2021)[18]	U.S.	MED	PROS			✓		
Modi et al (2017)[85]	U.S.	MED	PROS			✓		
Morello et al (2010)[19]	U.S.	PHAR	RET	✓		✓		
Moseley et al (2022)[11]	U.K	PT	RET	✓				
Nakamura et al (2014)[45]	U.S.	MED	PROS	✓				
Seif et al (2013)[44]	U.S.	INT	PROS	✓			✓	
Sick et al (2014)[37]	U.S.	INT	PROS	✓			✓	
Sick et al (2017)[88]	U.S.	INT	PROS			✓		
Stoddard et al (2011)[95]	U.S.	INT	RET		✓			
Tang et al (2022)[12]	U.S.	MED	RET					✓ (PC)
Thomson et al (2022)[101]	U.S.	MED	RET					✓ (PC)

(*Continued*)

Table 5 (Continued).

Author	Location	Profession	Design	Student Learning Outcomes				
				Clinical Skills	Leadership	Empathy for Underserved	Interprofessional Skills	Career Interest
Descriptive								
Abrão et al (2008)[43]	Brazil	MED	RET	✓				
Adel et al (2021)[49]	U.S.	MED	RET	✓				
Dekker et al (2015)[71]	Netherlands	MED	RET	✓				
Diaz et al (2016)[65]	U.S.	MED	PROS	✓				
Drummond et al (2021)[54]	U.S.	OT	PROS	✓			✓	
Forg et al (2020)[87]	U.S.	INT	RET			✓		
Godoshian et al (2019)[92]	U.S.	PT	RET			✓		✓ (UND)
Heller et al (2019)[100]	South Africa	MED	RET					✓ (UND & PC)
Mishan et al (2017)[32]	U.S.	MED	RET	✓				
Mohammed et al (2018)[33]	U.S.	PHAR	XS	✓	✓		✓	
Murzl et al (2017)[90]	U.S.	MED	RET			✓		✓ (UND)
Pozdnyakova et al (2019)[46]	U.S.	MED	RET	✓				
Schweitzer (2012)[34]	U.S.	MED	PROS	✓		✓		
Shrader et al (2010)[81]	U.S.	INT	PROS				✓	
Simmons et al (2019)[73]	U.S.	PHAR	RET				✓	
Simon et al (2019)[82]	U.S.	INT	PROS			✓	✓	
Stephens et al (2015)[36]	U.S.	MED	RET	✓	✓	✓	✓	
Vaikunth et al (2014)[98]	U.S.	MED	RET					✓ (PC)
Wee et al (2010)[60]	Singapore	INT	RET	✓	✓	✓		
Wees et al (2022)[51]	U.S.	MED	PROS	✓				
Mixed Methods								
Non-randomized trial								
Caratelli et al (2020)[77]	U.S.	INT	PROS				✓	
Chen et al (2021)[86]	U.S.	MED	RET	✓		✓		
Feldman et al (2018)[99]	U.S.	PA	RET					✓ (PC)
Fröberg et al (2018)[47]	U.S.	INT	XS	✓				
Schutte et al (2017)[61]	Netherlands	MED	PROS	✓			✓	
Shabbir et al (2015)[89]	U.S.	INT	PROS			✓		✓ (UND)
Sheu et al (2012)[102]	U.S.	INT	PROS				✓	
Descriptive								
Bennard et al (2004)[22]	U.S.	MED	RET	✓		✓	✓	
Borges et al (2007)[24]	U.S.	MED	PROS	✓		✓	✓	
Chopra et al (2020)[20]	U.S.	MED	RET		✓			
Christensen et al (2013)[27]	U.S.	MED	XS	✓		✓	✓	
Clark et al (2003)[84]	U.S.	INT	XS			✓		
George et al (2017)[68]	U.S.	INT	RET	✓		✓		✓
Gilkey et al (2006)[78]	U.S.	INT	RET				✓	
Gustaffson et al (2016)[79]	U.S.	INT	PROS				✓	
Hamso et al (2012)[97]	U.S.	MED	RET	✓				
Hefford et al (2021)[50]	Canada	PHAR	RET	✓				
Hill et al (2017)[94]	Australia	INT	PROS				✓	
Hu et al (2018)[66]	Canada	INT	PROS	✓			✓	
Kavannagh et al (2015)[70]	Ireland	INT	RET	✓		✓	✓	
McQuillan et al (2017)[31]	U.S.	MED	RET	✓		✓		
O'Brien et al (2013)[21]	New Zealand	INT	RET				✓	
Paparella-Pitzel et al (2021)[56]	U.S.	PT	RET	✓	✓		✓	
Pennington et al (2016)[63]	U.S.	MED	RET	✓				
Rockey et al (2021)[75]	U.S.	MED	RET	✓	✓	✓	✓	✓ (UND)
Sheu et al (2011)[35]	U.S.	INT	RET	✓		✓	✓	
Simmons et al (2009)[91]	U.S.	MED	PROS			✓		

Abbreviations: U.S, United States; UK, United Kingdom; XS, Cross-sectional; RET, Retrospective; INTV, Intervention; PROS, Prospective; DENT, Dentistry; MED, Medicine; NURS, Nursing; INT, Interprofessional; MID, Midwifery; OT, Occupational Therapy; OST, Osteopathy; PHAR, Pharmacy; PT, Physical Therapy; UND, Underserved; PC=Primary care.

Multiple studies reported on the association between SRC participation and student's future career interests and choices. Though some studies reported that involvement in an SRC did not influence the setting of students' future job pursuits (n = 3),[13,24,98] others reported SRC participation appeared to be linked with desire to and actual pursuit of a career in primary care (n = 6).[12,14,30,99–101] SRC participation was also associated in some studies with increased student desire/commitment/interest to work with underserved communities (n = 12).[25,30,50,53,75,83,89,90,92,96,100,102]

Discussion

Our review suggests that SRC participation has the potential to facilitate achievement of various student learning outcomes. As detailed in our narrative analysis of the literature, SRC participation was linked with improved clinical skills, interprofessional skills, empathy and compassion for underserved patients, and leadership experience. A strength of our review is the broad focus on the potential learning benefits of SRC participation, regardless of the students' field of study, and critical evaluation of the study methods which extend preceding reviews that had far narrower scope and less rigorous critical appraisal.[3,4] In addition to providing insight into the potential benefits students may obtain from participation, our findings offer insight into the quality of the research to date, as well as practical implications for those seeking to implement and/or evaluate SRCs.

As mentioned, heterogeneity complicated comparisons between studies and further synthesis of the literature. The main takeaways from the appraisal of studies using the MMAT are that there is room for improvement in the design of studies examining student learning outcomes, and that researchers should take care to report in full how they collected, analyzed, and reported any data they collected. With respect to the qualitative literature, an array of methodological approaches and analytical techniques were employed but the major weakness of the qualitative literature was that almost a third of studies did not adequately substantiate results with data interpretation. Quantitative studies were a mixture of descriptive and non-randomised controlled study designs, with nearly all collecting data via surveys. Non-randomised controlled studies were of high quality with few exceptions, whereas clarity regarding one or more MMAT quality criteria was missing for half of descriptive studies. Like qualitative and quantitative studies, mixed-methods studies, for the most part, collected qualitative data using a range of methods and quantitative data using surveys. While most communicated a clear research question, clear rationales for adopting a mixed-methods approach were rare, and most study designs had weaknesses.

Recommendations for future SRC learning outcome evaluation stem from the limitations identified during critical appraisal and synthesis. A lack of detail on the operations of SRCs hampers the ability of readers to determine relevance to their interests, as well as compare studies. Clearly detailing the operation hours, client-base, locale, etc. of SRCs would prove beneficial in future. Similarly, detailed descriptions of interventions (duration, frequency, activity, intensity, etc.) would be of benefit. In some cases, interventions seemed too limited in time and structure to have impacted student outcomes, sometimes as short as a single volunteering shift.[93] Moreover, many SRCs serve the needs of underserved communities (uninsured, homeless, elderly, etc.), which may limit their exposure to different standards of care.

Though students will experience natural growth as a part of their wider education, beyond what they may learn in an SRC, future quantitative evaluations should examine the impact of SRCs on learning outcomes prospectively rather than retrospectively, as has been done in most studies to date despite the potential for recall bias. Moreover, prospective (longitudinal) research that accounts for confounders (age, gender, ethnicity, socio-economic status, etc.) and allows for examination of temporal changes in valid outcome variables would provide a more robust understanding of the potential impact of SRC participation on learning outcomes. Especially if changes in outcomes can be compared to peers not involved in an SRC. When it comes to analyses, paired analyses, as opposed to merely reporting descriptive statistics. Also, when data allow, confounders (gender, age, level of study (eg, undergraduate vs postgraduate), profession (in interprofessional contexts) and hours spent involved in clinics) should be accounted for in analyses too, or at the very least measured and reported to characterise the sample.

While not necessarily a recommendation for improving future SRC evaluations per se, examining the impact on non-medical (ie, nursing, midwifery, and allied health, etc.) students would provide insight into the generalizability of student SRC learning benefits. Along similar lines, evaluation of SRCs in countries with public, or state-funded/subsidised, health-care systems would also determine the extent to which existing findings are generalizable to different contexts.

While some of the evidence is mixed, findings suggest that SRCs may benefit learning by providing participating students with experiences not usually available during training. These include opportunities to observe, practice, and develop competency performing various clinical skills, and interaction with other health-care professionals, particularly outside of their own profession, to develop interprofessional skills. Providing students with the chance to care for a diverse range of patients may also help to develop their social consciousness and capacity to understand and empathize with patients. Finally, experience in leadership roles and practicing their health profession in a variety of settings and circumstances can allow students to develop leadership skills and to make informed decisions regarding their future career paths.

Conclusion

SRCs participation can provide students with the opportunity to develop clinical skills, foster leadership, and cultivate empathy. Evidence concerning the impact of SRC participation on student's interprofessional skills and future career choices is promising, but requires further investigation. There is a need for clear and specific research questions and aims, as well as more purposeful data collection and analyses. Further research across professions and in settings outside of the U.S. is needed given differences in education and health-care systems, and population and disease characteristics.

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