Cross-year Peer Tutoring in Healthcare and Dental Education:  
A Review of the Literature

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Abstract
Cross-year peer tutoring (CYPT) programs show promise of potential benefits not only to the tutees and tutors, but also to the entire dental education field. A critical review of the literature was performed to determine the characteristics of studies assessing CYPT programs in the healthcare field, to see if there are adequate resources in the literature to aid dental institutions in making evidence-based decisions about their curriculum.  
A PubMed literature search was conducted to identify pertinent research. Only those articles that demonstrated programs that paired junior and senior students were included. A total of twenty articles were identified and analyzed for the characteristics of the CYPT program, the study groups compared, and the outcomes assessed. In the few studies that examined qualitative outcomes, many found success measured in positive outcomes for the tutors. However, there are too few studies that examine the qualitative outcomes of tutor interest in careers in dental education.  
With more contributions to literature in the dental field that specifically target preclinical dental education and tutor interest in careers in education, published within the context of the curriculum, dental education institutions can begin making more evidence-based decisions on the incorporation of CYPT programs into their curricula.  
Keywords: peer teaching; tutoring; health care education; dental education

1. Introduction
Topping (1996) defined peer tutoring as “people from similar social groupings who are not professional teachers but help each other to learn and learn themselves from teaching.” With this expected combination of outcomes, healthcare institutions are examining their cross-year peer tutoring (CYPT) programs in order to determine program effectiveness in maintaining the academic performance of their students, while enhancing the education of the tutees and tutors. A 2011 study found that in the 36 dental schools responding to the survey, 25 of the programs implement some formal teaching program involving teaching assistants, fellowships, or peer tutoring. (McAndrew, Brunson, & Kamboj, 2011) The 2009 senior survey conducted by the American Dental Education Association found that 44.3% of graduates plan to teach at some point in their career. However, graduating dental classes produce less than 1% of new dentists with immediate plans to enter teaching. (Okwuje, Anderson, & Valachovic, 2010). Additionally, a 2007-2008 association report indicated 369 full- and part-time vacant faculty positions. (Okwuje, Sisson, Anderson, & Valachovic, 2009). Therefore, CYPT programs benefit tutors by preparing them to teach at some point in their careers. In addition, CYPT programs have the potential to initiate interest in pursuit of full-time academic careers—a component that the dental field is in high need of.  
Studies on CYPT programs have mostly involved junior students within their first two years at the institution, being tutored by senior students on physical exam and clinical skills topics, in addition to general academic assistance programs. Generally, there is substantial evidence that peer tutoring has many positive effects for the tutees: improved test scores, student satisfaction, personal and professional development. (Topping, 1996). Several studies
have also found that tutors benefit by improving their own understanding of the course content, developing communications skills, and gaining confidence. All of these benefits enhance the tutors' professional development early on in their careers.

With greater financial demands and a need to generate new dentists with plans to enter academic careers, CYPT programs are vital to dental education institutions and the field as a whole. Thus, our study did a critical review of the literature involving cross-year peer tutoring programs that involved the pairing of junior and senior students. The characteristics of the CYPT programs in each study reviewed were examined to determine factors for success. Additionally, this research elucidated characteristics necessary for future studies on CYPT programs if these studies are to aid dental education institutions in deciding whether to incorporate CYPT programs in their curricula.

2. Methods

2.1 Inclusion and Exclusion Criteria

Only studies published in English examining the impact of peer tutoring between professional healthcare students were included. Additionally, only studies that demonstrated programs that paired upperclassmen tutors with underclassmen tutees were included. Included studies identified cross-year peer tutoring as an interpersonal educational relationship between two students: the tutor is the more experienced student who has been through at least one year of school, while the tutee is at least one year his junior and receives some method of educational assistance from the tutor. In order to examine a large number and variety of studies, no limitations were made on sample size, study format, or publication date.

2.2 Literature Search

A PubMed literature search was conducted to identify papers that studied the effects of cross-year peer tutoring on healthcare curricula. Several search methods were used to identify articles. MeSH Terms “Education, Medical”, and “Education, Dental” were used to properly isolate relevant studies. These initial article lists were then narrowed with search phrases such as, “peer tutoring”, “peer mentoring”, and “peer assisted learning”. Bibliographies of identified articles were reviewed for additional pertinent studies.

Articles were then selected based on certain criteria. Each article was examined and categorized based on subject matter and participants, goal of the study, groups of students evaluated, how the program was evaluated, the overall result of the study, and study limitations. The specific characteristics of each tutor program were also evaluated, including tutor selection criteria, tutor training, faculty involvement, tutor-tutee ratio, program time, tutor compensation, and whether tutors took over some of faculty members' teaching responsibility.

As study format varied drastically within the articles compiled, it was not possible to do any large meta-analysis of data collected. Instead, this review aimed to achieve a broad characterization of the different types of existing cross-year peer tutoring programs in place, and to qualitatively examine the overall influence of these programs on healthcare education.

3. Results

A total of twenty articles were identified that paired junior and senior students together in interpersonal educational relationships. All twenty studies were analyzed for the characteristics of the peer tutoring program, the study groups that were compared, and the outcomes that were assessed.

The purpose of this review is two-fold. Firstly, to determine the context in which CYPT programs have found success; additionally, to elucidate the types of future studies needed to aid dental schools in making evidence-based decisions about utilizing CYPT programs. Therefore, our research examines the characteristics of CYPT programs (Table 1), the study groups of each CYPT program (Table 2), and the outcomes of the CYPT programs (Table 3) in the literature reviewed. A summary of each individual article, including the limitations on each, can be found in Table 4.
Table 1. Characteristics of CYPT Programs in the Literature Reviewed

| Type of program?   |          |   |
|-------------------|----------|---|
| Medical           | 15       |   |
| Dental            | 4        |   |
| Physical Therapy  | 1        |   |

| Content tutored   |          |   |
|-------------------|----------|---|
| Didactic course/Basic Sciences | 6       |   |
| Physical exam/History taking/Clinical Skills | 14      |   |

| All Tutors participated voluntarily? |          |   |
|-------------------------------------|----------|---|
| Yes                                 | 17       |   |
| Not mentioned                       | 3        |   |

| Tutors selected based on set criteria? |          |   |
|---------------------------------------|----------|---|
| Yes                                   | 11       |   |
| No                                    | 7        |   |
| Not Specified                         | 2        |   |

| Number of hours tutors were trained  |          |   |
|-------------------------------------|----------|---|
| 0                                   | 7        |   |
| 1-5                                  | 3        |   |
| >5                                   | 3        |   |
| Not specified                        | 7        |   |

| Faculty members involved in tutoring program beyond training of tutors? |          |   |
|------------------------------------------------------------------------|----------|---|
| Yes                                                                    | 6        |   |
| No                                                                     | 14       |   |

| Tutee participation voluntary? |          |   |
|--------------------------------|----------|---|
| Yes                            | 7        |   |
| No                             | 12       |   |
| Not mentioned                  | 1        |   |

| Number of subjects involved in each study   |          |   |
|---------------------------------------------|----------|---|
| <50                                         | 5        |   |
| 50 -100                                     | 9        |   |
| > 100                                       | 5        |   |
| Not specified                              | 1        |   |

| Number of tutees working with one tutor    |          |   |
|--------------------------------------------|----------|---|
| 1                                          | 2        |   |
| 2-5                                        | 4        |   |
| >5                                         | 8        |   |
| Not specified                              | 6        |   |

| Total amount of time tutor spent with tutee |          |   |
|---------------------------------------------|----------|---|
| <10 hours                                   | 5        |   |
| >10 hours                                   | 9        |   |
| Not specified                               | 6        |   |

| Length of tutoring program                   |          |   |
|----------------------------------------------|----------|---|
| Single session                              | 3        |   |
| Multiple sessions                           | 8        |   |
| Entire course or semester                    | 6        |   |
| Multiple semesters or years                  | 3        |   |

| Tutors paid for time?                       |          |   |
|---------------------------------------------|----------|---|
| Yes                                         | 12       |   |
| No or not specified                         | 8        |   |

| Tutors took over some of faculty members’ teaching responsibility? |          |   |
|------------------------------------------------------------------|----------|---|
| Yes                                                              | 13       |   |
| No                                                               | 7        |   |
Tutees were only those who were not performing well academically?
Yes 1
No 19

Table 2. Study Groups Evaluated in the Literature Reviewed

Comparing outcomes: Peer tutor vs. no tutor 3
Comparing outcomes: Peer tutor vs. faculty 9
Comparing outcomes: Peer tutor vs. no peer tutor vs. faculty 1
Comparing outcomes: views of tutees in faculty and peer tutors combined teaching situations 2
Qualitative outcomes: views of tutees on tutoring program 4
Qualitative outcomes: views of peer tutors on tutoring 1

Table 3. Outcomes of CYPT Programs in the Literature Reviewed

Quantitative assessments: evaluation scores

Written test 8
- No significant difference in scores 5
- Faculty > Tutors 1
- Tutors > Faculty 0
- Tutors > No tutors 2
Rating by assessor 11
- No significant difference in scores 9
- Faculty > Tutors 0
- Tutors > Faculty 3

Qualitative ratings: peer tutor/tutee experience

Peer tutors liked/favored experience 4
Peer tutors likely to pursue teaching due to experience 1
Peer tutors have no significant increase in likelihood to pursue teaching due to experience 1
Tutees comparison rating 8
- No significant difference in rating 3
- Faculty > peer tutors 1
- Peer tutors > faculty 4
In peer tutor vs. no peer tutor, rated tutoring as helpful 1
Qualitative assessment of current tutoring programs- tutees are positive about it 5
Peer tutors were more reliable than faculty for duties 1
Table 4. Published Studies of Peer Tutoring Programs in Health Professional Schools

| Author Year Country | Subject Matter and Participants | Factors Examined by Study | Groups evaluated (n) | Evaluation Methods | Results | Limitations |
|---------------------|---------------------------------|---------------------------|----------------------|-------------------|---------|-------------|
| Haist 1997 USA      | Subject: physical examination   | Student performance on written and practical examination when tutored by peers or faculty. | Students tutored by peers (36) | Mean scores on a written exam and a practical examination (evaluated by standardized patients). | Scores on a written and practical examination were not significantly different. | Done at single institution |
|                     | Tutors: M4                     | Student performance on written and practical examination when tutored by peers or faculty. | Students tutored by faculty (64) | Students rated preceptors at beginning and end of course. | M4 preceptors rated their experiences very favorably. | Very basic skills taught |
|                     | Tutees: M1                     | Student ratings of faculty vs peer preceptors. | Students tutored by peers (93 students overall) | Student preceptors rated experience. | | Student preceptors selected based on academic success |
|                     |                                 | Impact of program on peer tutors. | | | | |
| Barnes 1978 USA     | Subject: medical history, physical examination | Student performance on practical examination when tutored by peers or faculty. | Students tutored by peers (13) | Independent, blinded trained reviewer judged performances on history and physical exam. | No significant differences in the performances. | Done at single institution |
|                     | Tutors: M4                     | Student ratings of faculty vs peer preceptors. | Students tutored by faculty (14) | Students rated preceptors at beginning and end of course. | | Relatively small sample size |
|                     | Tutees: M2                     | Peer tutor perceived ability and impact of program. | Students tutored by peers (13) | Student preceptors rated experience. | | Results may not be generalizable to other types of peer tutoring |
| Trevino and Eiland, 1980 USA | Subject: various basic science courses | If peer tutorial program improves test scores of poor-performing students. | Same students before and after tutoring was introduced (55) | Average course grade (method of assessment not mentioned) | Average course grades higher after tutoring. | Only students performing poorly tutored |
|                     | Tutors: graduate students, advanced medical students | | | | | No comparison group |
|                     | Tutees: M1, M2                 | | | | | Peer tutors highly selected and paid |
| Lake, 1999, USA     | Subject: physiology            | If peer tutoring program helps improve performance as students move from introductory to advanced course. | Students enrolled in the course when peer tutoring was available (69) | Difference between the introductory course grade and the advanced course grade; Letter grades converted into points on an 11 point system. | Those enrolled when peer tutoring was available had a smaller decline in course grade. | Compares two different semesters of students |
|                     | Tutors: 5th year physical therapy students (PT5) | Junior students views on peer tutoring | Students enrolled in the course when peer tutoring wasn’t available (45) | Students’ perceptions measured by two questions as part of the end-of-term student course evaluation. | Those who attended the tutoring sessions rated their perceived value of the tutoring sessions highly and expressed strong interest in having tutoring sessions for future courses. | Does not factor in if exams were identical |
|                     | Tutees: PT3                    | | | | | |
| Matthes, 2002, Germany | Subject: problem-based learning (PBL) in | Whether peer vs faculty tutoring in problem based | Students tutored by peers, junior faculty or senior | Mean exam scores (multiple choice questions, short- | Mean exam scores not significantly different. | Traditional exam may not be reflective evaluation of |

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| Study                                      | Country       | Subject       | Participants                                                                 | Methods                                                                 |
|-------------------------------------------|---------------|---------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Nestel and Kidd, 2003, United Kingdom     | Germany       | General       | First-year medical students of peer tutoring in patient-centered interviewing. | Students tutored by peers (20) Students tutored by faculty (19)          |
|                                           |               | physical      | If a student-taught course in physical diagnosis was as effective as a         | Multiple choice and fill in the blank exam; ratings of interviewing skills and “human warmth” by a person acting as a patient |
|                                           |               | assistance    | traditional faculty-taught course                                             | Performance was similar on all assessment methods, except M2 students performed better on a portion of the multiple choice test covering vocabulary. |
|                                           |               |               | M1 who volunteered to be taught by peers (17)                                |                                                                       |
|                                           |               |               | M2 taught by faculty the year prior who volunteered to take the exam (17)    |                                                                       |
| Schaffer, 1990, USA                       | United States | General       | Participation levels in the tutorial program via a retrospective study compared to if students seeking tutoring were those receiving poor grades on examinations | Correlation was made between students who sought tutoring and who had been identified by academic committee as performing below satisfactory on examinations |
|                                           |               | academic      | M1 tutored (228)                                                             |                                                                      |
|                                           |               | assistance    | M1 not tutored (198)                                                          |                                                                      |
|                                           |               |               | M2 tutored (88)                                                              |                                                                      |
|                                           |               |               | M2 not tutored (316)                                                         |                                                                      |
| Ebbert, 1999, USA                         | United States | General       | Tutte and tutor opinion of programs and their affect on academic performance | Written surveys of year-one and year-two co-op volunteers               |
|                                           |               | academic      | Students utilizing peer tutoring program                                     |                                                                       |
|                                           |               | assistance    | No control group                                                             |                                                                       |
| Goodfellow & Schofield, 2001, United      | United States | respiratory   | Success of peer tutorials                                                    | Students found the tutorials useful. Students were found to feel significantly more capable performing a respiratory examination after the tutorial. |
|                                           |               | examination   | Students utilizing peer tutoring program (49)                               |                                                                       |
|                                           |               |               | Evaluation questionnaire completed by students who attended peer tutorials using a 10 centimeter visual analogue scale to assess responses. |                                                                       |
| Lopez, 2010, USA                          | United States | General       | Peer mentoring program effectiveness                                          | Evaluation by survey. Questions                                        |
|                                           |               | academic      | Students who participate in                                                  | 70% of respondents from all classes agreed that having a                |
|                                           |               |               |                                                                                |                                                                       |
| Country        | Subject:                                | Process of peer-assisted learning and identification of strengths and weaknesses in a peer-tutoring program | Peer Tutors (2) and peer learners (14) | Evaluation of one peer-assisted learning session. Data collected from semi-structured interviews from tutors and tutees prior to and post session. | Interviews demonstrated that peer tutoring created a safe learning environment that facilitated a growth of confidence in both learner and tutor, helped foster education exchange between tutor and tutee, and that communication and learning was taking place freely and on a number of different levels between tutors and learners. | Tutors: M5 Tutors: M3 | Only looked at the process of peer assisted learning, did not aim to quantify any outcome data. |
|---------------|----------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------|
| Ireland       | patient communication                    | Process of peer-assisted learning and identification of strengths and weaknesses in a peer-tutoring program | Peer Tutors (2) and peer learners (14) | Evaluation of one peer-assisted learning session. Data collected from semi-structured interviews from tutors and tutees prior to and post session. | Interviews demonstrated that peer tutoring created a safe learning environment that facilitated a growth of confidence in both learner and tutor, helped foster education exchange between tutor and tutee, and that communication and learning was taking place freely and on a number of different levels between tutors and learners. | Tutors: M5 Tutors: M3 | Only looked at the process of peer assisted learning, did not aim to quantify any outcome data. |
| United Kingdom| clinical examination skills             | Effects of participation in a cross-year peer tutoring program in clinical examination skills on volunteer tutors' own skills and on their attitudes towards teachers and teaching. | Peer tutors (94) | Questionnaires completed by volunteer M3 tutors at the start of the program after they had planned and delivered their small group sessions. | Tutors reported that taking part in program had enhanced practical teaching skills and confidence in speaking to groups. Reported tutoring increased the likelihood that teaching would be a major part of their career and that they would undertake further teacher training | Tutors selected, trained extensively | Based on one session |
| Germany       | clinical procedural skills              | If peer-assisted learning is effective in technical skills training in a skills lab setting and if PAL is equally as effective as faculty staff-led training for M3. | Students tutored by peers (31) | Students tutored by faculty (28) | Students that received no tutoring (30) | Directly after receiving PAL-assisted, faculty-led or no skills lab training, students were assessed using an OSCE. Independently rated by two clinically experienced video assessors who were blind to both the aim of the study and its design. | Based on binary checklist ratings, both PAL and faculty-led students scored significantly higher in the OSCE than the non-trained control group. There was no significant difference between the PAL group and the faculty-led group with respect to OSCE binary checklist ratings. | Sample size small |
| UK            | resuscitation training                  | Efficacy of a peer-led tuition model for training healthcare students in basic life support compared to tuition delivered by clinical tutors. | Students tutored by peers (66) | Students tutored by faculty (62) | Practical skills tested by blinded examiners and knowledge by multiple choice exam. Students were asked how they rated the quality of teaching using a visual analogue score. Instructor reliability was measured by recording the attendance of instructors at the training sessions. | Students taught by their peers were significantly more likely to be successful in the end-of-course practical examination than those taught by clinical staff. The student instructors were also found to be more reliable than clinical staff at attending the training sessions. There was no significant difference in multiple-choice question results or student satisfaction rates | Explored very specific technical skill: are results generalizable to other learning objectives? | Sample size small to determine difference between two intervention groups |
| Denmark       | clinical procedural skills              | Quality of procedural skills teaching of student teachers and clinical associate | Students tutored by peers (31) | Students tutored | Participants pre-tested and post-tested on practical | There was no significant difference between groups in learning outcome regarding procedure 1 or in any of the Using the same set of tests for the pre and post testing could have induced a learning effect | Tutors: Senior | No control group of students who did not utilize program. |
### Nimmo 2007, USA

| Subject: | Prosthodontics and Occlusion |
|----------|-------------------------------|
| Tutors:  | D3 & D4                      |
| Tutees:  | D2                           |

Dental students as instructors in preclinical prosthodontics and occlusion courses, providing one-on-one instruction and evaluation of daily work for the D2 students. Evaluation by the D2 students of full-time faculty and student instructors at the end of the course, consisting of an instructor quality score, a survey of student instructors about their experience and a course debriefing with selected D2 students. Analysis of the evaluation mean scores indicates there is no evidence to suggest that the mean instructor-quality scores of student instructors are lower than that of full-time faculty instructors, and there is weak evidence to suggest that the mean instructor-quality scores of student instructors is actually higher than that of the faculty. Tutors could have received higher perceived marks because they were not involved with grading students Study did not have measured outcomes of students taught by only faculty vs students taught by peer + faculty combination.

### Nimmo 2008, USA

| Subject: | Prosthodontics |
|----------|----------------|
| Tutors:  | D4             |
| Tutees:  | D2             |

Use of senior dental students as instructors in preclinical prosthodontics courses for D2 from the perspective of preclinical performance on graded exercises. Two groups of students (34 and 48) alternated between faculty and student teaching. A statistical analysis was performed on the graded projects for the two courses, comparing the effect of type of instructor. The results indicate no significant difference for all groups. No monitoring of instruction or interaction outside of schooled lab sessions Grade inflation may have obscured some grading variables Results may not apply directly to other preclinical courses or disciplines.

### Haj-Ali 2007, USA

| Subject: | Morphology/Occlusion |
|----------|-----------------------|
| Tutors:  | D4                    |
| Tutees:  | D1                    |

Whether senior dental students could serve as effective instructors in a two-semester preclinical laboratory course and whether such teaching experience could enhance their interest in academics as a future career. D1 students were randomly assigned so that each student was instructed by a faculty member in one semester and a D4 in the other semester. Course evaluation forms completed by the first-year dental students at the end of each semester; a comparison of students’ performances in each course determined by faculty instructors and D4s; and the D4s’ self-report of their teaching experiences. Results showed no significant difference between the performance of D4s and faculty instructors in all criteria evaluated. Furthermore, there was no significant difference between the performance of students instructed by faculty members and those instructed by D4s in either semester. Despite the fact that such experience seemed to have minimal influence on students’ decision to consider academics as a future career, D4s do seem to provide effective instruction and thereby can serve to compensate for faculty shortages. Some non-response bias due to lack of full student participation in survey Results may not apply directly to other preclinical courses or disciplines D4 tutors highly selected and instructed by faculty.

### Author Year Country | Subject Matter and Participants | Factors Examined by Study | Groups evaluated (n) | Evaluation Methods | Results | Limitations |
|------------------------|-------------------------------|---------------------------|---------------------|-------------------|--------|------------|
| Haj-Ali 1998 USA       | Subject: Physical examination | Student performance on written and practical examination when tutored by peers or faculty. | Students tutored by peers or staff (93 students overall). | Mean scores (adjusted based on GPA) on a written test and an observed hour-long standard patient examination. | Written test scores not significantly different. | Done at single institution |
|                        | Tutors: 4th year medical students (M4) |                             |                     |                   |        |            |
|                        | Tutees: 1st year               |                             |                     |                   |        |            |
| Study | Year | Country | Subject | Tutors | Tutees | Impact of Program on Peer Tutors | Student Performance on Written and Practical Examination | Academic Success |
|-------|------|---------|---------|--------|--------|----------------------------------|-----------------------------------------------|-----------------|
| Haist | 1997 | USA     | Physical examination | M4 | M1 | Student performance on written and practical examination when tutored by peers or faculty. | Students rated preceptors at end of course. | Scores on a written and practical examination were not significantly different. Done at single institution. |
| Barnes | 1978 | USA     | Medical history, physical examination | M4 | M2 | Student performance on practical examination when tutored by peers or faculty. | Students rated preceptors at beginning and end of course. | No significant differences in how students rated peer preceptors vs faculty preceptors. |
| Trevino | 1980 | USA     | Various basic science courses | Graduate students, advanced medical students | M3 | Tutors: M4 or more based learning activity toward exam-related objectives. | No comparison group. | Peer tutors selected based on academic success. |
| Lake | 1999 | USA | Various basic science courses | 5th year physical therapy students (PTS) | PT3 | Students enrolled in the introductory course grade and the advanced course grade; letter grades converted into points on an 11 point system. Students' perceptions measured by two questions as part of the end-of-term student course evaluation. | No significant differences in how students rated peer preceptors vs faculty preceptors. | M4 preceptors rated their experiences very favorably. |
| Mathes, 2002 | Germany | Various basic science courses | Problem-based learning (PBL) in pharmacology | M4 or more advanced medical students | M3 | Whether peer vs faculty tutoring in problem-based learning affects the results of process evaluation by participants or their learning outcome. | Students rated preceptors at end of course. | Mean exam scores not significantly different. Traditional exam may not be reflective evaluation of effectiveness of PBL. Student tutors may make shortcuts that direct learning activity toward exam-related objectives. |
| Nestel and Kidd | 2003 | UK | Various basic science courses | Various basic science courses | M3 | Impact on first-year medical students of peer tutoring in patient-centered interviewing. | Students rated preceptors at end of course. | No differences seen in the ratings given by the independent assessors or simulated patients. Peer tutors contributed to just one of six sessions. | Period between the sessions. |
| Study | Year | Country | Subjects | Tutors | Tutees | Description | Findings |
|-------|------|---------|----------|--------|--------|-------------|----------|
| Rund, 1977, USA | | | Subject: physical diagnosis | Tutors: final year medical students | Tutees: M1 taught by students; M2 taught by faculty | If a student-taught course in physical diagnosis was as effective as a traditional faculty-taught course | Students who volunteered to be taught by peers (17) | Multiple choice and fill in the blank exam; ratings of interviewing skills and “human warmth” by a person acting as a patient | Performance was similar on all assessment methods, except M2 students performed better on a portion of the multiple choice test covering vocabulary. |
| Schaffer 1990, USA | | | Subject: General academic assistance | Tutors: M2 and M4 and graduate students | Tutees: M1 and M2, respectively | Participation levels in the tutorial program via a retrospective study compared to available performance parameters to see if students seeking tutoring were those receiving poor grades on examinations | M1 tutored (228) M1 not tutored (198) M2 tutored (88) M2 not tutored (316) | Correlation was made between students who sought tutoring and who had been identified by academic committee as performing below satisfactory on examinations | A statistically significant relationship was found to exist between poor performance on examinations and participation in the tutorial program for both the first and second-year medical students. |
| Ebbert, 1999, USA | | | Subject: General academic assistance | Tutors: M2 | Tutees: M1 and 1st year dental students (D1) | Tutee and tutor opinion of programs and their affect on academic performance | Students utilizing peer tutoring program | No control group | Written surveys of year-one dental and year-two co-op volunteers | Student responses were generally positive especially to new teaching formats. M1 and D1 report program good for basic science concepts, tips for studying and test taking, and “surviving” first years of school. M2 reported better teaching skills, more collegial interactions, and reviewing for USMLE step 1 material |
| Goodfellow & Schofield, 2001, United Kingdom | | | Subject: respiratory examination | Tutors: M4 | Tutees: M3 | Success of peer tutorials | Students utilizing peer tutoring program (49) | Evaluation questionnaire completed by students who attended peer tutorials using a 10 centimeter visual analogue scale to assess responses. | Students found the tutorials useful. Students were found to feel significantly more capable performing a respiratory examination after the tutorial. | Only one session given No comparison group to those who did not receive tutoring Small cohort |
| Lopez, 2010, USA | | | Subject: General academic assistance | Tutors: D2 | Tutees: D1 | Peer mentoring program effectiveness and relevance to current students | Students who participate in mentoring program (256) | Evaluation by survey. Questions regarding benefits of peer mentoring program, qualifications for mentors and preparation for mentorship, and time commitment | 70% of respondents from all classes agreed that having a mentor during their first year helped them transition to dental school, and 58% agreed that the mentor/mentee relationship was helpful beyond the freshman year. | No quantitative evaluation of academic performance No control group of students who did not utilize program. |

**Glynn 2006, United Kingdom**

- **Subject:** Patient
- **Process of:** Peer Tutors (2)
- **Evaluation of one:** Interviews demonstrated that
- **Only looked at the:**
| Country        | Subject | Description                                                                                                                                                                                                 | Methods                                                                                                                                  | Findings                                                                                                                                                                                                 |
|---------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ireland       |         | peer-assisted learning and identification of strengths and weaknesses in a peer-tutoring program among medical and nursing students.               | Peer tutors were trained and they delivered their sessions.                                                                            | Peer tutoring created a safe learning environment that facilitated a growth of confidence in both learner and tutor, helped foster education exchange between tutor and tutee, and that communication and learning was taking place freely and on a number of different levels between tutors and learners. |
| Buckley, 2007, UK | Clinical examination skills | Effects of participation in a cross-year peer tutoring program in clinical examination skills on volunteer tutors' own skills and on their attitudes towards teachers and teaching. | Questionnaires completed by volunteer M5 tutors at the start of the program after they had planned and delivered their small group sessions. | Tutors reported that taking part in program had enhanced practical teaching skills and confidence in speaking to groups. Reported tutoring increased the likelihood that teaching would be a major part of their career and that they would undertake further teacher training. |
| Weyrich, 2009, Germany | Procedural skills | If peer-assisted learning is effective in technical skills training in a skills lab setting and if PAL is equally as effective as faculty staff-led training for M3. | Directly after receiving PAL-assisted, faculty-led or no skills lab training, students were assessed using an OSCE. Independently rated by two clinically experienced video assessors who were blind to the OSCE binary checklist ratings. | Based on binary checklist ratings, both PAL and faculty-led students scored significantly higher in the OSCE than the non-trained control group. There was no significant difference between the PAL group and the faculty-led group with respect to OSCE binary checklist ratings. |
| Perkins, 2002, UK | Resuscitation training | Efficacy of a peer-led tuition model for training healthcare students in basic life support compared to tuition delivered by clinical tutors. | Students tutored by peers (66)                                                                                                           | Students taught by their peers were significantly more likely to be successful in the end-of-course practical examination than those taught by clinical staff. The student instructors were also found to be more reliable than clinical staff at attending the training sessions. There was no significant difference in multiple-choice question results or student satisfaction rates. |
| Tolsgaard, 2007, Denmark | Procedural skills | Quality of procedural skills teaching of student teachers and clinical associate professors in terms of participants' technical skills, knowledge and satisfaction with the teaching of two procedural skills. | Students tutored by peers (31)                                                                                                           | There was no significant difference between groups in learning outcome regarding procedure 1 or in any of the two written tests. Using the same set of tests for the pre and post testing could have induced a learning effect. No control group. Only studied two basic clinical skills- not necessarily transferable to more technical skills. |
4. Discussion

Peer tutoring has the theoretical potential to benefit all three parties involved: the tutee, the tutor, and the healthcare educational institution. The tutee learns the material while finding guidance through emotional support and mentorship from upper classmen. The tutors learn the material more in depth while learning how to teach, and also developing interest in academic careers. The institution dealing with greater financial demands can utilize budget-friendly programs while simultaneously developing academic careers. These positive outcomes are entirely dependent on the effectiveness of the tutoring programs to educate tutees at an equal if not higher level than when instructed by faculty. The purpose of this research is to determine in what context previous studies have found success in their CYPT programs, and to elucidate what further studies the dental field still requires in order to make informed decisions on utilization of CYPT programs.

Of the reviewed studies, fifteen examined peer tutoring in medical schools, four in dental schools, and 1 physical therapy program. With 141 medical school programs in the United States and 65 dental school programs, it is
understandable that there would be more studies from medical schools. (ADA, 2014; AAMC, 2014). Additionally, many dental schools implement informal tutoring programs that have not been the subject of a formal study; therefore, the literature available most likely does not reflect the wide variety of peer tutoring programs in place. However, of the available studies, several were limited in the fact that they involved single institutions and small sample sizes. Only five of the twenty studies involved greater than 100 subjects, while the rest of the studies examined study groups involving less than 100 subjects. (Lake, 1999; Mattges, Marxen, Link et al., 2002; Schaffer, Wile, & Griggs, 1990; Lopez, Johnson, & Black, 2010; Perkins, Hulme, & Bion, 2002). Additionally, seven of the CYPT programs taught a very specific skill set (i.e. portion of the physical exam) which causes concern that the success of those programs may not be generalizable to peer tutoring for other topics. (Haist, Wilson, Brigham, Fosson, & Blue, 1998; Haist, Wilson, Fosson, & Brigham, 1997; Barnes, Albanese, Schroeder, & Reiter, 1978; Goodfellow & Schofield, 2001; Weyrich, Celebi, Schrath, Möltner, Lammerding-Köppel, & Nikendei, 2009; Perkins, Hulme, & Bion, 2002; Tolsgaard, Gustafsson, Rasmussen, Hoiby, Müller, & Ringsted, 2007).

In order for dental education institutions to make evidence-based decisions on implementation of CYPT programs, the field requires more high powered studies involving CYPT programs that focus on multiple topics and skills. Additionally, dental institutions have the unique opportunity to utilize CYPT programs in preclinical education. Medical education studies on CYPT programs for physical exam and history taking skills are not fully reflective of the skills that one learns in preclinical courses. The physical exam and patient interview focuses on information gathering for diagnostic purposes, whereas preclinical education in dentistry is focused on learning procedural skills for healthcare delivery to patients. Therefore, the dental field is in need of high-powered studies on CYPT programs centered on preclinical education.

In terms of positive benefits for tutors, only five out of the twenty studies assessed tutor outcomes in terms of sentiments about the program. (Haist, Wilson, Brigham, Fosson, & Blue, 1998; Haist, Wilson, Fosson, & Brigham, 1997; Barnes, Albanese, Schroeder, & Reiter, 1978; Buckley & Zamora, 2007; Haj-Ali, Walker, Petrie, & Steven, 2007). Although four of the studies found that the tutors enjoyed the experience, (Haist, Wilson, Brigham, Fosson, & Blue, 1998; Haist, Wilson, Fosson, & Brigham, 1997; Barnes, Albanese, Schroeder, & Reiter, 1978; Buckley & Zamora, 2007) only two studies assessed the likelihood that these tutors would pursue teaching in their careers as a result of their experience (Buckley & Zamora 2007; Haj-Ali, Walker, Petrie, & Steven 2007). This aspect of CYPT is vital information for dental education institutions because of the high demand for dental faculty. Additional dental school openings in the U.S. have increased the demand for faculty in recent years. Yet even before these schools opened, a 2007-2008 association report indicated 369 full- and part-time vacant faculty positions. (Okwuje, Sisson, Anderson, & Valachovic, 2009) Unfortunately, there are also consistent findings that graduating dental classes produce less than 1% of new dentists with immediate plans to enter teaching. (Okwuje, Anderson, & Valachovic, 2010)

Thus, it is imperative to the dental field that educational institutions prioritize the development and training of future educators. It has been reported that 69% of surveyed dental education institutions already utilize formal student teaching programs, in order to stimulate interest in academic careers. (McAndrew, Brunson, & Kamboj, 2011) CYPT programs have the potential to contribute greatly in the initiative to train and develop future educators, while also greatly benefiting the tutees involved. This makes further research on the qualitative outcomes of CYPT programs for tutors very important to the dental profession as a whole.

The majority of the studies reviewed did not present the tutoring programs in the full context of the associated curriculum. This aspect of the studies is becoming increasingly important as problem-based learning (PBL) curricula and variations of hybrid curricula are adopted over traditional lecture format curricula. Studies have found no statistically significant difference in performance of students taught by experts or non-experts of the subject in PBL tutorials. (Park, Susarla, Cox, Da Silva, & Howell, 2007) This was attributed to the fact that the role of a tutor in PBL is to facilitate rather than deliver knowledge. These results imply that peer tutors in CYPT programs, despite not having expertise in the subject, might be capable of fulfilling faculty roles in a PBL curriculum. However, further studies on CYPT programs in the context of PBL curricula must be done to determine if this is indeed the case. Additionally, studies on CYPT programs in general need to report more in-depth descriptions of the surrounding curriculum in order for their results to be applicable in curriculum builders’ decisions on utilization of CYPT programs for their specific institution.
5. Conclusion
The dental field is in great need of studies on CYPT programs in dental education that cover preclinical education, since this is unique to dental education. Additionally, the focus of future studies should be placed on qualitative outcomes for tutors and their interests in teaching careers. Finally, studies on CYPT programs in general need to thoroughly present the context of their curricula such that if there are beneficial results, the ideologies can be more applicable to other educational institutions.

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