



Impact of physical therapy and occupational therapy student placements on productivity: a scoping review

Répercussions des stages en physiothérapie et en ergothérapie sur la productivité : une revue exploratoire

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Article abstract

Introduction: Clinical educators may perceive that student supervision is time consuming and reduces productivity. This perception is in contrast to research conducted in the 1990's that found students do not negatively impact productivity. There is a need to review the current literature on this topic as a result of health care cost-containment measures that emphasize efficiency. The purpose of this scoping review was to map and examine the impact of physical and occupational therapy student placements on productivity in the clinical environment.

Methods: PRISMA Scoping review methodology was used to identify relevant papers. A search was completed in MEDLINE, CINAHL, ERIC and Business Source Premier. Included studies measured clinician productivity while supervising a physical or occupational therapy student. Two reviewers independently reviewed studies according to pre-determined eligibility criteria.

Results and discussion: Fourteen studies met the inclusion criteria and were included in the review. Overall, the studies suggest that the supervision of students does not have a negative impact on productivity. However, the productivity measures varied in the type and methods which limits comparisons. This variability, along with the experience of stress by clinical educators as they attempt to satisfy multiple roles may account for the discrepancy between the perception and actual measure of productivity.

Conclusions: This scoping review found some evidence that students do not negatively impact productivity. This contrasts with the perception held by the supervising physical and occupational therapists. Further research is recommended to explore this discrepancy and determine optimal productivity measures matched to the characteristics of the environment.

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Impact of physical therapy and occupational therapy student placements on supervisor productivity: a scoping review Répercussions des stages en physiothérapie et en ergothérapie sur la productivité : une revue exploratoire

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Abstract

Introduction: Clinical educators may perceive that student supervision is time consuming and reduces productivity. This perception is in contrast to research conducted in the 1990's that found students do not negatively impact productivity. There is a need to review the current literature on this topic as a result of health care cost-containment measures that emphasize efficiency. The purpose of this scoping review was to map and examine the impact of physical and occupational therapy student placements on productivity in the clinical environment.

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Conclusions: This scoping review found some evidence that students do not negatively impact productivity. This contrasts with the perception held by the supervising physical and occupational therapists. Further research is recommended to explore this discrepancy and determine optimal productivity measures matched to the characteristics of the environment.

Résumé

Introduction : Les cliniciens éducateurs peuvent avoir l'impression que la supervision des étudiants prend du temps et réduit la productivité. Cette perception diffère de celle d'une recherche menée dans les années 1990 qui concluait que les étudiants ne modifiaient pas négativement la productivité. Il faut revoir la littérature actuelle sur ce sujet en raison des mesures de compression budgétaire dans les soins de santé qui mettent l'accent sur l'efficacité. L'objectif de cet revue exploratoire était de cartographier et d'examiner l'impact des stages en physiothérapie et en ergothérapie sur la productivité dans un milieu clinique.

Méthodes : La méthodologie de revue exploratoire selon Tricco et coll.¹ a été utilisée pour identifier les articles pertinents. Une recherche a été réalisée dans MEDLINE, CHINAL, ERIC et Business Source Premier. Les études incluses ont mesuré la productivité des cliniciens lors de la supervision d'un étudiant en physiothérapie ou en ergothérapie. Deux examinateurs ont examiné indépendamment les études selon des critères d'éligibilité préétablis.

Résultats et discussion : Quatorze études ont satisfait les critères d'inclusion et ont été incluses dans la revue. Dans l'ensemble, les études suggèrent que la supervision des étudiants n'a pas eu de répercussions négatives sur la productivité. Toutefois, les mesures de productivité avaient des types et des méthodes variables, ce qui limite les comparaisons. Cette variabilité, ainsi que l'expérience de stress que vivaient les cliniciens éducateurs qui tentent de satisfaire de multiples rôles pourrait expliquer la différence entre la perception et la mesure réelle de la productivité.

Conclusions : Cette revue exploratoire conclut que les étudiants ne réduisent pas la productivité. Ceci diffère de la perception actuelle des physiothérapeutes et des ergothérapeutes qui supervisent ces étudiants. D'autres recherches sont recommandées pour explorer cette différence et déterminer les mesures de productivité optimales qui correspondent aux caractéristiques de l'environnement.

Introduction

Clinical education is a critical component of the entry to practice curriculum.¹ A placement occurs when a student is assigned to a real-world healthcare environment for the purpose of clinical education. In Canada, in physical therapy and in occupational therapy clinical placements are commonly referred to as placements and fieldwork respectively. The term “placements” will be used for both health professions. A placement is when a student is placed in a real-world healthcare environment. During placements, students are supervised by clinicians, as the clinician carries out their regular clinical responsibilities. Clinical instructors facilitate students to apply the theory and skills learned in the classroom to develop the required competencies for clinical practice¹ and to the development of professional behaviour and professional identity.² Physical and occupational therapy education accreditation standards mandate that students complete full time placements of a minimum of 1025 and 1000 hours respectively in a variety of different practice areas.^{3,4} These hours are achieved over several placements ranging from one to three months in duration, making placements a substantial part of the entry to practice curriculum.¹

To deliver the clinical education curriculum, academic programs and clinical sites enter into partnerships commonly referred to as placement agreements.⁵ The agreements may also include a small amount of remuneration for the supervising clinician. The decision to offer a placement is generally left up to the discretion of the individual clinician.² Physical and occupational therapists recognize the value of placements to contribute to the development of future professionals and to keep up to date with their own skills.⁶⁻⁸ They also consider it an obligation to give back to the profession.⁷ Despite this, placement shortages are commonly reported in many countries including Canada.⁹

The supervision of multiple students allows for more student placements but is associated with advantages and disadvantages. The supervision of multiple students has shown positive benefits including collaborative learning and productivity.¹⁰ However, clinical educators report increased stress and workload.^{1,7,11} Most clinical educators prefer to supervise a single student.^{1,10} Thus, a large number of educators are needed for placements. This further challenges educational programs to find sufficient placements.

Physical and occupational therapists report several barriers when they are considering whether or not to supervise a student. Clinical educators report that students are time-consuming and negatively impact productivity.^{2,6,8,12,13} Other reported barriers include concern of getting an unprepared or struggling student and overall increased stress.^{8,13,14} Health care managers also report obstacles to student placements including: time commitments to orient students; training employees to be clinical educators; legal concerns and maintaining productivity demands.² However, it is not certain if the commonly reported perception of decreased productivity is consistent with actual productivity.

As healthcare systems adapt to increasing demands, cost containment measures are commonly implemented.^{9,15} Cost containment measures can encourage shorter lengths of stay for patients and increased productivity demands to maximize revenues.¹³ As clinicians adjust their practice to meet these demands, they may be less willing to supervise students if they believe that students will slow them down. Occupational therapists surveyed in the United States perceived that changes to the health care environment contributed to increased productivity expectations.¹⁶ They also expressed concern that students would negatively impact productivity and the student experience would be diminished.¹⁶ Thus, research that can objectively and accurately quantify the effect of students on clinician productivity is important.

Research conducted before the year 2000 studied the impact of student placements on productivity. Productivity in healthcare can be defined as the inputs put forth by a clinician compared to the outputs produced resulting in a positive outcome in the patient’s health status or function.¹⁷ In 1996, Ladyshevsky et al¹⁸ used an input measure of productivity and compared the number of minutes spent with patients between clinical educators with and without a student. The authors found an increase in direct patient care provided by students and clinical educators combined. While this is a positive finding, it was unclear if this impacted the number of patients seen in a day or patient outcome. Burkhardt¹⁹ completed a similar study in 1985 with occupational therapy students. Occupational therapists recorded their teaching activities, and the students recorded the number of treatments provided and found that the time put forth by the occupational therapists on teaching activities was offset by the student’s time spent on patient care. Outcome productivity measures between students and therapists

have also been studied. In 1997, Holland²⁰ compared the number of treatments per patient and a positive, negative or unknown outcome at discharge reported in the chart between a physical therapist alone and a physical therapist paired with a student. The latter treated more patients, yet had comparable outcomes and number of treatment sessions per patient suggesting increased productivity with no reduction in quality of care. While these studies suggest positive results, each study used a different method and measure of productivity making comparisons challenging.

In summary, there is a discrepancy reported in the literature between perceptions and measures of physical and occupational therapy student placements on productivity. Furthermore, healthcare system changes in Canada and in many parts of the world continue to emphasize productivity demands to control costs.^{9,15} It is unclear what current literature exists on productivity and placement within the context of today's healthcare environment. It is also unclear how productivity is being measured. Therefore, the purpose of the scoping review was to examine how physical and occupational therapy students on placement impact productivity in the clinical environment. Additionally, this review will explore what productivity measures have been used to determine the impact of students on productivity. A scoping review was selected to describe the variability in the methods, and measurement of productivity as it relates to student placements and to identify key areas of research and the development of strategies to support placements needs.

Methods and analysis

Research design

Tricco et al.²¹ PRISMA Checklist was the primary source for developing the protocol and reporting the methods and findings. Tricco et al. recommends mandatory reporting of eligibility criteria; information sources and search; selection of sources of evidence; data items and charting process; and synthesis of results. The study protocol was developed a-priori and is available on Open Science Framework (<https://osf.io/uwy56/>) or by contacting the author. Ethics approval was not required, as it does not include primary data collection of published research.

Eligibility criteria

The inclusion and exclusion criteria are listed in Table 1. Research participants were clinical educators supervising physical therapy and/or occupational therapy students on a full-time clinical placement. Included papers reported a quantitative or descriptive measure of productivity

describing inputs, outputs or patient outcomes. Studies were excluded if they explored participant perceptions of productivity. Included papers were conducted in Canada, United States, Australia, or the United Kingdom. These countries have physical and occupational therapy programs that are similar to those in Canada with comparable clinical education hour requirements.⁹ Included methodologies consisted of systematic reviews, randomized controlled trials, observational cohort and case-controlled studies and retrospective chart reviews. The authors sought objective measures of productivity, as such qualitative studies, narrative reviews and editorials were excluded. We limited the search to papers that were published since the year 2000 and were available in English.

Information sources and search

Four databases were searched on December 10, 2018. MEDLINE and CINAHL were searched to capture the relevant health and rehabilitation papers. ERIC and Business Source Premier were searched to capture education and business papers. The search terms were developed in consultation with an experienced health sciences librarian and refined by the author to balance feasibility and sensitivity of papers meeting the eligibility criteria. The initial search strategy was developed for MEDLINE using a combination of subject headings and keywords within the title and abstract and then translated into the language appropriate to the other databases. Examples search terms were "physical therapy," "occupational therapy," "placements," "fieldwork," and "productivity." The final search strategy for MEDLINE is in Appendix A, Table 2. The search was supplemented by hand searching reference lists of relevant papers and searching physical and occupational therapy association websites in the included countries. The results of the database and supplemental searches were exported into EndNote and duplicates were removed.

Selection of sources of evidence

Retrieved references from the search were exported into Excel including the first author, year of publication, title, journal and abstract. Two reviewers independently reviewed the title and abstracts of the retrieved papers to determine eligibility. Discrepancies were discussed to consensus. One reviewer had expertise in physical therapy placement education and management and the other reviewer brought experience as a hospital manager of allied health. Subsequently, the reviewers retrieved full text for eligible articles via electronic sources and contacting the authors as necessary. The full-text papers

were reviewed independently by the two reviewers and discrepancies were discussed to consensus and/or by consulting a third reviewer as necessary. Papers meeting the eligibility criteria following the full-text screening phase were included in the review.

Table 1. Inclusion and exclusion criteria

Topic	Inclusion	Exclusion
Types of participants	Students enrolled in a physical therapy or occupational therapy education program (graduate or undergraduate) Full-time 4-12-week clinical placements	Graduated physical and occupational therapy residents participating in a clinical education Placement lengths of greater than 12 weeks Observational or part time site visits Simulation experiences Student led clinics
Study Design	Retrospective chart reviews, pre-post designs, randomized controlled trials, survey methods to record a measure of productivity/time use	Qualitative, survey designs exploring perceptions, narrative reviews
Concept	Quantitative measure of productivity and/or patient outcome such as occasions of service, length of occasion, time use recording, patient satisfaction, length of stay	Participant perception of productivity No measure of productivity
Context	USA/Australia/Canada/UK Since the year 2000 Available in English	Countries not listed in the inclusion criteria Papers prior to the year 2000 Not available in English

The data items and charting process

Two reviewers developed the data chart based on recommendations by Peters et al.²² including: author, year, objectives, participants, concept or outcomes and context along with the purpose and objectives of the paper. The reviewers jointly extracted data from two of the papers to ensure consistency and to refine the data extraction chart. Subsequently, the reviewers independently extracted data from the included studies and both data extraction charts were compared for consistency. Any discrepancies were resolved by rereading the papers and discussion to consensus.

Synthesis of results

The purpose of the study and specific objectives guided the data analysis. An iterative process was used for the

synthesis with grouping and regrouping being guided by the review process and according to the objectives.¹ Papers were grouped by the setting, productivity measure, placement supervision model and direction of the findings. An interpretation of the findings is presented in the discussion section of this review.

Results

Literature search

A total of 631 papers were retrieved through the database search and 22 papers were retrieved from other sources. After removing duplicates, 555 papers were screened. Twenty-six full text papers were retrieved and assessed for eligibility. Of these, 14 papers met the inclusion criteria and were included in the review. Papers were excluded for the following reasons: qualitative study design (n = 3), narrative or editorial (n = 4) or did not measure productivity (n = 5). The flow diagram of the selection process is in Figure 1.

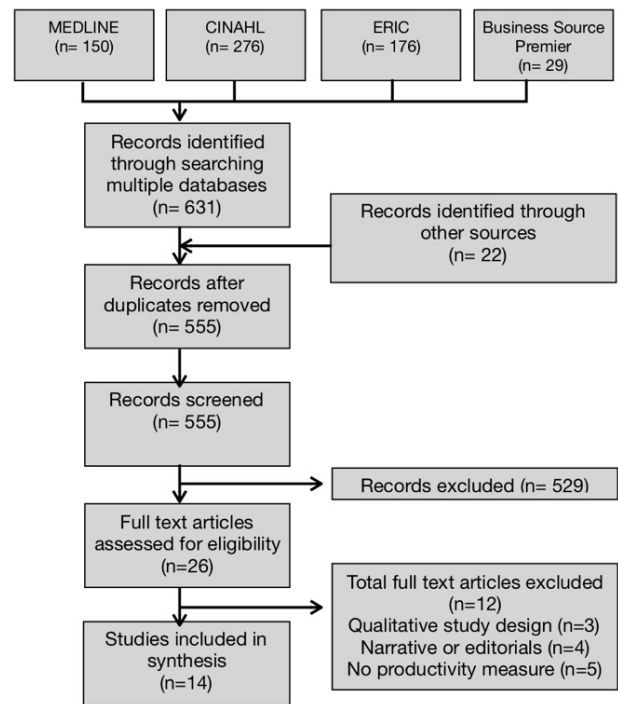


Figure 1. PRISMA Flow Chart

Study characteristics

Each study's profession (physical or occupational therapy), place of origin, design, methods, measures and main findings are presented in Appendix A, Table 3. The majority of the studies were from the USA (n = 7), followed by Australia (n = 4) and one each from Canada, England and Ireland. Most studies were in multiple treatment settings

($n = 8$) including acute care, rehabilitation and outpatient departments. The majority of the studies were retrospective reviews ($n = 7$), followed by prospective designs ($n = 5$). One study did not clearly state how data was collected and another paper was descriptive, but included retrospective quantitative measures of productivity. Nine papers studied physical therapy students, three studied occupational therapy, and two papers studied both disciplines. No observable difference in study characteristics were noted between the two disciplines.

Productivity measures

The majority of papers included output productivity measures most commonly the number of patients seen or number of billable units in a time period ($n = 10$). Three papers, all in orthopedic environments, used the number sessions per patient care episode as a productivity measure. Ten of the studies included an input measure, most commonly direct patient care in a unit of time. Of these, four compared direct patient care to other activities. Four papers used an outcome measurement. All papers used self-report measures of productivity and only one study explicitly mentioned the inclusion of students in difficulty.

Students and productivity

Twelve papers compared productivity measures between a clinical educator alone, and a clinical educator supervising a student. Seven of the papers noted that students positively impacted at least one productivity measure and five papers found no significant difference. One paper found an trend towards students providing more treatment sessions per patient care episode from assessment to discharge than the clinical educator alone.²³ Two papers included productivity measures on students but not their clinical educators. Two papers compared the difference in productivity between different supervision models. The supervision model refers to the ratio of students to clinical educators. Both papers that studied supervision model found an increase in at least one measure of productivity with multiple students.

Discussion

This scoping review sought to examine how students impact productivity in the clinical environment and describe how productivity is measured in this literature. This review identified 14 papers that met the inclusion criteria. Overall, the papers found that physical and occupational therapy students on placement have no

impact or a positive impact on productivity. The findings should be considered preliminary as all of the studies used self-report measures of productivity, the measures employed in the studies were variable, and majority obtained the measures retrospectively ($n = 8$). This section will aim to compare and contrast the findings with previous literature on productivity and explore the nature of the discrepancy of perceived and actual measures of productivity.

This review included studies that had been published since the year 2000. The studies prior to 2000 used similar study designs and similar measures of productivity including patients seen per day and visits per patient care episode.^{20,24} The studies were consistent with prior research showing a positive or no impact of students on productivity. The findings and measures used were also consistent among practice settings and disciplines. Acute care studies in our review found that there was increased productivity with a physiotherapy student, consistent with a similar study conducted in 1994 by Bristow et al.^{24,25} In outpatient settings, current and past studies both used the number of visits per patient care episode as a productivity measure and both found clinical educators with physiotherapy students saw more patients, with comparable number of care episodes.²⁰ Consistency in current and past studies was also noted in occupational therapists, as both found no difference on the provision of direct patient care.²⁶ Similar findings have also been studied in other professions such as medicine. Physicians supervising medical clerks in both outpatient neurology and family medicine were able to see higher volumes of patients when students were present.^{27,28} Overall, studies in this review found that students did not impact productivity and this is comparable to past research.

There was a need to review more recent literature due to the pressures on the current Canadian healthcare system to control costs. Clinical educators have reported an increased demand on productivity combined with reduced staffing levels.^{13,16,27} Despite these reports, we did not find studies that showed that students negatively impacted measures of productivity. Clinical educators may have potentially adapted their supervision style to meet the demands of the healthcare system or it may also be that educational programs better prepare students for today's healthcare system. It is noted that this paper was written in the context of the Canadian healthcare system and only one study was conducted in Canada. However, cost containment measures and productivity pressures are

commonly reported in USA and Australia where most of the studies were conducted.⁹ While it is believed that these studies can be applicable to the Canadian healthcare system, one must be mindful of the lack of research on this topic in Canada which may limit the applicability of the results.

This review also sought to describe what measures of productivity are being used to evaluate the impact of student on productivity. The concept of productivity in health human resources includes three components: input (eg. time spent by a clinician), output (eg. volume of patients) and outcome (eg. patient improvement).¹⁷ All three components are required to obtain an accurate indication of health human resource productivity. The papers in this review measured only one or two of the components, but none measured all three. Majority of papers in this review measured productivity using output measures and few of the papers included a measure of outcome. Patient outcomes should be an essential component of measuring productivity. A higher volume of and reduced time spent with patients resulting in poor patient outcomes is not an improvement in productivity. Only four studies in this review included a measure of outcome and all found no difference in outcome between patients treated by students with therapists' supervision compared to those treated by therapists alone,²⁸⁻³⁰ A reduction in outcome would not be expected as clinical educators provide supervision and are ultimately responsible for the care their students' provide. Overall, there was variability in the studies included in our review with respect to the productivity measurements used and the time comparisons. This continues to make comparisons among studies a challenge and more research is needed to determine optimal and comprehensive measures of productivity in physical and occupational therapy clinical environments.

While there is a need for more comprehensive measures of productivity, some variability in productivity measures between settings may be appropriate. Healthcare is complex and each setting has unique structures, processes and outcomes.³¹ The Donabedian model theorizes that the relationship between structure, process and outcome will impact quality of care.³¹ Structure refers to the organizational attributes, process refers to care activities and outcomes refer to the effectiveness of care.³¹ In this review, papers studying exclusively orthopedic settings measured the number of visits per patient care episode, whereas the other studies measured the number of

different patients seen in a time period, commonly per day. Similar productivity measures have been used for therapists productivity studies in outpatient and acute care.^{32,33} The number of patients seen per day may be more reflective of productivity in acute care as the timing and length of sessions is determined based on the patient's need and the therapist's caseload numbers. This is in contrast to outpatient settings where appointments are scheduled in advance and appointment length is primarily fixed. As such, the number of patients seen per day is determined in advance. Thus, the number of sessions required to achieve rehabilitation goals may be more reflective of productivity in outpatient settings. Stoikov et al.³⁴ demonstrated how the structure and process of a practice setting can impact the number of patients seen. Students in acute cardiorespiratory placements had more patient encounters per week compared to students in neurological rehabilitation.³⁴ Differences in productivity levels between settings was also noted in occupational therapy.³⁵ It is recommended that additional research be conducted to determine the optimal productivity measure based on the structure, process and outcome in a setting with consideration to how student impact may vary across settings.

This review identified that the placement supervision model may also influence productivity measures. While only two papers compared supervision models, both found that when a clinical educator supervises multiple students, there was a positive impact on the productivity measure. Perhaps supervising multiple students results in greater productivity.^{25,34} Students provide an opportunity to have more health human resources to contribute to the workload. The additional health resources provided by students allows for a greater potential number of patient encounters in a time period. This does require a shift in the clinical educator's responsibilities from patient care to teaching and supervision. Supervising multiple students may also have an indirect positive impact on productivity. Ladyshevsky et al.¹⁸ found supervising multiple students fostered peer learning and thereby students were less reliant on the clinical educator.¹⁸ Students in multiple supervision models may be able to answer each other questions, or assist each other with tasks that require two therapists. This frees the clinician educator to supervise the students and provide feedback on their quality of care. Thus, if the initial findings hold, the supervision of multiple students may be a key strategy to increase the number of students on placement while enhancing productivity.

Discrepancy between perception and measurement of productivity

As noted earlier in this paper, it is a commonly held perception that students reduce productivity.^{6,8} Clinical educators also report student supervision is time consuming and increases stress.^{8,13} In contrast, this review found several studies that suggest that students do not negatively impact productivity. An understanding of why this discrepancy exists may facilitate the development of strategies to support student placements.

One potential reason for the discrepancy may be related to variability in the selected productivity measure and the process of measuring productivity. Productivity is defined as the volume of outputs resulting from a volume of inputs to achieve an outcome.¹⁷ The majority of the papers used an output productivity measure to compare the presence and absence of students. However, an increase in the number of patients seen per day (output) that corresponds with more hours worked (input) or a poorer outcome, could not be considered an improvement in productivity. Thus, it is unclear if output measures were achieved through overtime hours, or reduced patient outcomes. Three studies did explore clinical educator activity levels and found the clinical educators devoted more time to teaching and less time to patient care. This was compensated by the student's provision of care.³⁶⁻³⁸ As part of their role therapists also spend time on critical tasks that do not face to face with patients including documentation, collaboration and caseload planning. It is not clear how studies captured these important tasks and how they contribute to productivity. While information on how clinical educators use their time is valuable, quality of care is still not addressed. It may be conceivable that the requirement of therapists to monitor their student(s) quality can contribute to their perceived stress.

The process of measuring productivity can also influence accuracy. Physical therapists have been found to overestimate the time spent on a patient encounter by 20 percent when self-report logs were compared to video recordings.³⁹ Clinical educators may also over-estimate the time spent on patient care and teaching activities when students were present contributing the perception that students are time consuming. However, video recording is not necessarily a feasible method of measurement. Considerations to improve accuracy of self-report productivity measures should include: recording of patient care time, non-patient tasks, overtime hours and a user-friendly method for daily input.⁴⁰ The studies in this review

varied in the detail reported on how self-report data was collected. Thus, one may question the accuracy of productivity findings if overtime and teaching time is not captured, over-estimation is occurring and outcome is omitted. These studies suggest the gap between student impact on clinical educator perception of productivity and measurement may in part be related to measurement errors.

While measurement error may contribute to the discrepancy between perceptions and actual measures, there are likely other factors at play. We recommend that further research be conducted to explore this discrepancy. Mixed methods study designs that combine both qualitative and quantitative components may provide further insight into this discrepancy. As noted in our literature review, studies indicate that clinical educators perceive student supervision as stressful.⁶ In both professions, supervising a student is often perceived by clinical educators to be in conflict with their employer's job expectations and is under recognized.^{14,41} As cost-containment policies continue to be implemented in healthcare organizations, it is conceivable that student supervision may further exacerbate feelings of stress. Combining measures of stress with productivity measures, may yield insight into the discrepancy.

Supervising a student in difficulty may further contribute to the perception of students negatively impacting productivity. Fear of a challenging student is reported as emotionally draining and a barrier to supervision.^{6,42} Of the papers reviewed, only one explicitly mentioned the inclusion of remediation students and small sample sizes in other papers may not have captured struggling students. Clinical educators supervising a failing student spend 20 percent more of their day on teaching activities and an average of 15 minutes per day during the placement in unpaid overtime.⁴³ The extra time required to supervise a struggling student may generalize to future students.⁶ Clinician experiences and productivity data with supervision of struggling students is an area for future exploration.

Limitations

The selected dates, language, limits and databases may not have captured all of the relevant literature on this topic. In an effort to balance feasibility and sensitivity, only the minimum of four databases was searched and there was minimal search of the grey literature. Further, the results were narrowed as the review was limited to papers

published in English and in few countries. Additionally, both authors that reviewed the papers for inclusion both had a background in physiotherapy which may have resulted in the review being completed from a physiotherapy lens. However, the third author had a background in occupational therapy and provided oversight for the scoping review through each of the stages. This topic is not easily studied through the use of randomized controlled trials and thus the quality of evidence for all studies was likely to be low. The studies reviewed had small sample sizes, many used retrospective or cohort designs and all used self-report measures which indicates support for the low quality of evidence available.

Conclusion

Our findings indicate that there is a large variation and lack of comprehensiveness regarding the measurement of students on clinician productivity. While studies in this review provide some evidence that students do not impact clinician productivity, further rigorous research on this topic is recommended to make firm conclusions. Further research on this topic is important because clinicians, perceive that students slow them down. Further studies, designed to understand the discrepancy between perception and actual measure would be beneficial and may assist with the development of strategies to increase placement offers. In addition, more research is recommended on the optimal process and measurement of productivity and whether there is an optimal measure for each profession and setting.

Conflicts of Interest: None of the authors have any conflicts of interest to declare.

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Appendix A

Table 2. Search strategy through MEDLINE

Search Concept	Searches	Results
Physical and Occupational Therapy	Exp Physical Therapist/ Exp Occupational Therapists/ Physiotherap*.tw,kf ((physical or occupational) adj3 (therap*). tw,kf ((allied health or rehab*) adj3 (professional* or practitioner*)).tw,kf 1 or 2 or 3 or 4 or 5	60,736
Clinical Education	Internship, Nonmedical/ "Internship and Residency"/ (clinical adj3(educat* or instructor* or supervis* or placement*)).tw,kf ((practice or student or placement) adj3 supervis*).tw,kf (fieldwork or preceptor* or internship* or practicum*).tw,kf 7 or 8 or 9 or 10 or 11	69,269
Productivity	efficiency/ or time management/ Workload/ (productive* or efficien* or workload* or output* or caseload* or activit* or input*).tw,kf ((unit or units) adj3 (billed or billing)).tw,kf ((length or service adj3 occasion*).tw,kf (patient* adj3 number*).tw,kf (time adj3 ("use" or usage)).tw,kf 13 or 14 or 15 or 16 or 17 or 18 or 19	3,079,910
Combined with AND	6 and 12 and 20	192
Limits	Limit 21 to (yr="2000-Current" and English)	150

Table 3. Study characteristics

Study	Context	Supervision Student(s): Clinical Educators	Study Design	Comparison	Sample Size	Productivity Measure and Method	Findings
Dillon et al (2003) ⁴⁴	PT+ USA Acute Rehab	1:1 & 2:1	Prospective	Clinician alone versus same clinician with student(s)	5 clinicians 6 students	# pt seen/day # assessments/day # hours worked/day	Clinician with student(s) saw increased patients No difference in assessments
Hake et al (2005) ²⁸	PT USA Acute ortho	2:1 & 3:1	Retrospective review of records	Clinician versus student treated patients	80 patients treated by 25 PTs, 80 patients treated by 26 students	Functional Outcome Measure scores # therapy sessions/patient Total # therapy minutes # visits/patient	No significant differences in any of the measures including outcome
MacDonald et al (2002) ²⁹	PT Canada Outpatient ortho	Not specified	Retrospective review	Clinician alone versus same clinician with student(s)	6 clinicians 5 students 422 patients	Direct patient care time Patient satisfaction	No difference in any of the measures including satisfaction
O'Sullivan et al (2007) ³⁶	PT Ireland Acute Outpatient	1:1 & 4:1	Prospective	Clinician alone versus same or different clinician with student(s)	17 clinicians 17 students	# new patients/week # follow-ups/week Hours of direct care and other activities	Clinicians with students had less follow ups compensated by student follow-ups. Clinician spent less on patient care but more on other tasks
Ozelie et al (2015) ³⁵	OT ^L USA Rehab	1:1	Retrospective review of hospital database	Clinician alone versus same clinician with a student	109 patient encounters from 56 clinicians	Proportion of direct patient care	No difference in direct patient care
Pabian et al (2017) ²⁵	PT USA Acute	1:1 & 2:1	Retrospective review of hospital database	Clinician alone versus same clinician with one or two students	20 clinicians 196 students	Billable services units/day standardized to an 8 hour work day	Clinicians with students had increased billable units, with most increase with two students Clinicians with students had no difference in measures between beginner and advanced students both groups had increased measures at week 6
Pivko et al (2017) ⁴⁵	PT USA Acute, Rehab Outpatient	Not specified	Prospective	Clinician alone versus same clinician with beginner or advanced student	31 clinician logs	# patients/hour # assessments/hour # billable units/hour # hours worked/day	Increased # of patients seen, minutes spent with patients and doubles with students, same number of discharges
Ricketts et al (2016) ³⁰	PT England Acute	Not specified	Not stated	Presence versus absence of students on the weekend	Not specified	# patients seen Minutes spent with patients # doubles seen # discharges	Clinicians with students had increased billed therapy units/month
Rindflesch et al (2009) ⁵⁵	PT & OT USA Acute Outpatient	2:1 & 3:1	Descriptive	Clinician alone versus different clinician with students	Not specified	Billed therapy units/month per full time equivalent	Clinicians with a student saw more patients, students spent more time
Rodger et al (2011) ³⁷	OT Australia All settings	Not specified	Prospective	Clinician alone versus same clinician with a student	18 clinicians 13 students	# patients seen/day # minutes spent with patients	

Rodger et al (2012) ³⁸	OT & Dietician Australia All settings	Not specified	Prospective	Clinician alone versus same clinician with a student	47 clinicians 34 students	# minutes spent on other tasks # patients seen/day # minutes spend with patients # minutes spent on other tasks	with patients and clinicians spent more time on other tasks Clinicians with a student saw more patients. Students spent more time with patients and clinicians spent more time on other tasks No difference in outcomes in student and clinicians treated patients, trend towards students needing more sessions/patient No difference in patients seen or minutes spent in direct care. Clinicians spent more time on other activities
Rone-Adams et al (2009) ²³	PT & OT USA Outpatient ortho	Not specified	Retrospective	Clinician treated versus student treated patients	17 clinicians 17 students	Patient reported functional status # treatments/patient Duration of treatments	Increased # of patients seen and decreased minutes spent with patients each week, most patients seen in cardiorespiratory placements, no difference in supervision model
Sevenhuysen et al (2014) ⁴⁷	PT Australia Acute Rehab	2:1	Randomized cross over and retrospective chart review	Traditional 2:1 supervision versus peer assisted model	14 clinicians 20 students	# patients seen/day Minutes spent on direct care Minutes spent on other tasks	Increased # of patients seen and decreased minutes spent with patients each week, most patients seen in cardiorespiratory placements, no difference in supervision model
Stoikov et al (2018) ³⁴	PT Australia Acute Rehab	2:1, 3:1 & 4:1	Retrospective review of workload	Cardiorespiratory, musculoskeletal, and neurological placements, week by week, supervision model	300 weeks	# patients seen/week by students Minutes spent on direct care by students	Increased # of patients seen and decreased minutes spent with patients each week, most patients seen in cardiorespiratory placements, no difference in supervision model