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Student and supervisor productivity change during nutrition and dietetic practice placements: a cohort study.

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Abstract
Aim
This study aimed to demonstrate how supervisors and students use their time during the three domains of nutrition and dietetic clinical placement and to what extent patient care and non-patient activities change during placement compared to pre- and post-placement.

Methods
A cohort survey design was used with students from two Queensland universities, and their supervisors in 2010. Participants recorded their time use in either a paper-based or an electronic survey. Supervisors’ and students’ time-use was calculated as independent daily means according to time use categories reported over the length of the placement. Mean daily number of occasions of service, length of occasions of service, project and other time use in minutes was reported as productivity output indicators and the data imputed. A linear mixed modelling approach was used to describe the relationship between the stage of placement and time use in minutes.

Results
Combined students’ (n= 21) and supervisors’ (n=29) time use as occasions of service or length of occasions of service in patient care activities were significantly different pre, during and post placement. On project-based placements in food service management and community public health nutrition, supervisors’ project activity time significantly decreased during placements with students undertaking more time in project activities.

Conclusions
This study showed students do not reduce occasions of service in patient care and they enhance project activities in food service and community public health nutrition while on placement. A larger study is required to confirm these results.

Keywords: professional education; clinical education; productivity; efficiency; dietetics; student placement,
Clinical education of students in the workplace is viewed as essential for developing competency for professional practice; however the productivity consequences are often contested. An improved supply and distribution of the health workforce through increased allied health tertiary clinical education places is seen as a national priority but adequate clinical placement hosts are difficult to find. Increased student numbers are a major driver of clinical placement shortages with additional factors including reduced length of hospital stay, workforce demographic shifts towards increased casualisation and new models of care also contributing. The National Health Workforce Taskforce (NHWT) estimated that from 2005 to 2013 more than 80,000 additional allied health clinical placement days would be needed annually.

A range of methods have been employed previously to capture the impact of clinical education placements on workplace productivity and the associated costs and benefits. Typically time use and/or occasions of service data have been used as the primary indicator of productivity changes. Various methods for measuring time use and occasions of service have been reported in dietetics, occupational and physical therapy, such as daily log sheets or time use diaries, with reduced productivity weightings given to the student. Australian studies in dietetics have focused on collecting data from students from a single university and only in the hospital setting or have described innovative methods of increasing placement capacity by placing students in pairs. In 2002, Torres et al measured dietetic activity, nutrition condition and time spent with patients of 26 students over an 8 week hospital placement. Hughes et al prospectively measured student activity in a 10 week hospital placement, including student service delivery and
supervisory practice related to the student service\cite{9}. Neither collected independent
supervisor activity.

However, no work that we have found has described the change in productivity or time-
use resulting from nutrition and dietetics clinical education placements across the three
domains of Individual Case Management (ICM), Food Service Management (FSM) and
Community/Public Health Nutrition (CPHN), as well as independent records of student
and supervisor activity and combining data from 2 universities. Clinical placements were
defined as per the Dietitians Association Australia (DAA) requirement; that is 10 week
ICM placement, a four to six week CPHN placement and a four to six week FSM
placement. The ICM placement is focussed predominantly on individual patient contact,
whereas the FSM and CPHN placements are project based.

The current study was part of a larger project investigating both supervisors’ and
students’ occasions of service and time use as a proxy for productivity in clinical
education placements in occupational therapy and nutrition and dietetics in Queensland,
Australia\cite{11}. In this larger study, only data pertaining to patient care was published for
both disciplines. The aim of the current study was to investigate how supervisors and
students use their time across the three domains of nutrition and dietetic placement and
to what extent occasions of service and non-patient activities change during placement
compared to pre- and post-placement.

Methods
A population based cohort survey design was used involving final year nutrition and dietetics students from two Queensland universities and their Queensland Health supervisors. Ethics approval was granted by the Human Research Ethics committees. One hundred and fifty one nutrition and dietetics students were eligible; namely those participating in their final year clinical placements in semester one in 2010. Eligible supervisors needed to have direct responsibility for student assessment in Queensland Health funded services (approximately n=140 supervisors). The number of supervisors was estimated from university data at the time of the study.

The study ran for 28 weeks, during which time students could potentially engage in two placements, ICM and FSM or ICM and CPHN. FSM and CPHN data were combined because the project activity was similar and it improved numbers in this domain. Supervisors were asked to participate two weeks prior and post placement and supervisors were matched with students. No student participated for more than 16 weeks, the maximum time for two placements. Recruitment was staggered to capture the maximum number of students on placement from both universities in the first six months of 2010. Participants could join at any stage of placement however the majority of students joined within the first two weeks of placement and the majority of supervisors joined two weeks prior to placement. Participants documented the time they worked either electronically or on paper, in 30 minute blocks, on three randomly-allocated days each week. Supervisor student dyads for all three domains were identified on the data collection sheet and occasions of service were defined as the number of patients seen by the student supervisor team, either together or separately. In all placements it was possible for one student to have different supervisors over the period and for supervisors
to be managing more than one student at a time. Changes in teams were tracked by the
participation codes provided by respondents in the survey. Length of an occasion of
service was the number of minutes spent with/managing a patient by the student-

supervisor team. If patients were seen by a supervisor and a student, only one supervisor
or student was counted per 30 minute time period so that an occasion of service would be
an output of the number of patients seen. Time use data for matched student-supervisor
teams showed their combined productivity. Inclusion criteria were established to ensure
outputs could not exceed 100 per cent of service delivery capacity. Time use categories
were used to facilitate consistent data entry (Table 1). Project activity replaced patient
care activities for FSM and CPHN placements and supervisors were again matched with

students.

Data were managed and labeled rigorously to ensure information from participants was
chronologically correct. It was important to know when missing weeks of data existed for
each participant. Each week’s data was labeled to form a continuous 10 week in ICM or

4-6 week in FSM/CPHN learning experience. To assist this process, participants were
asked to date each weekly survey to which they responded. Where there was uncertainty
regarding placement schedules, individual sites were contacted to obtain accurate

information.

The dataset was organised for analysis using Microsoft Excel 2007 (Microsoft
Corporation, 2007) and statistical analysis undertaken with SPSS for Windows (version
18.0, 2009, SPSS Inc., Chicago, Illinois). Supervisors’ and students’ time-use was
calculated as independent daily means according to time use categories reported over the
length of the placement. A Visual Basic macro was written and applied in Microsoft
Excel (Microsoft Corporation, 2007) to automatically bring data from the electronic survey responses into the database. Poor response rates from participants led to the decision to create an augmented dataset. This was achieved by imputing data where it was missing. Imputation occurred when a participant did not adequately report their daily activities but their supervisor or student partner’s response was available, making it clear how the other participant also spent their time. When there was missing data such as this but the time use for both participants could be explained for at least 75% of the working day based on the completed survey, the available time use information was used to augment the dataset by creating a new participant. Confidently assuming that one participant’s time use could explain how their pair used their time increased the total number of student-supervisor pairs. Where less than 75% of the working day could be calculated reliably, these time use periods were treated as missing data and not imputed. Consistent trends were demonstrated when the original and augmented datasets were compared, confirming the appropriateness of using the augmented dataset in subsequent analysis.

Mean daily number of occasions of service and length of occasions of service for supervisor/student dyads in ICM and time use in minutes for both supervisors and students separately in all placements was reported as productivity output indicators. In the models used to examine differences in number and length of occasions of service, the autoregressive error covariance structure provided the most adequate model. A linear mixed modeling (LMM) approach was used to describe the relationship between the stage of placement (pre-, during-, or post-placement) and the output indicator. LMM is well suited to dealing with missing observations and is versatile in implementing
different residual covariance structures. Unstructured, autoregressive and compound
symmetry residual covariance structures were trialed. Model accuracy was assessed using
deviance and Akaike’s Information Criteria. Significance of the overall effect of the stage
of the placement was tested and post-hoc t-tests were completed exploring differences on
the estimated marginal means from the LLMs. A more detailed explanation of the
statistical modeling is described in the large study11.

Results
After imputation, twenty one (21) sets of student data (14% response rate) and 29 sets of
supervisor data (21% response rate) was used. Sixteen (55%) of the supervisors were
supervising ICM placements, and the remaining 13 (45%) were supervising CPHN or
FSM placements. Seventy per cent (70%) of the supervisors were aged 34 years or less
and were all female. Eighty nine per cent (89%) were working in metropolitan areas, 7%
in regional and 4% remotely. The cohort was younger, with more supervisors working in
metropolitan areas than Australian dietitians generally12. The majority (63%) of
supervisors who provided demographic data had each supervised 10 or more students in
the past. A broad range of experience was represented in this survey with supervisors
reporting between one and a half to 26 years full time nutrition and dietetics experience,
with the average being just over 8.5 years. Students’ mean (±SD) age was 25±6.5 years
and 85% were female and were representative of the cohort from both universities. From
raw data on average (mean ±SD ), more students participated in the CPHN/FSM data
collection (11±2) compared to the ICM (3±1) and more ICM supervisors (10±1) than
CPHN/FSM (7±2). All participants provided data over three days for each week they
participated, however not every student and supervisor collected data every week. The linear mixed modeling accounted for missing data and the difference in amount of data available for analysis within each time period (pre, during and post placement).

The estimated marginal means for daily number of occasions of service per day for ICM was 3.39, 5.18 and 2.57 pre-, during and post-placement respectively. These results for student supervisor pairs however only relate to the first 6 weeks of placement as supervisor data was not available for the second half of the student placement. The results of the linear mixed models showed a statistically significant difference between the number of occasions of service delivered from pre to during placement (p=0.036), and from during to post placement (p=0.019) (Table 2). Mean daily length of occasions of service per day was 64.10, 71.94 and 69.21 minutes pre-, during and post-placement respectively. The differences in length of occasions of service were not significant across the three time periods. Table 2 also shows supervisor time spent in patient versus non patient activities with the latter broken down further into placement activities and service activities. There was a statistically significant difference between the ICM supervisors’ daily mean time spent in placement activities (model p= 0.002). Post hoc analysis indicated a significant difference between the daily mean supervisor time spent in placement activities pre- and post-placement (p=0.03), and during and post-placement (p = 0.001), with no time spent in placement activities after placement. There were no statistically significant differences in supervisors’ time spent in patient care, all non-patient care or service management activities pre, during or post placement. The model did not account for the total number of hours worked.
Figure 1 illustrates the raw time use data prior to the LMM approach and confirms that supervisors’ time spent in placement activities, such as assessment tasks were significantly greater during placements. Patient care, service management and other activities were reduced for supervisors, while students spent significant time in patient care activities (>320 minutes), however this difference in supervisor time disappeared with the modelling. Table 3 compares FSM and CPHN supervisors’ time use in various activities pre-, during and post-placement. There was a significant difference between the daily mean FSM and CPHN supervisor time spent in project activities pre- and during placement ($p=0.039$), and between pre- and post-placement ($p=0.01$) on project-based placements. For supervisor time spent in non-project activities post hoc analysis also showed a significant difference between the daily mean supervisor time spent in all non-project activities pre- and during placement ($p=0.005$), and between during and post-placement($p=0.002$).

During placement, supervisors’ time use in project activities decreased from pre-placement levels, however mean daily student time spent doing projects during placement was 322 minutes (Figure 2). During the two weeks post-placement, supervisors engaged in more service management activities and time use in project activities did not return to pre-placement levels.

Discussion

This study demonstrates that hosting students does not reduce service delivery during nutrition and dietetics placements. This is the first time student and supervisor productivity has been measured in nutrition and dietetic placements across all three domains of practice in Australia.
1 The number of student supervisor teams and hence data availability was particularly
2 small from the ICM domain however the mean number of occasions of service, 5.18/day,
3 is similar to the two other studies in dietetics, ranging from 3.6-5.5/day \(^8\) and 3.3/day \(^9\). In
4 both these studies, supervisor time was only accounted for as part of student involvement
5 with patients and independent supervisor data was not collected. The higher mean
6 occasions of service in our study compared to Hughes\(^9\) could be explained as an
7 increased level of activity when both supervisor and student activity is taken into account.
8 Table 2 indicates some patient care is managed by students as supervisor patient care
9 time decreases although not statistically significantly. Overall fewer minutes were spent
10 by ICM supervisors in service management activities during and post-placement
11 compared to pre-placement. It could be assumed that when students take on more of the
12 patient care of their supervisors, more time is spent other activities such as research rather
13 than service management. The data from Figure 1 suggests however that supervisors
14 were not working significantly more hours during placement with overall time recorded
15 less than 400 mins/day. 
16 Patient care in ICM has been identified as particularly labor intensive for supervisors as
17 students must develop a skill level of safety to practice to assist with patient care. Torres
18 et al\(^8\) have shown that as time spent in placement increases, dietetic student proficiency
19 in patient-related care activities improves and students spend more time engaged in direct
20 patient contact, working independently of the supervisor. Similarly, students on their
21 second and third placement have been found to have higher levels of workplace
22 productivity compared to students undertaking their first placement.
Ladyshewsky\textsuperscript{13} found increased productivity even when an efficiency factor of 60% was applied to physiotherapy student hours. Hughes et al\textsuperscript{9} applied a simplified cost benefit analysis to student activity assuming four levels of efficiency, 40%, 60%, 80% and 100% compared to a senior practitioner and when a nominal hourly wage was applied to supervisor and student hours, showed students would need to work at 80% of their supervisor’s efficiency throughout a ten week ICM placement to recover the costs of supervision. Increased hours spent as a measure of productivity however does not necessarily translate into better patient outcomes. A study of physiotherapists and occupational therapists and student dyads (n=17) found patients treated by therapists had fewer visits (10.8 visits for students, 9.1 visit for therapists), a shorter treatment duration (37.6 days for students, 27.2 days for therapists) and greater improvement in functional status\textsuperscript{14}. Our study did not measure outcomes such as follow-up treatment and functional status and this should be considered in future research. FSM and CPHN clinical education placement supervisors were able to transfer project-based work to students and focus on non-project activities. This is demonstrated by the significant decrease in supervisors’ time spent in project activities from before the placement to during the placement (Table 3). Even after the placement, the time spent on project-related activities did not recover to similar levels as those recorded pre-placement. In line with the reduction in time spent on project-related work during placements, FSM and CPHN supervisors’ time spent in non-project activities increased during placement and dropped to a level that was similar to pre-placement levels after the placement ceased. This time use pattern is consistent with the observation that supervising students in project-based placements appears to enable supervisors to work on non-project activities however more
time was required to undertake this. Overall supervisors in the CPHN placements worked significantly longer hours while students were on placement (Figure 2 and Table 3). Post-placement, FSM and CPHN supervisors continued to engage in placement activities, in contrast to ICM supervisors, who spent no time in placement activities post-placement. This is likely to reflect the different assessment formats and reporting requirements for the different placements and possibly the completion of projects undertaken by students while on placement.

Limitations of this research include the poor response and restriction to Queensland, so caution should be exercised in interpreting the results which may limit representativeness. Our combined data with occupational therapy students with higher numbers show similar results in ICM\(^1\). It was unfortunate that supervisors in the second half of the ICM placement did not participate in the data collection despite repeated attempts to encourage them to do so. Many of these supervisors were in regional and remote areas and in smaller facilities with possibly more complex roles and fewer staff and thus less likely to have time to participate. Accordingly students on their first ICM placement may have also found collecting data difficult. Even though this study was conducted under the auspices of senior allied health management in Queensland Health, the response rate remained poor and significant buy in from the whole profession would be required to increase response rate in future studies. Further corporate support of supervisors for undertaking this type of research may be required to increase participation rates. Every attempt was made through our imputation approach to use available data in a meaningful way to provide insight into an issue which has significant implications for nutrition and dietetics tertiary education. The two weeks of data collection that was used to capture
pre- and post-placement activity may also not be a valid representation of usual productivity for all supervisors. It is feasible that for the two weeks pre- and post-placement, the placement itself creates an impact on supervisor workload. It is clear supervisors work very hard to maintain service levels when students are on placement and collecting the data for this study could have added an extra burden which explained the low response rate. Strengths of this study include being the first of its kind to prospectively measure time use and productivity for project-based nutrition and dietetic clinical education placements. The method for collecting and analyzing data is robust and could be applied to larger studies on productivity in nutrition and dietetics or other allied health professions. It therefore provides important preliminary data for the nutrition and dietetics profession to inform clinical education policy.

This study trialled a novel method for reporting time-use during nutrition and dietetic clinical education placements in order to better understand changes in productivity and supervisory burden. Importantly, data were collected for all types of nutrition and dietetics clinical placements for the first time. Project-based placement supervisors were able to shift their time spent in project activities towards non-project related activities during placements while the projects were continued by students, however this may have been due to increased overall time spent while students were on placement. Occasions of service increased while students were on ICM placements suggesting supervisors work particularly diligently to maintain and even increase service delivery. Further research with a larger Australian sample is indicated in order to establish a clearer picture of the impact that clinical education supervision has on time use and service delivery. The
impact of clinical education placements on health outcomes, patient satisfaction levels and case-mix information could also be explored.
References


13 Ladyshewsky RK, Barrie SC, Drake VM. A comparison of productivity and learning outcome in individual and cooperative physical therapy clinical education models... including commentary by Sanders BS with authors' response. Physical Therapy. 1998; 78: 1288-301.

Table 1: Definitions of Time Use Categories for Students and Supervisors

<table>
<thead>
<tr>
<th>Direct patient care</th>
<th>Individual or group patient/client contact (member of the public); ward rounds; school visits; group-based therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect patient care</td>
<td>Preparing for patient/client contact (member of the public); travel; documentation and discharge planning; managing patient issues; documentation and evaluation of patient/client contact; peer support; case conferences</td>
</tr>
</tbody>
</table>

| Project Activities# |
|---------------------|---------------------------------------------------------------------------------------------------------------|
| Project interventions (no ethics approval required) | Primary prevention community interventions; community/stakeholder consultations; communication; peer support; partnership projects; consultancy work; reviewing workplace policies; undertaking quality improvement projects; audits; establishing evidence based practice |
| Project management processes | Reading literature; project preparation; report writing |

<p>| Placement Activities |
|----------------------|---------------------------------------------------------------------------------------------------------------|
| Engaging in placement assessment | Placement reports; completing other assessment requirements |
| Managing the placement | Orientation; tuition; debriefs; feedback to student; |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service management</td>
<td>Work unit meetings/communication eg. Emails; staff management/supervision; forms; human resource/payroll issues</td>
</tr>
<tr>
<td>Other</td>
<td>Research (ethics approved) – Formal research project – leading or participating; completing this survey</td>
</tr>
<tr>
<td></td>
<td>Teaching and training – not related to the placement – Delivering in-service; guest lecture</td>
</tr>
<tr>
<td></td>
<td>Break – Paid or unpaid breaks eg. Morning tea</td>
</tr>
<tr>
<td></td>
<td>Undefined – Tasks not described above</td>
</tr>
</tbody>
</table>

#Project activities were grouped with the category ‘other’ for ICM placement
Table 2: Linear Mixed Models Results for Selected Variables During Individual Case Management Placements

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-placement</th>
<th>During placement</th>
<th>Post-placement</th>
<th>Differing stages of placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of occasions of service</td>
<td>3.39 (2.17:4.61)</td>
<td>5.18 (4.19:6.17)</td>
<td>2.57 (1.32:3.82)</td>
<td>Pre &lt; During p=0.036*</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pre &gt; Post p=0.176</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>During &gt; Post p=0.019*</td>
</tr>
<tr>
<td>Length of occasions of service (min/day)</td>
<td>64.1 (32.15:96.04)</td>
<td>71.94 (51.01:92.88)</td>
<td>69.21 (34.88:103.54)</td>
<td>Model not significant</td>
</tr>
<tr>
<td>Supervisor time spent in patient care activities (min/day)</td>
<td>301.96 (249.91:354.00)</td>
<td>212.85 (162.56:263.14)</td>
<td>178.29 (89.02:267.56)</td>
<td>Model not significant</td>
</tr>
<tr>
<td>Supervisor time spent in all non-patient care activities (min/day)</td>
<td>116.47 (42.90:190.04)</td>
<td>101.18 (55.92:146.44)</td>
<td>69.71 (33.78:105.64)</td>
<td>Model not significant</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>During</td>
<td>Post</td>
<td>p-value</td>
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</tr>
<tr>
<td>Supervisor time spent in placement activities (min/day)</td>
<td>25.49 (2.84:48.34)</td>
<td>45.88 (23.71:68.05)</td>
<td>0 (0:0)</td>
<td>Pre &lt; During p=0.128</td>
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<tr>
<td>Supervisor time spent in service management activities (min/day)</td>
<td>99.04 (72.83:125.26)</td>
<td>71.54 (46.83:96.25)</td>
<td>105.42 (44.63:166.22)</td>
<td>Model not significant</td>
</tr>
</tbody>
</table>
Table 3: Linear Mixed Model Results for Selected Time Use Categories for Supervisors During Food Service and Community/Public Health Nutrition Placements

<table>
<thead>
<tr>
<th>Time Use Category</th>
<th>Estimated Marginal Mean (95% Confidence Interval)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-placement</td>
<td>During placement</td>
</tr>
<tr>
<td>Project activities (min/day)</td>
<td>134.09 (68.72:199.46)</td>
<td>71.51 (19.23:123.80)</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All non-project activities (min/day)</td>
<td>83.46 (-4.12:171.04)</td>
<td>301.99 (196.45:405.52)</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>Placement activities (min/day)</td>
<td>37.62 (-19.63:94.87)</td>
<td>96.70 (60.20-133.20)</td>
</tr>
<tr>
<td>Service management activities (min/day)</td>
<td>134.87 (37.93-231.81)</td>
<td>144.99 (75.52-214.47)</td>
</tr>
</tbody>
</table>
*statistically significant at the 5% level
Figure 1: Time Use of Supervisors pre-, during and post- and Students during Individual Case Management Placements

Figure 2: Time Use of Supervisors pre-, during and post- and Students during Foodservice Management and Community Public Health Nutrition Placement.

Figure 2: Time Use of Supervisors pre-, during and post- and Students during Foodservice Management and Community Public Health Nutrition Placement.
Supervisor Pre-placement

Supervisor during placement

Student during placement

Supervisor Post placement

Mean daily time (mins)

Other

Service Management

Placement Activities

Project Activities

Supervisors' and students' stage of placement
Pre-placement Supervisor during placement (Wks 1-6)

Student during placement (Wks 1-10)

Post placement

Mean daily time (min)

Supervisors’ and students’ stage of placement

- Other
- Service Management
- Placement Activities
- Patient Care