Education

Breadth *versus* volume: Neurology outpatient clinic cases in medical education

Dara V. Albert [a,*], Angela D. Blood [b], Yoon Soo Park [c], James R. Brorson [d], Rimas V. Lukas [d]

[a] Nationwide Children's Hospital, Ohio State University, Division of Neurology, 700 Children's Drive, Columbus, OH 43205, USA
[b] Rush Medical College, Rush University, IL, USA
[c] University of Illinois at Chicago, Department of Medical Education, IL, USA
[d] University of Chicago, Department of Neurology, IL, USA

ARTICLE INFO

ABSTRACT

This study examined how volume in certain patient case types and breadth across patient case types in the outpatient clinic setting are related to Neurology Clerkship student performance. Case logs from the outpatient clinic experience of 486 students from The University of Chicago Pritzker School of Medicine, USA, participating in the 4 week Neurology Clerkship from July 2008 to June 2013 were reviewed. A total of 12,381 patient encounters were logged and then classified into 13 diagnostic categories. How volume of cases within categories and the breadth of cases across categories relate to the National Board of Medical Examiners Clinical Subject Examination for Neurology and a Neurology Clerkship Objective Structured Clinical Examination was analyzed. Volume of cases was significantly correlated with the National Board of Medical Examiners Clinical Subject Examination for Neurology ($r = .290$, $p < .001$), the Objective Structured Clinical Examination physical examination ($r = .236$, $p = .011$), and the Objective Structured Clinical Examination patient note ($r = .238$, $p = .010$). Breadth of cases was significantly correlated with the National Board of Medical Examiners Clinical Subject Examination for Neurology ($r = .231$, $p = .017$), however was not significantly correlated with any component of the Objective Structured Clinical Examination. Volume of cases correlated with higher performance on measures of specialty knowledge and clinical skill. Fewer relationships emerged correlating breadth of cases and performance on the same measures. This study provides guidance to educators who must decide how much emphasis to place on volume *versus* breadth of cases in outpatient clinic learning experiences.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The USA Liaison Committee on Medical Education requires students to document exposure to a range of clinical cases during clerkships [1]. While the number of cases, or volume, logged during an outpatient clinical experience correlates with performance on objective measures of knowledge and clinical skill [2], studies have not examined the relationship between breadth of cases and performance.

Prior studies within specific medical specialties examine the case-mix encountered on clerkships, however they focus primarily on evaluating differences in types of cases seen and not their contribution to medical acumen [3,4]. Studies across specialties demonstrate that domain-specific knowledge and general problem solving skills are necessary for clinical competence [5], and across specialties variety of cases and quality of supervision may influence acumen [6]. Although case logs requiring a broad clinical exposure are *de riguer* for surgical residency training [7], little has been published on the role of breadth of exposure for non-surgical specialties, and its impact on clinical acumen.

This study hypothesized that the volume and breadth of cases encountered by students within the outpatient clinic component of a Neurology Clerkship would correlate positively with performance on measures of knowledge and clinical skill. The performance measures for this study include the National Board of Medical Examiners (NBME) Clinical Subject Examination for Neurology as an indicator of knowledge, and the Objective Structured Clinical Examination (OSCE) as an indicator of clinical skill. The role of the OSCE in assessment of students in a Neurology Clerkship has been previously reported [8–11].

2. Methods

The University of Chicago Institutional Review Board deemed this study exempt from review.

Case logs are from the outpatient component of the required 4 week Neurology Clerkship for 486 students from July 2008 through June 2013, totaling 12,381 patient encounters at The University of Chicago Pritzker School of Medicine. The majority of students are third years (n = 452, 93%), with one second year student (n = 1, 0.2%), and the remainder being fourth years (n = 33, 7%). The outpatient clinic experience occurs at two sites, The University of Chicago Medicine and Northshore University Health System a community-based teaching affiliate. Students' preferences are solicited when assigning students to sites, either University of Chicago Medicine (n = 366, 75%) or Northshore University Health System (n = 120, 25%). The outpatient clinic component of the clerkship is approximately 1 week in length. It encompasses adult, pediatric, general and subspecialty clinics. Degree of independence in patient evaluation varied from shadowing of faculty to independently taking the history, examining the patient, and presenting the assessment and management plan. This variability was not static and was influenced by a number of factors including the pace of the outpatient clinic, time available for teaching and motivation of the student.

Students log each outpatient clinic encounter with the primary diagnosis or chief complaint. Students who did not log any cases (n = 9, 1.8%) or did not include diagnoses/complaints (n = 1, 0.2%) are not included in the analyses. The cases were retrospectively classified into 13 categories: seizure, cerebrovascular disease, peripheral/neuromuscular, spinal disease/neck/back pain, central nervous system demyelinating disease/neuro-immunology, headaches, sleep disorders, neuro-oncology, movement disorders, dementia, other neurodegenerative disorders, other, and not listed (Table 1). When more than one diagnosis or chief complaint is listed, the primary one is used in the analysis. Some diagnoses, such as cerebrovascular, which form a substantial percentage of the cases encountered in the inpatient setting, compose a smaller number of the cases logged in the outpatient clinic. While students are provided with a schedule of suggested faculty with whom to work each half-day, their schedules are flexible to allow for the maximum amount of clinical exposure. In turn, the distribution of cases logged is influenced by numerous factors including patient availability, faculty availability, and student interest.

Students are assessed on the final day of their clerkship rotation via the NBME examination and the OSCE. In the OSCE, students collect a patient history, perform a complete neurologic physical examination, and complete a patient note to document their clinical formulation for two standardized patients (SP) cases. The OSCE score is made up of history and physical examination checklists completed by trained SP, and the patient note clinical formulation checklist scored by trained faculty.

Analysis includes pairwise Pearson correlations for each dependent variable (NBME, OSCE: patient history, OSCE: physical examination, OSCE: patient note) and the two independent variables (volume of each of the 13 diagnostic categories as well as breadth of each of the diagnostic categories). Volume is calculated based on number of patient encounters logged per category; breadth is coded as either one (student logged at least one case in the given category) or zero (student logged no cases in a given category) per category. Multiple linear regression compares the volume and breadth of cases overall with each dependent variable. Students are divided into quartiles of the academic year to evaluate for effects of clinical experience on outcomes.

3. Results

There are similar numbers of students present in each quartile of the academic year, and calendar year, p = 1.000 (Table 2). Based on a chi-squared test, there are no significant differences in student logs across quartiles or calendars years (χ^2 [12] = 1.40, p = 1.000).

3.1. Volume and breadth considering each diagnostic category

When considering each of the 13 diagnostic categories, the volume of cases seen per student correlates with performance on the NBME examination (r = .290, p < .001) and the OSCE patient note clinical formulation (r = .238, p = .010). Correlation is also present between volume of cases and the OSCE physical examination (r = .236, p = .011), a finding which was not noted in our original study [1] perhaps because a smaller data set was used. There is no significant correlation between volume of cases and the OSCE patient history component. Again when considering each of the 13 diagnostic categories, breadth of cases is significantly correlated with the NBME examination (r = .231, p = .017), however breadth is not significantly correlated with any component of the OSCE (history, physical examination, patient note) (Table 3). These results indicate that volume (rather than breadth) of cases has a stronger relationship to student performance in objectives measures of performance (NBME, OSCE).

3.2. Volume and breadth overall

The total number of cases logged by students, regardless of category, is significantly correlated with the NBME score (r = 0.118, p < .001), the OSCE physical examination (r = 0.97, p = .032), and the OSCE patient note clinical formulation (r = .101, p = .026). The total number of case categories logged by students, regardless of which ones, is also significantly correlated with the NBME score (r = .114, p = .012), however is not significantly correlated with any component of the OSCE. These results indicate that sheer volume of cases regardless of category has a strong relationship to student performance, while breadth of cases helps to some extent with NBME score. Students are therefore benefited by a large volume of cases in total, and even one case per category (rather than none) is helpful (Supp. Table 1, 2).

3.3. Specific case types

Interestingly, specific types of cases are significantly related to students' performance on other measures. For example, the NBME score is significantly related to the volume of cases for spine/neck/back pain (p = 0.002) and headaches (p = 0.006). This means that

Table 1
Cases per diagnostic category logged as part of the outpatient component of the 4 week Neurology Clerkship for 486 students

Category	Number of cases
Cerebrovascular disease	446 (3.6%)
Seizure	1305 (10.5%)
Dementia	217 (1.8%)
Peripheral/neuromuscular	1487 (12.0%)
Spinal disease, neck/back pain	409 (3.3%)
Central nervous system demyelinating disease/neuro-immunology	1545 (12.5%)
Neuro-oncology	1901 (15.4%)
Movement disorders	932 (7.5%)
Sleep disorders	489 (3.9%)
Headaches	1031 (8.3%)
Other neurodegenerative disorders	357 (2.9%)
Other	2031 (16.4%)
Not listed	231 (1.9%)
Total cases across all categories	12,381