Faculty Perceptions of the Biostatistics Knowledge among Ophthalmology Residents

Puneet S. Braich,[1,2] MD, MPH; Vikram S. Brar,[1] MD; Christopher T. Leffler, MD, MPH,[1]; Donna M. Windish, MD, MPH[3]

1. Department of Ophthalmology, Virginia Commonwealth University School of Medicine, Richmond, VA
2. Department of Biostatistics, Yale School of Public Health, New Haven, CT
3.Department of Internal Medicine, Yale School of Medicine, New Haven, CT

The authors have no financial interest to disclosure in the subject matter of this poster.

Introduction

Physicians must keep current with clinical information to practice evidence-based medicine (EBM). In doing so, most prefer to seek clinical summaries, which give the clinical bottom line,[1-3] Resources that maintain these summaries are typically limited in their inclusion of pathological conditions.[4] Therefore, to answer many of their clinical questions, physicians need to access reports of original research. This requires the reader to critically appraise the design, conduct, and analysis of each study and subsequently interpret the results.

Earlier studies demonstrated that practicing physicians, particularly those with no formal education in epidemiology and biostatistics, had a poor understanding of common statistical tests and limited ability to interpret study results.[5-7]

Further, post graduate training is usually the final learning time for physicians who may get little exposure to understanding biostatistical and research methods as medical students. Ophthalmology residents who must learn drastically new clinical exam skills and surgical techniques compared to those learned through a traditional medical school education may have little time or desire to understand simple statistical designs, models and how they pertain to the interpretation of clinical data. Faculty may perceive that residents understand the implications of statistical results when actually residents rely on the "summary statements" aka the bottom line of journal articles. How faculty perceive the understanding of their residents to appraise the ophthalmic literature may have implications for promotion, evaluation and patient care.

Purpose

To understand the perceptions of faculty clinicians regarding the biostatistics knowledge of their graduating versus entering ophthalmology residents.

Methods

Survey Development

We developed an instrument which sought the opinions of ophthalmology faculty in reflecting on the statistical methods and results most commonly represented in contemporary research studies To do this we reviewed all original articles published from June to December of 2012 in each issue of 6 Ophthalmology journals (*Ophthalmology, the American Journal of Ophthalmology, the British Journal of Ophthalmology, Journal of Cataract and Refractive Surgery, JAMA Ophthalmology (Archives of Ophthalmology), and RETINA*) and summarized the frequency of statistical methods described. From this review, we developed questions that focused on identifying and interpreting the results of the most frequently occurring simple statistical methods (eg, *t* test, analysis of variance) and multivariate analyses (eg, Cox proportional hazards regression, multiple logistic regression).

Methods (cont'd)

Survey Instrument

The survey contained 2 sets of questions: (1) demographic questions that included age, sex, year of graduation from most recent level of training, amount of time spent in research, role in the residency training program (program directors, clinical instructor, conference lecturer, Other core program faculty, or other), and geographic location; (2) questions on faculty opinions on their resident's ability to interpret and assess statistical concepts (see following slides, Appendix 1,2,3,4);

(3) A section getting the opinions of faculty members on beginning residents and graduating residents. Both with Likert scales. Far below expectations, below expectations, at expectations, greater than expectations and far greater than expectations. This same section posed questions on when along a physicians training should the majority of teaching occur on the understanding of statistical methods: during college/undergraduate courses, during medical school curriculum, during residency training, during fellowship training, during Advance degree education (e.g. MPH, PhD, MScm M.Ed etc), Other). The final questions was "how much do you agree with the following statement: To provide the best evidence-based care for their patients, it is critical that ophthalmologists have a strong understanding of statistical analyses and research methodology. Options were a) Strongly Disagree, b) Disagree, c) Agree, d) Strongly Agree"

Target Population

Faculty members in ophthalmology residency training programs Canada, Europe, and the USA. Surveys were emailed via a central distributing body (e.g. the SF Match service for the programs in the USA, and on an individual basis for the Canadian and European programs. A total of 333 faculty members submitted completed surveys from April 2013 – August 2013.

Analyses

Multiple logistic regression analyses were performed to identify significant factors that might be associated with faculty perception with statistical knowledge. Candidate variables included the demographic factors. The results of the correlation, bivariate, and effect modification analyses were used to determine which demographic variables to include in the multivariable model. Decisions to include factors in the multivariable regression analysis were based on the strength of correlated factors (r0.75) or a *P* value.05 on bivariate analyses. Forward stepwise regression was subsequently used to identify which demographic factors were independently associated with biostatistics knowledge scores. To adjust for multiple pairwise comparisons, a 2-sided level of statistical significance was set at *P*.01 using a Bonferroni correction.

Results

For items 10-14 (appendix 1-4) we eventually combined the categories ranging from 0-100 (5 subtypes) into a dichotomous <60% and ≥60%. We used this cutoff to symbolize a proficiency. I.e. if someone knows 60% or more about a statistical concept they are considered proficient at it. This is a cut off that has been recognized in prior literature.[7]

For Item 14, we combined all the questions for the 4 variables (continuous, nominal, ordinal, dichotomous) into 1 composite entitled "variables." Another grouping called "basic terms" consisted of the composite scores of the faculty impression of how residents understand p values, confidence intervals and the power of the study. Finally for Test analyses the remainder of the items in question 14 were grouped into one. See Tables 2 though 5.

Overall faculty ophthalmologists are of the opinion that almost 2/3 of entering residents (PGY-2 & 3) have a proficient understanding of the statistical analysis of the journal articles they read. Compared to entering residents, graduating residents (PGY 4 or higher given that in certain regions PGY-5 is part of residency). Are perceived to understand ~3/4.

Faculty opine that less than ½ of entering residents know how to perform an online literature search compared to nearly 2/3 of graduating residents (P < 0.05).

Approximately ¾ of entering residents are proficient at understanding statistical variable types and their uses while its over 80% of graduating residents have this proficiency (See slides). The same pattern is seen for basic terms (p< 0.05 for both).

Just over ½ of entering residents are believed to be proficient in understanding the commonly used statistical tests in the ophthalmic literature, compared to nearly 2/3 of graduating residents (P<0.05)

Factors associated with a faculty endorsing a lack of proficiency among junior residents for question 11 (Table 3), and inability to perform a proficient online literature search (Question 12, Table 4) were mean years from the time of graduation < 19 years, those faculty who rated their own knowledge of statistics as average or above, being a program director or another core faculty member. All of these factors were significant in the multivariate model. These same variables were associated with faculty ophthalmologists opining that greater amounts of senior residents had proficiency in these areas (P<0.05).

The vast majority of ophthalmology faculty perceive that junior and senior residents are familiar with discerning different types of variables (ordinal, continuous, dichotomous etc). Further they believe that there is no significant difference in the prevalence of this proficiency among junior and senior residents.

Faculty also endorse that the majority residents know basic terms statistics, the most common encountered being the meaning of a P value, the power of a study or confidence intervals.

Results (cont'd)

Compared to the prior categories faculty believe fewer senior and junior residents know the meaning or indication of certain statistical (i.e. T test, ANOVA, chi square, regression analysis). Furthermore, faculty endorse that the experience gained by a couple years of residency training does not improve this (P<0.05).

When asked if providing the best evidence-based care for their patients, is it critical that ophthalmologists have a strong understanding of statistical analyses and research methodology. 72% of faculty said agree or strongly agree, while 6% said strongly disagree and 22% said simply disagree.

Conclusions

Faculty ophthalmologists are unknowingly making evaluations of their trainees in every interaction whether it be through hearing a case presentation or witnessing surgical skills. One of the ways a resident may demonstrate a well rounded fund of knowledge is to have the ability to interpret the ophthalmic literature critically through the basic understanding of biostatistics and study design. This skill in necessary outside of training since our focus of practicing medicine in the modern era is through evidence based modalities.

Faculty perceive that greater numbers of senior residents are proficient in statistical methods and the ability to navigate their way through ophthalmic literature to make accurate appraisals of journal articles. An overwhelming amount of faculty ophthalmologist in private and academic settings believe that providing the best evidence-based care for their patients, requires that ophthalmologists have a strong understanding of statistical analyses and research methodology. We are currently investigating the actual performance of ophthalmology residents across the USA and will compare those results to the ones here on faculty perceptions

References

1. McColl A, Smith H, White P, Field J. General practitioner's perceptions of the route to evidence based medicine: a questionnaire survey. *BMJ*. 1998;316 (7128):361-365.
2. Young JM, Ward JE. Evidence-based medicine in general practice: beliefs and barriers among Australian GPs. *J Eval Clin Pract*. 2001;7(2):201-210.
3. Putnam W, Twohig PL, Burge FI, Jackson LA, Cox JL. A qualitative study of evidence in primary care: what the practitioners are saying. *CMAJ*. 2002;166(12):1525-1530.
4. Haynes RB. Of studies, syntheses, synopses, summaries, and systems: the "5S" evolution of information services for evidence-based healthcare decisions. *Evid Based Med*. 2006;11(6):162-164.
5. Berwick DM, Fineberg HV, Weinstein MC. When doctors meet numbers. *Am J Med*. 1981;71(6):991-998.
6. Weiss ST, Samet JM. An assessment of physician knowledge of epidemiology and biostatistics. *J Med Educ*. 1980;55(8):692-697.
7. Wulff HR, Andersen B, Brandenhoff P, Guttler F. What do doctors know about statistics? *Stat Med*. 1987;6(1):3-10.

Contact Information:
401 N 11th Street
Nelson Clinic, Suite 349
Richmond, VA 23298
None of the authors have any financial interests of conflicts
Puneet.Braich@aya.yale.edu

Appendix 1

10.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
Other than when specified by the resident's training program (e.g. journal club, conference presentations), what proportion of residents regularly read ophthalmology journals during? their training period?	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%

Appendix 2

11.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
When residents read ophthalmology journal articles (excluding case reports and editorials) how much do they understand from the methods and statistical analysis?	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%

Appendix 3

12.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
What proportion of residents you have trained could accurately perform an online literature search (e.g. pubmed, ovid, embase)?	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%

Appendix 4

13. What proportion of residents you have trained could accurately describe what is meant by	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
Continuous variables	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Nominal variables	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Ordinal variables	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Dichotomous variables	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
P values	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Confidence intervals	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
The power of a study	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
T-test	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Analysis of the Variance (ANOVA)	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Chi square test	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Regression Analysis	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%
Kaplan Meier Curve	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%	[] 0-20 % [] 21- 39% [] 40-59% [] 60-79% [] 80-100%

Table 1. Characteristics of Participants	Percentages may not round up to a 100.
Gender	
Male	53%
Female	47%
Age	
30-39 yrs	19%
40-49 yrs	32%
50-59 yrs	33%
60-69 yrs	9%
> 70 yrs	7%
Years from graduation	
< 5 yrs	12%
6-12 yrs	21%
13-19 yrs	25%
20 - 26 yrs	22%
> 27 yrs	20%
How much of your time is spent in research	
≤ 10%	82%
11-20%	11%
21-30%	4%
31%+	3%
How well do you rate yourself in terms of knowledge in both biostatistics and epidemiology?	
Very weak	6%
somewhat weak	26%
average	34%
somewhat strong	28%
very strong	6%
What is your roll in the residency program that you are affiliated with?	
Program director or associate program director	11%
Clinical instructor	20%
Conference Lecturer	7%
Other core program faculty	40%
Other	22%
What Geographic location best describes you? (Please select one)	
USA	52%
Canada	11%
Europe	11%
Other	6%
	18%

Table 2

10.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
Other than when specified by the resident's training program (e.g. journal club, conference presentations), what proportion of residents regularly read ophthalmology journals during? their training period?	[] 0-59% @78% [] 60-100% @22%	[] 0-59% @ 64% [] 60-100% @36% P< 0.05

Table 3

11.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
When residents read ophthalmology journal articles (excluding case reports and editorials) how much do they understand from the methods and statistical analysis?	[] 0-59% @ 36% [] 60-100% @ 64%	[] 0-59% @23% [] 60-100% @77% P < 0.05

Table 4

12.	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
What proportion of residents you have trained could accurately perform an online literature search (e.g. pubmed, ovid, embase)?	[] 0-59% @ 54% [] 60-100% @46%	[] 0-59% @ 27 [] 60-100% @ 63% P < 0.05

Table 5

13. What proportion of residents you have trained could accurately describe what is meant by	JUNIOR residents (PGY-2 & PGY-3)	SENIOR residents (≥ PGY-4)
variables	[] 0-59% @ 23% [] 60-100% @ 77%	[] 0-59% @ 18% [] 60-100% @ 82%
		P not < 0.05
Basic Terms	[] 0-59% @ 25% [] 60-100% @ 75%	[] 0-59% @17% [] 60-100% @ 83%
		P < 0.05
Test Analysis	[] 0-59% @47% [] 60-100% @ 53%	[] 0-59% @41% [] 60-100% @59%
		P is not < 0.05