The Use of Statistics in the *American Journal of Health Education* from 1994 through 2003: A Content Analysis

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Abstract

This study identifies the extent that knowledge of selected study designs and statistical techniques may assist readers in understanding the statistical component of articles in the American Journal of Health Education. *The frequency of and trend in use of selected statistical research designs and statistical methods is reported, based on 366 research and review articles in volumes 25 to 34, covering 1994 to 2003, of the Journal. Almost 85% of the articles employed a descriptive study design. An increase in cross-sectional surveys that was offset by a decrease in review articles over the study period characterized almost all of the descriptive study designs. Analytic study designs were represented primarily by clinical trials and quasi-experiments. Their use did not significantly increase over the study period. Although descriptive statistics were present in more than 83% of the articles, many other articles relied on statistics beyond the descriptive statistics, such as statistics associated with model validation (33.1%), the chi-square test (25.4%), analysis of variance (ANOVA; 17.2%),* t*-test/z-test (16.9%), the Pearson correlation coefficient (15.3%), and the F-test (13.1%). Beyond these no other statistical methods stand out from the rest as being favored among the authors of the Journal. Epidemiologic statistical methods were less frequently used. The estimated annual percentage change in the percentage of studies not employing statistical methods was –12.71 (95% confidence interval: –23.23, –0.76). A significant increase in use was observed for measures of central tendency/dispersion, ANOVA, Pearson correlation coefficient, and the use of validity/reliability statistics for instrument validation.*

Health educators strive to promote the health and well-being of populations by identifying needs for health education, planning and implementing health education programs, and acting as health resources for communities. The ability to access the scientific literature is vital for health educators to accomplish the responsibilities and competencies established by the National Commission for Health Education Credentialing (NCHEC, 2004). However, the extent that knowledge of research designs and statistical methods is required to effectively read selected health education journals is not fully appreciated.

Studies have previously assessed the use of study designs and statistical methods in medical and health-related journals. These studies have involved biomedical journals (Pilcik, 2003); general medical journals (Colditz & Emerson, 1985; Emerson & Colditz, 1983; Wang & Zhang, 1998); rheumatology and internal medicine journals (Cardiel & Goldsmith, 1995); psychiatric journals (Miettunen, Nieminen, & Isohanni, 2002); the *Journal of Family Practice* (Fromm & Snyder, 1986); ophthalmic journals (Juzych, Shin, Seyedsadr, Siengner, & Juzych, 1992); the rehabilitation literature (Schwartz, Sturr, & Goldberg, 1997); radiology journals (Elster, 1994); public health journals (Levy & Stolte, 2000); and surgical journals (Reznick, Dawson-Saunders, & Folse, 1987). However, as far as we are aware no study has assessed the use of study designs and statistical methods in the health education literature. This study identified the extent that knowledge of selected study designs and elementary statistical techniques may assist readers in understanding the statistical component of articles in the *American Journal of Health Education*.

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Figure 1. Categories of Descriptive and Analytic Studies

Category	Brief Description
Descriptive Studies	
Case report	Description of an individual patient characterizing a specific disease or syndrome
Case series	Description of a small group or cluster of individuals with the disease or symptoms
Cross-sectional	Study design where exposure and outcome are assessed at one point in time; the unit of analysis is the individual
Ecological	Study design where exposure and outcome are assessed at one point in time; the unit of analysis is the group
Hybrid	Study design combining two or more epidemiologic study designs
Focus group	Study of the response, attitudes, and opinions of a small group of individuals used to predict the responses of a larger population
Review	Includes literature reviews, summaries, or outlines of programs or projects, and information literature (theoretical papers or papers based on the opinions or experience of the author)
Web site analysis	Analysis of the content and effectiveness of Web sites or computer software
Delphi method	A technique for structured group communication that allows a group of individuals as a whole to deal with a complex problem
Analytic Studies	
Case control	Study design where subjects are selected on the presence of a disease and controls are selected on the absence of the disease before the exposure status is determined
Cohort	Study design where individuals are followed over time, including prospective, retrospective, and longitudinal studies
Clinical trial	A randomized controlled study design where study conditions are controlled and an intervention is implemented; the unit of analysis is the individual
Community trial	Study design where study conditions are controlled and an intervention is implemented on the group level
Meta/Pooled analysis	Studies that analyze data from a group of studies on the same topic
Quasi-experimental	Study that is conducted as an experiment although it is nonrandomized and where the investigator does not have total control over the intervention

METHODS

Review of Articles

This study assessed the content of volumes 25 through 34 of all full-length and review articles published in the *American Journal of Health Education* from 1994 to 2003. Editorials, personal perspectives, community learning ideas and procedures (CLIPS), and teaching ideas were not included in the study. Two investigators independently read the Abstract, Methods, and Results sections and scanned all other sections and tables of the articles for pertinent information. For each article the presence of selected descriptive and analytic study designs and statistical techniques was recorded and entered in coded form into a computer. Interreviewer disagreements were discussed with an expert third investigator who, after a third independent review of the article, resolved the conflicts.

Brief descriptions of the study design categories used to classify articles (Oleckno, 2002) are presented in Figure 1. Studies were broadly classified as either descriptive or analytic. Descriptive study designs describe the health of a population by characteristics involving person, place, or time. Analytic studies use comparison groups to investigate the determinants of disease by considering information about the association between exposure and disease outcomes. These two categories include several study designs, as described in the figure.

The categories of statistical techniques used to assess the statistical content of the articles are presented and described in Figure 2. These categories were modified from those of Emerson and Colditz (1983) to better fit the content of the journal. These modifications include descriptive statistics, more detailed categories of epidemiologic statistics, and more detailed categories of regression and analysis of variance (ANOVA) methods. As survival analysis is not commonly used in the journal, the survival analysis categories of Emerson and Colditz (life table, regression for survival, other survival analysis) were collapsed into one category that we designated "survival analysis."

Articles that did not employ any statistical measures were coded as "no statistical methods." The remaining articles were

Figure 2. Categories of Statistical Procedures Used to Assess the Statistical Content of Articles

Statistic	Brief Description
No Statistical Methods	No statistics
Descriptive Statistics	
Counts, ratios, proportions	Integer values and relations of one part to the whole
Measures of central tendency/dispersion	Includes mean, mode, median, standard deviation, interquartile range, range, standard error, etc.
Frequency Distributions	
Frequency distribution (graphical)	Classes or categories along with the numerical counts that correspond to each one, presented as a graph
Frequency distribution (tabular)	Classes or categories along with the numerical counts that correspond to each one, presented in a table
Contingency table	Rows of the table represent the outcomes of a discrete variable and the columns represent the outcomes of the other discrete variable.
Statistics for Continuous Data	
t-test/*z*-test	One-sample, matched-pair, and two sample *t*-tests.
F-test	Analysis of variance *F*-test
Other	Wald test, Fischer's LSD test
Nonparametric Tests	
Chi-square	Used to evaluate associations between discrete data
Fisher's exact test	Useful when sample size is small
Other	Sign test, Wilcoxon signed-ranks test, Wilcoxon-Mann Whitney test, McNemar's test, Mantel-Haenszel test, Somer's D, etc.
Epidemiologic Statistics	
Risk ratio	Ratio of the risk of disease between exposed and unexposed groups
Odds ratio	Ratio of the odds of exposure among cases to controls
Attributable risk	The amount of risk of disease among the exposed group that can be attributed to the exposure
Attributable risk %	The percentage of the risk of disease among the exposed group that can be attributed to the exposure
Population attributable risk	The amount of risk of disease among the exposed population that can be attributed to the exposure
Population attributable risk %	The percentage of the risk of disease among the exposed population that can be attributed to the exposure

screened for descriptive statistics; statistics for continuous data; contingency tables; nonparametric tests; epidemiologic statistics; regression/analysis of variance; and other selected statistical techniques. Any statistic employed by the researchers in the reviewed studies to analyze data, validate an instrument, test for differences, or draw conclusions was considered part of the statistical content of an article and was recorded. Epidemiologic statistics used in the introductory or discussion material of an article, based on outside sources, were not included in the analyses.

Data Management

Data on the study design and statistical content of the articles were entered into a Microsoft Excel™ spreadsheet. Counts and percentages were calculated in Excel, and the estimated annual percentage changes (EAPCs) in the percentage of use of selected study designs and statistical techniques, along with 95% confidence intervals, were derived in Statistical Analysis System (SAS) software, version 9.0 (SAS Institute Inc., Cary, NC). EAPCs for the selected study designs and statistical techniques were calculated by first fitting a regression line to the natural logarithm of the percentage (p) using calendar year (x) as a regressor variable. If $\ln(p)=mx+b$ is the resulting regression equation (with slope m) and 10 is the number of years, then $EAPC=100(e^m-1)$, where $e\approx 2.71928$ is the base of natural logarithms. EAPC 95% confidence intervals were derived as $100(e^{m\pm 1.96SE}-1)$, where SE is the standard error of m. EAPC is useful for evaluating trends over time, as it yields the percentage change in occurrence per year based on a linear model. For example, we observed that the EAPC for cross-sectional surveys was 6.59; this indicates that

Statistic	Brief Description
Incidence rate	The rate of new cases in a defined population.
Prevalence proportion	The proportion of the prevalence of a disease or health-related event in a population
Standardization of rates	Corrected rates to remove the confounding effect of an extrinsic factor such as age or race
Mortality rate	The rate of death occurring in a specified population
Regression/Analysis of Variance	
Simple linear regression	A continuous response or outcome variable that provides a measure of the regression function's intercept and slope for one independent variable
Multiple linear regression	A continuous response or outcome variable that provides a measure of the regression function's intercept and slope for more than one independent variable
Logistic regression	A technique that is appropriate for assessing the linear relationship between a dichotomous response variable with an explanatory variable
Multiple logistic regression	Same as logistic regression only for two or more explanatory variables
ANOVA[A]	Extension of the two-sample *t*-test to three or more samples
ANCOVA[B]	Extension of ANOVA in which a covariate is included in the model to control for the influence of confounding
MANOVA[C]	Extension of the ANOVA design in which there are two or more dependent variables
MANCOVA[D]	Extension of the ANCOVA design in which there are two or more dependent variables
Other Statistical Methods	
Pearson correlation	Classical product-moment correlation
Nonparametric correlation	Spearman's rho, Kendall's tau, test for trend, Cramer's V
Validation measures	Cronbach's alpha, factor analysis, Spearman-Brown, Test-retest, split-halves test
Transformation	Methods (logs, square) used to transform the data to get normality
Life expectancy	Based on life table methods
Multiple comparisons	Methods used to make multiple inferences on the same data sets; e.g., Bonferroni method, Scheffe method, Levene's test, Tukey-Kramer procedure, Duncan's test
Power	Use of the detectable (or useful) difference in determining sample size
Survival analysis	Cox proportional hazards model, Kaplan- Meier, actuarial, and life-table
Cost-benefit analysis	Estimating cost in comparison to health benefits
Other	Not included in the above categories, including cluster analysis, discriminant analysis, and some mathematical modeling

[A] Analysis of variance
[B] Analysis of covariance
[C] Multivariate analysis of variance
[D] Multivariate analysis of covariance

the percentage of articles using this study design increased, on average, at a rate of 6.59% per year over the 10-year study period.

RESULTS

Included in the final analyses were 366 articles that satisfied the criteria for selection. A summary of usage of the selected descriptive and analytic study designs is presented according to calendar year in Table 1. A large majority of articles (*N*=310, 84.7%) employed a descriptive study design. Of these articles 275 (88.7%) represented either a cross-sectional survey or a review study design. Of the 56 articles involving analytic studies, 47 (83.9%) represented either a clinical trial or a quasi-experimental study design.

Usage of statistical content of the articles is presented according to calendar year in Table 2. The majority of articles (*N*=306, 83.6%) used one or more statistical techniques. The frequency and percentage of articles using the selected statistical methods is as follows: descriptive statistics (*N*=305, 83.6%), statistics for continuous data (*N*=101, 27.6%), nonparametric tests (*N*=103, 28.1%), epidemiologic statistics (*N*=42, 11.5%), and regression/analysis of variance (*N*=98, 26.8%). The percentage of articles using descriptive statistics ranged from 83.3% for counts, ratios, and proportions, to 46.2% for contingency tables, 45.1% for measures of central tendency/dispersion, and 39.6% for frequency distributions.

The percentage of articles using statistics for continuous data ranged from 16.9% for the *t*-test/*z*-test to 13.1% for the *F*-test and 1.1% for other tests. The percentage of

Table 1. Frequency of Use of Descriptive and Analytic Study Designs in the *American Journal of Health Education* across Calendar Years 1994 to 2003

	1994		1995		1996		1997		1998		1999		2000		2001		2002		2003	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Descriptive Studies																				
Case study	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Case series	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Cross-sectional survey	11	27.5	11	28.9	12	36.4	9	27.3	9	22.0	10	21.3	12	31.6	14	53.8	18	48.6	15	45.5
Ecological	0	0.0	1	2.6	4	12.1	1	3.0	0	0.0	2	4.3	1	2.6	0	0.0	0	0.0	1	3.0
Hybrid	0	0.0	0	0.0	0	0.0	0	0.0	5	12.2	1	2.1	2	5.3	1	3.8	1	2.7	2	6.1
Focus group	1	2.5	1	2.6	0	0.0	0	0.0	2	4.9	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0
Review	24	60.0	19	50.0	10	30.3	16	48.5	19	46.3	25	53.2	16	42.1	7	26.9	10	27.0	8	24.2
Web site analysis	0	0.0	1	2.6	0	0.0	1	3.0	1	2.4	1	2.1	0	0.0	1	3.8	0	0.0	2	6.1
Delphi method	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	36	90.0	33	86.8	26	78.8	27	81.8	37	90.2	39	83.0	31	81.6	23	88.5	30	81.1	28	84.8
Analytic studies																				
Case-control	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Cohort	0	0.0	1	2.6	0	0.0	1	3.0	0	0.0	1	2.1	1	2.6	0	0.0	0	0.0	0	0.0
Clinical trial	1	2.5	0	0.0	5	15.2	2	6.1	2	4.9	2	4.3	2	5.3	0	0.0	2	5.4	2	6.1
Community trial	1	2.5	1	2.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.8	1	2.7	1	3.0
Meta/pooled analysis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Quasi-experimental	2	5.0	3	7.9	2	6.1	3	91	2	4.9	5	10.6	4	10.5	2	7.7	4	10.8	2	6.1
Total	4	10.0	5	13.2	7	21.2	6	18.2	4	9.8	8	17.0	7	18.4	3	11.5	7	18.9	5	15.2
Overall total	40	100	38	100	33	100	33	100	41	100	47	100	38	100	26	100	37	100	33	100

statistics for nonparametric data ranged from 25.4% for the chi-square test to 4.9% for other nonparametric tests and 1.4% for Fisher's exact test. Epidemiologic statistics were infrequently used, ranging from a percentage of use of 4.9% for prevalence proportions to 4.4% for odds ratios and 3.0% or less for any of the other measures. The percentage of use of regression/analysis of variance ranged from 17.2% for analysis of variance to 4.4% for multiple-linear regression, 3.3% for logistic regression, and 3.0% or less for any of the other measures. Finally, percentage of use of other statistical measures ranged from 33.1% for instrument validity/reliability to 15.3% for Pearson correlation, 6.0% for multiple comparisons, and less than 2.0% for any of the remaining measures.

Estimated annual percent change in use of selected study designs and statistical methods for the study period are presented in Table 3. Almost zero EAPC in the descriptive studies is the result of an offsetting of a significant increase in use of cross-sectional surveys and a significant decrease in use of review articles. The use of analytic studies increased, albeit insignificantly. The EAPCs for each of the categories of statistical methods indicate increasing use. Specific statistical methods where the increase in use was statistically significant include measures of central tendency/dispersion, ANOVA, Pearson correlation coefficient, and the use of validity/reliability statistics for instrument validation.

DISCUSSION

The increasing use of statistical methods in articles published in this journal is consistent with trends in use of statistical methods in two major public health journals where the proportion of articles using statistical methods and the average number of statistical methods used per article sharply increased over the three decade period surveyed (Levy & Stolte, 2000). The journal is favoring cross-sectional studies as opposed to review articles, which were the most common type of article appearing in the journal in the mid–1990s. The primary statistics appearing in the journal were associated with model validation, the chi-square test, ANOVA, *t*-test/*z*-test, the Pearson correlation coefficient, and the *F*-test. The increase in use of statistical methods can be explained primarily by increases in measures of central tendency/dispersion, ANOVA, Pearson correlation coefficient, and the use of validity/reliability statistics for instrument validation.

Epidemiologic statistical measures were less frequently used, and although the EAPC

Table 2. Frequency of Use of Statistical Methods in the *American Journal of Health Education* across Calendar Years 1994 to 2003

	1994		1995		1996		1997		1998		1999		2000		2001		2002		2003	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
No statistical methods	10	25.0	4	10.5	4	12.1	6	18.2	7	17.1	16	34.0	7	18.4	2	7.7	3	8.1	1	3.0
Descriptive Statistics																				
Counts, ratios, proportions	30	75.0	34	89.5	29	87.9	27	81.8	34	82.9	31	66.0	31	81.6	24	92.3	34	91.9	31	93.9
Central tendency/dispersion	14	35.0	13	34.2	16	48.5	15	45.5	13	31.7	15	31.9	18	47.4	17	65.4	25	67.6	19	57.6
Frequency dist. (graphical)	2	5.0	2	5.3	5	15.2	0	0.0	5	12.2	4	8.5	4	10.5	2	7.7	2	5.4	6	18.2
Frequency dist. (tabular)	8	20.0	14	36.8	9	27.3	5	15.2	10	24.4	12	25.5	15	39.5	15	57.7	12	32.4	13	39.4
Contingency table	16	40.0	13	34.2	19	57.6	15	45.5	19	46.3	19	40.4	18	47.4	12	46.2	21	56.8	17	51.5
Total	70		76		78		62		81		81		86		70		94		86	
Statistics for Continuous Data																				
t-test/*z*-test	8	20.0	6	15.8	7	21.2	2	6.1	4	9.8	4	8.5	10	26.3	7	26.9	7	18.9	7	21.2
F-test	6	15.0	3	7.9	6	18.2	6	18.2	0	0.0	6	12.8	4	10.5	5	19.2	6	16.2	6	18.2
Other	1	2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.8	1	2.7	1	3.0
Total	15		9		13		8		4		10		14		13		14		14	
Nonparametric Tests																				
Chi-square	10	25.0	6	15.8	11	33.3	4	12.1	8	19.5	10	21.3	11	28.9	9	34.6	13	35.1	11	33.3
Fisher's exact test	1	2.5	1	2.6	1	3.0	1	3.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0
Other	2	5.0	3	7.9	1	3.0	1	3.0	1	2.4	3	6.4	3	7.9	1	3.8	3	8.1	0	0.0
Total	13		10		13		6		9		13		14		10		17		11	
Epidemiologic Statistics																				
Risk ratio	1	2.5	1	2.6	0	0.0	1	3.0	1	2.4	2	4.3	0	0.0	0	0.0	0	0.0	0	0.0
Odds ratio	0	0.0	0	0.0	1	3.0	1	3.0	2	4.9	1	2.1	3	7.9	1	3.8	4	10.8	3	9.1
Attributable risk	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Attributable risk %	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Population attributable risk	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Population attributable risk %	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Incidence rate	3	7.5	1	2.6	0	0.0	0	0.0	0	0.0	0	0.0	1	2.6	0	0.0	0	0.0	0	0.0
Prevalence proportion	1	2.5	0	0.0	2	6.1	2	6.1	2	4.9	4	8.5	2	5.3	0	0.0	1	2.7	4	12.1
Standardization of rates	0	0.0	2	5.3	0	0.0	3	9.1	2	4.9	1	2.1	1	2.6	1	3.8	1	2.7	0	0.0
Mortality Rate	2	5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.0
Total	7		4		3		7		7		8		7		2		6		8	
Regression/Analysis of Variance																				
Simple linear	0	0.0	1	2.6	0	0.0	0	0.0	0	0.0	1	2.1	1	2.6	0	0.0	2	5.4	2	6.1
Multiple linear	2	5.0	2	5.3	2	6.1	0	0.0	2	4.9	0	0.0	0	0.0	4	15.4	3	8.1	1	3.0
Logistic	0	0.0	0	0.0	2	6.1	0	0.0	0	0.0	1	2.1	3	7.9	0	0.0	4	10.8	2	6.1
Multiple logistic	0	0.0	1	2.6	0	0.0	1	3.0	1	2.4	0	0.0	0	0.0	1	3.8	0	0.0	2	6.1
ANOVA[A]	5	12.5	4	10.5	9	27.3	4	12.1	5	12.2	7	14.9	7	18.4	5	19.2	9	24.3	8	24.2
MANOVA[B]	0	0.0	0	0.0	1	3.0	1	3.0	2	4.9	0	0.0	0	0.0	2	7.7	2	5.4	2	6.1
ANCOVA[C]	1	2.5	0	0.0	2	6.1	2	6.1	0	0.0	3	6.4	1	2.6	0	0.0	1	2.7	1	3.0
MANCOVA[D]	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	8		8		16		8		10		12		12		12		21		18	

Table 2. (continued)

	1994		1995		1996		1997		1998		1999		2000		2001		2002		2003	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Other Statistical Methods																				
Pearson correlation	3	7.5	5	13.2	4	12.1	6	18.2	3	7.3	6	12.8	6	15.8	6	23.1	8	21.6	9	27.3
Nonparametric correlation	1	2.5	3	7.9	0	0.0	0	0.0	0	0.0	1	2.1	0	0.0	0	0.0	2	5.4	0	0.0
Validity/Reliability statistics	4	10.0	9	23.7	12	36.4	9	27.3	9	22.0	9	19.1	16	42.1	17	65.4	18	48.6	18	54.5
Transformation	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.8	1	2.7	0	0.0
Life expectancy	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Multiple comparisons	0	0.0	3	7.9	4	12.1	0	0.0	1	2.4	0	0.0	6	15.8	3	11.5	4	10.8	1	3.0
Power	0	0.0	1	2.6	0	0.0	1	3.0	1	2.4	1	2.1	1	2.6	0	0.0	0	0.0	2	6.1
Survival analysis	0	0.0	1	2.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Cost-benefit analysis	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	6.1
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.7	0	0.0
Number of articles reviewed	40		38		33		33		41		47		38		26		37		33	

Note: The percentages in this table are based on the total number of articles reviewed for each year, as listed.
[A]Analysis of variance
[B]Multiple analysis of variance
[C]Analysis of covariance
[D]Multiple analysis of covariance

for these measures was positive, it was not statistically significant. This is consistent with the lack of observational case-control or cohort studies and very little use of analytic study designs. These types of studies tend to require more time, greater resources, and a higher level of statistical expertise than the cross-sectional and review type studies that make up the majority of the studies appearing in the journal. Nevertheless, as the fundamental role of epidemiology in health education becomes better understood (Merrill & White, 2002) and health educators become better-trained in the area of epidemiology, the use of these important epidemiologic statistics is expected to have an increasing presence in health literature.

A limitation of this study is that our categories were not completely mutually exclusive. Yet effort was made to classify and categorize articles most appropriately. Another limitation is in the generalization of the results. Although the general trend of increasing statistical use observed in this journal was consistent with that identified in other medical and health-related journals, the frequency and types of research designs and statistical methods may have differed. Hence, generalization of the results of this study to other health-related journals may not be appropriate.

This article is intended to identify the study designs and statistical techniques that could aid most profitably in the statistical training of the reader. With an increasing trend in statistical use involved in the *American Journal of Health Education*, familiarity with specific study designs and statistical methods will allow readers to access a greater proportion of the articles. Health educators interested in continuing their own education in statistics will find the results of this study valuable. In addition, the study may also be useful to individuals designing and teaching courses in quantitative methods for health educators.

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Table 3. Estimated Annual Percent Change (EAPC) in Percentage Use of Selected Study Designs and Statistical Methods over the Calendar Years 1994 to 2003

	EAPC	95% Confidence Interval
Study Designs		
Descriptive studies	0.32	−1.37, 0.75
Cross-sectional survey	**6.59**	**0.43, 13.13**
Review	**−7.78**	**−12.38, −2.94**
Analytic studies	2.33	-3.80, 8.85
Statistical Methods		
No statistical methods	**−12.71**	**−23.23, −0.76**
Any descriptive statistic	1.36	−0.97, 3.74
Counts, ratios, proportions	1.35	−0.98, 3.74
Central tendency/dispersion	**6.81**	**1.81, 12.06**
Frequency distribution (graphical/tabular)	7.81	−0.58, 16.91
Contingency table	2.90	−0.25, 6.14
Any statistic for continuous data	5.52	−3.67, 15.57
Any nonparametric tests	5.18	−0.71, 11.42
Chi-square	6.93	−0.35, 14.75
Any epidemiologic statistic	5.99	−4.86, 18.04
Any regression/analysis of variance	**9.44**	**3.17, 16.08**
ANOVA	**7.23**	**0.78, 14.09**
Pearson correlation	**11.83**	**4.60, 19.55**
Validity/reliability statistics	**15.92**	**6.95, 25.65**

Note: Bold type indicates statistical significance at the .05 level.

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