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Original Article

Survey research in podiatric medicine: An analysis of the reporting of response rates and non-response bias

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ABSTRACT

Background: Survey research is common practice in podiatry literature and many other health-related fields. An important component of the reporting of survey results is the provision of sufficient information to permit readers to understand the validity and representativeness of the results presented. However, the quality of survey reporting measures in the body of podiatry literature has not been systematically reviewed.

Objective: To examine the reporting of response rates and nonresponse bias within survey research articles published in the podiatric literature in order to provide a foundation with regard to the development of appropriate research reporting standards within the profession.

Methods: This study reports on a secondary analysis of survey research published in the Journal of the American Podiatric Medical Association, the Foot, and the Journal of Foot and Ankle Research. 98 surveys published from 2000 to 2018 were reviewed and data abstracted regarding the report of response rates and non-response bias.

Results: 67 surveys (68.4%) report a response rate while only 36 articles (36.7%) mention non-response bias in any capacity.

Conclusions: The findings suggest that there is room for improvement in the quality of reporting response rates and nonresponse in the body of podiatric literature involving survey research. Both nonresponse and response rate should be reported to assess survey quality. This is particularly problematic for studies that contribute to best practices.

1. Introduction

Surveys research methods have been used in podiatry to assess a variety of subjects, ranging from education to practice. Surveys have been used to examine podiatric medical students' computer literacy and the impact of the use of technology on learning, as well as other educational outcomes and experiences, such as students' perceived stress, empathy and multicultural awareness, and proficiency in the use of electronic medical records [1–7]. Surveys of podiatrists have also been used to assess an array of practice-related outcomes, from use of clinical best practices, to work-related stress, to experiences associated with interdisciplinary care teams [8–13]. Lastly, there are numerous examples of health surveys being used to assess population or patient risk behavior, as well as access to care and treatment needs specific to podiatry [14–17]. Other examples also exist on the use of survey research in podiatry, including institutional surveys. The utility of surveys as a research methodology is based primarily on the fact that surveys are a cost-effective means to gather large amounts of information quickly [18]. The survey method is also appropriate across a variety of study designs, ranging from descriptive studies to analytical studies, including randomized controlled trials [18,19].

While cost-effective, health surveys are often characterized by low (and declining) response rates compared to non-health-related surveys. This finding holds regardless of whether subjects are clinicians, patients, or the general population [20–24]. Historically, response rates have often been used as the primary indicator of survey quality. Therefore, declining response rates have led to concerns about survey study precision and potential nonresponse bias, or the extent to which nonrespondents are systematically different from respondents on key variables the survey was designed to study [25–28]. These differences could bias the estimates the survey was designed to make. As there is typically scant information available about those who fail to respond to a survey, researchers have used response rate as an indicator of survey quality, with the assumption being that the more nonresponse present, the higher the potential or likelihood that bias will be introduced into the survey estimates [20]. As a result, the inclusion of survey response

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rate has become an essential element of good practice related to the reporting of survey research results [19].

Recent literature, however, suggests that response rates alone may be an insufficient measure of not only nonresponse bias but also overall survey quality [20,23,29]. This is, in part, because there remains no consensus with regard to an "optimal" response rate in health research [24,28,30]. Moreover, existing research is mixed with regard to a potential positive association between response rates and the presence of nonresponse bias, with higher response rates not automatically resulting less biased estimates [26,29–32]. There is also little consensus on the factors producing the disconnect between survey participation rates and survey quality.

Regardless of the controversy surrounding the relationship between response rate and survey quality, it remains essential that researchers effectively report and assess survey quality as part of accepted standards with regard to scholarship; thereby allowing the reader to judge the methodological rigor of the study [19,33]. This includes the reporting of response rate, based on accepted practices and matrices [33]. Increasingly, however, in recognition of the limitations of response rate as an effective single measure of survey quality, it is also recommended that researchers report on nonresponse bias [25,27,28,34]. There are a number of approaches for calculating nonresponse bias, with a fundamental issue being the degree to which the researcher has access to the original population of interest. With total access to the population of interest, for example, it would be possible to conduct an abbreviated follow-up survey with initial nonrespondents to assess key study-specific measures of interest [26–28,34]. With more limited population access, one may compare the responses of early vs. late respondents on key study-specific measures, with late responders used as a proxy for nonresponders, or analyze known characteristics from the sample frame or population to determine potential differences between the response sample and nonresponders or the population as a whole. None of these measures are perfect, but they do inform the degree to which the process of survey participation may be associated with study-specific outcomes of interest, creating the potential for biased results.

While both the reporting of response rate and nonresponse bias are needed to fully assess survey quality, available evidence indicates that only approximately 70% of published articles in medical journals provide information on response rates and less than 20% of published health surveys broadly consider nonresponse bias [20,22,35]. There are also very few articles that examine survey reporting practices associated with specific branches of medicine or medical specialties. This paper examines the reporting of response rates and nonresponse bias within survey research articles published in the literature related to the foot and ankle; providing a foundation with regard to the development of appropriate research reporting standards within the profession.

2. Methods

This study is modeled on previous analyses conducted in the imaging professions [36]. It is a secondary review of survey research articles, published from 2000 to 2018, in three professional foot and ankle journals: the Journal of the American Podiatric Medical Association (JAPMA), the Foot, and the Journal of Foot and Ankle Research. The targeted journals were selected by the first author (VH). Given their prominence in the field and geographic distribution, it was anticipated that these journals would provide a representative insight into the survey reporting trends within podiatric medicine. Articles that reported a survey as the primary research tool were selected for inclusion in the analysis. Focus group studies, as well as in-depth interviews were not eligible for inclusion. Some mixed methods studies were eligible for inclusion if the survey was the dominant method of investigation. Clinical studies were also included if they had a minimum of 50 respondents and evidence of respondent autonomy with regard to participation. The journals were initially reviewed by one researcher (JM), who also made preliminary selections of eligible studies. These were then reviewed to confirm podiatric research focus by the lead author (VH). Final determination of study inclusion was made by the entire research team (VH, JM & JVG). Data extraction was conducted by JM under the guidance of JVG. When more than one survey was conducted within a study or more than one population was surveyed, the surveys were analyzed individually to incorporate multiple response rates. The final analyses and manuscript preparation was conducted by the research team.

2.1. Data analysis

To assess differences in the response rate among different journals, survey modes, populations, and countries, Mann—Whitney U or Kruskal—Wallis tests were conducted based on the number of categories present for each variable. These tests were appropriate due to the violation of the assumption of normally distributed data. The significance of proportional variation with respect to modes of survey distribution, population surveyed, reporting response rate, reporting non-response bias, and reporting measurement bias between the 3 journals was assessed using Pearson's Chi Square test or Fisher's Exact test. Fisher's Exact test was reported when any of the expected cell frequencies were less than five. Statistical analysis was performed using SAS 9.3 [37]. Significant results were reported where $p < 0.05$.

3. Results

3.1. Response rate

A total of 98 articles reporting survey results were identified as meeting the inclusion criteria (see Table 1). The majority of the survey articles were published in the *Journal of the American Podiatry Medical Association*. Importantly, 67 (68.4%) of these manuscripts reported a response rate. Response rates range from 5% to 100%, with the highest rates achieved by administrative surveys of academic leadership. The mean response rate across all studies was 53.7%. With regard to different types of surveys, there were significant differences across target populations (X^2(df = 5) = 26.3, $p < 0.0001$). Organizational surveys had higher response rates compared to surveys of podiatrists (U = 53.0, z = 2.10 p = 0.045) and patients (U = 40.0, z = 2.10 p = 0.049). Surveys of podiatry students/residents (U = 252.0, z = 3.38 p = 0.002), patients (U = 602.0, z = 3.78 p = 0.001), and populations classified as "other" (U = 197.5, z = 2.32 p = 0.027) also had significantly higher response rates compared to surveys of podiatrists. Lastly, surveys of podiatry students/residents experienced significantly higher response rates compared to patient surveys (U = 173.0, z = 2.07 p = 0.049). There were no differences in mean response rate by country of origin. There was also no discernable trend in the overall average response rates over the time period under review (Fig. 1). A review of the calculations presented also revealed a general lack of clarity in the definition or formulas used to compute survey response rate.

With regard to survey mode, the most common forms of survey administration were either electronic (n = 25) or mailed (n = 23) surveys (Table 1). Three studies did not report survey distribution method. There were significant differences in response rate across the various forms of survey administration (X^2(df = 4) = 18.1, p = 0.001). Interviewer-administered paper and pencil interview (PAPI) surveys had significantly higher response rates compared to electronic (U = 242.5, z = 3.299 p = 0.002), mail (U = 227.0, z = 3.27 p = 0.003), and eligible mixed-mode studies (U = 28.0, z = −2.30 p = 0.037). Interestingly, a comparison of different modes of survey administration across the three journals also revealed significant differences. Telephone (n = 3), face-to-face interviews (n = 1) and eligible mixed-mode (n = 7) studies were excluded from this analysis due to insufficient numbers of studies. There was, however, a significant difference in the proportion of electronic, mail, and PAPI surveys published across the three journals (p = 0.001, Fisher's exact

Table 1
Response rates from studies published in the Journal of American Podiatry Medical Association, The Foot, and the Journal of Foot and Ankle Research.

Comparison groups	Mean response rate (%) (SD)	Median response rate (%)	Range	
			Min (%)	Max (%)
Overall (n = 67)	53.7 (26.6)	55.6	5	100
Journals				
Journal of American Podiatry Medical Association (n = 37)	57.1 (25.5)	65	8	100
The Foot (n = 8)	64.1 (12.9)	65.9	37.3	79.6
Journal of Foot and Ankle Research (n = 21)	43.9 (30.0)	42	5	90.7
Response type				
Individual (n = 63)	52.3 (26.3)	54	5	100
Organization (n = 3)	83.0 (15.7)	80	69	100
Mode of administration				
Electronic (n = 25)	41.2 (29.4)	42	5	100
Mail (n = 23)	52.6 (21.6)	46	12.3	100
Paper & pencil (n = 9)	79.1 (10.9)	82.4	53.6	90.7
Telephone (n = 2)	80.3 (4.7)	80.3	76.9	83.6
Mixed mode (n = 6)	60.0 (20.7)	68.7	31	79.6
Population				
Organization (n = 2)	90 (14.1)	90	80	100
Podiatrists/podiatry specialists (n = 26)	33.8 (23.0)	31.3	5	88
Podiatry students/ residents (n = 9)	73.5 (18.4)	80	34	90.7
Administrators (n = 2)	76.5 (33.2)	76.5	53	100
Patients (n = 19)	62.0 (15.8)	65.9	32	81.7
Others (n = 8)	61.8 (26.2)	71.9	7.7	82.4
Country where survey was conducted				
United States (n = 21)	54.5 (30.0)	53.6	8	100
Other (n = 45)	53.3 (25.2)	56.2	5	90.7

test). Specifically, there were differences observed in the relative proportion of electronically administered surveys (31.7% *JAPMA*, 15.4% *The Foot*, 73.3% *JFAR*) in the three journals as compared to mail (39.0% *JAPMA*, 30.8% *The Foot*, 16.7% *JFAR*; p = 0.006, Fisher's exact test) and PAPI surveys (29.3% *JAPMA*, 53.9% *The Foot*, 10.0% *JFAR*; p = 0.001, Fisher's exact test).

In terms of the number of survey studies published during this period (all journals), there was an observed increase from 2000 (n = 2) to 2018 (n = 13). This increase appears to be due to the addition of published surveys by both *The Journal of Foot and Ankle Research* and *The Foot* after 2007 (Fig. 2).

There were no significant differences in average response rates reported across the three journals over the 18-year period under review (Fig. 3). While no differences in mean response rates were noted by country of origin (all studies), *The Journal of American Podiatry Medical Association* had a significantly higher proportion ($X^2(2) = 39.86$, $p < 0.001$) of survey studies conducted in the United States (61.2%) as compared to *The Foot* (5.9%) and *The Journal of Foot and Ankle Research* (0%). There were also significant differences in the proportion of surveys involving distinct populations between the three journals (p = 0.000, Fisher's exact test; $X^2(6) = 29.18$, $p < 0.001$). Organization (n = 2) and Administrator (n = 2) survey populations were excluded from this analysis due to small sample sizes. Differences in the proportion of podiatrist surveys (33.3% *JAPMA*, 0% *The Foot*, 59.4% JFAR) compared to podiatry students (22.2% *JAPMA*, 5.9% *The Foot*, 6.3% *JFAR*; p = 0.0128, Fisher's exact test), patients (22.2% *JAPMA*, 76.5% *The Foot*, 25.0% *JFAR*; p = 0.0000332, Fisher's exact test), and other populations (33.3% *JAPMA*, 0% *The Foot*, 59.4% *JFAR*; p = 0.0058, Fisher's exact test) were noted. There was also a significant difference in the proportion of podiatry student surveys (22.2% *JAPMA*, 5.9% *The Foot*, 6.3% *JFAR*) as compared to patient surveys across the three journals (22.2% *JAPMA*, 76.5% *The Foot*, 25.0% *JFAR*; p = 0.0178, Fisher's exact test).

3.2. Non-response bias

Of the 98 articles reviewed, 36 (36.7%) did address the issue of non-response bias in some form, either directly, by stating the possibility of non-response bias (n = 9), or indirectly, by mentioning that there could be some bias introduced given that not everyone responded (n = 27). A total of 19 studies (19.4%) reported conducting an actual analysis involving an examination of known characteristics from the sample frame

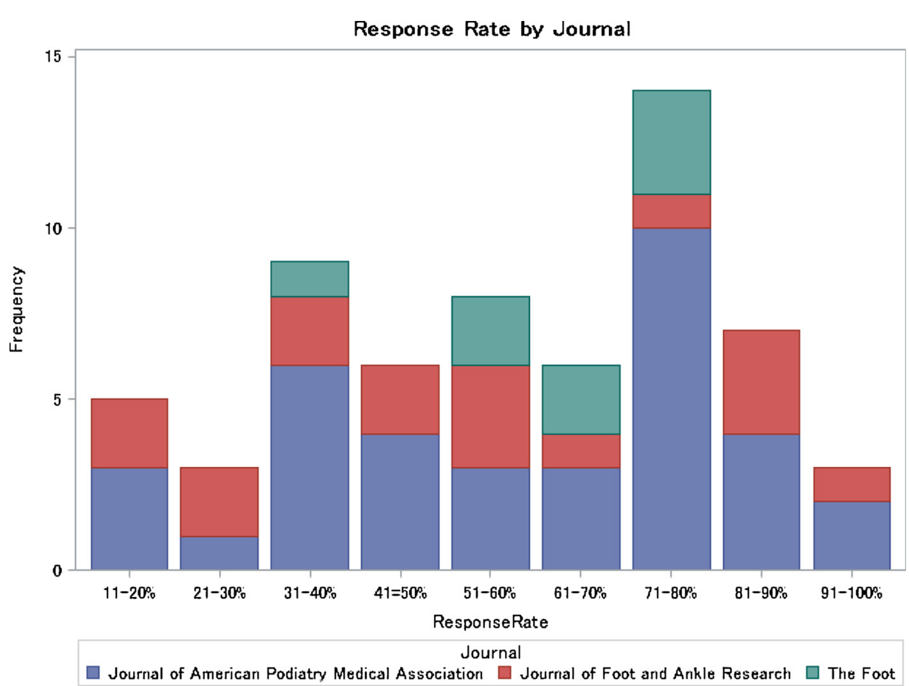

Fig. 1. Response rate by Journal.

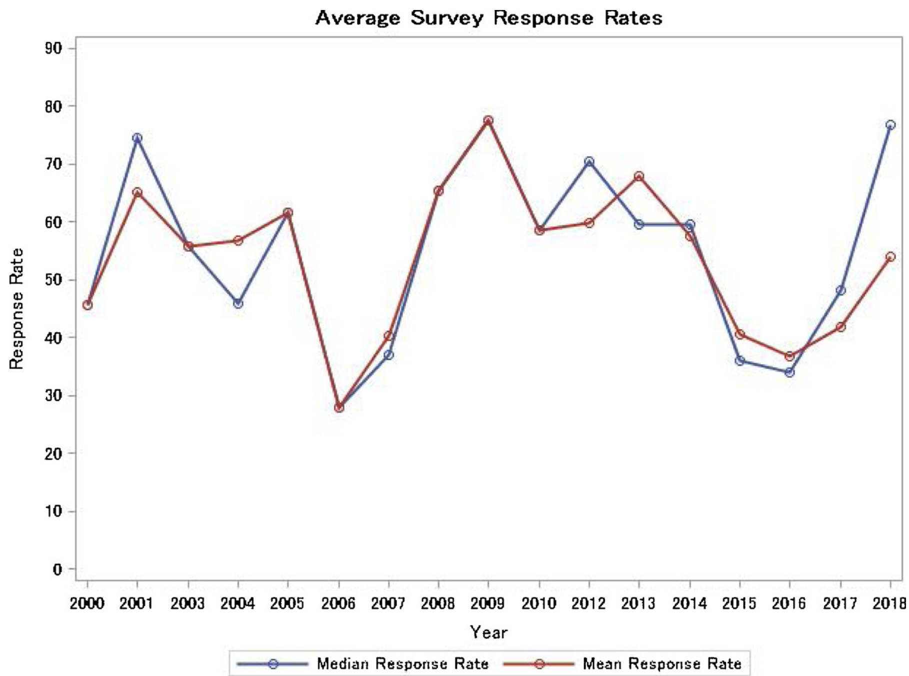

Fig. 2. Average survey response rates.

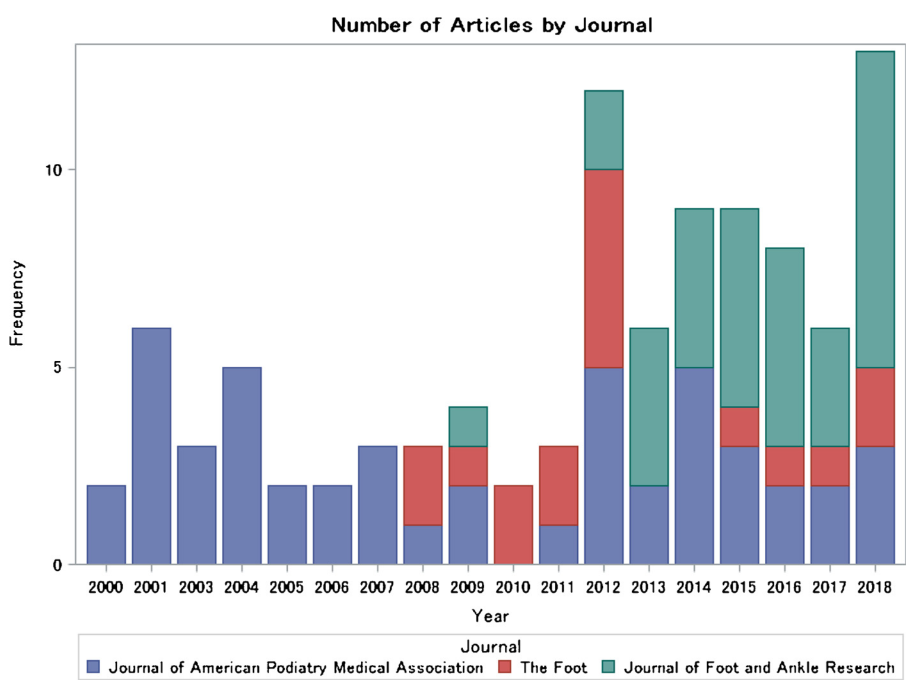

Fig. 3. Number of articles by Journal.

or population to determine potential differences between respondents and nonrespondents or the population as a whole. Even these, however, were generally not reported in sufficient detail to represent an adequate analysis of non-response bias. Exceptions were found in surveys of podiatrists, where sampled clinicians could be readily compared to population characteristics on key professional, practice and/or demographic criteria using professional databases, such as the one maintained by the American Podiatric Medical Association.

None of the studies that mentioned or performed an analysis of non-response bias suggested that potential bias was influential in the interpretation or application of their research findings. An analysis of differences in the report of non-response bias by journal was not conducted due to small sample sizes.

4. Discussion

In this review of three leading foot and ankle medical journals, it was clear that a preferred measure of survey quality was the report of response rate. Indeed, a clear majority of studies reviewed reported response rate in their results. This preference is not inconsistent with reviews of surveys published in other medical specializations, such as the aforementioned review of survey reporting in the imaging professions [36] or in professional literature generally [33,34]. Nor is it inconsistent with long-held understandings of good practices in the reporting of survey research results [19]. Response rates have long served as a measure of survey quality simply because non-response is often not random. While there has been concern that response rates in general are falling due to survey fatigue and other factors, falling response rates over time were not evident in this review. One potential reason is that podiatry is a relatively under surveyed field, and may not yet be experiencing the effects of survey fatigue based on the low volume of survey research published. Observed differences in response rate by survey administration mode and population type, on the other hand, are consistent with the literature [22,24,38]. Moreover, the literature suggests that mode of questionnaire administration can have serious effects on both data quality and applicability of survey results [38,39]. Reasons are complex, but relate to the relative cognitive burden placed on respondents by different survey modes [38]. Mode preference also comes into play to the extent that it is related to respondent confidence, comfort and convenience related to the survey experience [39]. For these reasons, it is important for the researcher to understand potential mode effects on data quality.

As noted, using response rate as a preferred measure of survey quality is problematic [24,25,27–29,32,40,41]. Factors undercutting the role of response rate as a primary indicator of survey quality include, but are not limited to, increasing refusals and study complexity. This does not mean that high response rates are not to be desired, as there are serious potential implications for survey non-participation [24,29]. Thus, researchers have explored strategies to improve response rates across different populations, including clinicians and the public. Arguably most famous of these is the Tailored Design Method (TDM), which provides guidelines for instrument development (i.e. surveys) and specifies the type and timing for initial contact, follow-up procedures and incentives [18]. Elements of the TDM have been applied successfully in a variety of relevant populations for podiatric research, including surveys of clinicians, patients, and administrators [21,23,42–46]. In order to conduct successful survey studies, researchers must be cognizant of subtle differences in interest and/or knowledge within a targeted population specific to survey topic(s), cultural changes, as well as potential variances in access to participants. These issues can significantly impact desired response rates, even when proven techniques such as TDM are used [45].

Increasingly, survey best practices now involve the report of nonresponse bias in addition to response rate. This shift is associated to an increasing focus on total survey error as a means to assess survey quality [47]. The report nonresponse bias was not particularly evident in the podiatric research literature reviewed in this study. Even in those instances where nonresponse bias was identified, it was not discussed in sufficient detail for the reader to draw necessary or desired conclusions regarding quality. Report of detailed survey disposition is particularly important for surveys with lower response rates [29]. This is in large part because surveys with low response rates can still be applicable and should be considered on their ability to accurately represent attitudes and behaviors of the target population [40]. To determine the accuracy of reported survey results, it is important to consider the underlying motives governing survey response. Some important considerations are related to the topic under study (e.g., topic relevance, interest, sensitivity, etc.), while others are unrelated, such as having enough time to complete the survey. The former plays a far more significant role in potential for nonresponse bias and should be assessed. Methodologies for conducting nonresponse analyses have been outlined [27,28]. For researchers designing a survey, it is also important to consider the potential for nonresponse bias before collecting data and to design studies such that accurate assessments of nonresponse bias are possible [27]. Once calculated, these indicators can then be used to impact of nonresponse on the quality of survey estimates.

5. Conclusion

Based on this review of survey reporting in the three journals, there is clearly room for improvement. The omission of response rates and inconsistent report of nonresponse error is particularly problematic for studies that contribute to best practices. In addition, there needs to be full and transparent disclosure of response rate and nonresponse error calculations, as this will allow readers to fully understand the nature of the indicators employed. Quality standards for reporting have been published elsewhere [19,33,48]. While it has been suggested that nonresponse bias may be less of an issue in surveys of clinicians due to the relative homogeneity of the population and related similarities in professional knowledge, behavior and attitudes [49], it is not suggested that researchers rely on such an assumption as it undermines the rigor and applicability of survey results. Moreover, such an assumption does not necessarily hold for patient or even some institutional surveys. Consequently, it remains essential that researchers exert due diligence in the conduct and reporting of surveys.

Conflict of interest

There are no conflicts of interest.

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