Evaluation & the Health Professions

http://ehp.sagepub.com

Methodologies for Improving Response Rates in Surveys of Physicians: A Systematic Review

Jonathan B. VanGeest, Timothy P. Johnson and Verna L. Welch

Eval Health Prof 2007; 30; 303
DOI: 10.1177/0163278707307899

The online version of this article can be found at:
http://ehp.sagepub.com/cgi/content/abstract/30/4/303

Published by:
SAGE
http://www.sagepublications.com

Evaluation & the Health Professions
Volume 30 Number 4
December 2007 303-321

10.1177/0163278707307899
http://ehp.sagepub.com
hosted at
http://online.sagepub.com

Methodologies for Improving Response Rates in Surveys of Physicians

A Systematic Review

Jonathan B. VanGeest
Kennesaw State University, Georgia
Timothy P. Johnson
University of Illinois at Chicago
Verna L. Welch
Morehouse School of Medicine, Atlanta

Although physician surveys are an important tool in health services and policy research, they are often characterized by low response rates. The authors conducted a systematic review of 66 published reports of efforts to improve response rates to physician surveys. Two general strategies were explored in this literature: incentive and design-based approaches. Even small financial incentives were found to be effective in improving physician response. Token nonmonetary incentives were much less effective. In terms of design strategies, postal and telephone strategies have generally been more successful than have fax or Web-based approaches, with evidence also supporting use of mixed-mode surveys in this population. In addition, use of first-class stamps on return envelopes and questionnaires designed to be brief, personalized, and endorsed by legitimizing professional associations were also more likely to be successful. Researchers should continue to implement design strategies that have been documented to improve the survey response of physicians.

Keywords: *physicians; surveys; research methods; response rates*

Physician surveys are an important tool in health services and policy research, providing cost-effective sources of information on physicians' attitudes, knowledge, and practices related to care delivery. Surveys have been used to assess a range of issues, from more routine subjects like knowledge of and/or compliance with evidence-based practice recommendations (Mosca et al., 2005; Schroy et al., 2001; Webster, Courtney, Huang, Matz, & Christiani, 2005) to highly sensitive topics such as substance abuse among

physicians (Hughes et al., 1999; McAuliffe et al., 1986), physician attitudes toward euthanasia (Emanuel et al., 2000; Farber et al., 2006; Meier et al., 1998), and physician manipulation of reimbursement rules for patients (Wynia, Cummins, VanGeest, & Wilson, 2000). Despite their importance, however, physician surveys are characterized by low response rates, raising concerns about the validity and generalizability of their findings (Asch, Connor, Hamilton, & Fox, 2000; Asch, Jedrziewski, & Christakis, 1997; Berk, 1985; Cartwright, 1978; Cull, O'Connor, Sharp, & Tang, 2005; Cummings, Savitz, & Konrad, 2001; Kellerman & Herold, 2001). Specifically, low response rates raise concerns about nonresponse bias or the likelihood that nonresponding physicians will be systematically different from the population under study. This concern is supported by research showing modest differences between responders and nonresponders and between early and late respondents on demographic and/or practice-related characteristics (Cartwright, 1978; Cockburn, Campbell, Gordon, & Sanson-Fisher, 1988; Cull et al., 2005; Goodman & Jensen, 1981; McFarlane, Olmsted, Murphy, & Hill, 2006; Myerson, 1993; Parsons, Warnecke, Czaja, Barnsley, & Kaluzny, 1994; Stocks & Gunnell, 2000; Tambor et al., 1993; Templeton, Deehan, Taylor, Drummond, & Strang, 1997; Thran and Gonzalez, 1999). As a result, researchers have investigated why physicians are less likely to respond to surveys and implemented strategies for improving physician participation.

Why Physicians Do Not Respond

In a seminal article, Seymour Sudman (1985) identified a number of reasons why professionals (e.g., physicians) might refuse to participate in surveys. Arguably the most important reason for nonresponse is lack of time. Physicians are busy and time spent completing a survey is time that could be spent seeing patients or used to attend to other—more important—tasks. A second and related issue involves the perceived salience of the study. Like other professionals, physicians will not take the time to complete a survey if the value of the study is not clear or is clear but perceived to be low. Third, physicians will generally not complete a survey when they have concerns about the confidentiality of the results. Finally, the likelihood of nonresponse is greater in cases where individual questions may appear biased or not allow the respondent a full range of choices on the subject. Lack of time is compounded by the increasing volume and length of surveys physicians are asked to respond to (Kaner, Haighton, & McAvoy, 1998; MacPherson & Bisset, 1995; McAvoy & Kaner, 1996). Researchers have also identified the

private practice office setting (with its various gatekeepers) as an additional barrier to physician participation (Berry & Kanouse, 1987; Heywood, Mudge, Ring, & Sanson-Fisher, 1995; Moore & An, 2001; Parsons et al., 1994).

Strategies to Encourage Physician Participation

Numerous strategies have been devised to increase physician response to surveys (Field et al., 2002; Kellerman & Herold, 2001; Sudman, 1985). These strategies generally fall into two categories: incentive-based interventions (both monetary and nonmonetary) and design-based approaches (e.g., personalized mailings, design-friendly questionnaires, sponsorship, etc.). Previous reviews have found token monetary incentives to be effective at improving physician participation (Field et al., 2002; Kellerman & Herold, 2001). However, questions remain regarding how much of an incentive is most cost-effective (Field et al., 2002; Halpern, Ubel, Berlin, & Asch, 2002; VanGeest, Wynia, Cummins, & Wilson, 2001). Less is know about the efficacy of nonmonetary incentives, although a review of the literature suggests mixed results in surveys of physicians (Thran & Berk, 1993). Design-based approaches have also been shown to increase physician cooperation (Cummings et al., 2001). Again, however, there is little consensus on the efficacy of the full range of techniques purported to increase response rates of physicians. In this article, we conducted a systematic review to determine the extent to which incentive- and designed-based strategies have been found to be effective in improving physician response to surveys.

Method

Experimental studies examining methods to improve physician response to mail surveys were identified through keyword searches of the MEDLINE, Scopus, Sociological Abstracts, and PsychINFO databases from 1975 to 2006. Searches by author using the same databases were also conducted for investigators with identified relevant articles. Finally, several seed sources (e.g., *Medical Care*, *Public Opinion Quarterly*, *Evaluation and the Health Professions*) were also referenced manually in an effort to establish a comprehensive set of studies to be included in the analyses. Further relevant articles and books were selected from the reference listings of the primary journal articles. Where appropriate, odds ratios (ORs) were calculated for individual studies as a measure of effect size for the different interventions identified

(Tu, 2003). In addition, weighted overall ORs were calculated for groups of studies analyzing like interventions.

Results

Impact of Incentives on Response Rates Among Physicians

Monetary incentives. A total of 21 articles (1981 to 2006) were identified that examined the effects of token monetary incentives on physician response to surveys. Incentive amounts ranged $1 to $50 and included both cash payments and charitable donations. Incentives also included opportunities to win cash lottery prizes. Selected studies comparing incentives to no-incentive controls are presented in Table 1. Taken as a whole, the weighted overall effect size reflected an association between monetary incentives and physician response (OR 2.13; 95% confidence interval [CI] 1.7–2.6). Unweighted average effect sizes for different incentive levels (minimum of 2 studies per level) are presented in Figure 1. Generally, even modest $1 incentives were associated with higher response rates among physicians (average OR across the relevant studies was 2.11) when compared with physicians receiving no incentive (Berk, Edwards, & Gay, 1993; Deehan, Templeton, Taylor, Drummond, & Strang, 1997; Donaldson et al., 1999, Easton, Price, Telljohann, & Boehm, 1997; Everett, Price, Bedell, & Telljohann, 1997; Gunn & Rhodes, 1981; Kasprzyk, Montano, St. Lawrence, & Phillips, 2001; Leung, Ho, Chan, Johnston, & Wong, 2002; Mizes, Fleece, & Roos, 1984; Moore & An, 2001; Robertson, Walkom, & McGettigan, 2005). The only exception was a small $1 donation to charity (Olson, Schneiderman, & Armstrong, 1993). With regard to larger incentives, results are mixed. As illustrated in Figure 1, there are little differences in serial increments over $1. This is supported by studies (not shown) which tested for and found no or nonsignificant differences between incentive levels (Gunn & Rhodes, 1981; Kasprzyk et al., 2001; Mizes et al., 1984; VanGeest et al., 2001). The only exceptions were studies by Asch, Christakis, & Ubel (1998) and Halpern et al. (2002), although their results may be compromised by the uniqueness of the $2 bill option employed. Comparative studies indicate that cash payments are more effective compared with charity inducements (Deehan et al., 1997), monetary donations to their alma mater (Gattellari & Ward, 2001), nonmonetary incentives (Easton et al., 1997; Tambor et al., 1993), or opportunities to win a cash lottery prize (Leung et al. 2002; Tamayo-Sarver & Baker, 2004). Prepaid monetary incentives are also superior to promised incentives (Berry & Kanouse, 1987;

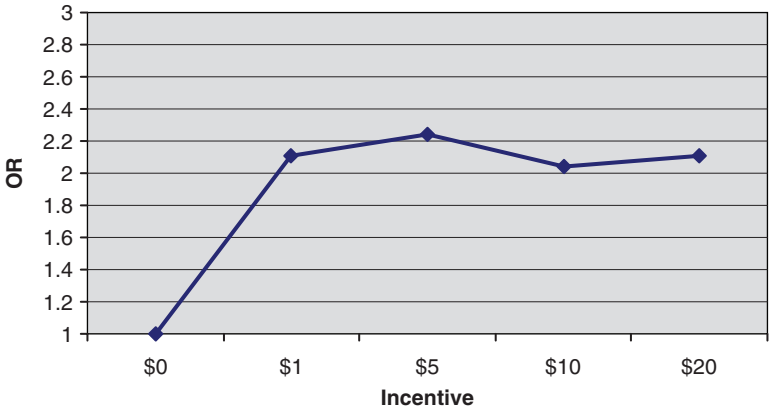
Table 1
Selected Studies Examining Monetary and Nonmonetary Incentives on Physician Response Rates

Monetary Incentives	Intervention	OR	95% CI
Gunn & Rhodes (1981)	$25 vs. no incentive	1.59	0.98–2.59
	$50 vs. no incentive	2.46	1.47–4.12
Mizes et al. (1984)	$1 vs. no incentive	2.66	1.03–6.86
	$5 vs. no incentive	2.66	1.03–6.86
Berry & Kanouse (1987)	Prepayment vs. postpayment	1.83	1.50–2.23
Berk et al. (1993)	$10 vs. no incentive	2.01	1.15–3.50
Everett et al. (1997)	$1 vs. no incentive	2.07	1.46–2.93
Deehan et al. (1997)	£5 vs. no incentive	2.07	1.55–2.76
	£10 vs. no incentive	3.03	2.30–3.99
Easton et al. (1997)	$1 vs. booklet	2.12	1.47–3.04
Donaldson et al. (1999)	$5 vs. no incentive	1.62	1.09–2.41
Moore & An (2001)	$10 vs. no incentive	1.98	1.37–2.87
Kasprzyk et al. (2001)	$15 vs. no incentive	6.38	3.36–12.12
	$25 vs. no incentive	6.06	3.20–11.47
Leung et al. (2002)	HKD$10	1.07	0.52–2.23
	HKD$20	2.09	1.13–3.88
	HKD$40	2.52	1.38–4.58
Delveno et al. (2004)	Prepayment vs. postpayment	1.81	1.42–2.30
Leung et al. (2004)	Prepayment vs. postpayment	1.81	1.32–2.48
Burt & Woodwell (2005)	$50 vs. no incentive	1.00	0.74–1.35
Robertson et al. (2005)	AU$2 lottery	1.48	1.00–2.18
Nonmonetary Incentives	**Intervention**	**OR**	**95% CI**
Sallis et al. (1984)			
2nd mailing	Pencil	2.30	0.81–6.54
3rd mailing	Pencil	0.91	0.41–2.03
Mullen et al. (1987)	Sticker	1.11	0.75–1.66
Bonito et al. (1997)	Risk disk	1.05	0.80–1.36
Ward et al. (1998)	Pen	0.96	0.72–1.28
Baron et al. (2001)	Prize draw	1.29	1.00–1.67
Clark et al. (2001a)	Pen	0.96	0.77–1.19
Halpern et al. (2002)	Candy	0.62	0.49–0.79
Moses & Clark (2004)	Prize draw	1.09	0.88–1.35
Burt & Woodwell (2005)	Candy	0.79	0.58–1.06

Note: OR = odds ratio; CI = confidence interval. Table includes only those studies where sufficient information was available to calculate odds ratio measures of effect size.

Delnevo, Abatemarco, & Steinberg, 2004; Leung et al., 2004). Collectively, when compared to promised incentives, prepaid incentives have a weighted overall effect size reflecting an association with improved physician response (OR 1.82; 95% CI 1.6–2.1).

Figure 1
Average Effect Size (OR) by Monetary Incentive Level



Nonmonetary incentives. Several studies also assessed the effectiveness of token nonmonetary incentives on physician participation, including stickers (Mullen, Easling, Nixon, Koester, & Biddle, 1987), pencils (Sallis, Fortmann, Solomon, & Farquhar, 1984), pens (Clark, Khan, & Gupta, 2001a; Ward, Bruce, Holt, D'Este, & Sladden, 1998), informational brochures (Easton et al., 1997), risk-assessment computer programs (Bonito, Samsa, Akin, & Matchar, 1997), and candy (Burt & Woodwell, 2005; Halpern et al., 2002; see Table 1). The effects of more substantial incentives (e.g., prize draws for a weekend trip or a personal digital assistant [PDA]) were also explored (Baron et al., 2001; Moses & Clark, 2004). Generally, when compared to physicians receiving no incentive, token nonmonetary incentives appear to have little or no impact on response rates (Bonito et al., 1997; Burt & Woodwell, 2005; Clark et al., 2001a; Easton et al., 1997; Halpern et al., 2002; Mullen et al., 1987; Ward et al., 1998). This is supported in the present analyses in which nonmonetary incentives had a weighted overall effect size (OR 0.97; 95% CI 0.82–1.14) reflecting a nonsignificant impact on physician response. There are, however, a couple of exceptions. In one study, the opportunity to receive continuing medical education (CME) credits was deemed to be an effective motivation for physician participation in a mailed questionnaire (McDermott et al., 2003). However, the CME credits were offered in conjunction with a small ($5) monetary incentive, making

it impossible to determine the independent effects of the CME credit on physician participation. The impact of CME credit is also not consistent, with a similar study concluding that CME credit was not as effective as a monetary incentive for inducing physician response (Tambor et al., 1993). In the other exception, the inclusion of a pencil in a second mailing resulted in an increased response (Sallis et al., 1984). However, when the same questionnaire was sent to another sample, inclusion of a pencil in the third mailing had no impact. Studies examining more substantial nonfinancial inducements also had mixed results, with only the opportunity to win a weekend trip for two resulting in a small but significant increase in physician response (OR 1.29; 95% CI 1.00–1.67; Baron et al., 2001). One study also explored the effect of magnitude of the prize draw—one big prize versus many small prizes—on physician response, finding the larger prize to be more effective despite lower odds of winning (Thomson, Paterson-Brown, Russell, McCaldin, & Russell, 2004).

Impact of Design-Based Strategies

Questionnaire design. Nine studies examined the impact of questionnaire design (e.g., length of questionnaire, paper size/quality, questionnaire format) on physician response. Intuitively, length of questionnaire would be of particular interest given that time constraints so prominently figure in physician participation. Only four studies, however, were identified that examined the effect of questionnaire length on physician response. One relatively small study found nonsignificant differences in response rates related to length of the survey (Marin & Howe, 1984). Other studies, however, suggest that shorter questionnaires result in higher cooperation rates (Cartwright & Ward, 1968; Hing, Schappert, Burt, & Shimizu, 2005; Jepson, Asch, Hershey, & Ubel, 2005). A simple average of individual ORs across the latter three studies was 2.33 (Table 2), with the weighted overall effect size reflecting an association between shorter questionnaire length and physician response (OR 2.0; 95% CI 1.1–3.7). Evidence from Jepson et al. (2005) even suggests that under certain conditions, physician participation will be sensitive to relatively small (under 1,000 vs. more than 1,000 word) differences in questionnaire length (OR 2.348; 95% CI 1.20–4.61). Studies have also examined print format, paper size, and paper quality on physician cooperation rates, with mixed results. For example, a recent study comparing single- versus double-sided printing found no differences in physician cooperation rates (Brehaut, Graham, Visentin, & Stiell, 2006). Other studies found the use of an attractive business letter format (Gullen & Garrison, 1973) and standard-sized (8.5 in. $\times$ 11 in.)

Table 2
Selected Studies Examining Design-Based Interventions on Physician Cooperation

Questionnaire Design	Intervention	OR	95% CI
Cartwright & Ward (1968)	Short form	3.33	1.70–6.54
Hing et al. (2005)	Short form	1.30	0.89–1.90
Jepson et al.(2005)	Short form	3.35	1.20–4.61
Personalization and Sponsorship			
Maheux et al. (1989)	Handwritten letter	1.90	1.27–2.83
	Personalized mailout	1.52	1.05–2.19
Bostic et al. (1992)	Physician contact	5.92	3.54–9.91
Asch & Christakis (1994)	Sponsorship	1.35	1.03–1.77
Ward & Wain (1994)	Telephone prompt	2.36	1.25–4.44
Heywood et al. (1995)	Physician contact	3.27	1.17–9.15
Osborn et al. (1996)	Advance contact	1.88	1.19–2.98
Temple-Smith et al. (1998)	Advance contact	1.35	0.80–2.27
Ward et al. (1998)	Physician contact	1.46	1.04–2.03
Bhandari et al. (2003)	Sponsorship	0.62	0.41–0.92
McKenzie-McHarg et al. (2005)	Handwritten signature	1.06	0.91–1.24
Leece et al. (2006)	Personalized letter	2.07	1.19–3.60
Type of Mailing			
Gullen & Garrison (1973)	First-class mail	2.02	1.69–2.42
Shiono & Klebanoff (1991)	First-class stamps	1.15	1.06–1.25
Urban et al. (1993)	First-class stamps	2.04	1.22–3.43
Del Valle et al. (1997)	Certified mail	2.09	1.35–3.22
Kasprzyk et al. (2001)	FedEx	1.44	0.90–2.33
Streiff et al. (2001)	First-class stamps	1.30	1.12–1.51

Note: OR = odds ratio; CI = confidence interval. Table includes only those studies where sufficient information was available to calculate odds ratio measures of effect size.

questionnaire booklets (Johnson, Parsons, Warnecke, & Kaluzny, 1993) to be associated with higher response rates. Paper quality, on the other hand, was not associated with increased physician cooperation (Clark, Khan, & Gupta, 2001b). Finally, one study was identified that examined open- versus closed-ended questionnaire formats on physician response (Griffith, Cook, Guyatt, & Charles, 1999). The closed-ended questionnaire format resulted in a 22% higher cooperation rate compared with the open-ended format.

Personalization and sponsorship. Several studies assessed the impact of a personalized cover letter on physician participation (Table 2). Three studies

found that a personalized cover letter and/or the inclusion of a handwritten note resulted in significantly higher response rates (Leece et al., 2006; Maheux, Legault, & Lambert, 1989; Olson et al., 1993). Another, however, found no difference in response rate between those sent a hand-signed letter and those sent a letter with a scanned signature (McKenzie-McHarg, Tully, Gates, Ayers, & Brocklehurst, 2005). Collectively, personalized cover letters and/or mailout packages had a weighted overall effect size (OR 1.51; 95% CI 1.1–2.2) reflecting an association with higher physician response. Direct contact (e.g., prenotification calls and/or letters in advance of a survey and follow-up contact) is another mechanism to personalize a survey that often results in improved physician response (Bostick, Pirie, Luepker, & Kofron, 1992; Heywood et al., 1995; Osborn, Ward, & Boyle, 1996; Ward et al., 1998; Ward & Wain, 1994). This includes contact by a medical peer, which has been found in some studies to increase physician participation (Bostick et al., 1992; Haywood et al., 1995). Exceptions include a study by Temple-Smith, Mulvey, & Doyle (1998) in which a medical researcher was able to contact a higher proportion of cases (80% vs. 69%), without increasing overall response. Taken as a whole, direct contact had a weighted overall effect size denoting a relationship with increased physician response (OR 2.3; 95% CI 1.42–3.64). Finally, attempts have been made to personalize surveys using endorsements by opinion leaders and/or professional associations, with mixed results (Asch & Christakis, 1994; Bhandari et al., 2003; Olson et al., 1993). Although organizational sponsorship generally improved participation, a study supported by expert surgeons actually resulted in a lower response rate, suggesting possible "limits of leadership" related to collegial sponsorship (Bhandari et al., 2003).

Type of mailing. Six studies were identified that compared physician response by type of mail and/or return mail employed (Table 2). Two studies were identified that examined the impact of the initial mailing on physician participation. In one study, certified mail resulted in a 16.5% increase in participation (OR 2.085; 95% CI 1.35–3.22) compared with first-class mail (Del Valle, Morgenstern, Rogstad, Albright, & Vickrey, 1997). In the other, FedEx resulted in an 8% increase over first-class mail (OR 1.444; 95% CI 0.90–2.33; Kasprzyk et al., 2001). With regard to the return mailing, studies have consistently found that return envelopes with first-class stamps result in higher physician response compared with franked or business reply return envelopes (Shiono & Klebanoff, 1991; Streiff, Dundes, & Spivak, 2001; Urban, Anderson, & Tseng, 1993). The weighted overall effect size across these three studies reflected an association between the use of first-class stamps and physician response (OR 1.3; 95% CI 1.1–1.5). Additionally, one

study compared the influence of multiple return mailing strategies on physician response to mailed questionnaires (Gullen & Garrison, 1973). Although this study identified a postcard reply as having the lowest participation rate compared to bulk and first-class mail, the different strategies were assessed in conjunction with other changes in the mail out package (e.g., different cover letters), making it impossible to determine the independent effects of the return mailing on physician cooperation. With regard to follow-up mailings, research suggests that the inclusion of a replacement questionnaire with the follow-up contact will improve participation (Ogborne, Rush, & Fondacaro, 1986; Vogel, Nowacek, Harlan, Tribble, & Thorup, 1983). One study was also identified that examined envelope size (initial mailing) on physician cooperation (Halpern et al., 2002). This study found no differences in the response rates of general internists and family practitioners to a study received in either a large or small envelope. Although the interventions differ, collectively the weighted overall effect size across studies examining postage/mailing strategies reflected an association between use of these strategies and physician response (OR 1.4; 95% CI 1.11–1.69).

Survey mode. Finally, several studies have examined survey mode as one potential mechanism to improve physician participation. For example, studies have examined response rates for telephone versus mailed surveys, with mixed results. Although some studies found mail surveys to have higher response rates compared with telephone surveys (Hocking, Lim, Read, & Hellard, 2006; Ogborne et al., 1986), others suggest that telephone interviews result in higher response rates (Parsons et al., 1994; Sibbald, Addington-Hall, Brenneman, & Freeling, 1994; Thran & Hixson, 2000). Parsons et al. (1994) also found evidence of mode preference across different medical specialties, with family practitioners more likely to select the mail option than surgeons. Use of e-mail and fax technologies has also been explored. In direct comparisons with mailed questionnaires, e-mail resulted in significantly lower physician response rates (Akl, Maroun, Klocke, Montori, & Schunemann, 2005; Raziano, Jayadevappa, Valenzula, Weiner, & Lavizzo-Mourey, 2001; Seguin, MacDonald, Godwin, & McCall, 2004; VanDenKerkhof, Parlow, Goldstein, & Milne, 2004). With regard to fax technology, there is evidence suggesting that, when incorporated within a mixed-method design, it may be a cost-effective method of increasing physician participation. In one study where pediatricians were offered a choice of three response modes, 26% responded by e-mail, 47% by fax, and 41% by mail (McMahon et al., 2003). In another, a larger percentage of respondents requested to be surveyed by fax compared with telephone or mail (Lensing et al., 2000). Finally, researchers have also

begun to explore the utility of the Internet in surveying physicians (see Braithwaite, Emery, de Lusignan, & Sutton, 2003). In one controlled comparison, an Internet-based survey resulted in a significantly lower response rate compared with a traditional mail survey (Leece et al., 2004). Other mixed mode (Internet vs. mail) studies of American urologists identified similar problems (Hollowell, Patel, Bales, & Gerber, 2000; Kim et al., 2000). There is also evidence that Internet surveys may present methodological issues related to sample representativeness (Braithwaite et al., 2003).

Discussion

Despite the importance of physician surveys in health services and policy research, and the ongoing concern over potential biases associated with low response rates to these surveys, there are relatively few randomized trials examining potential strategies to improve physician cooperation. Our review of available studies, however, does suggest a number of promising strategies for enhancing physician cooperation. Financial incentives, in particular, were shown to be effective in improving physician response to surveys. Surprisingly, even a small $1 incentive significantly improved participation by 18% to 21% (Everett et al., 1997; Mizes et al. 1984). In fact, the combined evidence regarding appropriate levels of incentive suggests that the steepest part of the incentive/response curve may be between $0 and $1, with diminishing returns to serial increments above that amount (Halpern et al., 2002; VanGeest & Johnson, 2001). These results mirror general population studies in which the use of token financial incentives averaged nearly a 20% increase in survey participation (Church, 1993; Fox, Clark, & Kim, 1988; Heberlein & Baumgartner, 1978; Yammarino, Skinner, & Childress, 1991). They are also consistent with studies examining the use of monetary incentives in surveys of nurses and allied health professionals (Paul, Walsh, & Tzelepis, 2005; Ulrich et al., 2005). In contrast, token nonmonetary incentives were much less effective in improving physician cooperation, with the cumulative evidence suggesting that nonmonetary inducements work only if physicians value them.

A number of design-based strategies were also identified as being potentially effective in improving physician response rates. For example, survey mode clearly had an impact on response, with postal and telephone surveys resulting in higher average return rates across the studies reviewed. Existing evidence also supports the use of mixed-mode formats that include fax and possibly e-mail options, as these give physicians more alternatives by which to respond to a survey in their busy schedules (Lensing et al., 2000; Parsons

et al., 1994). Choice of survey mode, however, often entails significant cost considerations and more studies are needed to identify the most cost-effective methodologies in surveys of physicians.

Although only a limited number of studies examined the impact of questionnaire design on physician cooperation, existing evidence does suggest that researchers should be succinct when designing physician questionnaires. Again, this is no surprise, given previous research on the association between questionnaire length and survey response (Dillman, Sinclair, & Clark, 1993; Heberlein & Baumgartner, 1978; Nakash, Hutton, Jorstad-Stein, Gates, & Lamb, 2006; Olmsted, Murphy, McFarlane, & Hill, 2005). Previous qualitative research with physicians also identified questionnaire length as a major factor in their willingness to participate (Kasprzyk et al., 2001). With regard to item response format, caution is necessary when drawing conclusions from the single study supporting the use of closed- versus open-item formats, as previous reviews have identified professionals as being more resistant to closed-ended questions compared with the general public (Deutscher, 1956; Sudman, 1985).

Findings related to personalization, sponsorship, and even mailing strategies are consistent with Sudman's (1985) recommendation concerning the need to establish relevance as a means of improving response. In a meta-analysis of population-based studies, use of prenotification letters and sponsorship had the largest effect sizes for increasing response rates (Fox et al., 1988). Similarly, endorsements by local, state, or national organizations also typically result in improved physician participation (Asch & Christakis, 1994). Use of certified mail and/or courier companies such as FedEx also enhances the importance of the mail out package, increasing the likelihood of physician receipt and cooperation. Finally, a note with regard to the use of replacement questionnaires in follow-up mailings: decisions must be carefully balanced against cost considerations, as previous reviews have found little evidence supporting the use of replacement questionnaires in promoting participation generally (Heberlein & Baumgartner, 1981).

Although not addressed explicitly in this review, number of contacts/length of field periods may be one of the most important determinants of physician response. Research suggests that number of contacts may explain up to 40% of the variance in response rates in surveys of the general public (Heberlein & Baumgartner, 1978). Similarly, there is growing consensus in the literature that lengthy field periods may be necessary in maximizing physician participation (Goodman & Jensen, 1981; Parsons et al., 1994; Sudman, 1985; Thran, Olson, & Strouse, 1987). For example, in one study, more than 30% of the completed surveys were obtained after 1 contact, but another 20% required

11 or more contact attempts (Parsons et al., 1994). This same study highlighted differences in number of contact attempts by mode of data collection, with only 6% of telephone interviews completed after 1 contact attempt compared with 60% finalized mail surveys in one mailing of the questionnaire.

Ultimately, a decision regarding what methodologies to employ to improve physician cooperation are embedded within cost-quality trade offs (Olmsted et al., 2005). The good news for those working in limited resource environments is that previous reviews identified smaller-than-anticipated differences between physician respondents and nonrespondents and between early and late responders (Field et al., 2002; Kellerman & Herold, 2001; McFarlane et al., 2006), suggesting low rates of nonresponse bias. This is often because of the homogeneity of physicians with regard to knowledge, training, attitudes, and behavior. Although changing, physicians remain a relatively homogeneous population compared to the general population. This suggests that researchers can still be strategic in employing any of the strategies identified in this review, especially when conducting a survey on a tight budget. That said, researchers should still make every effort to improve access to their target population by implementing design strategies demonstrated to improve physician participation rates, thereby increasing the legitimacy and credibility of their results.

References

Akl, E. A., Maroun, N., Klocke, R. A., Montori, V., & Schunemann, H. J. (2005). Electronic mail was not better than postal mail for surveying residents and faculty. *Journal of Clinical Epidemiology*, *58*, 425-429.

Asch, D. A., & Christakis, N. A. (1994). Different response rates in a trial of two envelop styles in mail survey research. *Epidemiology*, *5*, 364-365.

Asch, D. A., Christakis, N. A., & Ubel, P. A. (1998). Conducting physician mail surveys on a limited budget: A randomized trial comparing $2 bill versus $5 bill incentives. *Medical Care*, *36*, 95-99.

Asch, D. A., Connor, S. E., Hamilton, E. G., & Fox, S. A. (2000). Problems in recruiting community-based physicians for health services research. *Journal of General Internal Medicine*, *15*, 591-599.

Asch, D. A., Jedrziewski, M. K., & Christakis, N. A. (1997). Response rates to mail surveys published in medical journals. *Journal of Clinical Epidemiology*, *50*, 1129-1136.

Baron, G., De Wals, P., & Milord, F. (2001). Cost effectiveness of a lottery for increasing physicians' responses to a mail survey. *Evaluation and the Health Professions*, *24*, 47-52.

Berk, M. L. (1985). Interviewing physicians: The effect of improved response rate. *American Journal of Public Health*, *75*, 1338-1340.

Berk, M. L., Edwards, W. S., & Gay, N. L. (1993). The use of a prepaid incentive to convert nonresponders on a survey of physicians. *Evaluation and the Health Professions*, *16*, 239-245.

Berry, S. H., & Kanouse, D. E. (1987). Physician response to a mailed survey: An experiment in timing of payment. *Public Opinion Quarterly*, *51*, 102-114.

Bhandari, M., Devereaux, P. J., Swiontkowski, M. F., Schemitsch, E. H., Shankardass, K., Sprague, S., et al. (2003). A randomized trial of opinion leader endorsement in a survey of orthopaedic surgeons: Effect on primary response rate. *International Journal of Epidemiology*, *32*, 634-636.

Bonito, A. J., Samsa, G. P., Akin, D. R., & Matchar, D. B. (1997). Use of a non-monetary incentive to improve physician responses to a mail survey. *Academic Medicine*, *72*, 73.

Bostick, R. M., Pirie, P., Luepker, R. V., & Kofron, P. M. (1992). Using physician caller follow-ups to improve the response rate to a physician telephone survey: Its impact and implications. *Evaluation and the Health Professions*, *15*, 420-433.

Braithwaite, D., Emery, J., de Lusignan, S., & Sutton, S. (2003). Using the Internet to conduct surveys of health professionals: A valid alternative? *Family Practice*, *20*, 545-551.

Brehaut J. C., Graham, I. D., Visentin, L., & Stiell, I. G. (2006). Print format and sender recognition were related to survey completion rate. *Journal of Clinical Epidemiology*, *59*, 635-641.

Burt, C. W., & Woodwell, D. (2005, November). *Tests of methods to improve response to physician surveys*. Paper presented at the 2005 Federal Committee on Statistical Methodology, Arlington, VA.

Cartwright, A. (1978). Professionals as responders: Variations in and effects of response rates to questionnaires, 1961-77. *British Medical Journal*, *2*, 1419-1421.

Cartwright A., & Ward, A. W. (1968). Variations in general practitioners' response to postal questionnaires. *British Journal of Preventive and Social Medicine*, *22*, 199-205.

Church, A. H. (1993). Estimating the effect of incentives on mail survey response rates: A metal-analysis. *Public Opinion Quarterly*, *57*, 62-79.

Clark, T. J., Khan, K. S., & Gupta, J. K. (2001a). Provision of pen along with questionnaire does not increase the response rate to a postal survey: A randomized controlled trial. *Journal of Epidemiology and Community Health*, *55*, 595-596.

Clark, T. J., Khan, K. S., & Gupta, J. K. (2001b). Effect of paper quality on the response rate to a postal survey: A randomized controlled trial. *BMC Medical Research Methodology*, *1*, 12.

Cockburn, J., Campbell, E., Gordon, J. J., & Sanson-Fisher, R. W. (1988). Response bias in a study of general practice. *Family Practice*, *5*, 18-23.

Cull, W. L., O'Connor, K. G., Sharp, S., & Tang, S. S. (2005). Response rates and response bias for 50 surveys of pediatricians. *Health Services Research*, *40*, 213-226.

Cummings, S. M., Savitz, L. A., & Konrad, T. R. (2001). Reported response rates to mailed physician questionnaires. *Health Services Research*, *35*, 1347-1355.

Deehan, A., Templeton, L., Taylor, C., Drummond, C., & Strang, J. (1997). The effect of cash and other financial inducements on the response rate of general practitioners in a national postal survey. *British Journal of General Practice*, *47*, 87-90.

Delnevo, C. D., Abatemarco, D. J., & Steinberg, M. B. (2004). Physician response rates to a mail survey by specialty and timing of incentive. *American Journal of Preventive Medicine*, 26, 234-236.

Del Valle, M., Morgenstern, H., Rogstad, T. L., Albright, C., & Vickrey, B. G. (1997). A randomized trial of the impact of certified mail on response rate to a physician survey, and a cost-effectiveness analysis. *Evaluation and the Health Professions*, *20*, 389-406.

Deutscher, I. (1956). Physician reactions to a mailed questionnaire: A study in "resistentialism." *Public Opinion Quarterly*, *20*, 599-604.

Dillman, D. A., Sinclair, M. D., & Clark, J. R. (1993). Effects of questionnaire length, respondent-friendly design, and a difficult question on response rates for occupant-addressed census mail surveys. *Public Opinion Quarterly*, *57*, 289-304.

Donaldson, G. W., Moinpour, C. M., Bush, N. E., Chapko, M., Jocom, J., Siadak, M., et al. (1999). Physician participation in research surveys: A randomized study of inducements to return mailed research questionnaires. *Evaluation and the Health Professions*, *22*, 427-441.

Easton, A. N., Price, J. H., Telljohann, S. K., & Boehm, K. (1997). An informational versus monetary incentive in increasing physicians' response rates. *Psychological Reports*, *81*, 968-970.

Emanuel, E. J., Fairclough, D., Clarridge, B. C., Blum, D., Bruera, E., Penley, W.C., et al. (2000). Attitudes and practices of U.S. oncologists regarding euthanasia and physician-assisted suicide. *Annals of Internal Medicine*, *133*, 527-532.

Everett, S. A., Price, J. H., Bedell, A. W., & Telljohann, S. K. (1997). The effect of a monetary incentive in increasing the return rate of a survey to family physicians. *Evaluation and the Health Professions*, *20*, 207-214.

Farber N. J., Simpson, P., Salam, T., Collier, V. U., Weiner, J., & Boyer, E. G. (2006). Physicians' decisions to withhold and withdraw life-sustaining treatment. *Archives of Internal Medicine*, *166*, 560-564.

Field, T. S., Cadoret, C. A., Brown, M. L., Ford, M., Greene, S. M., Hill, D., et al. (2002). Surveying physicians: Do components of the "Total Design Approach" to optimizing survey response rates apply to physicians? *Medical Care*, *40*, 596-606.

Fox, R. J., Clark, M. R., & Kim, J. (1988). Mail survey response rate: A meta-analysis of selected techniques for inducing response. *Public Opinion Quarterly*, *52*, 467-491.

Gattellari, M., & Ward, J. E. (2001). Will donations to their learned college increase surgeons' participation in surveys? A randomized trial. *Journal of Clinical Epidemiology*, *54*, 645-650.

Goodman, L., & Jensen, L. (1981). Economic surveys of medical practice: AMA's periodic survey of physicians, 1966-1978. In Sudman S (Ed.), *Proceedings of the Third Biennial Conference on Health Services Research* (pp. 56-65). Rockville, MD: National Center for Health Services Research.

Griffith, L. E., Cook, D. J., Guyatt, G. H., & Charles C. A. (1999). Comparison of open and closed questionnaire formats in obtaining demographic information from Canadian general internists. *Journal of Clinical Epidemiology*, *52*, 977-1005.

Gullen, W. H., & Garrison, G. E. (1973). Factors influencing physicians' response to mailed questionnaires. *Health Services Reports*, *88*, 510-514.

Gunn, W. J., & Rhodes, I. N. (1981). Physician response rates to a telephone survey: Effects of monetary incentive level. *Public Opinion Quarterly*, *45*, 109-115.

Halpern, S. D., Ubel, P. A., Berlin, J. A., & Asch, D. A. (2002). Randomized trail of $5 versus $10 monetary incentives, envelope size, and candy to increase physician response rates to mailed questionnaires. *Medical Care*, *40*, 834-839.

Heberlein, T. A., & Baumgartner, R. (1978). Factors affecting response rates to mailed questionnaires: A quantitative analysis of the published literature. *American Sociological Review*, *43*, 447-462.

Heberlein, T. A., & Baumgartner, R. (1981). Is a questionnaire necessary in a second mailing? *Public Opinion Quarterly*, *45*, 102-108.

Heywood, A., Mudge, P., Ring, I., & Sanson-Fisher, R. (1995). Reducing systematic bias in studies of general practitioners: The use of a medical peer in the recruitment of general practitioners in research. *Family Practice*, *12*, 227-231.

Hing, E., Schappert, S. M., Burt, C. W., & Shimizu, I. M. (2005). Effects of form length and item format on response patterns and estimates of physician office and hospital outpatient department visits. National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey. *Vital Health Statistics*, *2*, 139, 1-32.

Hocking, J. S., Lim, M. S., Read, T., & Hellard, M. (2006). Postal surveys of physicians gave superior response rates over telephone interviews in a randomized trial. *Journal of Clinical Epidemiology*, *59*, 521-524.

Hollowell, C. M. P., Patel, R. V., Bales, G. T., & Gerber, G. S. (2000). Internet and postal survey of endourologic practice patterns among American urologists. *The Journal of Urology*, *163*, 1779-1782.

Hughes, P. H., Storr, C. L., Brandenburg, N. A., Baldwin, D.C., Jr., Anthony, J. C., & Sheehan, D. V. (1999). Physician substance use by medical specialty. *Journal of Addictive Diseases*, *18*, 23-37.

Jepson, C., Asch, D. A., Hershey, J. C., & Ubel, P. A. (2005). In a mailed physician survey, questionnaire length had a threshold effect on response rate. *Journal of Clinical Epidemiology*, *58*, 103-105.

Johnson T. P., Parsons, J. A., Warnecke, R. B., & Kaluzny, A. D. (1993). Dimensions of mail questionnaires and response quality. *Sociological Focus*, *26*, 271-274.

Kaner, E. F., Haighton, C. A., & McAvoy, B. R. (1998). "So much post, so busy with practice—so, no time!": A telephone survey of general practitioners' reasons for not participating in postal questionnaire surveys. *British Journal of General Practice*, *48*, 1067-1069.

Kasprzyk, D., Montano, D. E., St. Lawrence, J. S., & Phillips, W. R. (2001). The effects of variations in mode of delivery and monetary incentive on physicians' responses to a mailed survey assessing STD practice patterns. *Evaluation and the Health Professions*, *24*, 3-17.

Kellerman, S. E., & Herold, J. (2001). Physician response to surveys: A review of the literature. *American Journal of Preventive Medicine*, *20*, 61-67.

Kim, H. L., Hollowell, C. M. P., Patel, R. V., Bales, G. T., Clayman, R. V., & Gerber, G. S. (2000). Use of new technology in endourology and laparoscopy by American urologists: Internet and postal survey. *Urology*, *56*, 760-765.

Leece, P., Bhandari, M., Sprague, S., Swiontkowski, M. F., Schemitsch, E. H., & Tornetta, P. (2006). Does flattery work? A comparison of 2 different cover letters for an international survey of orthopedic surgeons. *Canadian Journal of Surgery*, *49*, 90-95.

Leece, P., Bhandari, M., Sprague, S., Swiontkowski, M. F., Schemitsch, E. H., Tornetta, P., et al. (2004). Internet versus mailed questionnaires: A controlled comparison. *Journal of Medical Internet Research*, 6, e39.

Lensing, S. Y., Gillaspy, S. R., Simpson, P. M., Jones, S. M., James, J. M., & Smith, J. M. (2000). Encouraging physicians to respond to surveys through the use of fax technology. *Evaluation and the Health Professions*, *23*, 348-359.

Leung, G. M., Ho, L. M., Chan, M. F., Johnston, J. M., & Wong, F. K. (2002). The effects of cash and lottery incentives on mailed surveys to physicians: A randomized trial. *Journal of Clinical Epidemiology*, *55*, 801-807.

Leung, G. M., Johnston, J. M., Saing, H., Tin, K. Y. K., Wong, I. O. L., & Ho, L. (2004). Prepayment was superior to postpayment cash incentives in a randomized postal survey among physicians. *Journal of Clinical Epidemiology*, *57*, 777-784.

MacPherson, I., & Bisset, A. (1995). Not another questionnaire!: Eliciting the views of general practitioners. *Family Practice*, *12*, 335-338.

Maheux, B., Legault, C., & Lambert, J. (1989). Increasing response rates in physicians' mail surveys: An experimental study. *American Journal of Public Health*, *79*, 638-639.

Marin, J., & Howe, H. L. (1984). Physicians' attitudes toward breast self-examination: A pilot study. *Evaluation and the Health Professions*, *7*, 193.

McAuliffe, W. E., Rohman, M., Santangelo, S., Fieldman, B., Magnuson, E., Sobol, A., et al. (1986). Psychoactive drug use among practicing physicians and medical students. *New England Journal of Medicine*, *315*, 805-810.

McAvoy, B. R., & Kaner, E. F. S. (1996). General practice postal surveys: A questionnaire too far? *British Medical Journal*, *313*, 732-733.

McDermott, M. M., Greenland, P., Hahn, E.A., Brogan, D., Cella, D., Ockene, J., et al. (2003). The effects of continuing medical education credits on physician response rates to a mailed questionnaire. *Health Marketing Quarterly*, *20*, 27-42.

McFarlane, E., Olmsted, M. G., Murphy, J., & Hill, C. A. (2006, May). *Nonresponse bias in a mail survey of physicians*. Paper presented at the annual conference of the American Association for Public Opinion Research, Montreal, Quebec.

McKenzie-McHarg, K., Tully, L., Gates, S., Ayers, S., & Brocklehurst, P. (2005). Effect on survey response rate of hand written versus printed signature on a covering letter: Randomised controlled trial. *BMC Health Services Research*, *5*, 52.

McMahon, S. R., Iwamoto, M., Massoudi, M. S., Yusuf, H. R., Stevenson, J. M., David, F., et al. (2003). Comparison of e-mail, fax and postal surveys of pediatricians. *Pediatrics*, *111*, e299-e303.

Meier, D. E., Emmons, C. A., Wallenstein, S., Quill, T., Morrison, R. S., & Cassel, C. K. (1998). A national survey of physician-assisted suicide and euthanasia in the United States. *New England Journal of Medicine*, *338*, 1193-1201.

Mizes, S., Fleece, L., & Roos, C. (1984). Incentives for increasing return rates: Magnitude levels, response bias, and format. *Public Opinion Quarterly*, *48*, 794-800.

Moore, D., & An, L. (2001, August). *The effect of repetitive token incentives and priority mail on response to physician surveys*. Proceedings of the annual meeting of the American Statistical Association, Atlanta, GA.

Mosca, L., Linfante, A. H., Benjamin, E. J., Berra, K., Hayes, S. N., Walsh, B. W., et al. (2005). National study of physician awareness and adherence to cardiovascular disease prevention guidelines. *Circulation*, *111*, 499-510.

Moses, S. H., & Clark, T. J. (2004). Effect of prize draw incentive on the response rate to a postal survey of obstetricians and gynecologists: A randomized controlled trial. *BMC Health Services Research*, 4, 14.

Mullen, P. D., Easling, I., Nixon, S. A., Koester, D. R., & Biddle, A. K. (1987). The cost-effectiveness of randomized incentive and follow-up contacts in a national mail survey of family physicians. *Evaluation and the Health Professions*, *10*, 232-245.

Myerson, S. (1993). Improving the response rates in primary care research. Some methods used in a survey on stress in general practice since the new contract (1990). *Family Practice*, *10*, 342-346.

Nakash, R. A., Hutton, J. L., Jorstad-Stein, E. C., Gates, S., & Lamb, S. E. (2006). Maximising response to postal questionnaires: A systematic review of randomized trials in health research. *BMC Medical Research Methodology*, *6*, 5.

Ogborne, A. C., Rush, R., & Fondacaro, R. (1986). Dealing the nonrespondents in a mail survey of professionals. *Evaluation and the Health Professions*, *9*, 121-128.

Olmsted, M. G., Murphy, J., McFarlane, E., & Hill, C. (2005, May). *Evaluating methods for increasing physician survey cooperation*. Paper presented at the annual conference of the American Association for Public Opinion Research, Miami Beach, FL.

Olson, L., Schneiderman, M., & Armstrong, R. V. (1993). Increasing physician survey response rates without biasing survey results. In *Proceedings of the section on survey research methods of the American Statistical Association* (pp. 1036-1041) Alexandria, VA: American Statistical Association.

Osborn, M., Ward, J., & Boyle, C. (1996). Effectiveness of telephone prompts when surveying general practitioners: A randomized trial. *Australian Family Physician*, *25*, S41-S43.

Parsons, J. A., Warnecke, R. B., Czaja, R. F., Barnsley, J., & Kaluzny, A. (1994). Factors associated with response rates in a national survey of primary care physicians. *Evaluation Review*, *18*, 756-766.

Paul, C. L., Walsh, R. A., & Tzelepis, F. (2005). A monetary incentive increases postal survey response rates for pharmacists. *Journal of Epidemiology and Community Health*, *59*, 1099-1101.

Raziano, D. B., Jayadevappa, R., Valenzula, D., Weiner, M., & Lavizzo-Mourey, R. (2001). E-mail versus conventional postal mail survey of geriatric chiefs. *Gerontologist*, *41*, 799-804.

Robertson, J, Walkom, E. J., & McGettigan, P. (2005). Response rates and representativeness: A lottery incentive improves physician survey return rates. *Pharmacoepidemiology and Drug Safety*, *14*, 571-577.

Sallis, J. F., Fortmann, S. P., Solomon, D. S., & Farquhar, J. F. (1984). Increasing returns of physician surveys. *American Journal of Public Health*, *74*, 1043.

Schroy, P. C., 3rd, Geller, A. C., Crosier Wood, M., Page, M., Sutherland, L., Holm, L.J., et al. (2001). Utilization of colorectal cancer screening tests: A 1997 survey of Massachusetts internists. *Preventive Medicine*, *33*, 381-391.

Seguin, R., MacDonald, S., Godwin, M., & McCall, M. (2004). E-mail or snail mail? Randomized controlled trial on which works better for surveys. *Canadian Family Physician*, *50*, 414-419.

Shiono, P. H., & Klebanoff, M. A. (1991). The effect of two mailing strategies on the response to a survey of physicians. *American Journal of Epidemiology*, *134*, 539-542.

Sibbald, B., Addington-Hall, J., Brenneman, D., & Freeling, P. (1994). Telephone versus postal surveys of general practitioners: Methodological considerations. *British Journal of General Practice*, *44*, 297-300.

Stocks N., & Gunnell, D. (2000). What are the characteristics of GPs who routinely do not return postal questionnaires: A cross sectional study. *Journal of Epidemiology and Community Health*, *54*, 940-941.

Streiff, M. B., Dundes, L., & Spivak, J. L. (2001). A mail survey of United States hematologists and oncologists: A comparison of business reply versus stamped return envelopes. *Journal of Clinical Epidemiology*, *54*, 430-432.

Sudman, S. (1985). Mail surveys of reluctant professionals. *Evaluation Review*, *9*, 349-360.

Tamayo-Sarver, J. H., & Baker, D. W. (2004). Comparison of responses to a $2 bill versus a chance to win $250 in a mail survey of emergency physicians. *Academic Emergency Medicine*, *11*, 888-892.

Tambor, E. S., Chase, G. A., Faden, R. R., Geller, G., Hofman, K. J., & Holtzman, N. A. (1993). Improving response rates through incentive and follow-up: The effect on a survey of physicians' knowledge of genetics. *American Journal of Public Health*, *83*, 1599-1603.

Temple-Smith, M., Mulvey, G., & Doyle, W. (1998). Maximizing response rates in a survey of general practitioners: Lessons from a Victorian survey on sexually transmissible diseases. *Australian Family Physician*, *27*(Suppl. 1), S15-S18.

Templeton, L., Deehan, A., Taylor, C., Drummond, C., & Strang, J. (1997). Surveying general practitioners: Does a low response rate matter? *British Journal of General Practice*, *47*, 91-94.

Thomson C. E., Paterson-Brown, S., Russell, D., McCaldin, D., & Russell, I. T. (2004). Short report: Encouraging GPs to complete postal questionnaires—one big prize or many small prizes? A randomized controlled trial. *Family Practice*, *21*, 697-698.

Thran, S. L., & Berk M. L. (1993). Survey of physicians: An overview. In *Proceedings of the International Conference on Establishment Surveys* (pp. 83-92). Alexandria, VA: American Statistical Association.

Thran, S. L., & Gonzalez, M. L. (1999). Characteristics of unlocatable physicians. In *Proceedings of the section on survey research methods of the American Statistical Association* (pp. 529-532). Alexandria, VA: American Statistical Association.

Thran, S. L., & Hixson, J. S. (2000). Physician surveys: Recent difficulties and proposed solutions. In *Proceedings of the section on survey research methods of the American Statistical Association* (pp. 233-237). Alexandria, VA: American Statistical Association.

Thran, S. L., Olson, L., & Strouse, R. (1987). The effectiveness and costs of special data collection efforts in a telephone survey of physicians. In *Proceedings of the survey research section of the American Statistical Association* (pp. 761-766). Alexandria, VA: American Statistical Association.

Tu, S. (2003). Developmental epidemiology: A review of three key measures of effect. *Journal of Clinical Child & Adolescent Psychology*, *32*(2), 187-192.

Ulrich, C. M., Danis, M., Koziol, D., Garrett-Mayer, E., Hubbard, R., & Grady, C. (2005). Does it pay to play? A randomized trial of prepaid financial incentives and lottery incentives in surveys of nonphysician healthcare professionals. *Nursing Research*, *54*, 178-183.

Urban, N., Anderson, G. L., & Tseng, A. (1993). Effects on response rates and cost of stamps vs. business reply in a mail survey of physicians. *Journal of Clinical Epidemiology*, *46*, 455-459.

VanDenKerkhof, E. G., Parlow, J. L., Goldstein, D. H., & Milne, B. (2004). In Canada, anesthesiologists are less likely to respond to an electronic, compared to a paper questionnaire. *Canadian Journal of Anesthesia*, *51*, 449-454.

VanGeest, J. B., & Johnson, T. P. (2001, October). *Methodologies for improving response rates in surveys of physicians*. Paper presented at the annual meeting of the American Public Health Association, Atlanta, GA.

VanGeest, J. B., Wynia, M. K., Cummins, D. S., & Wilson, I. B. (2001). Effects of different monetary incentives on the return rate of a national survey of physicians. *Medical Care*, *39*, 197-201.

Vogel, L. L., Nowacek, G., Harlan, J. F., Tribble, A., & Thorup, O. A. (1983). Impact of replacement questionnaire on the response rate of practicing physicians to mail questionnaire. *Journal of Medical Education*, *58*, 905.

Ward, J., Bruce, T., Holt, P., D'Este, K., & Sladden, M. (1998). Labour-saving strategies to maintain survey response rates: A randomized trial. *Australian New Zealand Journal of Public Health*, *22*(Suppl.), 394-396.

Ward, J., & Wain, G. (1994). Increasing response rates of gynecologists to a survey: A randomized trial of telephone prompts. *Australian Journal of Public Health*, *18*, 332-334.

Webster, B. S., Courtney, T. K., Huang, Y. H., Matz, S., & Christiani, D. C. (2005). Physicians' initial management of acute low back pain versus evidence-based guidelines. Influence of Sciatica. *Journal of General Internal Medicine*, *20*, 1132-1135.

Wynia, M. K., Cummins, D. S., VanGeest, J. B., & Wilson, I. B. (2000). Physician manipulation of reimbursement rules for patients: Between a rock and a hard place. *Journal of the American Medical Association*, *283*, 1858-1865.

Yammarino, F. J., Skinner, S. J., & Childress, T. L. (1991). Understanding mail survey response behavior: A meta-analysis. *Public Opinion Quarterly*, *55*, 613-639.