



Research Techniques Made Simple: Web-Based Survey Research in Dermatology: Conduct and Applications

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Web-based surveys, or e-surveys, are surveys designed and delivered using the internet. The use of these survey tools is becoming increasingly common in medical research. Their advantages are appealing to surveyors because they allow for rapid development and administration of surveys, fast data collection and analysis, low cost, and fewer errors due to manual data entry than telephone or mailed questionnaires. Internet surveys may be used in clinical and academic research settings with improved speed and efficacy of data collection compared with paper or verbal survey modalities. However, limitations such as potentially low response rates, demographic biases, and variations in computer literacy and internet access remain areas of concern. We aim to briefly describe some of the currently available Web-based survey tools, focusing on advantages and limitations to help guide their use and application in dermatologic research.

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Description: This article, designed for dermatologists, residents, fellows, and related healthcare providers, seeks to reduce the growing divide between dermatology clinical practice and the basic science/current research methodologies on which many diagnostic and therapeutic advances are built.

Objectives: At the conclusion of this activity, learners should be better able to:

- Recognize the newest techniques in biomedical research.
- Describe how these techniques can be utilized and their limitations.
- Describe the potential impact of these techniques.

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INTRODUCTION

Surveys are well-established tools used in the collection of both quantitative and qualitative data. Their application in dermatology ranges from collection of opinions, attitudes, and behavioral trends to measures of quality of life and outcomes (Asarch et al., 2009; Saczynski et al., 2013). Since the

first e-mail survey was published in 1986, there has been a shift from traditional survey methods (in-person interviews, telephone, and paper-based surveys) to Web-based surveys (Wright, 2005). Given the widespread popularity of Web-based surveys, it is valuable for investigators to be familiar with this modality. In this article, we aim to describe the

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Abbreviations: CHERRIES, Checklist for Reporting Results of Internet E-Surveys; HIPAA, Health Insurance Portability and Accountability Act

SUMMARY POINTS

- Web-based surveys are often useful, versatile, and cost-effective tools for gathering information.
- Web-based surveys provide researchers with a fast, flexible, and far-reaching tool for data collection and analysis.
- Despite many advantages, there are important limitations to consider when using Web-based surveys, including low response rates, potential biases, and ethical concerns.

applications, advantages, and limitations of Web-based survey tools.

SURVEY-BASED RESEARCH

Survey-based research collects participants' responses using a questionnaire that aims to analyze characteristics of a defined population. The methods of data collection can be quantitative, using numerical items or scores; qualitative, via open-ended questions; or a mix of both (Ponto, 2015). Surveys provide information ranging from disease incidence, attitudes, behaviors, perceptions, satisfaction, and quality of life measures to the assessment of medical knowledge, patient management, and evaluation of medical training institutions (Asarch et al., 2009; Ponto, 2015).

METHODS OF DATA COLLECTION

There are multiple survey modalities used for data collection, the most common being questionnaires, which can be delivered on paper (either in person or by mail), electronically, or by direct contact (e.g., over the phone or in-person interview) (Mandal et al., 2000). The far-reaching potential of the internet has made the Web-based format a compelling choice. With over 300 Web-based survey software programs available (Gill et al., 2013), there are many options and factors to consider when deciding which is the most appropriate tool for one's research investigation (Wright, 2005). Although use of these automated and electronic systems may augment survey creation, proper development is always and unavoidably a time-consuming process, given the need for careful question design and the testing that is needed for validation. Some advantages and disadvantages of Web-based surveys compared with traditional methods are listed in Table 1.

SAMPLE SELECTION

The main objective of sample selection is to garner participants who are representative of the desired study population. Sample selection may be random, nonrandom, or a combination of the two. Random sampling is commonly used when collecting quantitative data and can be aided by an online randomizer. Nonrandom sampling is often used for qualitative data collection, aimed toward a specific group of interest (Kelley et al., 2003). In addition, Web survey sampling may be classified into nonprobability and probability types. Nonprobability sampling, also described

as convenience sampling, is subject to the judgment of the researcher, and the sample is composed of volunteers and self-selected persons. Although these samples limit generalizability and statistical significance, they have utility in developing hypotheses or collecting non-inferential data (Fielding et al., 2017). Examples of nonprobability surveys include those using e-mail lists and opt-in panels (Fielding et al., 2017). Conversely, probability samples attempt to select participants randomly and minimize nonresponse bias to capture a broader representation (Fan & Yan, 2010). Surveys using non-list-based sampling with pop-up surveys and mixed-mode surveys with online options are probability based (Fielding et al., 2017). Although Web-based surveys offer the benefit of broad sampling without incurring additional cost, it is important to be aware of issues that may arise with sample selection, most importantly that of sampling and coverage errors. For example, these may occur when participants may not equally access the survey or have access to the internet (Fan and Yan, 2010). However, Web-based surveys may also augment access to traditionally hard-to-reach populations who share specific interests and form virtual cohorts on the internet (Wright, 2005). Mitigating sample bias may be achieved by providing computer access to desired survey participants, randomizing pop-ups on a Web page, or randomizing participants from an e-mail list server (Fielding et al., 2017).

DATA COLLECTION TOOLS

Online data collection tools facilitate survey and data management in clinical and translational research. Researchers have the option of selecting among hundreds of online survey software tools for their projects (Vehovar, 2014). Although the process of data collection may vary according to the selected tool, it generally follows a common framework (Figure 1). There are many tools available, two of which we have chosen to expand on given their current high rates of use. *Research electronic data capture* (i.e., REDCap) is a widely used tool in academic settings and has been used in over 4,000 articles. It is an example of a tool used for secure data collection. REDCap allows researchers to construct and manage online surveys and to save and export obtained data to statistical analysis software or as raw data files. Because of its cost, this tool is mainly available in academic research settings (Harris et al., 2009). Another example is SurveyMonkey, which is overall the most used tool. It is a low-cost, user-friendly software with the highest Web traffic of all survey tools, often used for market and health research (Gill et al., 2013; Vehovar, 2014). It is important to consider cost and design when selecting a survey tool. However, most importantly, one should choose a tool that is compliant with subject protection and data privacy as per the Health Insurance Portability and Accountability Act (i.e., HIPAA). Examples of HIPAA-compliant Web-based survey tools can be found in Table 2.

SURVEY DESIGN

Most online survey websites allow users to customize their questions and show responses in various formats, including dichotomous, multiple choice, or rating scales. Allowing for rapid development of Web-based surveys may be augmented

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Table 1. Advantages and disadvantages of Web-based surveys¹

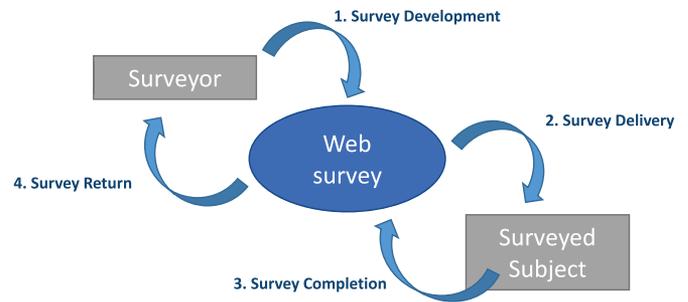
Advantages	Disadvantages
<ul style="list-style-type: none"> • Rapid development • Fast administration • Flexible questionnaire design • Low cost • Access to traditionally hard-to-reach groups • Low data entry errors • Possibly higher data quality compared with other survey modalities 	<ul style="list-style-type: none"> • Sampling biases • Self-selection bias • Internet access required • Computer literacy required • Relatively lower response rates • Technical problems

¹Adapted from Wright (2005) and Dykema et al. (2013).

by software tools, which may autopopulate survey design. A user-friendly design that is easy to navigate and presented in a simple, effective, and aesthetically appealing format is advisable and might serve as a motivational factor to a surveyed subject. Another component to take into consideration is the length of the questionnaire. Although there is no consensus in the literature, it is generally reported that briefer is better, with a concise questionnaire (<10 minutes) often preferred (Revilla and Ochoa, 2017). Providing the surveyed subject with the estimated time required for completion or number of questions to be answered may be a powerful strategy to aid in enhancing response rates (Oppenheimer et al., 2011). It is essential to check for quality of the survey content with standardized guidelines such as the Checklist for Reporting Results of Internet E-Surveys (i.e., CHERRIES) (Eysenbach, 2004), and important to pre-test the survey, making sure it is accessible across different operating systems and browsers.

Following is a list of key principles that might help to increase survey participation and improve the accuracy of responses (Dillman, 2014):

1. Consider whether using a Web-based survey is appropriate for your research project. Design a research question requiring input from a population with access to the internet.
2. Write a brief introduction including the study goals and investigators involved.
3. Create a concise, easy-to-understand, and “eye pleasing” screen that allows questions to be easily visible and read in entirety.
4. Make sure the font size and spacing are adequate for easy readability. Be consistent with wording and style.
5. Avoid horizontal scrolling and visually distracting backgrounds.
6. When possible, avoid open-ended questions.
7. Consider allowing the option of “not applicable” as an answer choice.
8. Check for possible biases in the wording or order of questions. Consider randomization of questions to avoid priming respondents, or place opinion questions toward the beginning of the questionnaire to prevent bias.



Adapted from Fan & Yan, 2010.

Figure 1. The Web survey process. Adapted from Fan and Yan, 2010.

9. Avoid similar or overlapping answer choices. Consider listing choices in alphabetical order.
10. Pilot test the questionnaire to evaluate feasibility, validity, and reliability.
11. Pre-test the Web survey before going live.
12. Carefully check the e-mail list for duplicate e-mail addresses. Consider choosing Web-based survey tools that are able to block duplicate responses from the same IP address.

SURVEY VALIDITY AND RELIABILITY

Web-based surveys have the advantage of simultaneously storing data, thus bypassing data entry errors (Table 3). In addition, Web-based surveys allow for the calculation of response rate or view rates to understand the extent of distribution. The view rate is specific to Web-hosted surveys and is defined as the ratio of unique survey visitors divided by unique site visitors (Eysenbach, 2004). Errors that may arise from electronic surveys, including coverage, measurement, and nonresponse errors, can be more readily identified and addressed. Strategies proposed to reduce these errors include the development of a multimodal design, (i.e., having Web-based and paper-based surveys available to reduce coverage errors); adoption of valid and reliable questionnaires to reduce measurement errors; and use of e-mail reminders to reduce nonresponses (Ponto, 2015). Another advantage of Web-based surveys is the ability to insert missing question reminders, which may result in higher completion rates (Dykema et al., 2013).

ADDRESSING NONRESPONSE RATES

One important limitation of Web-based surveys compared with other modalities is that despite providing higher rates of questionnaire completeness and shorter response time, they may be associated with lower response rates (Oppenheimer et al., 2011). Although response rates vary among studies, there is more literature to support lower response rates in Web-based survey design than otherwise compared with mail (Fan and Yan, 2010; Sebo et al., 2017). Several strategies, such as sending e-mail or phone call reminders, using a postal prenotification letter/invitation, and offering a link for a paper survey to be printed, have been shown to improve response rates (Dykema et al., 2013). For instance, a randomized controlled trial

Table 2. Examples of online survey tools and websites

Survey Tool	Website	HIPAA Compliant ¹	Cost ¹	Dermatology Citations
Active Web Survey	http://www.websm.org/db/18/3581/Software/Active_Websurvey/		Yes	—
Apian Software	http://www.apian.com			—
Campaign Monitor GetFeedback	https://www.getfeedback.com/pricing		Yes	—
CheckBox Survey	https://www.checkbox.com/pricing/online-subscription	Yes	Yes	—
CHOIR	https://choir.stanford.edu/clinical-practice/ (via institution website)			—
comScore	http://www.comscore.com/			—
DADOS survey	https://www.dadosproject.com	Yes		—
EZsurvey/Raosoft	http://www.raosoft.com/products/ezsurvey/			—
Formstack	https://www.formstack.com/	Yes	Yes	—
Formsite	http://formsite.com	Yes	Yes	—
HostedSurvey	http://www.hostedsurvey.com/home.html			—
GoogleForm	https://www.google.com/forms/about/			—
InfoPoll	http://infopoll.com/live/surveys.dll/web			—
Instasurvey	http://instasurvey.appdictive.dk			—
Key Survey	https://www.keysurvey.com/request/free-trial/		Yes	—
LimeSurvey	https://www.limesurvey.org		Free ²	—
LoopSurvey	https://www.loopsurvey.com	Yes	Yes	—
eSurveyPro	https://www.esurveyspro.com/Prices.aspx			—
Obsurvey	http://obsurvey.com			—
PatientGain	https://www.patientgain.com/			—
Perseus	http://www.perseusuk.co.uk/survey/software/professional.html			—
PollDaddy	https://polldaddy.com		Yes	—
PollPro	http://www.pollpro.com			—
PopSurvey	https://www.popsurvey.com			—
Qualtrics ²	www.qualtrics.com	Yes	Yes	Ahmad and Bruckner (2014), Fogel and Teng (2015), Gupta et al. (2017)
QuestionPro	https://www.questionpro.com/tour/		Yes	—
QuickTap Survey	https://www.quicktapsurvey.com			—
SmartSurvey	https://www.smartsurvey.co.uk			—
SoGo Survey	https://www.sogosurvey.com	Yes	Free	—
SurveyCrafter	https://www.surveycrafter.com/interim2/default.asp			—
SurveyLegend	https://www.surveylegend.com			—
SurveyNuts	https://surveynuts.com/en			—
SurveyMethods	https://surveymethods.com			—
SurveyMonkey ²	https://www.surveymonkey.com			Carter and Zug (2009), Donovan (2009), Ekroll and Faul (2013), Kirby et al. (2013), Kunde et al. (2013)
SurveyMoz	http://www.surveymoz.com			—
SurveyAct	http://www.surveyact.com			—
SurveyMetrics	https://survmetrics.com			—
SurveyGizmo	https://www.surveygizmo.com	Yes	Free	Oliver et al. (2017)
Survey Planet	https://www.esurveyspro.com/Prices.aspx			—
SurveyPal	https://www.surveypal.com			—
Rational Survey	http://www.rationalsurvey.com			—
REDCap	https://www.project-redcap.org	Yes		Gan et al. (2016), Liu et al. (2017), Mostaghimi et al. (2015), Nelson et al. (2018), Sobanko et al. (2016), Zhang et al. (2016)
TypeForm	https://www.typeform.com/			—
WorldApp KeySurvey	https://www.keysurvey.com			—
Wufoo	https://www.wufoo.com/pricing/		Free ²	—
Zoomerang	https://www.zoomerang.com/	Yes	Free ²	—
Zoro	https://www.zoho.com/survey/			—

Abbreviation: HIPAA, Health Insurance Portability and Accountability Act.

¹Blank cells indicate an unknown status for HIPAA compliancy and cost.

²Free basic package.

Table 3. Key aspects of survey design (Fielding et al., 2017)

Sampling	<ul style="list-style-type: none"> • Consider nonprobability vs. probability sampling depending on research question and accessibility of sample.
Navigation	<ul style="list-style-type: none"> • Decide on a “scrolling” vs. “paging” format depending on how many questions are visible on a single Web page. • Create visually appealing and simple Web page design with “welcome” and “thank you” screens.
Question composition	<ul style="list-style-type: none"> • Consider the data needed, write questions to answer the research goal, and avoid extraneous data collection. • Choose either open-ended or close-ended questions. • Include time frames to avoid recall bias. • Avoid “double-barreled” questions. • Avoid leading words to prevent bias. • Avoid negative questions.
Validity	<ul style="list-style-type: none"> • Measure how question addresses its intended purpose. • Write questions with clear intent with unambiguous answer choices.
Reliability	<ul style="list-style-type: none"> • Measure answer consistency. • Identify all points on rating scales with words to allow consistent interpretation. • Reliability may be verified with pilot studies of questionnaire.

analyzing response rates to mailed surveys among dermatologists found that having a personalized invitation was associated with a 7–10% increase in response rate (Levy et al., 2012). Another method often used to improve response rates is the offer of monetary or nonmonetary incentives. However, this approach has not been shown to increase rates of survey completion and may introduce sampling biases (Oppenheimer et al., 2011). Instead, lottery incentives have more efficacy in improving response rates (Oppenheimer et al., 2011).

STANDARDIZATION

Similar to checklists developed to ensure quality in randomized controlled trials and systemic reviews, the CHERRIES has been developed by the *Journal of Medical Internet Research* as a standardized approach to Web-based surveys (Eysenbach, 2004). This checklist comprises 8 categories: design, institutional review board (IRB) approval and informed consent, development and pretesting, recruitment process, survey administration, response rate calculation, preventing multiple entries, and analysis. CHERRIES aims to provide a clear framework, providing readers and reviewers a comprehensive understanding of studies using e-surveys (Eysenbach, 2004).

ETHICAL ISSUES

E-survey studies are often anonymous and exempt from institutional review board approval, thus not requiring signed informed consent. Investigators should consider data security measures such as encryption to protect the privacy of surveyed subjects. Web surveys offer a unique feature in which IP addresses could be collected, allowing geographic tracking of responses; however, this may be viewed as identifiable data, and researchers should consider stripping IP addresses from the dataset or turning off this feature with commercial Web survey tools (Buchanan and Hvizdak, 2009). With regard to data security, many surveys are HIPAA compliant. Nonetheless, it is recommended that participants be informed that as with any online interaction, nothing is fully secure and that the possibility of hacking exists (Buchanan and Hvizdak, 2009).

APPLICATIONS IN DERMATOLOGIC RESEARCH

Web-based surveys have been used for a wide range of investigations in dermatology regarding patient care (Del Rosso et al., 2017), epidemiological investigations (Lingala et al., 2014), medical education (Asarch et al., 2009), diagnostic criteria (Carrera et al., 2016), and clinical trials (Buller et al., 2015). Web-based surveys have been shown to improve adherence to treatment serving as a “virtual office visit” to drive patient compliance, as seen, for instance, in a weekly questionnaire asking respondents to verify compliance to using topical benzoyl peroxide (Yentzer et al., 2011). Surveys have also been used to analyze physician diagnostic methods and management patterns for dermatologic conditions (Asarch et al., 2009). Finally, surveys may be used in academic dermatology to consider the perceptions of residents and fellows in training and teaching (Asarch et al., 2009).

MOBILE WEB SURVEYS

As mobile technology advances, applications on consumer smart devices have attracted considerable attention as a modality for surveying. Mobile surveys on smartphones and tablets are often more convenient for patients and providers, allowing robust data collection. Immediacy of data entry reduces recall bias, because responders can enter information on a portable platform (Marcano Belisario et al., 2015). Additionally, smart devices are capable of capturing environmental information, such as photographs, videos, and physiologic data from sensors, which may broaden the scope of data collection (Marcano Belisario et al., 2015; Torous et al., 2016). Smartphone and tablet-based surveys have data equivalence to paper results, and respondents across all age groups prefer mobile methods to traditional paper surveys (Marcano Belisario et al., 2015). Mobile surveys have been used in biomedical research methods. For example, the DADOS platform, a CHERRIES-compliant mobile survey software, allows for the collection of patient data using mobile tablets in clinical settings (Shah et al., 2006).

SUMMARY

Web-based surveys are practical and invaluable resources for researchers and dermatologists. They are rapid and

MULTIPLE CHOICE QUESTIONS

- Which of the following is a disadvantage of Web-based surveys?
 - Access to difficult-to-reach groups
 - Reduced cost
 - Sampling bias
 - Rapid administration
- What is NOT an important consideration of Web-based survey construction?
 - Avoid horizontal scrolling
 - Avoid “not applicable” as an answer choice
 - Avoid similar answer choices
 - Avoid visually distracting backgrounds
- What is the view rate?
 - Number of unique site visitors
 - Number of total site visitors
 - Ratio of unique survey visitors to unique site visitors
 - Ratio of unique site visitors to unique survey visitors
- Which of the following is unique to Web-based surveys compared with traditional paper surveys?
 - Using incentives for survey completion
 - Use of the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) checklist
 - Making a concise questionnaire
 - Writing clear, understandable questions
- Which of the following is a potential application of Web-based survey research?
 - Assessing medical education
 - Analyzing treatment outcomes
 - Measuring patient satisfaction
 - All of the above

convenient, allowing efficient and often cost-effective data collection. Several platforms, both open source and subscription based, are available for research use and customization. Although there are important limitations, including nonresponse rates and technical challenges across platforms, internet-based surveys have the potential for wide-ranging applications if they are well designed. In dermatology, the Web-based survey has been successfully used to investigate a variety of research questions, including in clinical, academic, and administrative settings.

CONFLICT OF INTEREST

The authors state no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material is linked to this paper. Teaching slides are available as supplementary material.

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