Computing Response Rates for Probability-Based Web Panels

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Abstract
This paper builds and advances a previous publication on how to compute response metrics for online panels (Callegaro & DiSogra, 2008). It starts by describing how multi-stage response rates are computed for probability-based web panels (recruitment, profile, and completion rate) and their use in a cumulative response rate calculation. Also discussed is how to combine mixed mode recruitment methods in the computation of the recruitment rate. We then focus on standing panels that rely on continuous recruitment from multiple independent recruitment samples and introduce the concept of calculating response rates when multiple recruitment cohorts are involved. Finally, we present formulas for addressing panel attrition rates in both cross-sectional and longitudinal designs.

Key Words: Probability-based web panel; mixed-mode; response metrics; cumulative response rate.

1. Introduction

Research employing online panels is increasing every year, especially in the marketing sector (O'Muircheartaigh, 2008). Very recently, many national Election Studies were conducted with online panels (Clarke, Sanders, Stewart, & Whiteley, 2008). Online panels are also widely used in psychological research (Göritz, 2007), medical (Couper, 2007), and social research (Tortora, 2009).

Computing response rates is important in order to assess potential non-response bias in study samples that are drawn from online panels. Online panels can be classified in two groups: "volunteer" or opt-in panels, and pre-recruited probability-based panels (Fricker, 2008; Sikkel & Hoogendoorn, 2008). In the first case, the opt-in panels have no recruitment sample frame and thus the probability of selection is unknown. For these non-probability panels the computation of response rates is not possible since there is no defined denominator (American Association for Public Opinion Research, 2008). Moreover, the concept of a response rate for a self-selected sample inherently hides a variety of sample-related survey errors. For example, a high response rate in an opt-in panel sample might hide the fact that only those who always participate in surveys (assured responders) were invited (Bethlehem & Stoop, 2007).

In this paper we study the different developmental stages for panel membership, management and sampling, and some design features of probability-based online panels. This background is contextually essential in order to propose a set of metrics that can be used to compute response rates and possibly assess non-response error.

1.1 Current Standards for Computing Response Rates in Online Panels
Current standards for computing response rates for online panels focus mainly on the non-probability opt-in panels and in many cases these standards do not explicitly make this distinction between the two types of panels. ESOMAR (European Society for

Opinion and Marketing Research, 2005, 2008) and IMRO (Interactive Marketing Research Organization, 2006) issued some documents providing guidelines in computing response rates for online panels. While ESOMAR does not introduce a specific terminology, IMRO defines *response rate* as "based on the people who have accepted the invitation to the survey and started to complete the survey" and *completion rate* as "the proportion of those who have started, qualified and then completed the survey" (p. 13). A more detailed discussion, as well a description of older standards, is provided by Callegaro & DiSogra (2008).

Two more recent documents specifically discuss response rate issues for online panels. The first one, edited by Bob Lederer, is titled: "Platforms for data quality progress: The client's guide to rapid improvement of online research" (RFL Communications, 2008). Issued by the end of 2008, it was endorsed by the Market Research Association. In this document many rates are defined. For example, response rate is defined as the total number of attempted responses divided by the total invitations/intercepts minus the bounce-back, errors or request for removal (p. 17). Completion rate is defined as the total number of surveys calculated as completes divided by total number passing the screening criteria (p. 23).

Another document worth reviewing is the newly released ISO standard number 26362 (International Standard Organization, 2009). Under the definition of incentive (p. 2) ISO states: "the term 'response rate' cannot be used to describe respondent cooperation for access panels[1] [see participation rate (3.16)]". *Participation rate* is defined as the 'number of panel members who have provided a usable response divided by the total number of initial personal invitations requesting members to participate (p. 3). On the same note, as yet another proposal, the Journal of Medical Internet Research in 2004 suggested avoiding the term response rate and instead use the journal definitions of "view rate", "participation rate", and completion rate" (Eysenbach, 2004).

It seems clear that the terminology is still not standardized and that similar terms have different proposed calculations. The most detailed definition for response rate and dispositions codes is given by the American Association for Public Opinion Research (AAPOR). Although AAPOR does not yet specifically address online panels, it does define rates precisely for web surveys of specifically named individuals in a survey (American Association for Public Opinion Research, 2008).

The most detailed exposition of computing response metrics for online panels is found in the recent work of Callegaro and DiSogra (2008). The authors define the concept and computation for recruitment, profile, retention, and completion rates. These four rates are shown to be the components for computing a "cumulative response rate." The cumulative response rate can only be calculated for probability-based online panel surveys.

2. Probability-based Online Panel Designs

When building a probability-based online panel there are three design-related methodological features to address:

- Use of a single recruitment cohort versus multiple recruitment cohorts
- Within-household selection of a panel member or whole household recruitment

[1] Access panel is defined as "sample database of potential respondents who declare that they will cooperate for future data collection if selected" (p. 1)

- How to collect data from households with no Internet access (a coverage issue)

Single recruitment cohort vs. multiple recruitment cohorts
In a single recruitment cohort, one recruitment effort from a single recruitment sample is worked until all the sample units are fully attempted and a final disposition code is assigned to each. A recruitment cohort is those sample cases selected to be contacted to have potential panel members invited to join the panel. Panels with a single recruitment cohort are built once. The longitudinal composition of the panel is determined by its attrition and panel life possibly set by a predetermined end date.

Multiple recruitment cohorts are a feature of an ongoing recruitment effort to build and maintain a panel for an indefinite period. It might be also the case that multiple recruitment cohorts are a result of a periodic fielding strategy for a single recruitment sample (i.e., fielding replicate subsets of a single larger sample over time). An example of a single recruitment cohort is the "Face-to-Face Recruited Internet Survey Platform" called FFRISP (Sakshaugh, et al., 2009) which recruited about 1,000 members in the summer of 2008. Examples of continuous cohort recruitment are the Knowledge Networks KnowledgePanel®, The Gallup Panel™ , and the RAND American Life Panel (ALP). KnowledgePanel recruits continuously over the year with a dual frame approach using both RDD and address-based sampling (Dennis, 2009). The Gallup Panel (Tortora, 2009) and ALP (RAND, 2005) recruit throughout the year via RDD. A third approach taken by the Dutch Long-term Internet Study for the Social Science (LISS) panel, (CentERdata, 2009; Scherpenzeel, 2009) starts with one cohort and then recruits a refreshment cohort after some period of elapsed time. LISS initially recruited about 5,000 households in 2007 and is planning to draw a refreshment sample some two years later.

Once a household in a recruitment sample has been contacted, there are two possibilities: randomly recruit one member or attempt to recruit all members of the households usually based on some eligibility criteria. One example of the first case is the 2008-2009 American National Election Survey (ANES) panel where one member per household, U.S. citizen, and age 18 and older as of November 4, 2008 (Election Day) was recruited (DeBell, Krosnick, Lupia, & Roberts, 2009). Examples of whole household recruitment are KnowledgePanel, and The Gallup Panel where both attempt to recruit all members age 13 and older who reside in the sampled household.

In building a representative online Web panel, there are different methods to address the fact that there will be households in the sample that do not have Internet access upon recruitment (see Figure 1). One option is to provide all sampled households with an Internet device whether they have Internet access or not. This was, for example, the strategy of Knowledge Networks from 1999 until mid of 2002. Every recruited household was given a WebTV[2] and dial-up Internet service (Dennis, 2009). A similar approach was used by the now discontinued Dutch Telepanel (Saris, 1998) where households were given a desktop computer and a modem. In Germany, *forsa.omninet* gives all recruited households a device that connects to the TV and enables them to complete online surveys (Güllner & Schmitt, 2004; Krause, 2005). In Italy, Gfk is giving all recruited households a custom touch screen handheld device (called *dialogue machine*) that enables members to answer surveys via wireless mobile phone technology (Licastro, 2009). A hybrid approach is taken by the FFRISP, where all recruited members are given a laptop computer unless they opt to use their own computer instead. Non-internet and dial-up households

[2] http://www.webtv.com/pc/

are provided with broadband internet connection (Sakshaugh, et al., 2009). It is interesting to note that giving panel members a device to complete surveys does not necessarily mean it enables the household to connect to the Internet. For example, *forsa.omninet* panel members can connect only to the company's server for their surveys and not to the Internet (Krause, 2005). The same approach is used by Gfk in Italy where their dialogue machine does not have an Internet browser.

The most common approach is to provide just the non-Internet households with some sort of Internet connection and device. The Internet status is evaluated during recruitment where Internet households are invited to complete surveys using the panel member's personal email address, computer, and Internet connection. When non-internet households are encountered, several options are possible. The panel management company can provide the recruited household member(s) with an email address and a device for the household to use. For example, Knowledge Networks provided a WebTV up to January 2009 and a laptop computer thereafter (Dennis, 2009). The LISS panel is providing non-Internet households with a desktop computer called SimPc, which is basically a remote terminal with a simplified operating system (Scherpenzeel, 2009).

Another option for including and surveying non-Internet households is to collect their data with a different mode. This is the approach used by The Gallup Panel, for example, where the non-internet households are surveyed usually via mail and occasionally via telephone and Interactive Voice Recognition (IVR) (Rookey, Hanway, & Dillman, 2008). A Canadian company, EKOS, maintains a hybrid Internet-telephone panel called Probit. Non-internet members of this panel are surveyed via telephone (Probit, 2009).

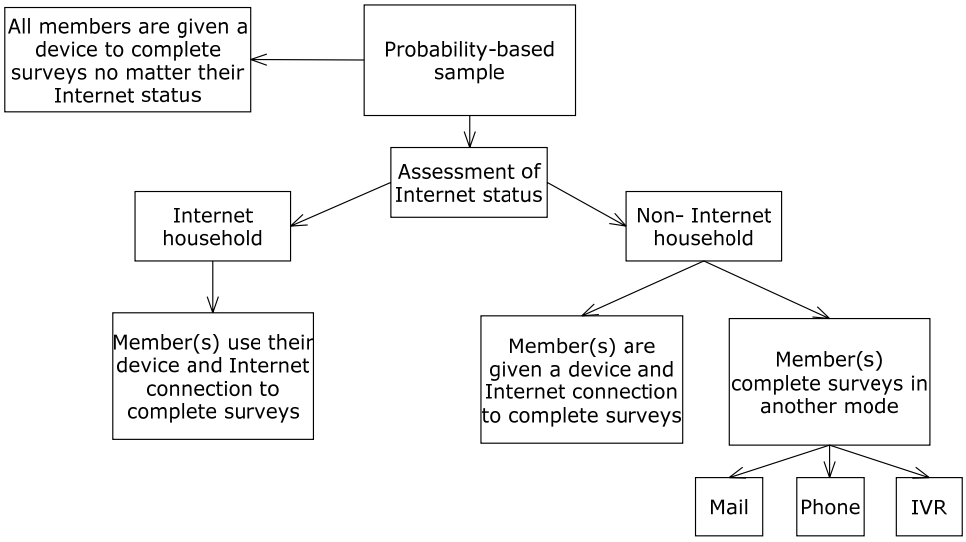

Figure 1. Methods of dealing with non-Internet households

These three non-Internet household options play a role in how response rates are computed and will be discussed in Section 3.

2.1 Different Uses of an Online Panel

Although online or Web panels employ the "panel" term, the meaning is generally different as Göritz, Reinhold and Batinic (2002) recognized early on. In the traditional sense, "panel surveys measure the same variables with identical individuals at several points in

time" (Hansen, 2008, p. 330). The main goal is to study change over time in what would technically be a longitudinal panel. On the other hand, online panel members are now more typically sampled from the larger panel and interviewed for a unique study. These smaller samples address different topics, each in a cross-sectional fashion. Any individual panel member can be re-sampled to be part of another study at a different time. In using a parallel with the market research literature, online panels can be classified as *discontinuous access panels* whose "prescreened respondents report over time on a variety of topics" (Sudman & Wansink, 2002, p. 2). Even under this general definition, it is still true that online panels can be ideally utilized for longitudinal purposes where the same study subjects, not the entire panel membership, are interviewed at different points in time on the same topic (Göritz, 2007).

The longitudinal feature of online panels has been used recently for national election studies (Dennis & Thompson, 2009). In some cases a longitudinal subsample was used to survey panel members from an existing probability-based panel. This is was done for the 2008 national Annenberg election study (Johnston, 2008) and the Associated Press-Yahoo panel (Kruse, et al., 2009) using members from KnowledgePanel. Some national election studies are built with a longitudinal design in the traditional household panel sense. In this case all panel members are invited to complete each wave. The ANES 2008-2009 Panel Study is an example of this particular design (DeBell, et al., 2009).

3. Multiple Stages in Computing Response Rates

Probability-based Web panels are generally built in two stages: a recruitment stage and a profile (enrollment or connection) stage. In the first stage the sample unit is contacted and, depending on the eligibility criteria, a number of respondents are recruited to be part of the panel. Depending on the mode of recruitment, face to face, telephone or mail (ABS), for example, a *recruitment rate* (RECR) can be computed. This can be done using the disposition codes proposed by AAPOR (2008). The recruitment rate is also the first stage where non-response is introduced.

The recruited respondents express their intention to be member of the panel, but eventually only a subset of them will become active members due to a variety of reasons (e.g., change of mind, problems connecting/receiving emails, etc.). Most panels send a "profile survey" to newly recruited panel members to collect basic demographic information and to welcome them to the panel. If these potential panel members answer this survey, they become part of the "active panel" and as such can be selected for studies. Not every panel follows this exact procedure; some may assign new recruits to studies right away and then collect profile information some time subsequent to that assignment. At this profiling stage, a *profile rate* (PROR) can be computed depending on the mode of data collection. For example, the Gallup organization sends recruited households a mail questionnaire. Upon its completion, the household members who respond become part of the panel (Tortora, 2009). This profile stage also has a non-response dimension.

Lastly, when a panel member is assigned to a study sample, a *survey completion rate* (COMR) for that specific study can be calculated. If mixed modes are used (e.g., a different mode for non-Internet households), then the survey completion rate has to be calculated separately for each mode and then combined. This survey completion stage also has its own non-response component.

The combination of the three above mentioned stages produces a cumulative response rate defined as Cumulative Response Rate 1 (CURR1):

$$Cumulative\ response\ rate\ 1 = RECR \times PROR \times COMR$$

Callegaro and DiSogra (2008) explain in details these three stages. Lee (2006), and Hoogendoorn & Daalmans (2009) study non-response issues associated with each of these stages.

4. The Concept of Recruitment Cohorts for Panel Designs Using Continuous Recruitment Over Time

When there is more than one recruitment cohort, the computation of the different rates becomes more complex. This is because in a given sample selected for a study there will be panel members coming from different recruitment cohorts. Figure 2 illustrates the concept providing three recruitment cohorts as an example. When the specific study sample is drawn from only one recruitment cohort, the computation of the cumulative response rate is straightforward. This is however not the most common case. Many probability-based panels have continuous recruitment that has been taking place over a number of years. Examples of continuous recruitment panels are KnowledgePanel, started in 1999 (Dennis, 2009), and CentERpanel, started in 1990 (Toepoel, Das, & van Soest, 2009). As can be imagined, many cohorts of respondents were recruited over the years for both of these panels.

The definition of recruitment cohort depends on the panel organization. For example, at Knowledge Networks a cohort is defined as the number of sample units that belong to a weekly sample replicate fielded as part of an RDD sample (Callegaro & DiSogra, 2008). In the case of address-based sample recruitment (DiSogra, Callegaro, & Hendarwan, 2009), the cohort is the sample of addresses used in the recruitment mailing at a specific point in time.

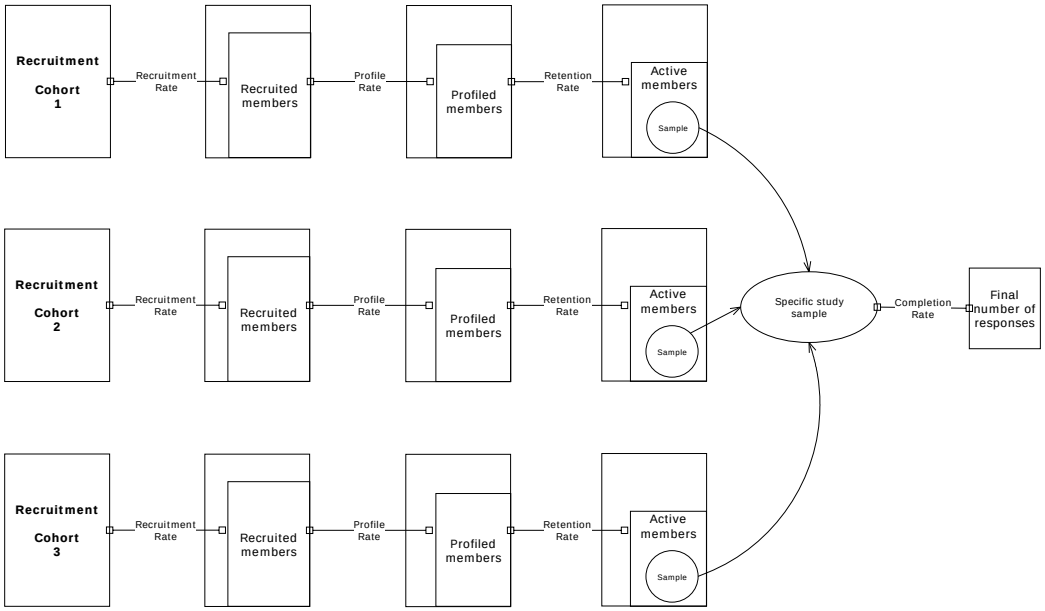

Figure 2. Example of a sample drawn from 3 different recruitment cohorts.

5. Computing Cumulative Response Rates with Multiple Cohorts

In order to compute a cumulative response rate it is necessary to track down each respondent to his or her original recruitment cohort. There are two possible extreme cases: each respondent comes from the same recruitment cohort (this is the simplest case), or each and every respondent comes from a different recruitment cohort. Either way, the computation should follow the following steps:

1. Identify the recruitment cohort of each respondent from the study-specific sample
2. Compute the cohort-specific recruitment, profile and retention rate for each respondent's respective cohort
3. Compute the study specific multiple-cohort recruitment, profile, and retention and rates, and the overall study completion rate
4. Compute the cumulative rate 1 and 2

In order to calculate step number 2, a weighted cohort average determines RECR, PROR, and RETR.

$$Weighted\ cohort\ average\ for\ RECR = \frac{\sum_{c=1}^{n} w_c RECR_c}{\sum_{c=1}^{n} w_c}$$

Where *c* is the cohort (up to *n* cohorts); *w* is the number of study respondents belonging to a given cohort, *c*; and, RECR is the recruitment rate for cohort *c*.

The same weighted cohort average is used to calculate PROR and RETR. The final product will depend on the diversity of the different cohort metrics existing among the cases in the final study sample.

6. Attrition Rates for Cross Sectional and Longitudinal Designs

6.1 Typology of Attrition

There are three kinds of attrition in online panels: voluntary, involuntary, and attrition due to ineligibility rules. Attrition is tied to the concept of active and non-active panel members. When panel members are placed in a non-active status, they are counted in the attrition formula and at the same time they are sampled for specific studies. In case of voluntary attrition, members contact the panel organization and ask to be removed from the panel. A similar case is when a panel member is placed in a requested temporary non-active status because of vacation, illness or other personal reasons.

In the case of involuntary attrition, the panel organization changes the status of some panel members to non-active based on some rules/policies. For example, if a panel member does not respond to a specified number of consecutive surveys, that member is placed in the non-active status. This action is common among online panels. Some members just stop answering surveys without proactively communicating to the panel managers that they no longer want to be members. In the final case where a panel member becomes ineligible, the reasons can be varied, such as, moving outside the originals sampling area (e.g., abroad), a situation prevents the person from regularly answering surveys (e.g. going in the military), or they become physically or mentally incapacitated including death.

Because active status can be temporary or permanent, each of the three attrition typologies can have different outcomes depending on the time that they are computed. In the case of involuntary attrition, for example, the panel organization might re-contact lapsed panel members with the goal of convincing them to return to active status again.

6.2. Attrition Rates for Cross-sectional Designs

Attrition rates for a cross sectional design should be computed at a cohort level. In fact, depending of the recruitment mode, the time of the recruitment and other variations in the recruitment effort, e.g. oversampling, each cohort will have its own unique attrition rate. The unit of analysis can be at a month level, for example, but other time references can be used. For this reason, in Callegaro & DiSogra (2008), we proposed the following formula:

$$Attrition\ rate\ (ATTR\_M_t) = \frac{Cohort_a@Time_t - Cohort_a@Time_{t+1}}{Cohort_a@Time_t}$$

Where *M* represents "month" with *t* the starting month, and *t*+1 the following month. This same formula can be modified to address a different time frame for attrition measurement. The following is used to answer the question of what percent of panel members are lost in a year due to attrition where *Y* represents "year" with *t* the starting year and *t*+1 the following year.

$$Attrition\ rate\ (ATTR\_Y_t) = \frac{Overall\ active\ panel@Time_t - Overall\ active\ panel@Time_{t+1}}{Overall\ active\ panel@Time_t}$$

The overall active panel at time *t*+1 should not count the new recruits. Another way to express the same concept is to look at the probability of surviving one year on the panel (Sikkel & Hoogendoorn, 2008).

6.3. Attrition Rates for Longitudinal Designs

When a subsample of a panel (or more rarely the entire panel itself) is used in longitudinal designs, we can apply formulas from the literature of traditional household panels. At this time, however, there is no agreed upon standard on how to report attrition rates (Lynn, 2005). Attrition rates for longitudinal studies will be based on waves and not on a unit of time (e.g. months) as in the previous case. Lynn (2005) provides the most thorough discussion on response rates for longitudinal design and De Keulenaer (2007) offers an example applied to the Belgian household panel. For this paper, we take Lynn's approach and produce formulas for attrition rates.

Before computing an attrition rate it is important to note there are two possible longitudinal designs. The first design is where every member that was invited at wave 1 is invited in all subsequent waves independent from their being a respondent or non-respondent. This design is called an *unconditional invite design*. This is the most common design and produces a dataset where there will be missing cases in each subsequent wave. In the second design, using an example with 3 waves, only the members who responded to wave 1 are invited to complete wave 2 and only the members who completed wave 2 are invited to complete wave 3. This design is called an *conditional invite design*. As constructed, this design produces a dataset where there are data for all respondents in each wave.

The unconditional invite design rate can be labelled as a *maximum attrition rate*. In this case only those respondents who completed all survey waves are counted. If a respondent misses at least one wave, he/she will be counted as a non-respondent or "attritor."

$$Maximum\ attrition\ rate = \frac{First\ wave\ respondents - All\ waves\ respondents}{First\ wave\ respondents}$$

This above formula produces the same number for unconditional and conditional designs. The attrition rate between waves looks at the number of attritors between two consecutive waves and can be expressed as a wave-to-wave attrition rate:

$$Wave\ to\ wave\ attrition\ rate = \frac{Respondents@wave_t - Respondents@wave_{t+1}}{Respondents@wave_t}$$

With this formula attrition matrices can be produced. In an unconditional design, the values from one wave to the next wave do not necessarily decrease because at every wave all baseline sample units are invited. In a conditional design the values in the matrix will be at best the same if not most likely lower when moving from wave to wave.

Finally, there is a *baseline-on-wave* attrition rate that refers back to the number of respondents at wave 1 as the base. This is useful in knowing the attrition for any given wave relevant to the starting sample size or base that is the number of cases in wave 1.

$$Baseline - on - wave\ attrition\ rate = \frac{Respondents@baseline - Respondents@wave_t}{Respondents@baseline}$$

7. Conclusion

In order to compare survey results from different Web panel surveys, it is important to have a standardized method for computing the survey's response rate. In the case of probability-based Web panel surveys, these response rates should incorporate the panel recruitment rate, profile rate, retention rate and finally the study-specific completion rate. These are factors in a multiplicative or cumulative response rate calculation. Further, in panels with ongoing recruitment, each panel member in a study's sample should contribute the recruitment, profile and retention rate that is specific to that panel member's recruitment cohort.

We have introduced the reader to the concept of incorporating this multiple cohort approach in the calculation of a Web panel survey's cumulative response rate. It is our conclusion that this provides the most accurate and relevant response rate because it captures the dynamics of a panel member's history with regard to non-response and attrition for the cohort of cases that become part of the sample drawn from the panel for a given study. This recognizes the complexity that makes up a panel sample and further differentiates the probability-based Web panel's more robust response rate from the very limited and simplistic completion rate that is the restricted domain of the volunteer, opt-in panel.

The paradigm in defining what is a good response rate changes for a Web panel. This is because the mathematical product of a multi-factor, cumulative response rate will limit the range of what that rate will be. Single digit and very low double digit percents are to be expected as the norm. These low rates should not be misconstrued by the reader as a

reflection of the survey quality being poor since this percent does not tell the story as to what may be the bias in the sample. The cumulative response rate is meant to be a metric for comparing different panel surveys in conjunction with other methodological dimensions when assessing the quality of a survey. Thus, the importance of standardizing these metrics moves us closer to being able to do just that. Certainly, a relatively higher cumulative response rate is more desirable and would positively correlate with the judgement of what is the better quality survey, all else being equal.

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