

**Panel Attrition and its Effects on Results from a Longitudinal Study:  
An Examination of Changes in Participants and Attitudes in a Web-based Panel Survey of  
HIV and AIDS Stigma Attitudes**

*By:*  
Rodney Baxter and Elizabeth Dean  
RTI International\*

*Presented at:*  
American Association for Public Opinion Research 59<sup>th</sup> Annual Conference

May 13-16, 2004

Phoenix, Arizona

**Abstract:** Longitudinal studies offer the opportunity to examine trends over time both in terms of participation and attitudes. However, the loss of participants from one wave to another can result in bias of survey results. The Study of HIV and AIDS Stigma, conducted for the Centers for Disease Control (CDC), is a longitudinal study of a national, RDD selected Knowledge Networks panel investigating knowledge of HIV and AIDS, as well as attitudes and beliefs surrounding this issue. The survey was initially conducted in summer 2000 with a follow-up in spring 2003. Comparisons are made of panel participants and non-participants between the 2 waves, as well as changes in attitudes. Non-participants at time 2 include non-respondents who are still on the panel, and non-respondents from attrition (who have chosen to withdraw from the panel). In addition, we investigate changes in attitudes over time and discuss the implications of differing panel participation on those changing attitudes and how this may result in biased data. Analysis indicates that participants with more positive attitudes in wave 1 were less likely to participate in wave 2 resulting in potential bias to the results.

## **Introduction**

Longitudinal studies present a unique opportunity to study change over time in attitudes and respondent participation. In contrast to cross-sectional studies which can only show trends over time, longitudinal designs allow for looking at whether individuals attitudes changed between time periods, the amount of change, and allow the analysis of covariates of the attitude change (e.g., age, education, exposure to new health information, etc.). In terms of participation

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\* RTI International is a trade name of Research Triangle Institute.

over time, panel retention can be studied and covariates of panel retention can be analyzed as well. However, recruiting participants, maintaining the panel, and achieving high response rates from a longitudinal panel can be very expensive. Using a web panel for longitudinal research provides a unique opportunity to test this type of research design with this relatively new data collection methodology.

This study investigates the attitudes and beliefs about people with HIV or AIDS. Prejudice and stigma towards people with HIV and AIDS is an important component in understanding societal attitudes about this disease. Negative attitudes towards people with HIV can result in people with HIV being socially isolated and experiencing discrimination. The stigma surrounding AIDS and negative stereotypes about people with AIDS are thought to affect treatment choices and lessen disclosure of HIV status of people with HIV. A consequence of both of these behaviors is less treatment of the disease and not informing sexual partners, both of which can contribute to the further spread of HIV (Chesney and Smith, 1999).

One of the main researchers in this field, Gregory Herek, has studied HIV stigma and developed the main indicators used in this research (Herek, Capitanio, and Widaman, 2002). Herek and colleagues studied the trends in stigma at three points in time: 1991, 1997, and 1999. They found that stigma levels increased from 1991 to 1997 but then decreased in 1999. Similarly, Herek et al also found that inaccurate knowledge about how one can be infected by HIV increased from 1991 to 1997 and decreased in 1999. These trends show that stigma attitudes and inaccurate knowledge are decreasing which may indicate increasing acceptance of people with HIV.

The CDC HIV Stigma study provides two additional points in time, 2000 and 2003, to add to these trend lines. By analyzing these results the trends can continue to be followed, and

generalizations made about the changes in stigma attitudes and knowledge about HIV infection. In addition, correlates of attitude change and participation can be used to answer the larger question of what kinds of attitudes and levels of knowledge are associated with those who continue to respond, compared to those who drop out of the panel, and those who continue in the panel but choose not to participate at time 2.

### **Web Panel Background**

The 2003 HIV Stigma Study<sup>1</sup> used the Knowledge Networks web-enabled panel for data collection. The Knowledge Networks panel is built from a probability-based RDD sample drawn from all 10-digit telephone numbers in the United States. RDD respondents who agree to participate in the panel are provided with free hardware, free Web access, free e-mail accounts for each resident of the household over 13, ongoing technical support and an incentive program to encourage continued participation. Knowledge Networks constructs the panel with a complex stratification design that incorporates the known probabilities of selection associated with geographical location, the number of phone lines and people in each household, and whether or not the phone number is listed. All matched telephone numbers are sent to a telephone interviewing organization for participant recruitment.

To ensure consistent delivery of survey content, each household is provided with identical hardware, even if they currently own a computer or have Internet access. Microsoft's WebTV is the hardware platform currently used by the Knowledge Networks panel. The device consists of a set-top box that connects to a TV and the telephone. It also includes a remote keyboard and pointing device. WebTV has a built-in 56K modem that provides the household

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<sup>1</sup> See Lentine et al (2000) for more detail about the 2000 HIV stigma study.

with a connection to the Internet. The base unit also has a small hard drive to accommodate large file downloads, including video files. File downloads do not require any user intervention and usually occur during off hours.

The web-enabled panel has several significant advantages. It allows for rapid data collection, just like other web surveys. Surveys can be programmed, fielded and closed out in a matter of weeks. It is also a relatively inexpensive mode, like other web surveys. Finally, the panel allows access to a known population designed to match the demographic characteristics of the US population.

### **Methodology**

For the 2003 HIV Stigma Study (also referred to throughout as CDC panel), panel members first received a notification e-mail on their WebTV letting them know there was a new survey available for them. The e-mail notification contained a button to click on to start the survey. (No login name or password is required for connection to the survey.) A reminder e-mail was sent one week after the initial notification e-mail. The field period lasted from May 14 to June 12, 2003.

Of the 5,868 participants in the 2000 Survey on Health and Aging, 2,461 were still members of the web enabled panel when the 2003 CDC HIV Stigma study began with these same panel participants. The Stigma follow-up survey was not planned as a recurring component of a research plan. There was a research project proposed to look at a subsample of the Time 1 respondents and the effects of exposure to media content about AIDS on attitudes. A contact rate of 78% was obtained, with 1,927 panel members replying to the invitation e-mail. Of these cases, 1,553 completed surveys yielding a 63% completion rate.

## Results

### ***Attitudes and Beliefs: Cross-Sectional Trends***

Initial comparisons were made of results from three Herek studies (Herek et al., 2002) and results from the CDC panel study for both stigma attitudes and accuracy of knowledge. Table 1 provides the results for the stigma attitudes comparison. To evaluate stigma attitudes, respondents were asked whether they strongly agree, agree, disagree, or strongly disagree with the following statement: People who got AIDS through sex or drug use have gotten what they deserve. Those that strongly agree or agree with the statement are considered to have stigma towards people with AIDS (PWAs), and those that disagree or strongly disagree with this statement do not have stigma towards PWAs. In 1991, 20.3 percent of Herek et al's respondents agreed that people with AIDS had gotten what they deserved. This figure significantly increased between 1991 and 1997 to 28.1 percent indicating a significant increase in stigma from 1991. Between 1997 and 1999 stigma attitudes decreased by three percent (to 24.8 percent), but this downward trend was not statistically significant. Between the 1999 Herek et al. study to the first CDC study in 2000, there was a significant decline of nearly seven percent in stigma attitudes for the weighted data. This was followed by a slight decrease from 18.3 percent to 17.9 percent

**Table 1. Responsibility for AIDS over Time 1991 to 2003  
(Percent answering strongly agree or agree)**

Year	Survey	Percent (%)	n	p <sup>2</sup>
1991	Herek	20.3	538	--
1997	Herek	28.1	1309	.0001
1999	Herek	24.8	669	ns
2000	CDC	18.3	5232	.0001
2003	CDC	17.9	1526	ns

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<sup>2</sup> p is the probability associated with the z score for a one tailed test for the two sample difference of proportions test (Lutz, 1983) comparing the percentage that agreed at the current year with the same percentage for the previous year.

from the first CDC panel in 2000 to the second CDC panel in 2003, but this change is not statistically significant.

Overall, stigma attitudes have consistently decreased between 1997 and 2000, and the from weighted CDC panel data in 2003 it would appear that stigma attitudes have leveled off. However, as demonstrated in Table 2 below, the unweighted results provide additional context to this finding and show that the trend of decreasing stigma attitudes actually continues for panel respondents. While the unweighted Stigma estimates significantly increased ( $p<.05$ ) by 2.5 percent from T1 all to T2 all, the weighted results decreased by .8 percent (but this change was not statistically significant). However, if we look only at the results for the CDC longitudinal panel (those answering the question in both the T1 and T2 surveys) the results reverse, with the weighted results increasing 1.6 percent (but not significantly) and the unweighted estimates declining 1.5 percent. Interestingly, the unweighted estimates for the CDC panel (who completed at both T1 and T2) were higher in 2000 than the estimates for all CDC T1 participants (22.3% versus 18.3%).

**Table 2. CDC Stigma Results Unweighted and Weighted**

Year	Survey	Unweighted Percent (%)	Weighted Percent (%)	n
2000	CDC T1 all	18.3	18.7	5232
2003	CDC T2 all	20.8	17.9	1526
2000	CDC panel	22.3	17.2	1383
2003	CDC panel	20.8	18.8	1383

Table 3 shows the results over time to a question (referred to as “Inaccurate Beliefs”) that measures the accuracy of respondents’ beliefs about how HIV can be transmitted. Respondents were asked: How likely is it that a person could become infected with HIV (the virus that causes AIDS) by being coughed or sneezed upon? Answer choices included very likely, somewhat

likely, somewhat unlikely, or very unlikely or impossible. Those that answer very likely, somewhat likely, or somewhat unlikely are scored as having inaccurate beliefs about AIDS transmission (Herek et al, 2002). For 1991, 45.7 percent of the respondents had inaccurate beliefs, and this percentage went up to 53.6 percent in 1997, representing a significant increase in inaccurate beliefs. While this indicator decreased in 1999 by three percent to 50.4 percent, this decline was not statistically significant. The first CDC panel study in 2000 showed a significant decrease in this indicator of nine percent to 41.4 percent. A significant decrease of seven percent in the inaccurate beliefs of AIDS transmission was reported in 2003, down to 34.2 percent. Similar to the finding for stigma attitudes, the inaccurate beliefs figure for 2003 is below the original (1991) low value of 45.7 percent, and the difference between those two values is statistically significant ( $p > .0001$ ). The trend over time since 1997 has been a steady decrease in inaccurate beliefs about AIDS transmission, with significant decreases coming after 1999.

**Table 3. Inaccuracy in Beliefs about HIV Transmission over Time 1991 to 2003  
(Percent answering Very Likely, Somewhat Likely, or Somewhat Unlikely)**

Year	Survey	Percent (%)	n	p
1991	Herek	45.7	538	---
1997	Herek	53.6	1309	.0001
1999	Herek	50.4	669	ns
2000	CDC	41.4	5232	.0001
2003	CDC	34.2	1526	.001

These data illustrating the change over time in both stigma attitudes and knowledge of HIV transmission set up the larger question about the possible causes of these differences. Did attitudes and knowledge change over time, did the characteristics of who was participating change over time, or is there some other cause? The remainder of this paper investigates and discusses potential causes of the observed differences.

### ***Attitudes and Beliefs: Attrition T1 to T2***

Attrition by Stigma and Inaccurate Knowledge Results. Table 4 shows the unweighted results of the Stigma question for T1 Only respondents and panel T2 respondents' answers to this question at T1. This comparison will show us how the T1 only respondents and T2 respondents differed in their attitudes at T1. T1 only respondents are significantly more likely (84 percent) to show lower stigma attitudes compared with panel T2 respondents' answers at T1 (76 percent). This shows that the panel has lost members that have lower stigma attitudes, which could bias the data at T2. The weighted results, shown in Table 5, produce similar results.

**Table 4. Unweighted Stigma question results comparing Panel T1 respondents to the answers of Panel T2 respondents at T1.**

	T1 Only		Panel T2 (ans to T1)		Total	
	%	n	%	n	%	n
Agree/Strongly Agree	16.0	564	23.1	395	18.3	959
Disagree/Strongly Disagree	84.0	2961	76.9	1312	81.7	4273
Total	100.0	3525	100.0	1707	100.0	5232

**Table 5. Weighted Stigma question results comparing Panel T1 respondents to the answers of Panel T2 respondents at T1.**

	T1 Only		Panel T2 (ans to T1)		Total	
	%	n	%	n	%	n
Agree/Strongly Agree	16.1	560	23.8	411	18.7	971
Disagree/Strongly Disagree	83.9	2911	76.2	1312	81.3	4224
Total	100.0	3471	100.0	1723	100.0	5194

Results for these same comparison groups (T1 Only respondents versus panel T2 respondents' answers at T1) were also compared for the inaccurate beliefs questions. T1 Only respondents unweighted data (see Table 6) shows they were significantly more likely (60 percent) to show accurate knowledge about how AIDS is transmitted than their panel 2 respondent counterparts at T1 (53 percent). Weighted responses followed this same pattern

(see Table 7). This demonstrates that those with more accurate knowledge were less likely to participate at T2 which also could bias the data towards reports of inaccurate knowledge.

**Table 6. Unweighted Inaccurate Knowledge question results comparing Panel T1 respondents to the answers of Panel T2 respondents at T1.**

	T1 Only		Panel T2 (ans to T1)		Total	
	%	n	%	n	%	n
Very/Somewhat Likely	39.7	1554	47.6	911	42.3	2465
Very Unlikely/Impossible	60.3	2363	52.5	1005	57.7	3368
Total	100.0	3917	100.0	1916	100.0	5833

**Table 7. Weighted Inaccurate Knowledge question results comparing Panel T1 respondents to the answers of Panel T2 respondents at T1.**

	T1 Only		Panel T2 (ans to T1)		Total	
	%	n	%	n	%	n
Very/Somewhat Likely	39.8	1543	47.7	924	42.4	2467
Very Unlikely/Impossible	60.2	2334	52.3	1013	57.6	3347
Total	100.0	3877	100.0	1937	100.0	5814

Taken together, these results demonstrate that those with more tolerant stigma attitudes and those with more accurate knowledge about AIDS transmission are disappearing from the panel between T1 and T2; both of these factors could impact the results at T2 by showing increased stigma attitudes and increase inaccurate knowledge when this may not be a true attitude change, but rather a consequence of panel attrition.

Effect of Non-Response at T2 on Attitude/Belief Estimates. It is also important to compare the answers at T1 for T2 respondents and non-respondents to see if the results are biased among those who stay in the panel at T2. Table Eight shows that T2 respondents and non-respondents did not differ significantly (77.6 percent and 73.7 percent, respectively) on their stigma attitudes (see Table 8). While this difference is not significant, it is nearly a 4 percent

difference, with T2 respondents having lower stigma attitudes than their non-respondent counterparts.

**Table 8. Panel 2 Respondents and Non-Respondents Stigma Attitudes at T1.**

	Panel T2 Resp (ans to T1)		Panel T2 Non-Resp (ans to T1)	
	%	n	%	n
Agree/Strongly Agree	22.4	313	26.3	82
Disagree/Strongly Disagree	77.6	1082	73.7	230
Total	100.0	1395	100.0	312

Similarly, T2 panel respondents and non-respondents did not have significant knowledge differences (53.8 percent and 46.9 percent, respectively) at T1, with over half of each showing accurate beliefs (see Table 9). While this difference is not statistically significant, there is nearly a 7 percent difference with T2 respondents having more accurate knowledge.

**Table 9. Panel 2 Respondents and Non-Respondents Inaccurate Beliefs at T1.**

	Panel T2 Resp (ans to T1)		Panel T2 Non-Resp (ans to T1)	
	%	n	%	n
Very/Somewhat Likely	46.2	716	53.1	195
Very Unlikely/Impossible	53.8	833	46.9	172
Total	100.0	1549	100.0	367

The trends of T2 respondents having more tolerant stigma attitudes and more accurate knowledge about AIDS transmission could somewhat offset the potential problem of T2 data not showing as accurate estimates for stigma attitudes and knowledge due to the loss of panel members with more tolerant stigma attitudes and more accurate knowledge of AIDS transmission between T1 and T2.

Changes in Attitudes for Respondents to Both Panels. Finally, it is important to see whether the attitudes and beliefs of respondents to both panel studies changed over time to evaluate whether the attitudes and knowledge changes observed between T1 Only respondents

and T2 respondents is influenced only by panel attrition (discussed above) or whether true changes in these factors are also impacting the T2 results. No significant stigma attitude changes from T1 to T2 were observed for those panel members who responded at both T1 and T2 (see Table 10), however their reported stigma attitudes moved slightly (by 3 percent) in the direction of less stigma attitudes between T1 and T2. This shows that stigma attitudes are continuing to improve among these panel respondents.

**Table 10. Stigma attitudes of Panel T2 respondents at T1 and T2.**

	Panel T2 (ans to T1)		Panel T2 (ans to T2)	
	%	n	%	n
Agree/Strongly Agree	23.8	411	21.8	316
Disagree/Strongly Disagree	76.2	1312	79.2	1206
Total	100.0	1723	100.0	1522

Respondents to both T1 and T2 exhibited a significant shift in the accuracy of their knowledge of AIDS transmission from T1 to T2 with their knowledge significantly improving by 11.4 percent (see Table 11). This may reflect the effectiveness of increased educational campaigns about how the disease is transmitted.

**Table 11. Inaccurate Beliefs of Panel T2 respondents at T1 and T2.**

	Panel T2 Resp (ans to T1)		Panel T2 Non-Resp (ans to T2)	
	%	n	%	n
Very/Somewhat Likely	47.7	924	36.3	560
Very Unlikely/Impossible	52.3	1013	63.7	983
Total	100.0	1937	100.0	1543

It appears that the stigma attitudes of panel participants to both waves continued to improve towards less stigma and their knowledge of AIDS transmission significantly improved thereby continuing the trend observed in the Herek et al. data from 1997 to 1999. This finding may also

mean that the changes in attitudes and knowledge observed from 2000 to 2003 are not just a result of the changing make up of panel participants, but rather a real change in attitudes and knowledge over time. Before coming to such a conclusion, however, it is important to examine the socio-demographic characteristics of those with higher stigma attitudes, as well as the characteristics of participation types (those who drop out from the panel after T1, those who continue in the panel but do not participate at time 2, and those that participate at both T1 and T2).

### ***Socio-Demographics: Attrition Results***

Attrition Results by Demographics. Table 12 presents unweighted breakdowns of the socio-demographic characteristics of panel participants at T1 and T2. Panel T1 participants are more likely to be younger<sup>3</sup> (53.4 percent are 18-44 versus 33.1 percent), Black (10.6 percent

**Table 12. Demographics of Panel T1 versus Panel T2**

		<b>Panel T1</b>	<b>Panel T2</b>	<b>Absolute Difference</b>
<b>Gender</b>	Male	48.8	47.7	1.1
	Female	52.8	52.4	0.4
<b>Age</b>	18-24	10.6	4.1	6.5 ***
	25-34	19.4	9.3	10.1 ***
	35-44	23.4	19.7	3.7 ***
	45-54	20.4	23.4	3.0 **
	55-64	9.9	15.1	5.2 ***
	65+	16.2	28.4	12.2 ***
<b>Race</b>	White	81.4	86.6	5.2 ***
	Black	10.6	8.0	2.6 ***
	American Indian	2.0	1.7	0.3
	Asian/Pacific Islander	2.5	2.4	0.1
<b>Education</b>	No HS diploma	9.5	9.2	0.3
	HS diploma	31.6	36.9	5.3 ***
	Some college	33.6	30.4	3.2 **
	BA+	25.2	23.6	1.6
<b>Income</b>	LT 10K	4.0	4.0	0.0
	10K-24K	14.8	17.1	2.3 **
	25K-49K	37.0	39.5	2.5 *
	50K-75K	27.4	26.2	1.2
	75K+	16.8	13.2	3.6 ***

\*p<.05, \*\*p<.01, \*\*\*p<.001

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<sup>3</sup> The mean age of panel 1 members was 44.9 years while panel 2 members averaged 52.3 years (p<.001).

versus 8 percent), have some college (33.6 percent versus 30.4 percent), and higher incomes<sup>4</sup> (16.8 percent with income of \$75,000 or more versus 13.2 percent) than are their panel T2 counterparts. Conversely, panel T2 participants are more likely to be older (66.9 percent are 45 or older versus 46.6 percent), White (86.6 percent versus 81.4 percent), have a high school diploma (36.9 percent versus 31.6 percent), and have low to moderate incomes (56.6 percent versus 51.8 percent have income between \$10,000 and \$49,999).

We also looked at the relationship between the demographics and the dependent variables (stigma attitudes and inaccurate knowledge). Table 13 presents the correlations of demographic variables and stigma attitudes for panel members at T1 and T2, and table 14 presents correlations

**Table 13. Correlations stigma attitude with demographics, for T1 and T2 panel members.**

Stigma Attitude	Panel 1	Panel 2
Gender	-0.066 ***	-0.060 **
Age	0.169 ***	0.203 ***
Educ HS	0.049 ***	0.040
Educ Some Coll	-0.036 **	-0.027
Educ Bach Coll	-0.036 **	-0.045
White	0.077 ***	0.084 ***
Black	-0.110 ***	-0.112 ***
HH Income	-0.030 *	-0.045

**Table 14. Correlations inaccurate knowledge with demographics, for T1 and T2 panel members.**

Inaccurate knowledge	Panel 1	Panel 2
Gender	-0.023	-0.053 *
Age	0.181 ***	0.159 ***
Educ HS	0.074 ***	0.091 ***
Educ Some Coll	-0.022	-0.057 *
Educ Bach Coll	-0.093 ***	-0.087 ***
White	-0.004	-0.004
Black	0.035 **	0.014
HH Income	-0.051 ***	-0.087 ***

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<sup>4</sup> The mean income of panel 1 members was \$38,500 compared to \$36,500 for panel 2 members ( $p < .001$ ).

for inaccurate knowledge. Several of the correlations for each panel are significant, and all are in the expected direction. The correlations across the two groups are similar, and it does not appear that there is an interaction between attrition and the demographic variables.

Respondent Only Characteristics at T1 and T2. Another way to look at attrition and the effect of attrition on study results is to see what, if any, differences there are between respondents at T1 and respondents at T2. Panel respondents at T1 are more likely to be younger<sup>5</sup> (53.4 percent aged 44 or younger versus 32.9 percent), Black (10.6 percent versus 7.6 percent), and have a higher income<sup>6</sup> (\$75,000 or greater, 16.8 percent versus 13.5 percent) than are their T2 panel respondent counterparts (Table 15). T2 panel participants are more likely to be older (67.1 percent aged 45 or older versus 46.5 percent), White (87.2 percent versus. 81.4 percent), have a high school diploma (34.3 percent versus 31.6 percent), and have a moderate income (57.2 percent versus 51.8 percent).

The pattern of younger respondents dropping out of the panel between waves may be explained by the consistent finding in the survey literature that shows that younger people are less likely to participate in surveys. It may be that younger people find the web TV technology too limiting for their purposes and prefer to use a computer for web access, and the benefit of having the web TV may be less of a reward for younger people than it is for middle aged or older people. Both of these possibilities could contribute to younger people leaving the panel in higher rates between Time 1 and Time 2. African Americans, those with some college, and those with higher incomes are also more likely to drop out from the panel between Time 1 and Time 2.

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<sup>5</sup> The average age of panel 2 non-respondents was 44.9 years compared to 52.5 years for panel 2 respondents ( $p < .001$ ).

<sup>6</sup> Panel 2 respondents average income was \$36,500 compared to \$38,500 for panel 1 respondents ( $p < .001$ ).

**Table 15. Demographic Comparison of T1 and T2 Panel Respondents.**

		Panel T1	Panel T2	Absolute Difference
<b>Gender</b>	Male	48.8	47.2	1.6
	Female	52.8	50.4	2.4
<b>Age</b>	18-24	10.6	3.7	6.9 ***
	25-34	19.4	9.2	10.2 ***
	35-44	23.4	20.0	3.4 **
	45-54	20.4	24.3	3.9 ***
	55-64	9.9	15.0	5.1 ***
	65+	16.2	27.8	11.6 ***
<b>Race</b>	White	81.4	87.2	5.8 ***
	Black	10.6	7.6	3.0 ***
	American Indian	2.0	1.9	0.1
	Asian/Pacific Islander	2.5	2.1	0.4
<b>Education</b>	No HS diploma	9.5	8.4	1.1
	HS diploma	31.6	34.3	2.7 *
	Some college	33.6	32.3	1.3
	BA+	25.2	25.1	0.1
<b>Income</b>	LT 10K	4.0	4.0	0.0
	10K-24K	14.8	17.4	2.6 *
	25K-49K	37.0	39.8	2.8 *
	50K-75K	27.4	25.3	2.1
	75K+	16.8	13.5	3.3 ***

\*p<.05, \*\*p<.01, \*\*\*p<.001

We examined the relationship between the demographics and the dependent variables (stigma attitudes and inaccurate knowledge) for respondents only at T1 and T2. Table 16 presents the correlations of demographic variables and stigma attitudes for panel members at T1 and T2, and table 17 presents correlations for inaccurate knowledge. Several of the correlations for each panel are significant, and all are in the predicted direction. The correlations across the two groups are similar, and it does not appear that there is an interaction between attrition and the demographic variables.

**Table 16. Correlations of stigma attitude with demographics, for T1 and T2 respondents only.**

Stigma Attitude	Panel T2 Resp T1 ans	Panel T2 NonResp
Gender	-0.082 **	0.034
Age	0.191 ***	0.257 ***
Educ HS	0.027	0.073
Educ Some Coll	-0.006	-0.114 *
Educ Bach Coll	-0.050	-0.007
White	-0.081 **	0.103
Black	-0.101 ***	-0.161 **
HH Income	-0.058 *	0.834

**Table 17. Correlations of inaccurate knowledge with demographics, for T1 and T2 respondents only.**

Inaccurate knowledge	Panel T2 Resp T1 ans	Panel T2 NonResp
Gender	-0.062 **	-0.011
Age	0.171 ***	0.113 *
Educ HS	0.072 *	0.144 **
Educ Some Coll	-0.042	-0.107 *
Educ Bach Coll	-0.080 **	-0.102 *
White	0.005	-0.026
Black	-0.007	0.084
HH Income	-0.088 ***	-0.084

## Discussion

The unweighted data examining change over time in both stigma attitudes and inaccurate knowledge showed a steady decrease in stigma attitudes and inaccurate knowledge. This set up the larger question of what were possible causes of these differences. The data showed that the panel lost members with lower stigma attitudes and more accurate knowledge from T1 to T2, but that non-respondents at T2 were more likely to have higher stigma attitudes and increased reports of inaccurate knowledge with T2 respondents coming being the most moderate in both attitudes and knowledge. The end result of this may be that the panel attrition from T1 to T2 combined with the non-response at T2 may not bias the data since they, in effect, cancel each other out.

Additionally, when examining what, if any, change in attitudes and knowledge occurred between T2 respondents from their answers at T1 to T2, the data showed that stigma attitudes and transmission knowledge are continuing to improve among these respondents, although this increase levels out once the data are weighted back to the CPS population estimates.

When examining the demographic characteristics associated with panel attrition, we found that younger, Black, with some college, and higher incomes are more likely to drop out of the panel from T1 to T2, and the makeup of respondents between T1 and T2 different in that T2 panel respondents are more likely to be older, White, have a high school diploma, and have a moderate income.

Relevant KN Methodological Work. A more comprehensive study of KN web panel attrition has also shown that those panel members who are younger in age (44 and under) are more likely to leave the panel, while those who are older (45 and older) are more likely to stay (Dennis and Li, 2003). Their research found differences between active panelists and lost panelists on a wide variety of background questions, but these differences were reduced once the data are weighted. In addition they found that for 20 of these background items, showing an average difference of almost 11 percent between active and lost panel members, if the effects of demographic variables such as gender, education, household income, race/ethnicity, household size and population size are controlled for, the average difference is reduced to less than six percent.

A study was also performed to cross validate the 2003 HIV Stigma follow-up. The survey also fielded a fresh cross-sectional KN panel sample of 1000 (Dennis, 2003). Surveys were completed by 791 respondents for a 79% response rate. The new cross-sectional sample more closely represented the U.S. population than did the Stigma follow-up survey, but still

somewhat under-represented younger adults and over-represented older. However when both samples were weighted they closely matched CPS numbers. The two samples were comparable on the two questions of interest, Stigma and Accuracy of Beliefs once the data were weighted. However the Stigma follow-up survey showed somewhat lower stigma than the cross-sectional, 17.9% compared to 21.6%.

### **Conclusions/Future Direction**

The results and experiences of this project suggest that guidelines should be developed for the use of web panels for longitudinal research. The attrition and changes in demographic composition of those participating in the follow-up study suggest that for a web panel to be successful for longitudinal research, the panel available for follow-ups should be replenished on a regular basis. It appears that three years is too long a delay between follow-ups, so a period of two years at minimum, or ideally, one year between follow-ups should be used. In this way the panel could be used more as a “rolling panel” with additional respondents recruited at each follow-up to be available for the next study point in time. These respondents could also be invited to participate based on the demographic and background strata that need to be replenished.

The use of web enabled survey panels can be a cost effective method for performing longitudinal analysis, but like other longitudinal designs must cope with the problems of respondent recruitment, participation, and attrition. Web panels are able to recruit initial participants that are representative of the general population, but now must develop better methods of retention and if retention methods fail, develop methods for replenishment of a specific panel group. Methods should be developed as well to improve the participation of

groups that are less likely to accept the invitation to participate in a survey. Follow-up methods could be improved as well to improve participation.

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Author contact: Rodney Baxter [rbaxter@rti.org](mailto:rbaxter@rti.org)

## Appendix A: Further Demographic Comparisons

Socio-demographic Comparisons to the CPS. Table A1 compares demographic variables from the panel respondents at T1 to the Current Population Survey (CPS). Comparisons to CPS results will tell us how well the participants in our survey match the U.S. population. However, due to the large difference in sample size between the CDC study and the CPS (approximately 66,000 cases difference), significant differences appear with at little as one to two percent difference in data. Since such small differences are not meaningful (in part because they are influenced so much by the large sample size of the CPS), we have chosen only to report significant difference of three percent or greater.

**Table A1. Socio-demographic Comparisons of Panel T1 Participants versus CPS**

		<b>Panel T1</b>	<b>CPS</b>	<b>Absolute Difference</b>
<b>Gender</b>	Male	48.8	48.9	0.1
	Female	52.8	51.1	1.7 *
<b>Age</b>	18-24	10.6	13.1	2.5 ***
	25-34	19.4	18.6	0.8
	35-44	23.4	22.1	1.3 *
	45-54	20.4	18.2	2.2 ***
	55-64	9.9	11.7	1.8 ***
	65+	16.2	16.3	0.1
<b>Race</b>	White	81.4	83.3	1.9 ***
	Black	10.6	11.9	1.3 **
	American Indian	2.0	0.8	1.2 ***
	Asian/Pacific Islander	2.5	3.9	1.4 ***
<b>Education</b>	No HS diploma	9.5	17.0	7.5 ***
	HS diploma	31.6	32.8	1.2
	Some college	33.6	26.7	6.9 ***
	BA+	25.5	23.4	1.8 **
<b>Income</b>	LT 10K	4.0	7.6	3.6 ***
	10K-24K	14.8	19.5	4.7 ***
	25K-49K	37.0	30.0	7.0 ***
	50K-75K	27.4	19.4	8.0 ***
	75K+	16.8	23.4	6.6 ***

\*p<.05, \*\*p<.01, \*\*\*p<.001

When comparing all Time 1 respondents to the CPS, no significant differences were found for gender, age, or race, however differences were observed for education and income. Two types of people were under-represented in the CDC Time 1 respondents when compared to the CPS figures including those with: no high school diploma (by 7.5 percent), low income (less than \$10,000 by 3.6 percent; \$10,000-\$24,000 by 4.7 percent), and high income (\$75,000 or greater by 6.6 percent). A few other types of people were over-represented in the CDC study including people with: some college (by 6.9 percent.), and middle income (\$25,000-\$49,999 by 7.0 percent; \$50,000-\$74,999 by 8 percent).

Panel participants at T2 differ from the CPS in terms of age, race, education, and income, but not in terms of gender (Table A2). Panel T2 members over-represent middle age and older people (45-54 years by 5.2 percent; 55-64 years by 15.1 percent, and 65+ years by 28.4 percent), Whites (by 3.3 percent), those with moderate education (high school diploma by 4.1 percent; some college by 3.76 percent), and those with middle incomes (\$25,000-\$49,999 by 9.5 percent; \$50,000-\$74,999 by 6.8 percent) compared to CPS. Conversely, those aged 25-34 (by 9.3 percent), Blacks (3.9 percent), those with no high school diploma (7.8 percent), those with low or high incomes (under \$10,000 by 3.6 percent; greater than \$75,000 by 10.2 percent) are under-represented in the CDC Time 1 data.

Several of the observed differences between the CDC data (both for Time 1 and Time 2) and the CPS are fairly large, and are cause for concern if the data is left unweighted. The unweighted data from CDC study is less representative of the general population on three key socio-demographic areas (age, race, and education). However, applying weights to the cases where either under- or over-representation exists would correct for these differences (by making under-represented cases count more and over-represented cases count less).

**Table A2. Comparison of Socio-demographics of Panel T2 and CPS respondents**

		<b>Panel T2</b>	<b>CPS</b>	<b>Absolute Difference</b>
<b>Gender</b>	Male	47.7	48.9	1.2
	Female	52.4	51.1	1.3
<b>Age</b>	18-24	4.1	13.1	0.9 ***
	25-34	9.3	18.6	9.3 ***
	35-44	19.7	22.1	2.4 *
	45-54	23.4	18.2	5.2 ***
	55-64	15.1	11.7	3.4 ***
	65+	28.4	16.3	12.1 ***
<b>Race</b>	White	86.6	83.3	3.3 *
	Black	8.0	11.9	3.9 ***
	American Indian	1.7	0.8	0.9 ***
	Asian/Pacific Islander	2.4	3.9	1.5 ***
<b>Education</b>	No HS diploma	9.2	17.0	7.8 ***
	HS diploma	36.9	32.8	4.1 ***
	Some college	30.4	26.7	3.7 ***
	BA+	23.6	23.4	0.2
<b>Income</b>	LT 10K	4.0	7.6	3.6 ***
	10K-24K	17.1	19.5	2.4 **
	25K-49K	39.5	30.0	9.5 ***
	50K-75K	26.2	19.4	6.8 ***
	75K+	13.2	23.4	10.2 ***

\*p<.05, \*\*p<.01, \*\*\*p<.001

T2 Panel Respondents versus CPS. Panel respondents from T2 differ from CPS respondents in terms of age, race, education, and income, but not in terms of gender (see Table A3). T2 respondents are more likely to be older (67. Percent aged 45 or older versus 46.2 percent), White (87.2 percent versus. 83.3 percent), have some college (32.3 percent versus 26.7 percent), and of moderate income (65.1 percent versus 49.4 percent) compared to CPS respondents. CPS respondents are more likely to be younger (31.7 percent aged 34 or younger versus 12.9 percent), Black (11.9 percent versus 7.6 percent), have no high school diploma (17 percent versus 8.4 percent), have low or high income (7.6 percent less than \$10,000 versus 4 percent; 23.4 percent higher than \$75,000 versus 13.5 percent).

**Table A3. Comparison of T2 Respondents to CPS.**

		<b>Panel T2 R</b>	<b>CPS</b>	<b>Absolute Difference</b>
<b>Gender</b>	Male	47.2	48.9	1.7
	Female	50.4	51.1	0.7
<b>Age</b>	18-24	3.7	13.1	9.4 ***
	25-34	9.2	18.6	9.4 ***
	35-44	20.0	22.1	2.1 *
	45-54	24.3	18.2	6.1 ***
	55-64	15.0	11.7	3.3 ***
	65+	27.8	16.3	11.5 ***
<b>Race</b>	White	87.2	83.3	3.9 ***
	Black	7.6	11.9	4.3 ***
	American Indian	1.9	0.8	1.1 ***
	Asian/Pacific Islander	2.1	3.9	1.8 ***
<b>Education</b>	No HS diploma	8.4	17.0	8.6 ***
	HS diploma	34.3	32.8	1.5
	Some college	32.3	26.7	5.6 ***
	BA+	25.1	23.4	1.7
<b>Income</b>	LT 10K	4.0	7.6	3.6 ***
	10K-24K	17.4	19.5	2.1 *
	25K-49K	39.8	30.0	9.8 ***
	50K-75K	25.3	19.4	5.9 ***
	75K+	13.5	23.4	9.9 ***

\*p<.05, \*\*p<.01, \*\*\*p<.001