2017 – 2021 PSRC HOUSEHOLD TRAVEL SURVEY PROGRAM: LESSONS AND RECOMMENDATIONS

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1.0 OVERVIEW

This document includes recommendations for future travel survey data collection based on findings from PSRC's household travel survey (HTS) program and other recent HTS. These findings and recommendations are outlined in several sections:

- **Equity Lessons from the PSRC HTS Program**
    - Compensatory Oversampling and Differential Incentives
    - Third-Party Income Data Usage
    - Online Panel Sampling Methods
    - Additional findings: Modelling Response as a Function of Block Group Characteristics
- **Equity Lessons from Other HTS Programs: Transit Outreach**
- **PSRC Data Cleaning Impacts on Quality and Analysis Outcomes**
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While the recommendations in this document may benefit many types of survey data collection, analysis is based solely on HTS data collection to-date, which may vary from other types of surveys (e.g., shorter surveys or surveys with less sensitive / personal information).

2.0 EQUITY LESSONS FROM THE PSRC HTS PROGRAM

The PSRC household travel survey program took several key steps throughout 2017, 2019, and 2021 to improve representation in the final survey data. These included compensatory geographic oversampling, offering differential incentives in mailed invitations, using third party data for sampling, and integrating online panel sampling. The following section evaluates the impact of these methods throughout 2017 – 2021.

2.1 COMPENSATORY OVERSAMPLING AND DIFFERENTIAL INCENTIVES

The PSRC HTS incentive structures throughout the three-wave program shown in Table 1 below. RSG and PSRC adjusted these incentives each year based on sampling priorities and observations from previous data collection waves. Note that these structures applied only to households recruited through address-based sampling (ABS). Online panel sample incentives were handled separately through the online panel provider.

TABLE 1: PSRC HTS PROGRAM INCENTIVE STRUCTURES

YEAR	INCENTIVES OFFERED	NOTES
2017	**Online:** $10 per household **rMove app:** $15 per adult	Downtown Redmond households received an additional $10 per household. In the final weeks of the study, households outside King County were also offered an additional $10 per household after recruiting into the study to encourage retention. This
2019	**Online:** $15 per household **rMove app:** $25 per adult	
2021	**Online:** $15 – 25 per household (No rMove app data collection)	Some geographies were offered $25 per household in the mailed invites based on the share of low-income and POC people in the geography. These differential incentives were defined as part of the sampling plan (described further in the 2021 final report).

Table 2 shows the response rates from 2017 – 2021 in block groups that correspond to the 2021 sampling groups. Total response rates declined across the three waves except

for the geographies that were offered the higher incentive in 2021, which suggests that the differential incentive was somewhat impactful.

TABLE 2: GEOGRAPHIC RESPONSE COMPARISON

2021 SAMPLING SEGMENT	2021 EXTRA INCENTIVE	2017 RESPONSE RATE	2019 RESPONSE RATE	2021 RESPONSE RATE
Low POC	None	6.89%	5.47%	5.48%
Medium POC	None	6.47%	4.57%	4.46%
Low-Medium POC & High Low Income	None	5.61%	4.36%	3.84%
High POC	None / $10*	6.08%	3.38%	3.79%
Very High POC	$10	4.15%	3.33%	3.58%

* The extra incentive was added for this segment in Pierce County in the latter part of the 2021 survey. About 2.3% of the invitations in this segment were offered the extra incentive.

Table 3 and Table 4 show the unweighted income and race/ethnicity distributions among ABS respondents in 2017 – 2021 compared to 2015 – 2019 ACS estimates. Table 3 shows that compensatory oversampling for income was successful in all three years, as the unweighted income distributions from the three years of surveys are similar to each other and to the ACS distribution. The extent of compensatory geographic oversampling was increased in 2021 relative to the earlier years to improve race/ethnicity distributions, and the extra up-front incentives were offered for the highest POC segment (described further in the sampling plan and 2021 final report). As a result, the 2021 survey was successful in increasing the share of respondents with Hispanic, Black, Asian, and other/multiple races or ethnicities. Even with the extensive oversampling and extra incentives, however, the 2021 ABS sample had a low share of Black and Hispanic respondents compared to ACS.

TABLE 3: INCOME SHARE BY YEAR (UNWEIGHTED) COMPARED TO ACS

HOUSEHOLD INCOME	2015 – 2019 ACS	2017	2019	2021*
Under $25,000	12.2%	10.7%	9.3%	10.8%
$25,000-$49,999	15.6%	15.2%	14.4%	15.6%
$50,000-$74,999	15.9%	14.7%	15.3%	14.1%
$75,000-$99,999	13.5%	12.8%	13.7%	13.5%
$100,000 or more	42.8%	39.5%	41.1%	38.3%
Prefer not to answer	-	7.1%	6.1%	7.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

TABLE 4: RACE/ETHNICITY SHARE BY YEAR (UNWEIGHTED) COMPARED TO ACS

RACE / ETHNICITY	2015 – 2019 ACS	2017	2019	2021*
Hispanic	9.9%	2.4%	2.5%	3.9%
White	64.1%	65.8%	71.0%	61.5%
Black	5.5%	1.9%	2.1%	3.7%
Asian	13.0%	15.8%	10.7%	16.1%
Other / Multiple	7.5%	6.6%	7.7%	8.0%
Prefer not to answer	-	7.5%	5.9%	6.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

*These tables include only ABS data from 2021 to allow closer comparisons to previous years.

Table 5 indicates why extensive geographic oversampling was not successful in matching the actual race/ethnicity distribution indicated by ACS for Black or Hispanic populations. In the Medium, High, and Very High POC segments that were oversampled most strongly, the response rates among Black and Hispanic invitees were all below 2%, while the response rates are above 3% in almost all of the other cells in the table. Since we do not know the actual race/ethnicity of invitees who did not respond, these calculations assume that the race/ethnicity distribution of households randomly invited from each block group is the same as the distribution indicated by the ACS block group data. The total response rate in the Very High POC block groups is not lower than in the

High POC block groups, which suggests that the extra incentives offered in the Very High POC segment prevented those response rates from falling even lower.

TABLE 5: 2021 ABS RESPONSE RATES (RR) BY SAMPLING SEGMENT AND RACE/ETHNICITY

SEGMENT	INVITES	WHITE RR	BLACK RR	HISPANIC RR	ASIAN RR	OTHER RR	TOTAL RR
Low POC	6,209	5.6%	2.5%	3.6%	4.2%	4.4%	5.3%
Medium POC	8,449	5.1%	1.9%	1.5%	4.7%	2.7%	4.2%
High POC	7,932	5.8%	1.9%	1.2%	3.7%	3.1%	3.7%
Very High POC	17,754	8.1%	1.5%	1.8%	3.8%	2.9%	3.7%
High Low-Income	7,680	4.0%	2.1%	3.0%	4.8%	2.2%	3.7%
Total	48,024	5.6%	1.6%	1.8%	3.9%	3.0%	4.0%

2.2 THIRD-PARTY INCOME DATA USAGE

In 2021, the project team purchased third-party income data to support sample plan development and mailing schedules.[1] Table 6 shows the match between the income estimate purchased from MSG and the reported income for households that responded to the study. For those with a known value in the MSG data, the highest match is on the diagonal, and the next highest match is one category higher or lower. This suggests that the data is accurate on a broad level. In those cases where MSG reported an unknown income, the breakdown is most like those in the $25-50K or $50-100K range, although the reported incomes are only for the responding households, so may be skewed toward the higher ranges due to income-related non-response bias.

TABLE 6: CORRESPONDENCE BETWEEN MSG INCOME ESTIMATE AND REPORTED INCOME

MSG INCOME ESTIMATE	REPORTED INCOME					
	$0-25K	$25-50K	$50-100K	100-200K	$200K up	Total
$0-25K	28.9%	28.9%	24.0%	15.7%	2.5%	**100.0%**
$25-50K	12.7%	28.1%	35.0%	19.6%	4.6%	**100.0%**
$50-100K	6.6%	13.2%	38.6%	32.1%	9.6%	**100.0%**
100-200K	2.7%	8.3%	25.6%	42.3%	21.1%	**100.0%**
$200K up	0.8%	2.4%	16.0%	36.8%	44.0%	**100.0%**
Unknown	18.0%	18.1%	29.1%	23.4%	11.4%	**100.0%**
Total	**12.0%**	**16.5%**	**29.9%**	**28.2%**	**13.4%**	**100.0%**

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[1] Purchasing appended income information comes at no additional cost if name is also purchased (which was the case in 2021). If name is not already purchased, the appended income information is $0.09 per address with available information.

Table 7 shows the response rates and number of invitations by MSG estimated income category. Those with estimated income below $25K clearly have the lowest response rate at 3.1%, compared to 5.0% and higher in the two upper income categories. MSG reported unknown income for 41.0% of the addresses. The response rate for those addresses was quite low at 3.6%, like the $25-50K category.

TABLE 7: RESPONSE RATE BY MSG INCOME LEVEL

MSG INCOME	RESPONSE RATE	INVITES	% INVITES
$0-25K	3.1%	3,898	8.1%
$25-50K	3.7%	6,960	14.5%
$50-100K	4.6%	7,950	16.6%
$100-150K	4.6%	4,938	10.3%
$150-200K	5.0%	2,213	4.6%
$200K up	6.1%	2,050	4.3%
Unknown	3.6%	20,015	41.7%
Total	**4.0%**	**48,024**	**100.0%**

Overall, the close match between MSG income estimates and reported incomes as well as the large systematic variation in response rates by MSG group indicate that using this additional data can be a cost-effective strategy to compensate for income-related non-response bias. One strategy in the future may be to mail out invitations to all addresses with MSG income below $50K or unknown, while holding some percentage of addresses in the higher MSG income categories in reserve and not mailing invitations to those reserve addresses. (This was done in a small way in 2021 but could be done more extensively in the future.) Compared to geographically based compensatory oversampling in block groups with a high percentage of low-income households, this approach has the advantage that it applies to all block groups in the region and not just to a selected subset of block groups, which helps reduce the level of extreme weights.

2.3 ONLINE PANEL SAMPLING

The 2021 survey included online panel sampling methods for the first time as part of the Household Travel Survey program. This method was introduced to save costs and test the viability of using panel sampling for future household travel surveys (which will be used to support the PSRC model, unlike the 2021 household travel survey). RSG and PSRC worked with two panel providers – Full Circle Research and Marketing Systems Group (a panel aggregator) – to implement the panel sampling. Both were non-probability panels but aimed to recruit demographically representative respondents.

High-Level Response Comparison

The following tables show the differences among adult respondents (age 18+) between the ABS and Online Panel sample sources. All tables are unweighted.

Demographic Comparison

Between the two sampling methods, online panel respondents were more likely to be younger, lower income, and unemployed. The online panel respondents were also more likely to be non-White and non-Asian (both of which tend to be overrepresented in the ABS data compared to ACS).

TABLE 8: ADULT RESPONSE BY SAMPLE SOURCE

SAMPLE SOURCE	COUNT	PERCENT
Address Based Sample (ABS)	3,438	79.9%
Online Panel	864	20.1%
Total	**4,302**	**100.0%**

TABLE 9: INCOME BY SAMPLE SOURCE

HOUSEHOLD INCOME	ABS	ONLINE PANEL	TOTAL
Under $25,000	8.6%	13.3%	9.6%
$25,000-$49,999	13.6%	21.8%	15.2%
$50,000-$74,999	12.7%	16.3%	13.4%
$75,000-$99,999	14.3%	13.2%	14.1%
$100,000-$199,000	28.5%	24.4%	27.7%
$200,000 or more	14.3%	5.2%	12.4%
Prefer not to answer	8.2%	5.8%	7.7%
Total	**100.0%**	**100.0%**	**100.0%**

TABLE 10: RACE / ETHNICITY BY SAMPLE SOURCE

RACE / ETHNICITY	ABS	ONLINE PANEL	TOTAL
African American	5.1%	6.9%	5.5%
American Indian	1.5%	3.2%	1.9%
Asian	18.2%	12.6%	17.1%
Hispanic	1.3%	1.0%	1.3%
Native Hawaiian or Pacific Islander	5.4%	6.5%	5.6%
White	65.7%	75.3%	67.6%
Other	2.3%	2.3%	2.3%
Prefer not to answer	6.8%	1.6%	5.7%
Total[2]	**106.3%**	**109.4%**	**107.0%**

TABLE 11: IMPUTED RACE / ETHNICITY BY SAMPLE SOURCE

RACE / ETHNICITY	ABS	ONLINE PANEL	TOTAL
Hispanic	6.0%	6.6%	6.1%
Black	4.2%	5.0%	4.4%
Asian	17.4%	10.3%	16.0%
White	65.3%	69.8%	66.2%
Other / multiple	7.0%	8.3%	7.3%

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[2] Respondents could select more than one race / ethnicity, so columns in this table sum to greater than 100%

RACE / ETHNICITY	ABS	ONLINE PANEL	TOTAL
Total	100.0%	100.0%	100.0%

TABLE 12: EMPLOYMENT STATUS BY SAMPLE SOURCE

EMPLOYMENT STATUS	ABS	ONLINE PANEL	TOTAL
Employed full time (35+ hours/week, paid)	47.4%	38.3%	45.6%
Employed part time (fewer than 35 hours/week, paid)	7.2%	12.2%	8.2%
Self-employed	5.9%	6.6%	6.0%
Unpaid volunteer or intern	0.6%	0.8%	0.7%
Homemaker	5.1%	8.9%	5.8%
Retired	21.7%	16.2%	20.6%
Not currently employed	10.8%	16.0%	11.9%
Employed but not currently working (e.g., on leave, furloughed 100%)	1.3%	1.0%	1.3%
Total	100.0%	100.0%	100.0%

TABLE 13: AGE BY SAMPLE SOURCE

AGE	ABS	ONLINE PANEL	TOTAL
18-24 years	6.4%	14.5%	8.0%
25-34 years	20.9%	19.9%	20.7%
35-44 years	20.0%	20.8%	20.2%
45-54 years	14.0%	15.3%	14.3%
55-64 years	15.8%	14.8%	15.6%
65-74 years	15.6%	12.4%	14.9%
75-84 years	6.1%	1.7%	5.2%
85 or years older	1.2%	0.6%	1.0%
Total	100.0%	100.0%	100.0%

Travel Behavior Comparison

In looking at reported travel, the online panel respondents had much higher shares of zero-trip days and lower trip rates overall. The online panel respondents were asked to report their travel for "yesterday" while the ABS respondents were asked to report their travel for a preassigned day in the future, so some of this difference may also be attributed to the difference in survey design. Differences in trip rates were also consistent across age and employment categories (i.e., online panel rates were lower across all groups).

TABLE 14: TRIP RATE AND ZERO TRIP DAYS BY SAMPLE SOURCE

CHARACTERISTIC	ABS	ONLINE PANEL	TOTAL
Percent of person-days with 0 trips	25.7%	39.0%	28.4%
Average trips per person-day	2.64	1.79	2.47

TABLE 15: TRIP RATE BY EMPLOYMENT STATUS & SAMPLE SOURCE

EMPLOYMENT STATUS	ABS	ONLINE PANEL	TOTAL
Employed full time (35+ hours/week, paid)	2.64	1.85	2.50
Employed part time (fewer than 35 hours/week, paid)	3.02	1.83	2.66
Self-employed	3.10	1.82	2.82
Unpaid volunteer or intern	2.68	2.29	2.59
Homemaker	2.70	2.17	2.53
Retired	2.68	1.82	2.54
Not currently employed	2.06	1.33	1.86
Employed but not currently working (e.g., on leave, furloughed 100%)	2.83	2.11	2.71
Total	2.64	1.79	2.47

TABLE 16: TRIP RATE BY AGE & SAMPLE SOURCE

AGE	ABS	ONLINE PANEL	TOTAL
18-24 years	1.99	1.32	1.75
25-34 years	2.60	1.73	2.43
35-44 years	2.70	1.95	2.54
45-54 years	2.76	1.95	2.59
55-64 years	2.79	1.81	2.60
65-74 years	2.72	2.03	2.61
75-84 years	2.67	1.60	2.60
85 or years older	1.65	1.00	1.58
Total	2.64	1.79	2.47

Further Investigation of Differences Between ABS and Online Panel Respondents

The 2021 weighting process adjusted for differences between the ABS and online panel adult respondents in terms of the various ACS targets used for weighting. This section reviews the unweighted joint distributions across three variables—employment status, college degree status, and income group—to see if they reveal any more subtle differences between the groups of respondents.

Table 17 shows the 2 x 2 distribution of employment status and college degree status in the 2021 ABS and online panel unweighted data and the weighted 2019 ACS data for adults. Compared to the ACS data, the ABS data has a higher percent of people with college degrees, but a lower percentage of people who are employed. (Some of the difference in employment may be due to the drop in employment levels due to the pandemic.) The online panel sample also has a lower number of people employed compared to ACS, but the group that is most over-represented are people with no job and no degree.

Table 18 and Table 19 take the four groups from Table 17 for each sample type and look at the income distribution of the unweighted data compared to 2019 ACS. Table 18 shows that within each employment/degree category, the unweighted ABS income share is within 9% of the ACS income share. Most cells are within 5%, although there is a small under-representation of higher income households overall (possibly due to the extent of oversampling in low-income areas). Table 19, on the other hand, shows larger discrepancies from the ACS income distribution, with under-representation of people with high incomes in all four groups, and over-representation people with low incomes, particularly among those with no college degree. Overall, compared to ACS data, the online panel sample is more skewed toward people with no employment or degree and toward people with lower incomes relative to their employment and education status. The ABS sample is more skewed to toward people with higher education, and their incomes generally reflect their employment and education levels.

TABLE 17: UNWEIGHTED DISTRIBUTION BY EMPLOYMENT AND DEGREE STATUS—ABS AND OP COMPARED TO 2019 ACS

EMPLOYMENT AND DEGREE	2021 ABS-ADULT	2021 OP-RESPONDENT	2019 ACS ADULTS WEIGHTED	DIFFERENCE ABS-ACS	DIFFERENCE OP-ACS
not employed - no degree	21.5%	29.4%	21.5%	0.0%	7.9%
not employed - with degree	18.0%	13.5%	10.0%	8.0%	3.5%
employed – no degree	20.8%	27.4%	37.0%	-16.2%	-9.6%
employed - with degree	39.6%	29.6%	31.6%	8.0%	-2.0%
Total	**100.0%**	**100.0%**	**100.0%**	**0.0%**	**0.0%**

TABLE 18: INCOME BY EMPLOYMENT AND DEGREE STATUS—UNWEIGHTED ABS COMPARED TO 2019 ACS

DIFFERENCE ABS – ACS	NOT EMPLOYED - NO DEGREE	NOT EMPLOYED WITH DEGREE	EMPLOYED NO DEGREE	EMPLOYED WITH DEGREE	TOTAL
Under $25,000	4.4%	-3.0%	5.2%	1.0%	2.2%
$25,000-$49,999	1.8%	5.2%	5.8%	3.2%	3.4%
$50,000-$74,999	0.1%	-2.7%	2.0%	2.7%	0.1%
$75,000-$99,999	4.4%	4.0%	-0.1%	4.1%	2.3%
$100,000-$199,999	-6.9%	3.0%	-8.9%	-3.0%	-4.4%
$200,000 or more	-3.8%	-6.5%	-4.0%	-8.0%	-3.5%

TABLE 19: INCOME BY EMPLOYMENT AND DEGREE STATUS—UNWEIGHTED ONLINE PANEL (OP) COMPARED TO 2019 ACS

DIFFERENCE OP – ACS	NOT EMPLOYED - NO DEGREE	NOT EMPLOYED WITH DEGREE	EMPLOYED NO DEGREE	EMPLOYED WITH DEGREE	TOTAL
Under $25,000	10.9%	-2.4%	7.4%	1.7%	6.9%
$25,000-$49,999	4.1%	9.7%	23.1%	6.0%	11.5%
$50,000-$74,999	5.5%	0.2%	0.7%	6.8%	3.9%
$75,000-$99,999	-4.0%	4.5%	-1.7%	5.8%	0.3%
$100,000-$199,999	-10.1%	1.1%	-19.1%	1.0%	-9.4%
$200,000 or more	-6.4%	-13.0%	-10.4%	-21.3%	-13.2%

2.4 ADDITIONAL FINDINGS: MODELLING RESPONSE AS A FUNCTION OF BLOCK GROUP CHARACTERISTICS

It can be difficult to untangle the many possible influences on response rates, so responses rates for the 2017, 2019 and 2021 ABS surveys were modeled at the block group level as a function of block group characteristics. This was done using a binary logit model, where each block group for each year was treated as two observations: if NI invitations were sent to a block group in a particular year and NR complete household responses were obtained from that block group in that year, then it is treated as one observation choosing to respond with weight NR and another observation choosing not to respond with weight (NI-NR). The weights were also normalized by the mean value of NI in each year so that each block group would have an average weight of 1.0.

Table 20 shows the model estimation results using the first specification. There is one model for each of the three years plus a joint model across all three years combined. Block group characteristics related to lower response rates have negative signs and are indicated by red shading in the t-statistic column, with darker shades for more strongly negative effects. Green shading for positive estimates and t-statistics indicate the strength of characteristics related to higher response rates.

As one would expect, block groups with higher fractions of Black, Hispanic, Asian, and other non-White race/ethnicity groups have lower response rates, as do block groups with a high fraction of households renting their dwelling and with a high fraction of households with a very low income below $10,000. Block groups with a higher percentage of adults with college degrees, higher transit and bike commute mode shares, a higher percent of zero-vehicle households and a higher population density (the log of persons per square mile in the block group) tend to have higher response rates. For the block groups in which people were offered higher incentives in 2021, the effect is positive and marginally significant (t-statistic of 1.4).

Residual effects were estimated by county (relative to Snohomish County, which was set as the base). In 2017 and 2019, King County showed a significantly higher residual response rate, while in 2021 Pierce County showed a significantly lower residual response rate.

In the fourth model with the three years combined, 2021 is used as the base year, and 2017 has a positive residual response rate that is not explained by all the other variables in the model, while 2019 has a significantly negative residual response rate. This result indicates that response rates in the PSRC region were not significantly lower in 2021 than in 2019 after all the variables in the model are taken into account, and in fact seem to have been somewhat higher than one would expect based on 2019 evidence.

TABLE 20: RESPONSE RATE MODEL ESTIMATION RESULTS BY YEAR AND IN TOTAL

UTILITY FOR THE RESPONSE ALTERNATIVE	2017 ESTIMATE	2017 T-STAT.	2019 ESTIMATE	2019 T-STAT.	2021 ESTIMATE	2021 T-STAT.	COMBINED ESTIMATE	COMB T-STAT.
constant	-3.397	-14.9	-3.752	-16.5	-4.039	-13.8	-3.629	-25.9
BLOCK GROUP FRACTIONS								
Hispanic	-0.263	-0.9	-0.078	-0.3	-0.844	-2.9	-0.488	-3.0
Black	-0.558	-2.1	-0.798	-3.1	-0.294	-1.0	-0.549	-3.7
Asian	-0.204	-1.4	-0.731	-4.1	-0.433	-2.0	-0.336	-3.6
Other Non-White	-0.469	-1.1	-0.246	-0.6	-0.139	-0.4	-0.282	-1.2
Age 18-34	0.554	2.7	0.063	0.3	-0.097	-0.3	0.237	1.9
Age 65 and over	0.126	0.4	0.530	1.8	0.295	0.8	0.334	1.8
Zero-Vehicle HH	0.613	2.4	0.199	0.8	0.020	0.1	0.316	2.0
Renting HH	-0.366	-2.7	-0.756	-5.1	-0.471	-3.2	-0.429	-5.3
Income under $10K	-1.181	-3.2	-1.179	-3.2	0.043	0.1	-0.934	-4.2
Income $10-25K	-0.131	-0.4	-0.098	-0.3	0.476	1.4	0.112	0.6
Income $150-200K	0.523	1.4	-0.345	-0.8	1.208	2.7	0.575	2.5
Income $200K+	-0.016	-0.1	-0.622	-2.1	0.032	0.1	-0.174	-1.0
Transit commute share	0.235	1.0	1.082	4.4	0.444	1.3	0.619	4.1
Work from home	0.909	2.0	0.260	0.6	-0.049	-0.1	0.388	1.4
Walk commute share	-0.448	-1.9	0.011	0.0	0.341	0.9	-0.264	-1.8
Bike commute share	0.479	0.8	1.502	2.3	1.650	1.2	1.021	2.5
College degree	0.807	4.6	0.670	3.7	1.019	4.3	0.826	7.6
OTHER VARIABLES								
LN(Pop./sq.mile)	0.001	0.1	0.074	2.9	0.092	3.0	0.039	2.7
Extra incentive	n/a		n/a		0.123	1.4	0.017	0.3
Year=2017							0.089	2.4
Year=2019							-0.140	-3.8

UTILITY FOR THE RESPONSE ALTERNATIVE	2017 ESTIMATE	2017 T-STAT.	2019 ESTIMATE	2019 T-STAT.	2021 ESTIMATE	2021 T-STAT.	COMBINED ESTIMATE	COMB T-STAT.
Year=2021							base	
King County	0.271	2.8	0.290	3.4	-0.035	-0.4	0.173	3.5
Kitsap County	-0.032	-0.2	-0.183	-1.7	0.012	0.1	-0.046	-0.7
Pierce County	0.000	0.0	-0.034	-0.4	-0.216	-2.4	-0.087	-1.6
Snohomish County	base		base		base		base	

One hypothesis for why response rates might be lower in some regions than in others (and why they seem to be going in opposite directions in rural areas as opposed to urban areas in some regions) is that they could be related to differences in attitudes toward the role of government agencies and government spending, and how these attitudes can be related to political preferences. It is inadvisable to ask political party preferences directly in a travel survey, so it was necessary to look for external data to indicate the spatial pattern of such preferences. A national database of 2020 voting results at the voting precinct level is available online from Harvard University. RSG used a GIS reallocation process with shapefiles of voting precincts and Census block groups to estimate the number of votes for Donald Trump and Joseph Biden cast in each block group in November 2020. Table 21 shows the block groups stratified by the percent of votes for Donald Trump and the 2021 ABS response rate within each stratum. For those block groups with less than 10% of votes for Donald Trump, the response rate was 6.5%, while for those block groups with more than 50% of votes for then-President Trump, the response rate was only 2.7%. Thus, the table indicates a major difference in response rates that may be related to political attitudes. (The last two columns of the table show that the ABS sample and the online panel (OP) sample do not differ very substantially in terms of their distribution across the strata.)

TABLE 21: RESPONSE RATES COMPARED TO BLOCK GROUP PERCENT OF 2020 PRESIDENTIAL VOTES FOR DONALD TRUMP VS. JOSEPH BIDEN

BLOCK GROUP % OF VOTES FOR TRUMP IN 2020	ABS RESPONSE RATE	% ABS ADULTS	% OP ADULTS
0 to 10%	6.5%	9.4	11.4
10 to 20%	5.5%	21.1	15.6
20 to 30%	3.8%	27.5	28.6
30 to 40%	3.4%	23.1	22.9
40 to 50%	3.7%	14.3	17.1
50% or more	2.7%	4.5	4.4
Total	**4.0%**	**100.0**	**100.0**

To see if this additional variable would prove significant when other correlated variables are also considered, the block group percent of votes for Donald Trump was added to the model specification from, and the new results are shown in Table 22. Even when all other block group characteristics are included in the model, the new variable for the fraction of votes for the Republican candidate is the most significant variable in the model (except for the alternative-specific-constant) for all three years, with a very negative effect on response rates. To test whether this "political polarization" effect has strengthened over time, it was interacted with the year variable in the combined model and shows a very similar estimate for all three years.

An interesting result is that the negative coefficients for the Black, Hispanic, and Other Non-White percentages are also now larger and more significant than in the first version of the model, although that is not true for the Asian percentages. The effects of several variables have become smaller and less significant than in Table 20, including the positive effects of college education, transit and bike mode share, and population density. The positive residual for 2017 vs 2021 has also largely disappeared, although the negative residual for 2019 vs 2021 remains. Perhaps most important, all the residual differences between the four counties have become insignificant in this model.

It is not obvious how PSRC can use this finding that response rates are strongly related to political preferences, except perhaps to keep any messaging in the promotional and informational survey materials as politically neutral as possible.

TABLE 22: RESPONSE RATE MODEL ESTIMATION RESULTS BY YEAR AND IN TOTAL (VERSION 2)

UTILITY FOR THE RESPOND ALTERNATIVE	2017 ESTIMATE	2017 T-STAT.	2019 ESTIMATE	2019 T-STAT.	2021 ESTIMATE	2021 T-STAT.	COMBINED ESTIMATE	COMB. T-STAT.
Constant	-2.172	-6.8	-2.196	-6.7	-2.732	-6.8	-2.239	-11.2
BLOCK GROUP FRACTIONS								
Hispanic	-0.249	-0.8	-0.161	-0.6	-1.009	-3.4	-0.555	-3.4
Black	-0.832	-3.1	-1.278	-4.8	-0.656	-2.2	-0.903	-5.9
Asian	-0.048	-0.3	-0.550	-3.1	-0.434	-2.0	-0.227	-2.4
Other Non-White	-0.651	-1.5	-0.618	-1.5	-0.381	-1.0	-0.535	-2.3
Age 18-34	0.582	2.8	0.008	0.0	-0.135	-0.5	0.217	1.7
Age 65 and over	0.242	0.8	0.487	1.7	0.096	0.3	0.293	1.6
Zero-vehicle HH	0.825	3.2	0.413	1.6	0.174	0.5	0.512	3.3
Renting HH	-0.438	-3.2	-0.815	-5.4	-0.450	-3.1	-0.462	-5.7
Income under $10K	-1.223	-3.4	-1.162	-3.2	-0.124	-0.3	-0.988	-4.5
Income $10-25K	-0.244	-0.8	-0.330	-1.1	0.370	1.1	-0.040	-0.2
Income $150-200K	0.688	1.9	-0.278	-0.7	1.220	2.7	0.656	2.8
Income $200K+	0.075	0.3	-0.511	-1.8	0.095	0.3	-0.084	-0.5
Transit commute share	-0.263	-1.0	0.453	1.7	-0.071	-0.2	0.052	0.3
Work from home	0.741	1.6	-0.028	-0.1	-0.223	-0.4	0.173	0.6
Walk commute share	-0.660	-2.8	-0.181	-0.8	0.145	0.4	-0.463	-3.1
Bike commute share	-0.395	-0.6	0.303	0.5	0.414	0.3	-0.023	-0.1
College degree	0.478	2.6	0.172	0.9	0.576	2.2	0.402	3.4
Trump vote %-2017	-1.844	-5.4					-1.853	-7.9
Trump.vote %-2019			-2.179	-6.5			-1.939	-8.6
Trump.vote %-2021					-1.698	-4.6	-1.985	-8.0
OTHER VARIABLES								
LN(Pop./sq.mile)	-0.050	-2.0	0.014	0.5	0.039	1.2	-0.015	-0.9
Extra incentive	n/a		n/a		0.106	1.2	-0.002	0.0

UTILITY FOR THE RESPOND ALTERNATIVE	2017 ESTIMATE	2017 T-STAT.	2019 ESTIMATE	2019 T-STAT.	2021 ESTIMATE	2021 T-STAT.	COMBINED ESTIMATE	COMB. T-STAT.
Year=2017							0.034	0.5
Year=2019							-0.180	-2.5
Year=2021							base	
King County	0.091	0.9	0.128	1.4	-0.102	-1.2	0.038	0.7
Kitsap County	-0.009	-0.1	-0.146	-1.3	0.062	0.6	0.003	0.0
Pierce County	0.066	0.6	0.051	0.6	-0.173	-1.9	-0.022	-0.4
Snohomish County	base		base		base		base	

3.0 EQUITY LESSONS FROM OTHER HTS PROGRAMS: TRANSIT OUTREACH

As noted above, PSRC has taken many steps throughout the HTS program to improve response and sample representation, including oversampling geographies with higher shares of low-income and minority populations, offering differential incentives, and engaging online panels. For future survey efforts, PSRC could also consider inviting participants from transit agency contact lists, if available. This method was tested successfully as part of Metropolitan Council's 2021 Household Travel Survey, described below.

Approach

The Metropolitan Council HTS team invited members of Metro Transit's transit assistance program (TAP) subscriber list via email and text message. The TAP list is comprised of known low-income users and overlaps with other traditionally hard-to-reach groups. Messages were sent directly from Metro Transit to legitimize the study. Respondents who completed the study received $20 per household for reporting one day of travel online or $30 per adult for reporting seven days of travel via the rMove smartphone app.

Results

This method was first piloted as part of Metropolitan Council's COVID-19 survey in the fall of 2020. While the full results from the 2021 HTS are not yet available, Table 23 shows a sample comparison from the COVID-19 survey in 2020. Note that non-Metro Transit respondents were recruited from the 2019 Household Travel Survey participants (who were initially recruited via ABS methods). Trends from the 2021 HTS suggest similar differences between the Metro Transit participants and the rest of the sample. Early results from the 2021 HTS also suggest that completion rates are comparable or higher than ABS methods for much lower costs.

TABLE 23: DEMOGRAPHICS OF METRO TRANSIT RESPONDENTS COMPARED TO PANEL RESPONDENTS IN METROPOLITAN COUNCIL'S COVID-19 SURVEY

	METRO TRANSIT RESPONDENTS (N = 74)	MET COUNCIL'S COVID-19 RESPONDENTS (N = 1,977)
Asian	7%	4%
Black or African American	24%	2%
Hispanic, Latino, or Spanish Origin	5%	2%
Age under 35	39%	17%
Household Income Less Than $50,000	67%	16%
Traveled by bus in the last 7 days	45%	3%
Traveled by rail in the last 7 days	19%	2%

While this sample source is biased toward certain modes, the method may still be a very useful complement to traditional ABS methods in future PSRC surveys, particularly to reduce the amount of required geographic oversampling.

4.0 PSRC DATA CLEANING IMPACTS ON QUALITY AND ANALYSIS OUTCOMES

4.1 INTRO

After each wave of data collection in 2017, 2019, and 2021, RSG performed light cleaning and preparation of the survey dataset to deliver to PSRC. Prior to RSG weighting the dataset, PSRC conducted a closer review of the data and further cleaned the dataset (including revising trip information and dropping a small number of households from the dataset).

The section below evaluates the broader impacts of PSRC's data cleaning process by analyzing key metrics before and after cleaning. Given that the 2021 dataset did not include rMove data collection, this analysis is focused on 2019. All figures represent unweighted data (since data was only weighted after the final cleaning).

4.2 2019 DATA COMPARISONS (UNWEIGHTED)

The biggest impact from PSRC's post-delivery data cleaning is a notable drop in the number of complete household days in the dataset (separate from the smaller drop in households and complete person days in the dataset). The differences are larger in the online diary than in the rMove diary (Table 26). As expected, the differences are also more pronounced among employed and middle-aged respondents (Table 28 and Table 29) who report more trips overall.

The impacts on mode share are minimal except for walk and car trips, which decrease and increase, respectively (Table 30). The differences in purpose share are more noticeable with greatest changes in change mode and home purposes, which decrease and increase, respectively (Table 31).

TABLE 24: HOUSEHOLD, DAY, AND TRIP TABLE COUNTS

RECORDS	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
Households	3,076	3,044	-1%
Days (Total)	17,709	17,393	-2%
Days (Household Complete)	14,714	10,554	-28%
Trips (Total)	81,113	72,855	-10%
Trips (Complete Household Days)	65,471	40,849	-38%

TABLE 25: COMPLETE DAY ATTRIBUTES

ATTRIBUTE	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
Person-Complete Days / Total	91%	95%	4%
Household-Complete Days / Total	83%	61%	-22%
% Zero Trip Days	14%	14%	0%

TABLE 26: TRIP RATE BY PARTICIPATION METHOD

PARTICIPATION METHOD	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
rMove Diary	4.75	4.10	-13.6%
Online Diary	3.60	3.45	-4.0%
Total	**4.45**	**3.87**	**-13.0%**

TABLE 27: TRIP RATE BY HOUSEHOLD INCOME

HOUSEHOLD INCOME	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
Under $25,000	3.98	3.43	-13.8%
$25,000-$49,999	4.37	3.67	-16.0%
$50,000-$74,999	4.73	4.14	-12.4%
$75,000-$99,999	4.46	3.70	-17.1%
$100,000 or more	4.51	4.01	-11.2%
Prefer not to answer	3.82	3.32	-13.1%
Total	**4.45**	**3.87**	**-13.0%**

TABLE 28: TRIP RATE BY EMPLOYMENT STATUS (AGE 18+)

EMPLOYMENT STATUS	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
Employed full time (35+ hours/week, paid)	4.94	4.12	-16.6%
Employed part time (fewer than 35 hours/week, paid)	5.03	4.45	-11.6%
Self-employed	4.76	4.14	-13.2%
Unpaid volunteer or intern	5.11	4.21	-17.6%
Homemaker	4.25	4.18	-1.8%
Retired	3.75	3.52	-6.2%
Not currently employed	3.84	3.20	-16.6%
Total	**4.70**	**4.01**	**-14.6%**

TABLE 29: TRIP RATE BY AGE GROUP

AGE GROUP	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
Under 5 years old	3.06	3.00	-1.9%
5-11 years	3.17	3.01	-5.1%
12-15 years	2.93	3.16	7.8%
16-17 years	2.76	3.13	13.4%
18-24 years	4.73	3.87	-18.3%
25-34 years	4.88	4.02	-17.6%
35-44 years	4.90	4.26	-13.1%
45-54 years	4.88	4.27	-12.5%

AGE GROUP	ORIGINAL DATA DELIVERY	FINAL DATA DELIVERY	% DIFFERENCE
55-64 years	4.37	3.75	-14.2%
65-74 years	3.91	3.67	-6.1%
75-84 years	3.84	3.64	-5.2%
85 or years older	2.25	2.19	-2.8%
Total	**4.45**	**3.87**	**-13.0%**

TABLE 30: TRIP RATE AND SHARE BY TRAVEL MODE

TRAVEL MODE	ORIGINAL TRIP RATE	FINAL TRIP RATE	TRIP RATE DIFFERENCE	ORIGINAL TRIP SHARE	FINAL TRIP SHARE	SHARE DIFFERENCE
Walk	1.27	0.92	-27.5%	28.6%	23.8%	-4.7%
Bike	0.11	0.11	-6.8%	2.6%	2.7%	0.2%
Car	2.49	2.30	-7.6%	56.0%	59.4%	3.5%
Taxi	0.00	0.00	12.3%	0.1%	0.1%	0.0%
Transit	0.39	0.37	-5.6%	8.8%	9.6%	0.8%
School bus	0.02	0.03	23.4%	0.5%	0.7%	0.2%
Other	0.03	0.03	-2.1%	0.7%	0.7%	0.1%
Shuttle/Vanpool	0.03	0.03	20.6%	0.6%	0.9%	0.2%
TNC (Uber, Lyft, or other smartphone-app car service)	0.06	0.05	-22.6%	1.4%	1.3%	-0.2%
Carshare (e.g., ZipCar, Car2Go)	0.02	0.01	-30.6%	0.4%	0.3%	-0.1%
Bikeshare	0.01	0.00	-55.0%	0.1%	0.1%	-0.1%
Scooter or e-scooter (e.g., Lime, Bird, Razor)	0.00	0.00	-9.8%	0.0%	0.0%	0.0%
Long distance (e.g., airplane)	0.01	0.01	11.2%	0.3%	0.3%	0.1%
Total	**4.45**	**3.87**	**-13.0%**	**100.0%**	**100.0%**	**0.0%**

TABLE 31: TRIP RATE BY TRIP PURPOSE

TRIP PURPOSE	ORIGINAL TRIP RATE	FINAL TRIP RATE	TRIP RATE DIFFERENCE	ORIGINAL TRIP SHARE	FINAL TRIP SHARE	SHARE DIFFERENCE
Home	1.21	1.29	6.9%	27.2%	33.4%	6.2%
Work	0.45	0.52	15.9%	10.2%	13.5%	3.4%
Work-related	0.18	0.19	4.8%	4.1%	4.9%	0.8%
School	0.14	0.11	-23.9%	3.2%	2.8%	-0.4%
Escort	0.17	0.22	25.8%	3.8%	5.6%	1.7%
Shop	0.51	0.35	-30.3%	11.4%	9.2%	-2.3%
Meal	0.37	0.28	-24.1%	8.2%	7.2%	-1.0%
Social/Recreation	0.68	0.47	-31.1%	15.4%	12.2%	-3.2%
Errand/Other	0.43	0.42	-4.3%	9.8%	10.7%	1.0%
Change mode	0.30	0.02	-93.9%	6.7%	0.5%	-6.3%
Total	**4.45**	**3.87**	**-13.0%**	**100.0%**	**100.0%**	**0.0%**

5.0 RECOMMENDATIONS FOR FUTURE DATA COLLECTION

Based on the findings above, RSG recommends the PSRC consider the following when planning for future travel survey data collection:

- **Use means other than substantial geographic oversampling to reach demographic targets.** The 2021 survey very significantly oversampled some geographies with the goal of increasing the share of low-income and minority race/ethnicity respondents in the final sample. While all targets were met, the method was inefficient and resulted in a high variation in the expansion weights. While some level of compensatory geographic oversampling is still recommended for future surveys, RSG does recommends restricting sampling rates for all geographies to be no higher than 2 or 3 times the sampling rate for the general population. In addition to geographic oversampling, PSRC can rely more heavily on third-party data purchased with addresses. While such data is currently only useful for income, useful third-party data on race/ethnicity may become available in the future. RSG also recommends more extensive use of direct outreach and recruitment through community-based organizations. Finally, convenience sampling via transit customer lists and/or university student lists can be a very efficient supplement to ABS.

- **Continue offering differential incentives.** Offering extra incentives to "hard-to-survey" populations can be a very cost-effective means of making ABS samples more representative. The extra incentives can be sent out with survey invitations to specific geographic areas, as was done in the 2021 PSRC survey. They can also be offered to specific types of households in all areas based on information gathered in the recruitment survey to encourage those households to complete all stages of the survey.

  As an example, suppose that offering an extra $10 incentive increases response rates from 2.5% up to 3.0% to get 300 responses within a given sampling stratum. With a response rate of 2.5% it would be necessary to send 12,000 invitations to get 300 responses, but with a 3.0% response rate, only 10,000 invitations would need to be sent to get 300 respondents. So, paying $3,000 in extra incentives (300 x $10) avoids the need to send 2,000 invitations. As long as the marginal cost of each invitation (address, printing, mailing, reminders, etc.) is higher than $1.50[3], then paying the extra incentive saves money, increases the response rate, and reduces the tendency for non-response bias. In general, the lower the response rate without paying the extra incentive, the more

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[3] In 2021, the cost to mail to each household was $1.60. This included sample, printing, and postage costs. Postage costs tend to increase over time, but this cost is otherwise similar to what could be expected in the future.

cost-effective it is to use the extra incentives—a reason to use them for the most hard-to-survey sampling strata.

- **Consider whether extensive PSRC data cleaning prior to data weighting is still valuable in the future.** It is difficult to evaluate the specific 2019 PSRC data cleaning for two reasons. First, although RSG analyzed to some extent how it affected the data, RSG does not know exactly how the data cleaning was done by PSRC. Second, and perhaps most importantly, since 2019, survey technology and data cleaning practices have greatly advanced. For example, RSG has done a great deal of work to improve both the rMove app and the rMove data cleaning and processing algorithms. Together, these changes are likely to reduce or avoid much of the types of data cleaning PSRC carried out in 2019. Particularly for smartphone-based data, it would be advisable for PSRC to allow the firm collecting the data to clean and QA/QC the data before undertaking any further data cleaning in-house.

- **Require travel diary information from all household members and require all other information of at least all adults (instead of just the primary adult).** To accommodate the sample source tests in 2021, the survey asked some questions of all household members, some questions of just person 1 in the household, and some questions of all adults. This method made the participation method easier for respondents but required three sets of weights to analyze all questions in the survey (all respondents, adults only, main respondents). To ensure future data is as easy to use as possible, PSRC should ask the same questions for all relevant adults in each household.

- **If used, align online panel participation more closely with ABS or other participation methods.** Sampling from online panels can significantly reduce the cost of travel survey data collection. The use of online panels in the 2021 PSRC survey was done in a way that was as similar as possible to typical online panel surveys, with a single adult providing travel data that (a) was only for their own travel and not for other household members, and (b) that was retrospective for the previous day's trips, instead of for a pre-assigned travel day. These differences caused non-response bias in the form of much lower trip rates among online panel respondents than among ABS respondents. These differences also made the online panel data difficult to use in analysis because they required a separate set of weights and could not be used for household-level travel analyses.

Table 32 below summarizes the advantages and disadvantages of using online panels for travel survey in four different ways: (a) the way they were used for PSRC, (b) requiring panel respondents to provide retrospective travel data by proxy for all other household members, (c) using a two-stage survey with a pre-assigned travel day (as is typically done for ABS online surveys), and (d) the same as (c), but also allowing a smartphone option using an app such as rMove.

Online panels may provide data quality comparable to ABS but at a lower cost if using approaches (c) or (d). Although RSG has not yet tested the use of panels with either of those approaches, some panel providers seem willing to accommodate them. Before using online panels in these ways, it would be important to conduct further testing and better understand how each panel provider recruits and manages its own panel of respondents. (Generally, the panel providers with more sophisticated recruitment and maintenance approaches charge higher prices.)

In summary, RSG does not recommend repeating the use of online panels in the same way that it was done in the 2021 PSRC survey. However, RSG will continue to investigate the use of online panels with other approaches that more closely mirror how surveys are administered with ABS respondents.

TABLE 32: ADVANTAGES AND DISADVANTAGES OF ONLINE PANEL APPROACHES FOR TRAVEL SURVEYS

ONLINE PANEL APPROACH	ADVANTAGES	DISADVANTAGES
Option A: Ask for main respondent's travel only. Online-only survey done in one sitting, reporting retrospective travel for the previous day. (Used for 2021 PSRC HTS)	Low burden and most like other surveys that are administered to online panel respondents. Yields high response rates and panel providers are amenable / can offer low cost per complete.	Having travel data for only one person per household requires a different weighting method and complicated methods for combining with ABS. No travel data for children. High number of zero-trip days and fewer trips per day (retrospective non-response bias).
Option B: Same as above but ask for travel data for all household members for the previous day, reported by proxy.	Collects travel for all household members, which allows the same weighting methods as ABS. Easier to combine data.	Higher burden and may drive lower response rates with less cooperation and higher cost quotes from panel providers. Retrospective bias is likely to be even worse for proxy responses.
Option C: Same as above with a two-stage approach and assigned travel date in the future.	Same advantages as option B and removes the retrospective bias.	Higher burden and may drive lower response rates. Some panel providers may not allow or else charge higher cost (but likely still much lower cost than ABS).
Option D: Same as above but also allow the 7-day smartphone app (e.g., rMove) option.	Most comparable to current ABS methods and best practices.	Very few disadvantages as long as the panel provider is agreeable and can deliver the sample. Response rates should be as high as the option above, as it provides a choice for another method for response. Expected costs are still much lower than ABS.

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