Outreach Research—Survey and Focus Groups

DIYers and Used Oil Disposal

Initial Results and Recommendations

January 2002

California Environmental Protection Agency
Integrated Waste Management Board

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Executive Summary

The California Integrated Waste Management Board (CIWMB) contracted with the Public Research Institute (PRI) at San Francisco State University to conduct focus groups, develop and pilot an improved survey instrument and methodology, and conduct a statewide survey in order to help the Board better define and understand the target audiences for its outreach efforts and to design more effective outreach tools and messages to encourage behavioral change.[*] The contract directed PRI to:

- Provide current information about the oil disposal behavior, media use, attitudes, and message and incentive receptivity of Californians who change their own motor oil (do-it-yourselfers, or DIYers).
- Address the problem of response bias in past used oil surveys in order to obtain more accurate estimates of the used-oil recycling behavior of DIYers.
- Improve the methodology for estimating used-oil-recycling behavior.

The project consisted of four phases: a review of recent research on survey methodology and environmental issues and recycling; focus groups of DIYers not previously studied; design and execution of pilot studies to assess the effectiveness and efficiency of alternative survey methods to produce more accurate reports of used-oil recycling behavior in diverse populations; and a statewide survey, incorporating the results of the pilot study, to estimate DIY and improper disposal statewide.

The initial results of the project are presented in this report: basic frequency tabulations and other descriptive statistics, crosstabulations, limited multivariate analysis to assess the potential value of further analysis of the data, and recommendations for further study.

PRI began research of academic literature for the project in April 2000. In order to improve the ability of the planned research to reach Hispanic populations, PRI organized a forum of researchers experienced in working with Latinos. The pilot study took place in March and April of 2001. The statewide survey took place in June and July, 2001.

The statewide survey research was conducted for the CIWMB in 1994.[1] The study reported here updates the findings of that research.

Principal Findings

See also the Findings and Recommendations section at the end of this report.

DIYers

1. *What percent*? An estimated 19 percent of households change their own oil. The rate of DIY in California has probably declined from the 23 percent estimated in 1994.
2. *How many*? There are an estimated 2.3 million DIYers in California, unchanged from 1994. The *rate* of DIY has declined, but population increase leaves the *number* of DIYers about the same.
3. *Who are they*? Eighty-seven percent of DIYers in California are men. People are more likely to change their own oil if they are under 65.

[*] Contract #IWM C-9067 for $150,000.

4. *Where are they*? Sixty percent of DIYers live in the Bay Area or Southern California Coastal regions; 89 percent live in these regions plus the Central Valley and Southern California Inland. *Rates* of DIY are higher in rural areas, but the *numbers* are concentrated in the cities.

Improper Disposal

5. *Estimated rates*. An estimated 19 percent of DIYers dispose of used oil improperly by one of the five measures of improper disposal developed for this study and used throughout this report: respondents reported improper disposal directly *or* were unable to name or locate a collection center to which they said they took their oil. Other measures yield estimates of 8 percent to 36 percent. All of these estimates are lower than the Board's estimates of oil sold to the public and unaccounted for, but the survey estimates come closer than previous survey estimates do.

6. *Trend in improper disposal*. By the most similar measure, the 2001 survey estimates 8 percent improper disposal compared to 18 percent estimated by the 1994 survey. The aggregate data show that used oil collected from the public has increased. Because of unknown rates of underreporting improper disposal in both surveys, both of the survey estimates are low. The apparent change from 1994 to 2001 may reflect a decline in willingness to report improper disposal as well as a reduction in actual improper disposal.

7. *Where are the improper disposers*? Most improper disposers (57 percent) are located in the densely populated, highly urbanized regions of California—the Bay Area and the Southern California Coastal region. Substantial numbers (30 percent) also live in the Central Valley and Southern California Inland regions. Again, rates of DIY and rates of improper disposal are probably both greater in rural areas, but the numbers are in the urban centers.

8. *Race and ethnicity.* The statewide survey did *not* find different rates of improper disposal among ethnoracial groups. The 1994 statewide survey found that Hispanics disposed of used oil improperly at much higher rates than other groups, but the 2001 survey does not support the conclusion that Hispanics or any other group dispose improperly at higher rates than other groups.

9. *Newcomers*. Nevertheless, reported improper disposal is high—40 percent—among California residents who have lived in the U.S. less than five years, but drops off to native-born levels or lower among immigrants and migrant workers who have lived in the U.S. 15 years or more (8.5 percent).

10. *Convenience*. Convenience has a major impact on collection of used oil by certified collection centers. DIYers who reported living 3 miles or more from a collection center were most likely to dispose improperly. Improper disposers were more likely than other DIYers to say that closer collection facilities and curbside recycling would promote more frequent recycling among DIYers.

11. *Demographics*. This initial analysis of the survey data did not turn up other clear differences in demographics between improper disposers and DIYers who reported disposing of used oil legally. Possibly people in rural areas dispose of used oil improperly at higher rates than urban residents—the data are not conclusive in the initial analysis—and possibly women dispose improperly more than men. Multivariate analysis might confirm or disconfirm these possibilities or turn up differences that are obscured by the simpler data description methods employed for this first report.

Improper Disposal and Outreach

12. *Awareness*. There is no evidence that proper disposers are any more aware of specific impacts of used oil on the environment than improper disposers. This implies that lack of knowledge of specific impacts is not a key factor in improper disposal, with implications for how outreach is conducted.

13. *Differences in media use and leisure activities*. The survey data do *not* reveal substantial differences between improper and proper disposers in media use or in leisure activities. This suggests that outreach cannot be effectively targeted to improper disposers as a distinct group and will have to be directed toward DIYers generally.

Survey Methodology

14. *Methodology*. The pilot and statewide surveys developed, tested, and showed the effectiveness of survey methods to estimate improper disposal more accurately than previous surveys. Further methodological work is needed to investigate the properties of the methods, to establish their validity, and to improve them.

Recommendations

These recommendations are presented in greater detail, along with other recommendations, in the Findings and Recommendations section of this report.

1. *Additional research*.
   a. Additional analyses of the survey data should be carried out beyond the scope of this initial report. Questions that require more analysis continue to be raised and will be raised in the future as a broader audience of local program people engage with these findings.
   b. Research should also be continued on the properties of the measures of improper disposal developed for this survey; on the validation and improvement of alternative measures of disposal for future surveys; on other data collection methods that do not rely on surveys; on shade tree mechanics; on curbside pickup programs; and on communities where DIY rates might approach 80–90 percent.
   c. Research is indicated on trends and possible limits to the collection of used oil through certified collection centers. The Board's own aggregate data on used oil collection should be analyzed for trend—the annual rate of increase in used oil collected through certified collection centers may be declining, and the trend should be investigated and projected mathematically into future years.

2. *Outreach to DIYers*. Because DIYers who reported illegal disposal are for the most part not significantly different in media habits, leisure activities, or demographics from DIYers who claimed proper disposal, most outreach can be targeted toward DIYers generally. Outreach efforts are likely to reach the most DIYers with morning or afternoon radio advertisements, and by directing outreach to public events well attended by men and by families, including sports events and events that draw large numbers of people who are interested in automobiles, such as auto racing and auto shows.

3. *Outreach to newcomers*. California continues to experience an inflow of immigrants and migrant workers, a constant stream of people who have not been exposed to California standards and methods of used oil disposal. Special outreach efforts should be directed toward such newcomers, who report considerably higher rates of improper disposal than other groups.

4. *Consider alternative approaches to outreach*. Other research suggests that street signs may be more cost-effective than traditional mass media advertising. For some groups, in-person approaches may be much more effective than media advertising.

5. *Reconsider curbside pickup programs*. The data show that curbside pickup programs achieve a very high level of recycling. Although localities have not implemented new curbside recycling programs in recent years, this survey and other research indicate that convenience is a major predictor of recycling behavior, and curbside pickup certainly is convenient. Studies of the engineering, implementation, and effectiveness of curbside recycling programs should be considered to find out why some localities have had problems with curbside pickup and what the solutions might be.

6. *Local surveys*. In order to obtain more detailed information about DIYers in particular localities and about the effects of local programs, regional or local surveys are still needed. Such surveys should build on the methodological improvements developed by this project, provided that the improvements themselves are subjected to further analysis and validation.

Introduction

The California Integrated Waste Management Board contracted with the Public Research Institute in March 2000 to carry out a study of automotive do-it-yourselfers (DIYers)—people who change the oil in their household vehicles. The study consisted of three phases: 1) focus groups with rural farmworkers and independent truckers, frequent DIYers who have not been previously studied; 2) a pilot survey to test survey methodology; and 3) a statewide survey to estimate the prevalence of DIY and illegal used oil disposal.[*]

Purpose

The present study was intended to update the Board's data about DIYers and improper disposal from a statewide survey conducted in 1994.[2] That study concluded that, compared to other groups, Hispanics contributed disproportionately to illegal used oil disposal in California. The present study aimed to reexamine the finding that Hispanics contributed disproportionately to improper disposal, and to help the Board better define and understand the target audiences for its outreach efforts and design more effective outreach tools and messages to encourage behavioral change.

Specific objectives of the DIYers and Used Oil Disposal Study were to:

- Provide current information about the oil disposal behavior, media use, attitudes, and message and incentive receptivity of Californians who change their own motor oil (DIYers), including estimation of the rate of DIY statewide.

- Address the problem of response bias in past used oil surveys in order to obtain more accurate estimates of improper used oil disposal by DIYers.

- Improve the methodology for estimating used-oil-recycling behavior.

[*] The original design called for three focus groups of DIYers not previously studied: farm owners, rural farmworkers, and independent truckers. Only focus groups of independent truckers and farmworkers were conducted. Funds budgeted for the focus group of farm owners were not spent.

Of special concern to this project were problems of bias in surveys of used oil disposal. PRI's proposal for the project included research efforts to ameliorate bias and improve estimates of statewide DIY and illegal disposal.

PRI began reviewing academic research for the project in April 2000, looking for work on response bias (giving an inaccurate response to survey questions), non-response bias (the biasing effect of non-participation in surveys), recycling behavior, and related issues of survey methodology.

Response bias. In survey research, the social desirability problem is the tendency of respondents to overreport the performance of socially desirable behavior or underreport socially undesirable behavior. It is a commonly cited culprit for inaccurate measurement of illegal or embarrassing behavior as well as socially desirable behaviors such as volunteering and voting. Surveys of alcohol consumption show that respondents regularly underreport their consumption.[3] In studies of recycling behavior, recycling has been overreported in surveys when compared to observational measures of recycling, such as measurement of respondents' household waste.[4] Nevertheless, surveys are still the most cost-effective way to obtain information about DIYers and improper disposers, and extensive efforts have been made to reduce social desirability bias and improve survey measurements of behavior.

Non-response bias. Non-participation in surveys among groups that are difficult to reach and who are often more reluctant to be interviewed is a common problem and may bias survey results. These groups include people with lower-than-average income and education, African-Americans, and Hispanics. Hispanics were of particular concern in this study because the 1994 Deen & Black survey had concluded that Hispanics contributed disproportionately to improper used oil disposal, because many are employed as farmworkers and may be migrant or live in residences without postal addresses. Therefore, they are difficult to reach in a telephone survey, and previous research indicated that Hispanics are particularly prone to social desirability bias.[5,6] In order to improve the ability of the planned research to reach and effectively interview Hispanic populations, PRI hosted a forum of researchers experienced in working with Latinos in November 2000, in addition to the extensive literature review.

The experimental design of the pilot study was informed by the forum as well as the literature review on reducing social desirability and increasing response among difficult-to-reach and Hispanic populations. The pilot study took place in March and April of 2001. Analysis of the methods tested in the pilot study informed the methodology of the statewide survey, which took place in June and July 2001.

This report presents study objectives and methodology, results of focus groups and a pilot survey, and a first look at results of the statewide survey.

The Pilot Survey

Purpose

In its proposal to the CIWMB, PRI included the design and execution of an experimental pilot survey, deemed necessary because previous surveys of DIYers' behavior produced inaccurate estimates of illegal disposal compared with statewide sales figures. These inaccurate estimates are mostly thought to be a function of social desirability bias and non-response bias. PRI explored ways of reducing the effects of these biases so that the follow-up statewide survey would yield

more accurate information about DIYers—who they are, how they dispose of their oil, and their attitudes, media use, and activities.

A special effort was made to reach and interview rural residents and Hispanics in the pilot survey.

The pilot survey was successful in reaching substantial numbers of Hispanic respondents and in developing and demonstrating the effectiveness of survey questions and interviewing techniques that increased reporting and detection of improper disposal.

Table 1. Objectives and Purpose of the Pilot Survey

Pilot Survey Objectives		Purpose of Pilot Survey
Increase survey response by Hispanic, rural, and immigrant groups	➔	Improve the design of the statewide survey
Improve reporting and understanding of used oil disposal	➔	
Achieve more accurate estimates of used oil disposal practices	➔	

Sample

For the pilot survey, PRI used an ethnicity-targeted, random-digit-dialed (RDD) sample in order to increase the number of interviews conducted with Hispanics, especially Spanish-speaking immigrants. To obtain an adequate number of rural DIYers for subgroup analysis, three counties of varying urban influence were selected based upon their Urban Influence Code assigned by the United States Department of Agriculture (USDA).[7] From these counties, telephone exchanges in which the estimated proportion of Latino households was 40 percent or higher were used in order to increase the proportion of Hispanics in the reached sample.

The sampling method was successful in obtaining higher numbers of rural and Spanish-speaking respondents, allowing PRI to study these subgroups closely in preparation for designing the statewide survey.

The rate of participation for reached households in the pilot study was 47 percent to 52 percent over the three counties from which sample was drawn. Higher participation rates can be achieved but at high cost. For the cost and given the high level of resistance to participation in surveys, these are good numbers.

Table 2. Pilot Survey Sample Characteristics

Sampling Plan	Characteristics of the Pilot Survey Sample	
• Ethnicity targeted RDD (Hispanic) • Rural, mixed rural/urban, and urban counties: - Imperial (rural) - Monterey (mixed) - San Diego (urban) • After interviewing 200 non-DIYers, screen for DIY status and interview only DIYers.	DIYers N=400 Shade tree mechanic users* N=30 Garage/shop users N=160 Former DIYers N=29 **Total: 400 DIYers** **219 non-DIYers**	• 56% Spanish-speaking • 55% rural • 51% born in USA • 44% born in Mexico

* "Shade tree mechanics" are informal mechanics, typically unlicensed and unregulated, who change oil and do minor repairs for family and acquaintances, often in a residential yard, driveway, or street.

Survey Design and Results

Upon extensive literature review and advice from researchers experienced in working with Hispanics in California, PRI designed an experimental pilot survey to test different measures of used oil disposal and different interviewing styles.

Interviewing in Spanish. PRI hired bilingual interviewers so that Spanish-speaking respondents could be addressed immediately in Spanish, to avoid losing them during an attempted switch from an English to a Spanish-speaking interviewer.

How do neighbors dispose of used oil? Answering questions about neighbors' disposal practices may make it easier for DIYers to admit improper disposal themselves. PRI tested the effect of question order on DIYers' responses about their disposal practice: one-half of respondents were asked questions about neighbors' disposal *before* answering about their own disposal method, while the other half were asked the questions about neighbors *after* reporting their own disposal method.

Checking respondents' claims. If respondents said that they took used oil to a collection center, we asked them to name the collection center or at least name the street it was on. If they could not provide this information, we concluded that they probably did not take their oil to a collection center.

Admitting that you don't dispose properly ***sometimes***. Surveys have asked DIYers about their habitual disposal behavior, and it is difficult for people to admit that they habitually dispose of oil illegally. PRI asked a series of questions about times when DIYers might not have been able to take their oil to a collection center (when it was too inconvenient, when they did not know where there was a collection center, or for any other reason) even if they reported taking their oil to a collection center. These questions gave respondents the opportunity to admit to improper disposal after all, perhaps because the questions themselves offered justifications for sometimes not recycling. Or perhaps respondents had already been offered the opportunity to assure the interviewer, and themselves, that they generally do the right thing.

Conversational interviewing. PRI also tested a conversational interviewing mode, in which half of the respondents completed **standard mode** interviews (strictly standardized question wording

and probing) and half-completed **conversational** interviews (in which interviewers were encouraged to interact with respondents in a conversational manner, adhering less strictly to the interview script). The research literature on Hispanic populations as well as advice from the forum of Hispanic researchers informed PRI that most Spanish speakers are accustomed to participating in friendly conversations. They may be uncomfortable participating in typical survey interviews using standard script and the typical down-to-business approach.[8] All conversational interviews asked questions about neighbors' disposal *before* asking about the respondent's disposal behavior.

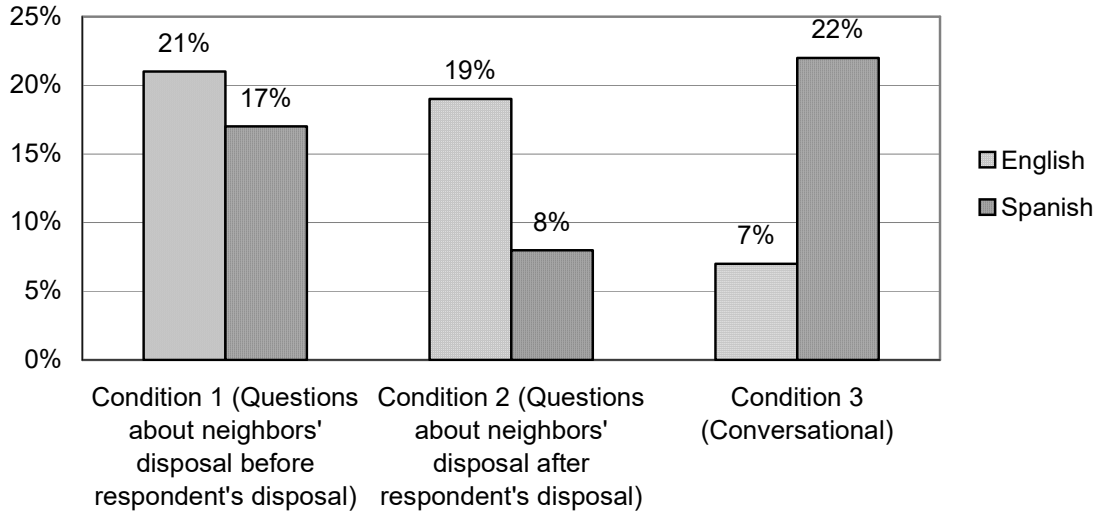
It was somewhat unclear whether Spanish-speaking interviews created a different context than those conducted in English, as interviewers reported that Spanish speakers seemed more talkative than English speakers even during standard interviews. Spanish interviews, conversational and standard, took longer on average than English interviews, while there was no significant time difference between Spanish-conversational and Spanish-standard mode interviews.

Nonetheless, Spanish-speakers who participated in conversational interviews were the most likely to reveal improper disposal methods to the interviews (22 percent), while DIYers who were interviewed in English in conversational mode were the least likely to reveal improper disposal (7 percent). The typical Spanish-speaking respondent wanted to have a conversation with the interviewer; conversational interviewing seemed culturally appropriate. The typical non-Hispanic English-speaking respondent wanted to finish the interview; standard interviewing, with its more rapid and mechanical delivery, seemed culturally appropriate for this group. For English speakers, asking about neighbors' disposal *before* questions about the respondent's disposal behavior produced a 21 percent improper disposal rate. When questions about neighbors' disposal were asked *after* questions about respondent's disposal, 19 percent reported illegal disposal.

Asking the questions about neighbors' disposal *before* DIYers were asked about their own disposal methods yielded the highest overall rate of improper disposal (19 percent). An additional 11 percent responded that there had been at least one time in the year prior to the interview when they had not taken their oil to a collection center because of inconvenience, not knowing where there was a collection center, or another reason.

See Figure 1 for reported improper disposal in the pilot survey by language of interview, and for interview condition.

Figure 1. Pilot Survey—Percent Reported Improper Disposal by Language of Interview and Experimental Condition (N=400)



Based upon these results, PRI decided in the statewide survey:

- To use the standard interviewing style for non-Hispanic respondents; interviewers were permitted to use a more conversational style with Spanish-speaking respondents.
- To ask questions about neighbors' disposal *before* questions about DIYers' own disposal practices.
- To ask a series of questions to induce respondents to admit to improper disposal or to detect probable improper disposal even if they did not admit it.

See Table 3 for a synopsis of the pilot study design, results, and implications for the statewide survey.

Table 3. Pilot Study Design and Results

Pilot Study Components	Design	Results	Implications for Statewide Survey
Conversational interviewing ➔	Half participated in conversational interviews, half with strictly scripted questions and probing.	Conversational increased reporting of improper disposal among Spanish speakers but had an adverse effect on English speakers.	**Employ standard interviewing with English speakers.**
Questions about neighbors ➔ (Standard interviews only; all conversational interviews had questions about neighbors *before* questions of their own disposal.)	Half received questions about neighbors' disposal *before* questions about their own disposal, half *after.*	Questions about neighbors *before* questions of DIYers' own disposal increased reporting of improper disposal for English and Spanish speakers.	**Ask questions about neighbors *before* questions about respondent's disposal behavior.**
Alternative measures of disposal (two examples): ➔ Detecting non-recycling. Where do you take your used oil? Some respondents cannot say either a name or a street. Admitting non-recycling. Has there been a time in the past year when you have not recycled because of inconvenience, you didn't know where there was a facility, or other reasons?	All DIYers were asked alternative measures of disposal.	Eleven percent of DIYers who reported taking oil to a collection center could not give a name or a street. An additional 13 percent of DIYers admitted not having taken oil to a facility at least once in the past year.	**Include alternative measures of disposal.**

The Statewide Survey

Purpose

The statewide survey was intended to update and improve upon the 1994 Deen & Black survey data, informing the CIWMB and its used oil recycling program about current prevalence, disposal practices, media use, and attitudes of DIYers in California in order to better define and understand the target audience for their outreach efforts. The statewide survey was designed based on the results of PRI's extensive literature review, the Hispanic research forum, and results of the pilot study in March and April 2001.

Method

Data collection for the statewide survey took place in June and July 2001. Respondents had the choice of being interviewed in Spanish or English. Because the conversational style of interviewing was successful in the pilot survey for Spanish-speakers, Spanish-speaking interviewers were allowed to use a more conversational style when conducting interviews in Spanish.

Sample

A complex sample design was employed in order to gather the maximum possible information at the least cost. Rural residents are more likely to be DIYers but because there are far fewer rural residents in California than urban residents, they are less likely to be selected in a random sample. In order to obtain adequate numbers of rural residents for meaningful analysis, the sample was stratified according to urban/rural status based on the USDA Urban Influence Code. Counties with a code 1, "metropolitan," constituted the **urban stratum** (83 percent of California's actual population), and counties with codes 2–9 were placed in the **rural stratum** (an estimated 17 percent of California's actual population). PRI obtained a random-digit-dial sample frame of 20,000 California residents, in which half of the telephone numbers were drawn from the counties in the urban stratum, half from counties in the rural stratum. Telephone numbers for calling were drawn randomly from this frame.

The stratified sampling plan was successful in producing a sufficient number of residents of rural counties: the 3,808 adults reached by telephone include 1,858 (49 percent) from rural and 1,950 (51 percent) from urban counties.

PRI contracted to interview 1,200 adult Californians. Because most of the high-priority issues focused on the sample of DIYers, a sample target of 800 DIYers (67 percent) and 400 non-DIYers (33 percent) was set. As DIYers were estimated to be only a fraction of California adults, a screening process was implemented to obtain the target number of DIYers and non-DIYers.

In the first phase of the survey, PRI interviewed all DIYers and non-DIYers who agreed to participate in it. If the person answering the initial call indicated that someone in the household changed the oil in household vehicles (a DIYer), interviewers asked to speak to that person and only interviewed him or her.

After the target number of non-DIYers had been interviewed (420), we began the second phase, working toward the target of 800 interviews with DIYers. In the second phase, all persons contacted by telephone were first screened for DIY status by asking them who changed the oil in their household vehicles. At that point, non-DIYers were thanked and the interview was terminated. Only DIYers were fully interviewed in the second phase.

All households that were interviewed in the first phase or that answered at least the screening question in the second phase constitute the **reached sample**. All households that completed a full interview in either phase comprise the **interviewed sample**.

For analysis of the **reached sample**, a sampling weight was applied to adjust for the deliberate oversampling of rural residents. Values of the sampling weight were 0.35 for interviews from rural counties and 1.62 for interviews from urban counties.

For analysis of the **interviewed sample**, a combined sampling and screening weight was applied to adjust simultaneously for urban-rural stratification with disproportionate sampling and for the disproportionate representation of DIYers obtained through the screening process. Values of the combined sampling and screening weight ranged from 0.118 for rural DIYers deliberately oversampled to 3.13 for urban garage/shop users who were deliberately undersampled.

The combined stratification and screening process, with disproportionate random sampling followed by weighting, permits us both to make accurate statewide estimates and to provide reliable information about DIYers and about people in rural areas of California that would not be available with a simple random sample of California households obtained at equivalent cost.

Margins of error. From the reached sample (N=3,808) we obtain an estimate that 19 percent of Californians change their own motor oil (DIYers). The margin of error for this estimate is $\pm$ 1.5 percent at the 95 percent confidence level, using a statistical routine designed for stratified and weighted survey data.[*]

The fully interviewed sample (N=1,206) permits analysis of differences between DIYers and non-DIYers. These are often in the form of percentages estimated for subgroups. For example, we obtain the estimate that 17.2 percent of whites in California change their own motor oil. This estimate is based on 738 whites in the sample; its margin of error is $\pm$ 2.6 percent at the 95 percent level of confidence. For the estimated 23.4 percent of Hispanics who change their own oil (N=256), the margin of error is $\pm$ 5.5 percent. Margins of error are greater for estimates based on smaller subsamples and for estimates of population percentages closer to 50 percent than for percentages closer to zero or 100.

Table 4 summarizes the main features and purposes of the statewide samples.

[*] All analysis was performed using the -svy- series of commands by the *STATA* Corporation, Version 7.0.

Table 4. Samples for the Statewide Survey

Sample		Sample Breakdown		Purpose
Reached sample: 3,808 people were interviewed briefly to determine who changed motor oil in their household. **Margin of error: ± 1.5% at 95% level of confidence**	➔	DIYer STM user Garage/shop user	842 133 2,833	Estimate the prevalence of do-it-yourself (DIY) oil changing in California.
Interviewed sample: 1,206 people out of the reached sample were interviewed about oil-changing practices and demographics. **Margin of error: ± 2.9% at 95% level of confidence; may be more for subsamples and less for percentages close to zero or 100. See text.**	➔	DIYer STM user Garage/shop user	786 22 398	Compare DIYers and non-DIYers. Assess explanations for DIY and DIY cessation.
Interviewed sample (DIYers only): 786 of the interviewed sample were DIYers. They received the full interview, answering questions about oil disposal, media use, and other issues. **Margin of error: ± 3.6% at 95% level of confidence; may be more for subsamples and less for percentages close to zero or 100. See text.**	➔	DIYer	786	Study the DIYers and their oil-disposal practices, knowledge, and beliefs, and their media use.

Sample Characteristics

The rate of participation in full interviews for reached households in the statewide survey was 47 percent.[*,9] Interviews were conducted in English and Spanish, with 1,081 full interviews in English and 125 in Spanish (11.6 percent).

Table 5 shows that African-Americans, Asians, and Latinos are underrepresented, or appear to be underrepresented, in the sample compared with the 2000 Census figures. There are four reasons for this. First, the Census data are for the population as a whole, but only adults are eligible for the survey. Greater percentages of the African-American, Asian, and Latino populations in California are children, so any survey of adults will pick up fewer respondents from those groups than the population data indicate.

Second, African-American and Asian residents are concentrated in urban areas, and we deliberately undersampled urban areas in order to have analyzable data on people in rural areas of California.

Third, we experienced lower survey response rates among African-Americans, which is common in survey work.

Fourth, the contract did not provide for interviewing in any Asian language and resources did not permit it, so the survey certainly missed people of Asian origin whose English language skills are poor and who might have been willing to participate in the survey if we had been able to interview in Asian languages.

People with lower income and education levels tend to participate in surveys less frequently, and Table 5 shows that the interviewed sample also underrepresents them somewhat.

[*] Participation rates of 40-50% are common in household surveys in which interest and incentive to participate is low, unless large sums are allocated to increase participation. This participation rate is the proportion of completed interviews in households we were able to reach on the telephone where someone either completed an interview or clearly refused to participate: completed interviews/(completed interviews + refusals). The calculation omits (a) potential respondents who had initially refused or were scheduled for callbacks at the time interviewing was halted and (b) telephone numbers that we had dialed one or more times without reaching a person, where potentially eligible respondents might also have lived. If we take these potential respondents and numbers into account, the response rate is 38%. See endnote 9.

Table 5. Characteristics of the Statewide Interviewed Sample (N=1,206)

Category	Interviewed Sample		Population of California
Race/ethnicity*	White	63%	51%
	African-American/black	3%	6%
	Asian/Pacific Islander	6%	12%
	Native American	2%	<1%
	Hispanic/Latino	22%	28%
	Other/mixed ethnicity	4%	2%
Age*	18 to 24	12%	14%
	25 to 44	45%	43%
	45 to 64	31%	28%
	65 and older	12%	15%
Income†	Less than $15,000	10%	14%
	$15,000 to $24,999	15%	12%
	$25,000 to $39,999	22%	17%
	$40,000 to $69,999	29%	28%
	$70,000 to $99,999	11%	28%
	$100,000 or more	12%	14%
Education† (Persons 25 years and over)	Less than high school	8%	22%
	High school	34%	20%
	Some college	36%	30%
	College graduate	29%	18%
	Graduate school	10%	10%

* U.S. Census Bureau, Census 2000 of Population and Housing, Summary File 1.

† U.S. Census Bureau, Census 2000 Supplementary Survey.

Who Changes Oil for California Households?

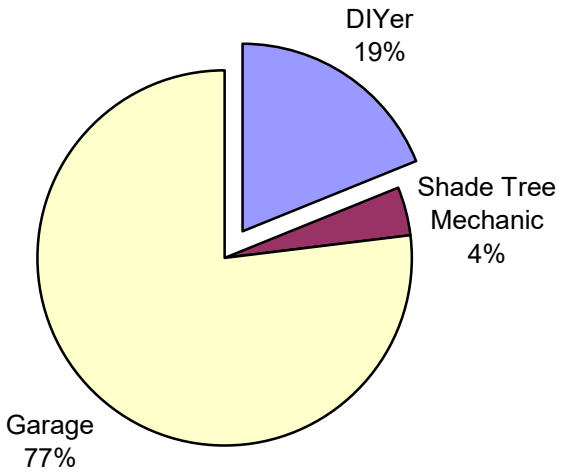
In 2000–2001, DIYers changed motor oil in 19 percent of California households (Figure 2). Because residents of California with lower levels of education and income are underrepresented in the survey sample because of their higher rates of nonparticipation, and because Asian newcomers, mainly Chinese, are underrepresented due to language, 19 percent is probably an underestimate.

"Shade tree mechanics" (STMs) changed oil in 4 percent of households. STMs are informal mechanics, typically unlicensed and unregulated, who change oil and do minor repairs for family and acquaintances, often in a residential yard, driveway, or street. Seventy-seven percent of households took their vehicles to a garage or auto repair shop.

Projecting these percentages onto the total number of households in California, we estimate at least 2.3 million DIYer households and 500,000 who take their automobiles to a STM.

Who changes oil?	Number of households
DIYer	2.3 million
STM	0.5 million
Garage or shop	9.4 million

Figure 2. Who Changes Oil for California Households? (N=3,808)



Trend

The proportion of California households in which oil is changed by a DIYer has probably declined since the previous statewide survey in 1994. The Deen & Black survey in 1994 estimated that 23 percent of California households had a DIYer, with a margin of error of ± 1.6 percent. The survey reported here estimates 19 percent DIYers with a margin of error of ± 1.5 percent. The probability that sampling error alone could have produced the estimated 4 percent decline is small. Still, we are not entirely certain that the decline is real because of unknown differences in survey methodology and participation.

The number of DIYers in California may not have changed since 1994: the *rate* of DIY has probably declined, but population increase leaves the *number* of DIYers about the same.

Former DIYers

The survey asked non-DIY households whether they had had their oil changed by a DIYer within the two years prior to the interview. Nine percent of non-DIY households said they did. DIY probably fluctuates with unemployment and income, rising in recessions, falling in period of peak economic activity.

The former DIY households constitute an estimated 7.3 percent of all households. The survey did not attempt to determine how many households shifted from non-DIY to DIY.

Of the former DIYers, one-third said that they stopped changing their own oil because of time or convenience issues; 17 percent said that disposing of the used oil was too much of a problem.

Who are the DIYers?

Income

Table 6 shows that DIYers have somewhat lower household incomes than garage/shop users on average. Income influences DIY oil-changing somewhat, but it is not a determining influence on DIY—people with both low and high incomes prefer to change their own oil.

People who have their oil changed by STMs tend to have substantially lower household incomes—more than 60 percent of STM users have household incomes lower than $25,000—suggesting that income *is* a strong motivator for using STMs rather than established garages or oil-changing facilities.

Table 6. Household Income by DIY Status (N=992)

Household Income	DIYer	STM User	Garage/Shop User	California Households*
Less than $15,000	**8%**	32%	9%	14%
$15,000 to $24,999	**15%**	29%	12%	13%
$25, 000 to $39,999	**23%**	15%	17%	17%
$40,000 to $69,999	**31%**	12%	30%	28%
$70,000 or higher	**23%**	12%	32%	28%
	100%	100%	100%	100%
N of respondents	660	20	312	

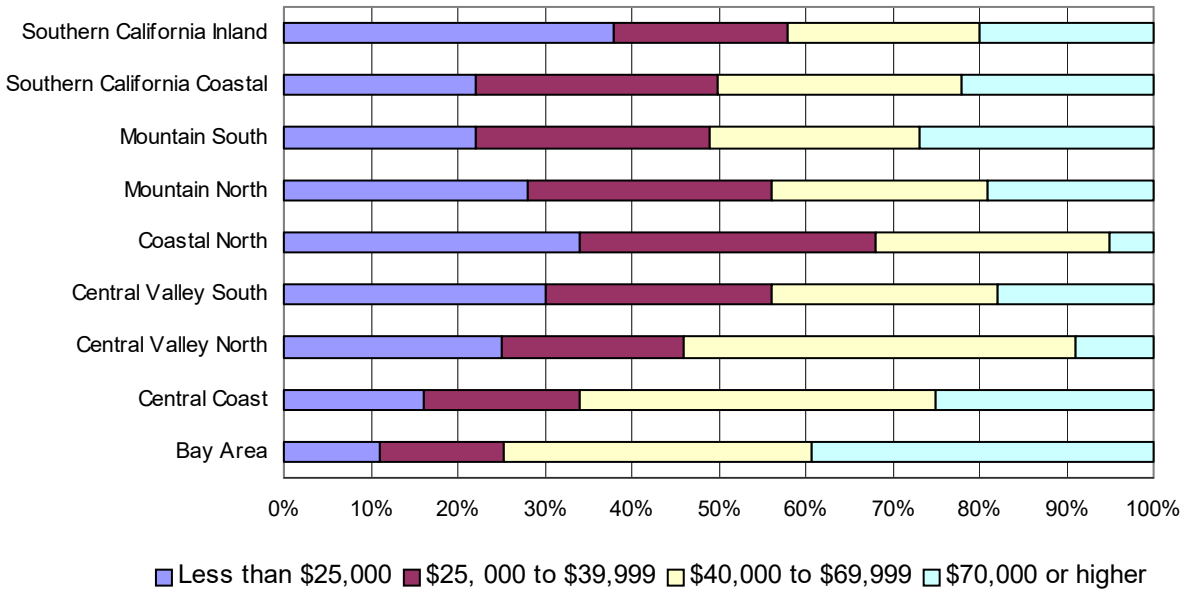
*U.S. Census Bureau, Census 2000 Supplementary Survey.

Note: differences in household income between DIYers, STM users, and garage/shop users are statistically significant in spite of the small number of STM users.

Income by Region

DIYers in the Bay Area tend to have somewhat higher income than those in other regions, while DIYers in the Southern California Inland and Coastal North regions have lower than average household income (Figure 3).

Figure 3. DIY Household Income by Region (N=992)

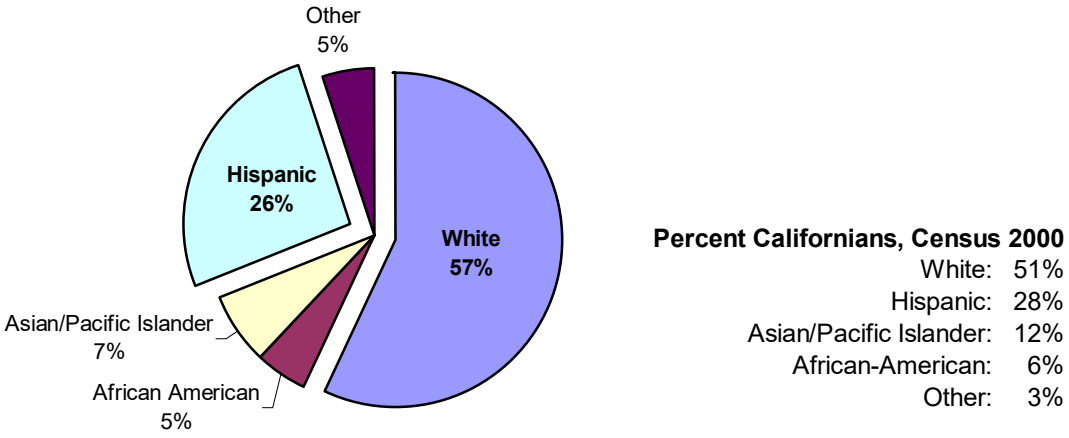


Because 2000 Census data for household income are not yet available at the county level, it is not clear whether the differences between region in Figure 3 simply reflect differences in income between regions, or real differences in the income levels of DIYers by region.

Race

An estimated 17 percent to 24 percent of all the largest ethnoracial groups are DIYers, with no statistically significant differences between groups (Figure 4). The distribution of DIYers by race is determined primarily by the size of each group in the California adult population. However, this probably understates the percent of DIYers who are African-American and Asian. These groups participated in the survey at lower rates. African-Americans, for example, might well comprise 10 percent rather than 5 percent of DIYers in California. Research that targets these groups would be necessary to ascertain their DIY and disposal behavior accurately.

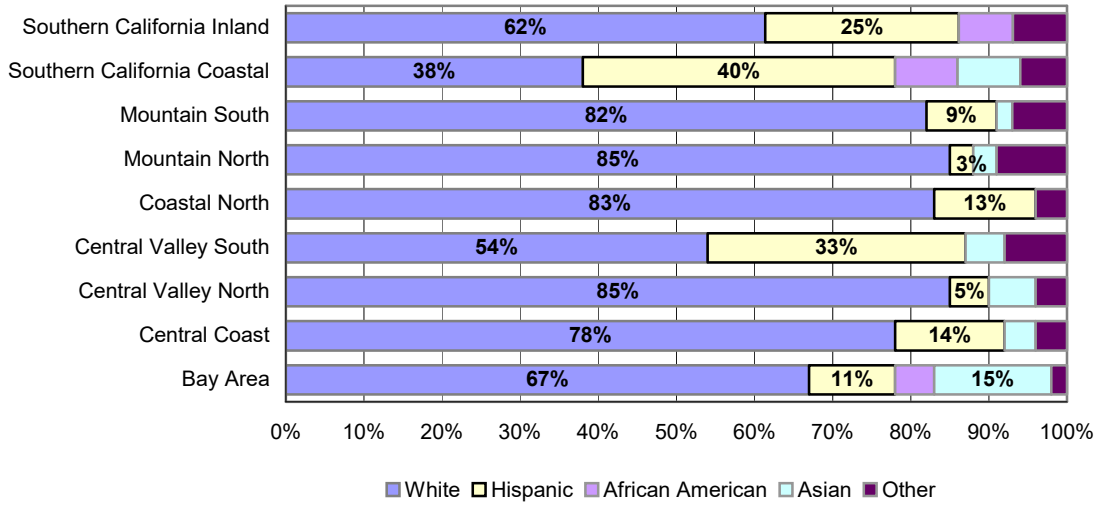
Figure 4. California DIYers by Race (N=753)



DIYers by Region and Race

Figure 5 shows that whites are a majority of DIYers in all regions except the Southern California Coastal region, where 40 percent of DIYers are Hispanic and 38 percent are non-Hispanic whites. In the San Francisco Bay Area, Asian/Pacific Islanders are 15 percent of DIYers, a higher proportion than other regions. Outreach efforts to particular groups of DIYers reached by different media and in different languages may be important in some regions.

Figure 5. DIYers by Region and Race (N=753)



Age

Table 7 shows how DIYers and non-DIYers in the survey, and Californians generally (Census), are distributed over the adult age range. DIYers are clearly younger than non-DIYers—nearly twice as likely as non-DIYers to be 18–24, much less likely to be 65 and older.

Table 7. Age of DIYers, Non-DIYers, and Californians

	DIYers	Non-DIYers	All Californians*
18 to 24	**15%**	8%	14%
25 to 44	**49%**	45%	43%
45 to 64	**30%**	28%	28%
65 and older	**7%**	18%	15%
Total	**100%**	100%	100%

* U.S. Census Bureau, Census 2000 of Population and Housing, Summary File 1.

Education

DIY is related to education. Twenty-four percent of people with high school education or less change their own oil, followed by 19 percent of those with some college or B.A. degrees and 11 percent of those with graduate school education. Nevertheless, substantial numbers of DIYers are found at all levels of education.

Table 8 compares education levels of DIYers with the education levels of all Californians 25 and older. The sample DIYers 25 and older with less than high school education are a smaller group (8 percent) than in the population (22 percent). However, this is about the same difference as in Table 5, Characteristics of the Statewide Interviewed Sample, so the difference between DIYers

and population here is the result of underrepresentation of people with less than high school education in the sample as a whole, not because DIYers are really different from Californians generally with respect to education.

Table 8. Education Levels of DIYers and of the Population 25 and Older

	Percent of all California DIYers, (N=758)	Percent of California DIYers 25 and older, (N=658) (For comparison with Census data)	Percent Californians 25 and older*
Less than high school	**7%**	8%	22%
High school	**31%**	28%	20%
Some college	**29%**	28%	30%
College graduate	**25%**	27%	18%
Graduate school	**8%**	9%	10%
Total	**100%**	100%	100%

* Census 2000 Supplementary Survey, U.S. Census Bureau, 2000.

Language Spoken, Country of Origin, and Years in U.S.

Spanish speakers are slightly more likely to change their own oil: 22 percent of Spanish speakers, 24 percent of bilingual English-Spanish speakers, and 18 percent of English-only speakers are DIYers. However, the differences are not statistically significant at conventional levels. More data or multivariate analysis is necessary to determine whether Spanish language or limited English language are in fact associated with DIY oil changing.

Californians born in the U.S. and those born in other countries are equally likely to be DIYers, and DIY is *not* related to how long people born in other countries have lived in California.

Where Do DIYers Live?

Of the California Geographical Areas designated by the CIWMB, the Coastal North region has the highest rate of DIY at 36.9 percent (Table 9). It is apparent that DIY rates are lowest in the three highly urbanized regions listed first. People in rural regions are indeed more likely to change their own oil; nevertheless, almost 70 percent of all DIYers in California live in Southern California and the Bay Area (cumulative DIYers column), and almost 90 percent live in those regions and the Central Valley combined.

Although the big numbers are in the cities, outreach efforts and other programs in regions with higher rates of DIY—such as Coastal North and the two Mountain regions—will reach a higher proportion of DIYers.

Table 9. Prevalence of DIY Households by Region

	Percent DIY	Households in region*	Households w/DIYers	Percent of all CA DIYers	Cumulative DIYers
Southern California Coastal	**17.7%**	5,648,989	997,047	**38.7%**	38.7%
Bay Area	**16.9%**	2,620,188	442,550	**19.8%**	58.5%
Southern California Inland	**19.8%**	1,187,553	234,898	**11.1%**	69.7%
Central Valley South	**26.4%**	1,129,694	298,239	**10.5%**	80.2%
Central Valley North	**21.3%**	867,106	184,607	**8.5%**	88.7%
Central Coast	**20.2%**	486,431	98,162	**3.8%**	92.5%
Mountain South	**27.0%**	132,932	35,825	**3.4%**	95.9%
Coastal North	**36.9%**	121,507	44,812	**2.5%**	98.3%
Mountain North	**26.3%**	88,052	23,175	**1.7%**	100.0%

*State of California Department of Finance, County Population Projections with Age, Sex and Race/ Ethnic Detail. Sacramento, California, December 1998. California regions are mapped at <www.ciwmb.ca.gov/lgcentral/summaries/regional/CaRegMap.htm> as of October 22, 2001.

How Much Oil Do DIYers Consume?

The survey asked respondents the make and year of every vehicle in their household; the number of quarts they replaced per oil change; and the number of times they had changed the oil in the vehicle in the past year. We asked also about the number of quarts added between changes. We multiplied number of quarts per change times the number of changes; multiplied number of quarts typically added between changes times the number of changes; summed across vehicles for each respondent; converted to gallons; and projected this estimated sample total onto the population.

The survey data yielded an estimated mean of 6.7 complete oil changes per year for DIYers. California DIYers consumed an average of 35.2 quarts of motor oil in the year 2000–2001. Projected onto the estimated 2.3 million DIYers in California, we estimate that they used 20.8 million gallons of oil for oil changes and oil added between changes in household vehicles.

The survey estimate of 20.8 million gallons in 2000–2001 is lower than the CIWMB's estimate from sales data that "the California 'do-it-yourself' public purchased an estimated 33 million gallons of lubricating oil in 2000."[10] However, the 33 million gallons include sales of oil to the public that was used by non-household vehicles and in non-vehicle equipment not covered by the survey. Underrepresentation of African-Americans and Asians and of lower-education and lower-income groups in the statewide sample also contributes to underestimation of total oil used. All things considered and given the difficulty of recalling accurately how often people changed oil in the past year, the survey estimate is not far off the mark, which increases our confidence in the survey data.

Table 10 shows survey estimates of oil consumption by region, listed in order of descending gallons consumed in 2000–2001. The order of the regions and the percentage shares of statewide

oil consumption differ somewhat from the estimates of the number of DIY households per region summarized in Table 9. The Southern California Coastal region and Central Valley South loom larger in share of oil consumed; DIYers in most other regions consumed smaller shares of oil than their percentages of statewide DIYers.

Table 10. Consumption of Oil by Region—Survey Estimates

	DIY Households	Annual Gallons Consumed	Percentage of Total Oil Consumed	Cumulative
Southern California Coastal	997,047	9,004,192	**43.3%**	43.3%
Bay Area	442,550	3,864,591	**18.6%**	61.9%
Central Valley South	298,239	2,615,776	**12.6%**	74.5%
Central Valley North	184,607	1,841,306	**8.9%**	83.4%
Southern California Inland	234,898	1,702,807	**8.2%**	91.6%
Central Coast	98,162	778,836	**3.7%**	95.3%
Coastal North	44,812	384,216	**1.8%**	97.2%
Mountain South	35,825	349,453	**1.7%**	98.8%
Mountain North	23,175	240,956	**1.2%**	100.0%
Total	2,359,314	20,782,133	**100.0%**	

Improper Disposal

In order to reduce social desirability bias in the reporting of used oil disposal, PRI developed a set of verification and prediction questions in addition to the survey item that asked DIYers straightforwardly how they disposed of the used oil from their oil changes in the past year. These measures were tested in the pilot study and determined to be effective in identifying some DIYers who may be improper disposers at least some of the time but are unwilling to reveal illegal disposal practices in the survey setting. All of the measures are born out of the fact that past surveys have grossly underestimated improper disposal.

The verification and prediction questions included asking respondents to state the name or the street of the collection center to which they reportedly took their used oil for recycling. It also asked respondents if they had, at any time in the past year, been unable to recycle used oil because of inconvenience, because they did not know where they could dispose of used oil, or for any other reason, or because they were turned away. Respondents were also asked about their neighbors' disposal practices. Table 11 lists the questions for each measure.

Table 11. Measures of Improper Disposal

Measures of Improper Disposal		Question Asked
1	**Admitted improper disposal**	For each oil change, can you tell me what you did with the used oil?
2	**Can't name center**	Can you tell me the name or the street of the collection center where you took the used oil?
3	**Haven't recycled at least once**	In the past year, has there been a time when you weren't able to take your used oil to a collection facility... 1) ...because you did not know where to find one? 2) ...because it was too inconvenient for you to do so? 3) ...for any other reason?
4	**Turned away from a collection center**	In the past year, have you been turned away from a collection center because it was too full and not taking any more oil?
5	**Reported neighbors' improper disposal**	What do you think most of your neighbors (who are also DIYers) do with their used oil?

Measure 1 is obvious enough. Most improper disposers do not want to admit it, but those who do admit it are clearly classifiable as such. Each of the subsequent measures is based on a conjecture. We use measures 2–5 to predict that respondents who told us they took their oil to a collection center actually did not.

The question for Measure 2—"Can you tell me the name or the street of the collection center where you took the used oil?"—was asked of people who said they took their used oil to a collection center. Measure 2 is based on the proposition that people who can name neither the center nor the street where it is located probably did not actually take their oil there.

Measure 3 is based on the premise that people might be unwilling to admit flat out that they do not recycle their used oil, but they will be less unwilling to admit that they *sometimes* "weren't able" to take their oil to a collection facility for particular, plausible reasons. The three questions give respondents permission to admit failure to recycle. Although we cannot verify through independent observations that respondents who admit sometimes failing to recycle actually consistently dispose of oil improperly, we suspect that is the case for many of these respondents.

Measure 4 accepts that a respondent may have taken oil to a facility but they may have been turned away. An estimated 6 percent of DIYers, or 138,000 people, said this had happened to them at least once within the past year. Again, many of these may not have actually deposited their oil at a collection center.

Measure 5 is based on the premise that respondents who will not reveal their own improper oil disposal may project it onto their neighbors.

We use these five measures to develop incremental estimates of improper disposal. Each successive question produces an increment of respondents who had not admitted improper

disposal but now reveal that they lack knowledge consistent with actual recycling, or they admit to some problem or barrier that at least sometimes prevents them from recycling, or they attribute improper recycling to their neighbors.

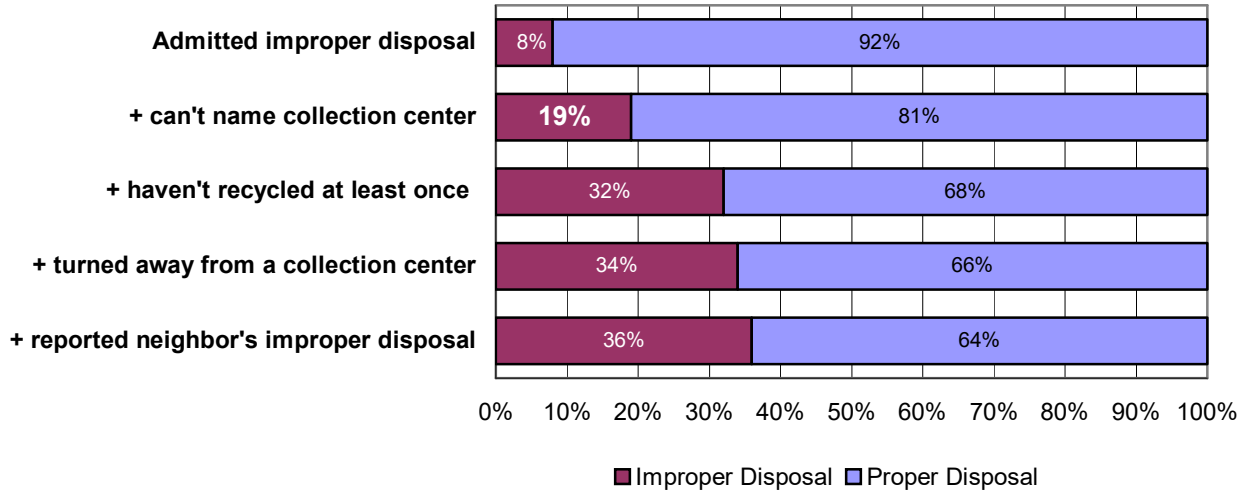
Incremental Estimates of Improper Disposal

Figure 6 displays the estimates of improper disposal composed by applying each of the five measures incrementally, adding to the respondents classified as "likely improper disposal" on the previous measure. None of the measures except measure 1 is on the face of it an entirely valid indicator of improper disposal—but of course measure 1 by itself grossly underestimates improper disposal. We believe that the combination of measures 1 and 2 is very likely to be accurate. The status of the other measures and therefore of the incremental estimates in Figure 6 remains hypothetical, needing further analysis and verification by independent observation.

We regard inability to name either a collection facility or its street location as a dependable indicator that a respondent actually does not recycle. We see in Figure 6 that 8 percent of respondents admitted improper disposal outright, but an additional 11 percent could not name a facility or its location. We estimate, then, that these respondents—19 percent of the DIYers—dispose improperly. We use this measure throughout this report to estimate improper disposal and identify improper disposers of used oil. We are reasonably confident that these DIYers have not recycled their oil. We are also confident that many respondents say they recycle but actually do not, and they do not answer any of these questions positively. Respondents are reluctant to reveal illegal behavior or behavior they are ashamed of.

Measure 3, admitting to failure to recycle at least once for at least one reason, taps an additional 13 percent of DIYers, for an estimate of 32 percent improper disposers. Measures 4 and 5 add relatively little (2 percent each) to the totals accumulated by the previous measures. The highest estimate, 36 percent, is still far lower than the percentage of used oil generated by the DIY public, not lost in driving, and not recycled, which is 65 percent.[11]

Figure 6. Incremental Estimates of Improper Disposal



Who Are the Improper Disposers?

There are no significant differences between improper disposers—19 percent of DIYers with incremental measure 2—and DIYers in general in terms of race, income, education, gender, or age. Considering these demographic items, for all intents and purposes, improper disposers are like DIYers in general.

Improper Disposal and Region

Regional estimates of improper disposal range from 16 percent in the Bay Area to 28 percent in the Mountain South region (Table 12, data column 1). These rates appear to be related to differences between regions in their urban-rural makeup. The most urban regions show the lowest percentages of improper disposers, while very rural Mountain regions have the highest percentages.

The differences between regions in the rate of improper disposers in column 1 of Table 12 are *not statistically significant* overall, but improper disposal *is* significantly related to county percent rural (1990 Census). Based on all the DIYers (N=786), the rate of improper disposal is:

- 16 percent in urban counties (0–9.9 percent rural), with 70 percent of the state's population.
- 25 percent in the more rural counties (10–100 percent rural), with 30 percent of the state's population.

Data columns 2 and 3 in Table 12 show how improper disposers are distributed over region compared to population. The Southern California Coastal region has a lower percentage of improper disposers (39 percent) than population (49 percent), a statistically significant difference. The survey data estimate that the Mountain South region has 5 percent of the state's improper disposers compared to only 1 percent of population, and this difference is also statistically significant. That is, it probably represents a real difference between the concentration of improper disposers in the Mountain South region and the share of the state's population there.

Table 12. Percent Improper Disposal by Region

	Percent of DIYers Who Dispose of Oil Improperly, by Region* (N=786)	Improper Disposers by Region (N=164)	Population by Region (2000 Census)
Southern California Coastal	19%	39%	49%
Bay Area	16%	18%	17%
Central Valley South	22%	11%	10%
Southern California Inland	18%	10%	10%
Central Valley North	19%	8%	6%
Central Coast	23%	4%	4%
Mountain South	28%	5%	1%
Mountain North	26%	2%	1%
Coastal North	20%	2%	1%
Total	-	99%**	99%**

* The bases of these percentages are the estimated numbers of DIYers in each region.
** Does not add to 100 percent because of rounding.

Improper Disposal and Race

Differences between ethnoracial groups in the percentage of improper disposers are not statistically significant. There may be differences, but there are too few African-American and Asian-origin DIYers in the sample to justify any conclusion.[*] There is no evidence to support a conclusion that Hispanics dispose improperly at a disproportionate rate or make a disproportionate contribution to overall improper disposal in California.

It is also instructive to run percentages in the other direction, to answer the question—"Of all improper disposers in California, what percent are of each ethnoracial group?"—comparing the statewide distribution of improper disposers to the distributions of DIYers and of the statewide population, in Table 13. Although African-Americans and Asians are improper disposers at somewhat higher levels than they are DIYers in the sample, the differences between the three distributions of Table 13 are not great, and they are not statistically significant.

[*] An estimated 28 percent of the Asian-origin and 27 percent of the African-American DIYers were improper disposers, but these estimates are based on only 41 Asian and 20 African-American DIYers—not enough to support conclusions about differences compared to other groups. An estimated 16 percent of Hispanic and 19 percent of white DIYers were improper disposers based on 179 and 469 interviews, respectively. Additional interviews with Asians and African-Americans could determine whether their rates of improper disposal are different than rates of other groups.

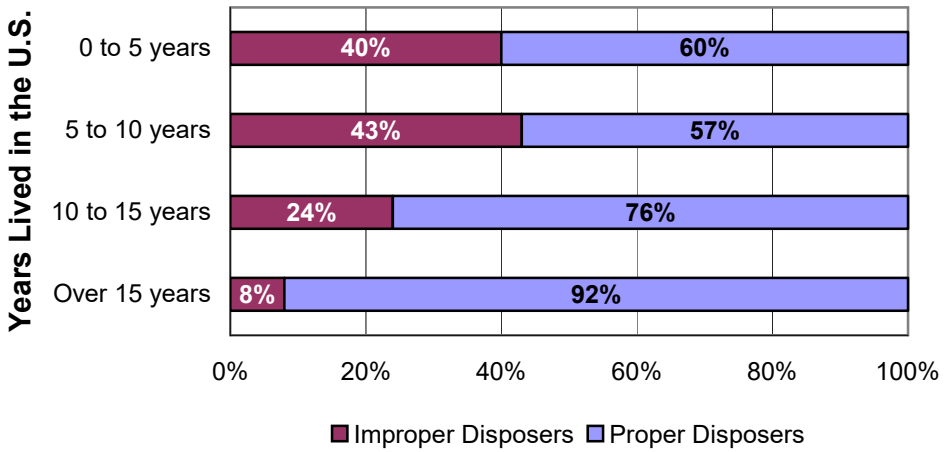
Table 13. Improper Disposers in California by Race (N=753)

	DIYers (N=753)	Improper Disposers (N=155)	Actual Population (2000 Census)
White	57%	56%	51%
African-American	5%	7%	6%
Asian	7%	11%	12%
Hispanic	26%	21%	28%
Other	5%	5%	3%
Total	100%	100%	100%

Improper Disposal and Years Lived in the U.S.

Twenty-three percent of DIYers in California were born in another country. For these immigrant DIYers, the number of years lived in the U.S. is significantly related to illegal disposal: those who have lived in the U.S. for 10–15 years or longer are less likely to use an illegal disposal method than newer immigrants. Figure 7 shows that the proportion of improper disposers, 40-43 percent for people who have lived in the U.S. for up to 10 years, drops off to 24 percent for 10-15 years and 8 percent for people who have lived here 15 years or longer.

Figure 7. Improper Disposal by Years Lived in the U.S. (N=154)



Recall that Hispanics in general are not significantly more likely to dispose improperly. In spite of that, the survey data show that *newcomers to the U.S.*—both Hispanic and non-Hispanic—*are* more likely than other DIYers to dispose improperly. Newcomers are more likely to dispose improperly than non-immigrants and more likely than residents born abroad who have lived in the U.S. 15 years or more. Among the improper disposers who were born abroad, 75 percent have been in the U.S. for less than 15 years. All of this implies a significant concentration of improper disposers among newcomers. The largest single group of non-Hispanic newcomers are of Chinese origin, but the non-Hispanic newcomers are very diverse and include many Europeans.

The survey data indicate that 80–90 percent of DIY non-Hispanic newcomers (0–15 years) and about 60–80 percent of DIY Hispanic newcomers live in urban areas. It might be difficult to design effective outreach to newcomers generally, but these findings suggest that DIYers who are recent immigrants to the U.S. do improperly dispose at substantially higher rates. Perhaps effective outreach could be devised to the largest language groups and through organizations that serve the needs of newcomers.

Improper disposal among recent immigrants is apparently not a problem of awareness of particular impacts of used oil on the environment. Recent immigrants were about as aware of particular impacts as long-term immigrants, who in turn are as aware as DIYers born in the U.S. However, newcomers may well be less aware of conveniently located collection centers, and in any case their oil-disposal behavior is different.

Storage and Reuse of Used Oil

Many DIYers temporarily store their used oil at their residences before they dispose of it. Fifteen percent of all DIYers surveyed said that they had stored used oil on their premises within the past year. This survey did not ask respondents how long they typically store oil, but it is telling that 91 percent of those who reported storing oil in the past year still had the oil on their premises at the time of the interview. These respondents reported a mean of 5.4 gallons of oil in storage. Roughly, this translates into an estimated 1.5 million gallons of used oil stored by DIYers at the time of the survey. Most of those who said that they store oil (95 percent) claimed that they eventually dispose of the oil properly.

Table 14 shows that urban residents are less likely than rural residents to store oil; they also store less oil than rural residents on average.

Table 14. Used Oil Storage by Urban/Rural Residence

	Average Gallons in Storage (N=114 DIYers Who Store)	Percent DIYers Who Store Oil (N=779 DIYers)
Urban counties	4.65	12%
Rural counties	7.39	16%

An estimated 3 percent of California DIYers save their used oil for household or other vehicle reuse. The most common use reported is lubrication of tools and wood. Reuse that directly reintroduces used oil to the environment is infrequent, on the accounts of survey respondents.

Table 15. Most Common Reported Uses for Used Oil (N=32 reusers)

Method of Reuse	Frequency	Percent
Equipment/wood lube	16	55%
Filter and reuse for smaller engine	7	24%
Kill weeds/herbicide	3	10%
Other	3	10%

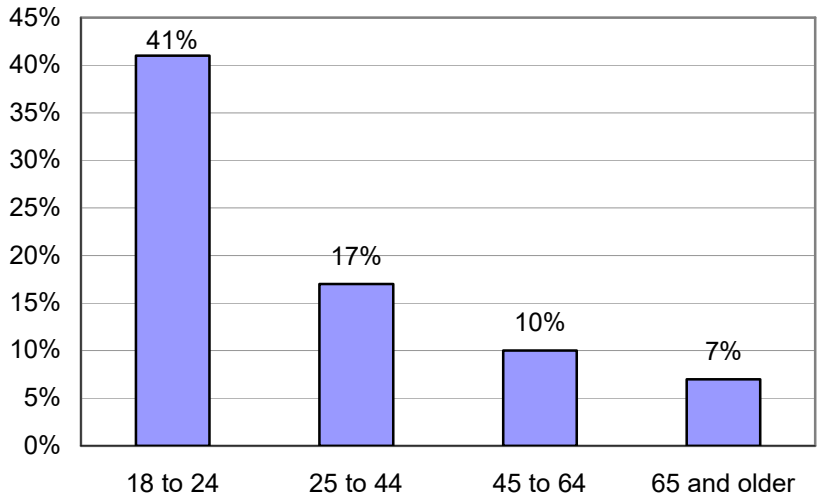
Shade Tree Mechanics

Eighteen percent of the DIYers interviewed were also "shade tree mechanics," (STM); that is, they reported changing oil in vehicles other than those driven, owned or operated by members of their household in the year prior to the interview. Of the DIYers who said that they were also STMs, 13 percent were employed as professional mechanics but also changed oil for vehicles outside of their job or place of work. STMs may be more likely to dispose of used oil improperly than other DIYers (23 percent of STMs compared to 19 percent of non-STM DIYers), but the difference is not statistically significant.

An estimated 84 percent of all STMs in California live in urban counties (less than 10 percent rural).

STMs do *not* differ from other DIYers in terms of race, income, language, education, or urban/ rural residence, but young DIYers are much more likely to be STMs than older DIYers are (Figure 8).

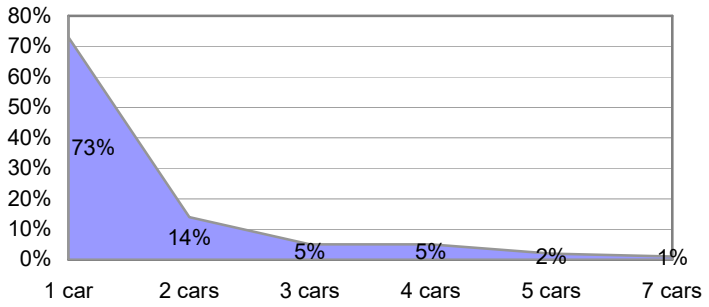
Figure 8. Percent of DIYers at Each Age Who Are Also Shade Tree Mechanics (N=750)



Frequency of STM Oil Changes

Most STMs change oil in other people's vehicles infrequently—less than once a month; 28 percent report doing so once a month or more. Eighty-seven percent of STMs change the oil in only one or two vehicles at a time (Figure 9). The STMs we gathered data from in this survey are not big operations, or they would not reveal their volume of business in the telephone survey setting.

Figure 9. STMs: Number of Vehicles Changed at a Time (N=113)



Number of vehicles in which oil is changed is related to frequency. Frequent STMs (changing oil at least once a month) report changing the oil in an average of 2.18 vehicles at a time, compared to STMs who change oil less than once a month, who report changing oil in an average of 1.26 vehicles at a time.

Statewide, it appears that STM oil changes do not generate a large amount of used oil; however, DIYers who are also STMs tend to change the oil in their household vehicles more often, and they consume on average 15 percent more oil annually than DIYers who are not STMs.

There is not enough data here to support further analysis of STMs or to estimate the statewide amount of oil consumption or improper disposal by this group. However, if DIYers generally are reluctant to reveal their disposal practices, STMs are probably even more reluctant to do so for a telephone survey. Additional study of this population might be warranted employing non-survey methods. STM oil changing might be more widespread than this survey indicates.

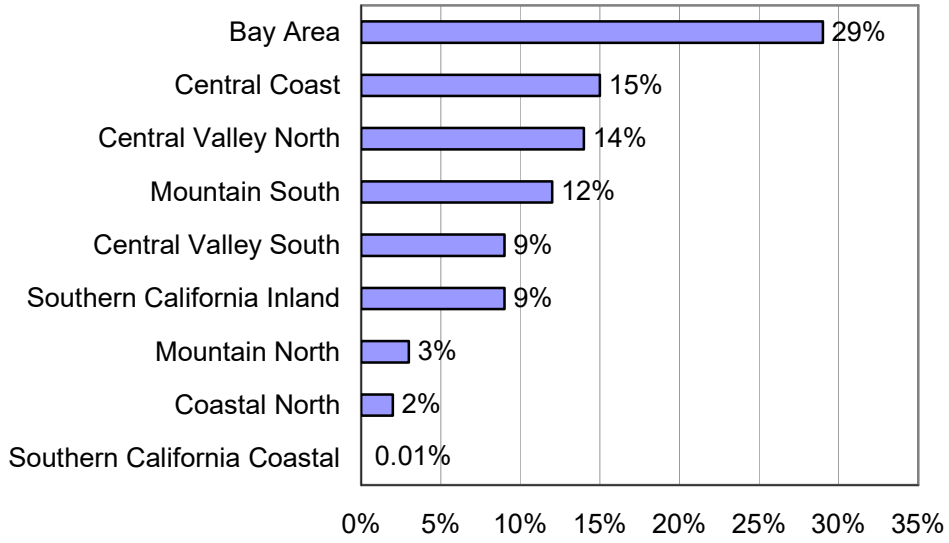
Curbside Recycling

An estimated 10 percent of California DIYers report using curbside recycling programs to dispose of their used oil. Curbside programs also account for 10 percent of used oil collected from the public.[12] Only 2 percent of those who say that they have curbside recycling programs in their community report using other methods of disposal.

DIYers in the Bay Area region report the highest rate of curbside recycling at 29 percent, accounting for 59 percent of all curbside recycling reported in the statewide survey. Seventy-four percent of Santa Clara County DIYers reported using its curbside programs.[*,13] In Alameda and Sacramento counties, 30 percent and 25 percent of surveyed DIYers reported using curbside recycling, respectively.

[*] All cities and unincorporated areas listed on the Santa Clara County Waste Management Board's Web site provide curbside recycling of used motor oil and filters; most also provide screw-top containers for used oil disposal and sealable bags for filter disposal.

Figure 10. Reported Curbside Recycling by Region (N=779)



Motivation and Awareness

In the past decade, the CIWMB has made a substantial effort to educate the public about the hazards of improperly disposed used oil as part of its program to increase recycling. The survey addressed these efforts by including several questions gauging DIYers' awareness of specific environmental impacts of used oil and their opinions on what incentives would motivate other DIYers to recycle. DIYers were also queried about how convenient they feel proper disposal of used oil is in their area.

DIYers Answer Why Used Oil Should Be Recycled

DIYers were asked what they thought was the most important reason that used oil is supposed to be recycled. Table 16 shows that most DIYers were aware that it is an environmental issue.

Table 16. Reasons Used Oil is Supposed to be Recycled (N=759)

Reason	Percent
Because of environmental issues	84%
Conserve energy/reduce dependence on foreign oil	3%
Cheaper to use re-refined or recycled oil	5%
All of the above	6%
Didn't know oil was supposed to be recycled	0%
Other reason	2%
Total	100%

DIYers and Awareness of Specific Environmental Impacts

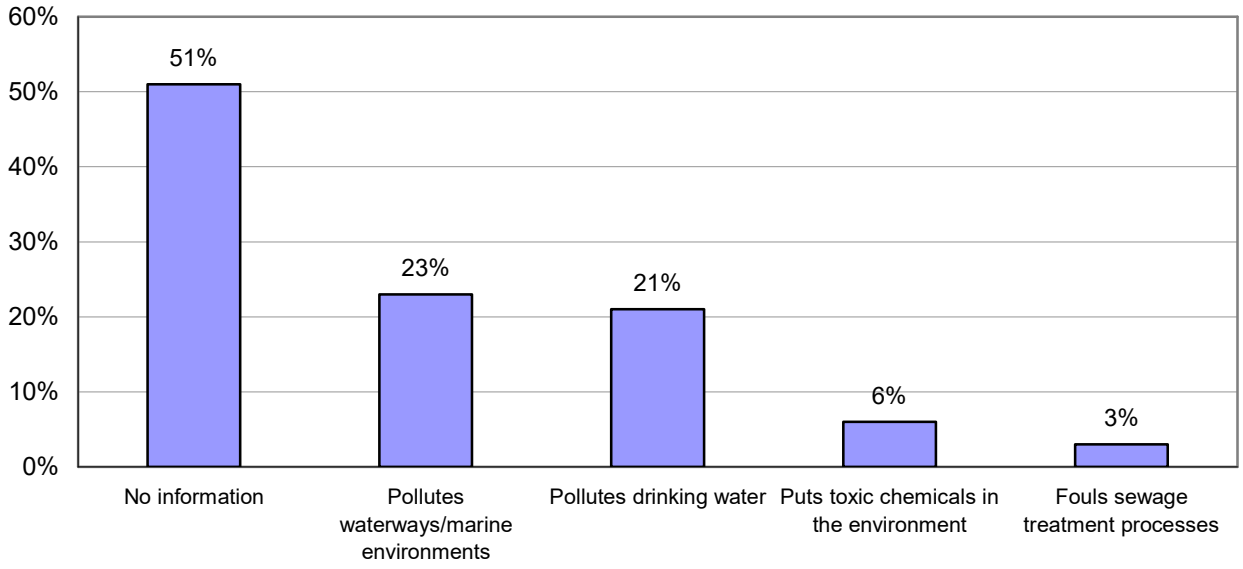
The CIWMB, funding regional and local organizations, has been disseminating information to the public via outreach campaigns to educate DIYers on the environmental hazards of improperly disposing used oil. To measure whether DIYers could recall any specific information on the environmental impact of used oil, and whether awareness of this information is correlated with their oil-disposal behavior, we asked DIYers if they could, unassisted by the interviewer, provide any information they had read, seen, or heard about the specific impacts of used oil on the environment.

Figure 11 shows that half of the DIYers surveyed could not give any specific information. Of those who could repeat specific information that they had heard, most knew that used oil pollutes drinking water and/or waterways and marine environments.

However, contrary to expectations, DIYers who were aware of specific environmental hazards of used oil were no more likely to recycle than those who were not aware. This finding suggests that emphasizing awareness of specific environmental hazards of used oil may not be an effective way to increase recycling of used oil.

Figure 11. DIYer Awareness of Specific Impact of Used Oil on the Environment (N=768)

(Percentages add to more than 100 percent because some respondents named more than one hazard.)



DIYers and Incentives to Take Oil to Collection Facilities

DIYers were given several possibilities that might make used oil recycling easier or strengthen the incentive to recycle, and they were asked if each would make DIYers much more likely, somewhat more likely, or no more likely to recycle their used oil (Table 17). About two-thirds of the DIYers felt that free recycling containers, collection events, curbside recycling, and closer collection facilities would all make DIYers more likely to recycle. One item produced a significantly greater response: a monetary incentive.

Table 17. DIYers' Responses to Factors That Might Increase Recycling (N=747)

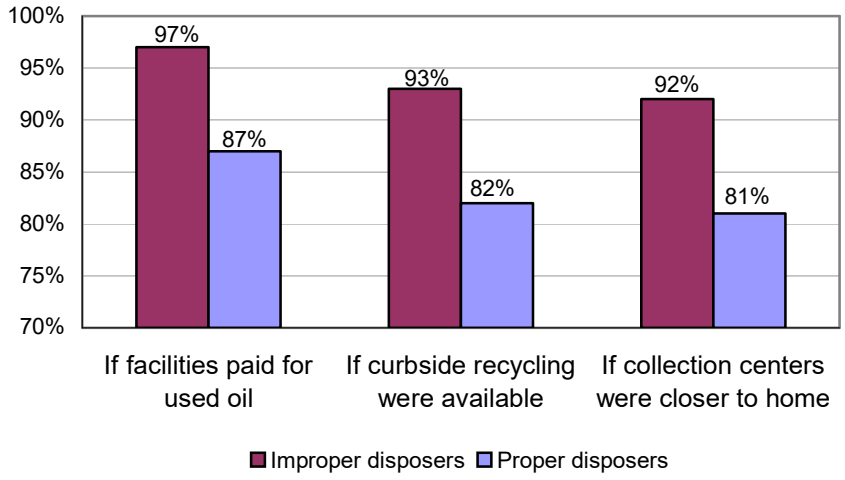
	Recycling much more likely
…if your collection facility paid for your used oil?	79%
…if people were supplied with free oil recycling containers?	69%
…if household hazardous waste collection events took place in your area?	66%
…if curbside recycling was available in your area?	65%
…if a collection facility was closer to home?	64%

Improper Disposers and Incentives to Recycle

Improper disposers were more likely than proper disposers to think that DIYers would recycle more if collection facilities were closer to their homes, if facilities paid for used oil, and if curbside recycling was available. Improper disposers registered interest in and possibly responsiveness to both payment and convenience—whether with facilities close to home or with curbside pickup—with payment garnering the greatest interest.

Figure 12. Response to Incentives and Convenience of Recycling (N=747)

(Percent responding "more likely to recycle")



The CIWMB's certified collection center program already provides that centers offer and pay 16 cents per gallon for used oil turned in to them—though the migrant workers' focus group said they had never been offered anything. The survey queried respondents about the level of monetary incentive they thought would be necessary to get people to recycle their used oil. Forty-four percent thought an incentive of $1.00 per gallon would do it; 56 percent named amounts from $2 to $4 per gallon and up. In the opinion of the DIYers, an effective monetary incentive would be much greater than the CIWMB's present incentive.

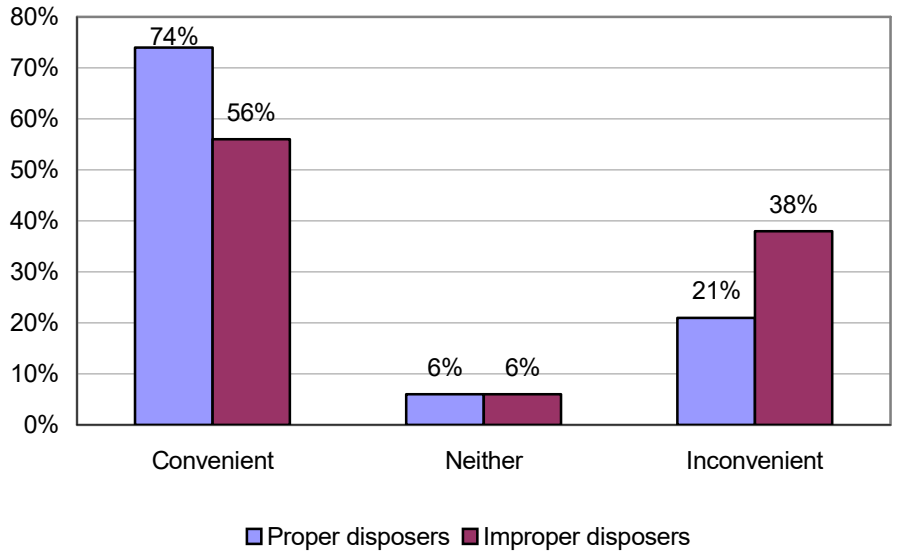
Convenience

Overall, 70 percent of DIYers surveyed said that taking used oil to a collection center in their area was convenient. However, Figure 13 shows that improper disposers were much more likely to describe taking used oil to a collection center in their area as inconvenient.

Rural DIYers were slightly more likely than urban DIYers to feel that taking used oil to a collection center in their area is inconvenient: 77 percent of urban residents said it was convenient compared to 71 percent of rural residents.

Hispanic and white respondents were more likely than African-Americans and Asians to report that taking oil to a collection center is convenient in their area.

Figure 13. Convenience of Taking Oil to a Collection Center by Proper/Improper Disposers (N=752)



Perceived Convenience of Collection Facilities and Distance from Home

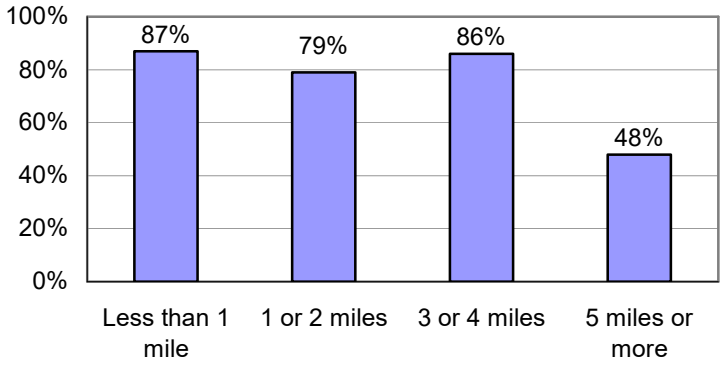
Over one quarter of DIYers surveyed said that a collection center was 5 or more miles from their home; these DIYers were less likely than all others to feel that taking oil to a collection center in their area is convenient.

Assessments of convenience are related to respondents' perceptions of distance from home to a collection facility—the more distant they think the collection facility is, the less convenient it is. *Improper disposal is also related to distance*: improper disposal runs at 28 percent for DIYers three or more miles from a facility but only 15 percent for DIYers who report that a facility is less than three miles from their home.

Because these are survey data, we are dealing with perceptions of distance, and we do not know whether the perceptions are accurate. It might be just as important to influence perceptions with information about collection facilities as to create more facilities.

Figure 14 shows the percentage of DIYers who said that taking used oil to a collection center in their area is convenient, by their reported distance from the nearest collection center.

Figure 14. Convenient to Take Oil to a Collection Center by Distance of Center from Home (N=461)

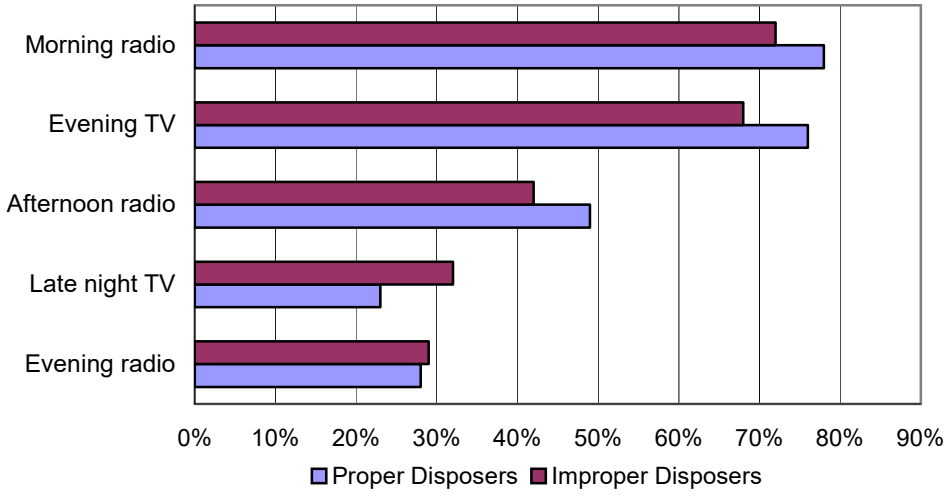


Media Use and Communication Outlets

Figure 15 shows that DIYers report similar habits of media use regardless of whether they dispose of used oil improperly. Morning radio and evening television have the largest audiences among both proper and improper disposers.

Forty-six percent of DIYers report reading a daily newspaper, and an additional 25 percent read a newspaper once per week. Most DIYers read newspapers in English: 94 percent of those who read a newspaper daily, and 84 percent of those who read a weekly newspaper.

Figure 15. Time of Day DIYers Listen to Radio and Watch TV



Television Programming

The first two rows of Table 18 show that improper disposers and all DIYers are only a little different in their television viewing. The differences are not statistically significant—there is no

media niche that will target improper disposers precisely. However, they do watch TV news and movies more than they watch sports or comedy/variety shows.

Table 18 shows also that differences between regions in television watching by DIYers are not large enough to be statistically significant or to shape media outreach.

Eighty-five percent of DIYers who watch TV daily or weekly do so only in English; 14 percent watch TV in Spanish or both Spanish and English.

Table 18. TV Programming Watched by Improper Disposers and by DIYers by Region (N=727)

(Cell values are the percent in the group or region who watch the indicated TV programming.)

TV Programming	News	Sports*	Movies*	Comedy/ Variety*
All DIYers	48%	21%	18%	16%
Improper Disposers Only	**41%**	**14%**	**29%**	**16%**
All DIYers by Region:				
Bay Area	49%	25%	22%	14%
Central Coast	52%	20%	16%	24%
Central Valley North	51%	18%	16%	18%
Central Valley South	52%	18%	18%	18%
Coastal North	36%	21%	19%	13%
Mountain North	48%	19%	26%	19%
Mountain South	40%	8%	15%	13%
Southern California Coastal	44%	23%	20%	17%
Southern California Inland	57%	15%	7%	18%

* Group differences by region are not statistically significant.

White and African-American respondents report watching comedy/variety shows more often than Hispanic or Asian DIYers; other types of programming frequently watched by DIYers show no significant differences by race.

Radio Programming

Table 18 shows radio programming listened to by all DIYers and improper disposers only, and DIYers by region. As with TV viewing, improper disposers do not listen to clearly different radio programming. News is also the most common type of programming that DIYers, including improper disposers, listen to.

DIYers in the most rural regions (Coastal Central and North, and the Mountain regions) are considerably more likely to listen to country radio stations than DIYers in other regions. In most regions, news attracts the largest audience.

Table 19. Radio Programming Listened to by Improper Disposers and by DIYers by Region (N=786)

Radio Programming	News	Rock/ Classic Rock*	Country
All DIYers	32%	16%	14%
Improper Disposers Only	**27%**	**16%**	**17%**
All DIYers by Region:			
Bay Area	45%	16%	14%
Central Coast	36%	16%	24%
Central Valley North	34%	19%	21%
Central Valley South	31%	19%	20%
Coastal North	19%	28%	26%
Mountain North	28%	19%	34%
Mountain South	43%	9%	33%
Southern California Coastal	26%	18%	9%
Southern California Inland	30%	33%	7%

* Differences in news and country radio listening by region are statistically significant at the .05 level; differences in rock listening by region are statistically significant at the .09 level.

Leisure Activities

Table 20 shows that sporting events, whether as a spectator or participant, are the most common pastime activity among DIYers. More DIYers in Southern California report attending church than in Northern California.

Many DIYers reported participating in leisure activities with their families, specifically with children. As with television watching and radio listening, improper disposers are not much different than DIYers generally, and differences between regions are typically not great.

Table 20. Pastime Activities of DIYers by Region (N=786)

Leisure Activities	Spectator Sports	Sports teams/ Leagues*	Church	Family Events/ Activities*
All DIYers	25%	35%	28%	25%
Improper Disposers	**20%**	**31%**	**27%**	**18%**
All DIYers by Region:				
Bay Area	36%	35%	24%	26%
Central Coast	28%	27%	35%	19%
Central Valley North	29%	39%	26%	31%
Central Valley South	21%	28%	29%	20%
Coastal North	18%	28%	16%	20%
Mountain North	29%	38%	18%	24%
Mountain South	15%	27%	28%	22%
Southern California Coastal	22%	35%	30%	26%
Southern California Inland	22%	44%	33%	16%

* Differences in participation in sports teams and family events are not statistically significant.

An Illustrative Multivariate Analysis—Explaining DIY

This section summarizes a multivariate analysis of do-it-yourself (DIY) oil changing. The project called for limited multivariate analysis to demonstrate what can be done with it. The survey was designed to support multivariate analysis.

Why Do Multivariate Analysis?

The displays of statewide survey data in the preceding sections of this report yield valuable information about oil changing, oil disposal, media patterns, and awareness of Californians. The displays have provided views of the distribution of single variables (for example, Figure 4) and of crosstabulations of two variables ("bivariate analysis," for example, Figure 7 and Figure 13).

There are three main reasons for conducting multivariate analysis as well. First, multivariate analysis adds information that cannot be obtained in any other way. For example, with bivariate tables we can see the rate of DIY among men compared to women, among people of different ages; among people in urban and in rural areas, and among people who do or do not own trucks. Multivariate analysis permits us to estimate the rate of DIY among groups defined by many characteristics at once, or taking into account, mathematically, the effects of many influential factors. Bivariate tables and graphs do not take other factors into account.

From the statewide survey we estimated that DIYers change oil in 19.3 percent of California households. Breaking down this finding by gender—the bivariate display—we estimate that the rate of DIY for women is 5.3 percent; for men, 31.5 percent. We can also break DIY rates down by urban and rural residence, age, truck ownership, and other variables. The additional step of multivariate tables and more complex methods of analysis, such as logistic regression, permit us to pinpoint combinations of characteristics and the rates of DIY for people who share those attributes. For example, we may discover that 70–80 percent of young men in rural areas who own trucks and do not have post-B.A. education change their own oil. (That is indeed what we estimate with a multivariate analysis presented below.) *Multivariate analysis gives us more information, findings that are not available without it*.

The second reason for doing multivariate analysis is this: the differences and relationships we observe in bivariate displays may be fundamentally altered when we take other factors into account. It is not uncommon for relationships to disappear when subjected to multivariate analysis; for new relationships to spring up that were not visible in bivariate tables; and for relationships to change direction from positive to negative or vice versa. While these shifts in the analyzed data from the bivariate to multivariate views do not appear in every study, they appear often enough to require multivariate attention. Multivariate analysis is necessary in order to ascertain that relationships we observe in bivariate displays continue to be supported when we bring other variables into the analysis. *Multivariate analysis corrects errors of interpretation that are common when we rely only on bivariate displays*.

The third reason for multivariate analysis is to provide necessary parameters for mathematical models of the processes under study. Modeling a system of interrelated processes yields predictions of key quantities; for example, predictions of DIY, cessation of DIY, improper disposal, and the rate of change of improper disposal under varying assumptions about in-migration to California. *Multivariate analysis supports mathematical models that predict how a system changes over time.*

The present survey will not support the complete development of models of the DIY and disposal process, but it will provide a foundation.

Methods, Variables, Hypotheses

The non-technical reader can omit this section and the following section. Go directly to "Estimated Probabilities" below.

The method of multivariate analysis used here is logistic regression, which is appropriate for variables like DIY that are measured in the survey with only two values, DIY or not, 1 and 0.

We pursue here the *explanation* of DIY—answers to the question, What explains why some people change their own oil while others do not? We begin with the obvious and with variables that have been shown in the statewide survey bivariate tables or in the pilot study or other work to be related to DIY, then we add variables that are probably or plausibly related to DIY under some theoretical proposition or even just a hunch.

Men are surely more likely to change oil than women are, and we know from prior work that people in rural areas are more likely to do so than city dwellers. We surmise that people with higher education and higher incomes are less likely to be DIYers because they can afford to pay for oil changing. They are more likely to be are busy professionals with less interest in and less aptitude for working with their hands. We suppose that younger people are more likely to change oil than older people, perhaps partly because of income but also because of the greater physical energy of the young—and there is no question that getting under a vehicle to drain its oil is a physical activity. It is also possible that people who own trucks are more likely to change their own oil than people who own only automobiles. And we want to assess in the multivariate context the possibility that Hispanics or other ethnoracial groups are more likely to be DIYers.

So the variables we will examine and our hypotheses about DIY are:

Variable	**Hypothesis**
Gender	Men more than women
Urban/rural residence	Rural residents more than urban residents
Education	The more education, the lower the probability of DIY
Income	The higher the income, the lower the probability of DIY
Truck ownership	Truck owners more than others
Age	The greater the age, the lower the probability of DIY
Hispanic ethnicity	Hispanics more than other groups
Other race/ethnicity	Uncertain

All but one of these variables are clearly related to DIY in bivariate tables, and the relationships are statistically significant, except for other race/ethnicity. *Hispanic* ethnicity is related to DIY in the bivariate display—23.4 percent of Hispanics are DIYers, compared to 17.9 percent of non-Hispanics, and the relationship is statistically significant (p=.046).

The percentage differences between African-Americans and Asians and other groups are similar but the subsample sizes for African-Americans and Asians are smaller, so these differences are not statistically significant. Multivariate analysis may enable us to confirm a real relationship that is not strongly supported by the bivariate analysis, or we may discover that the difference disappears altogether once we have taken other factors into account. For example, it may be that it is not the ethnoracial group and its propensities that affect DIY, but education or income, on which groups differ.

Logistic Regression

When we run a logistic regression of DIY on these variables, we ask whether each one is still related to DIY once we take the other variables into account. The logistic regression measures the relationship between each of these variables and DIY, adjusting for the influence of the others.

Analysis of multivariate relationships involves sifting through results for many different combinations of variables. Only one of dozens of equations examined is presented here.

Analysis requires selecting a particular expression or measure of each variable. "Hispanic" and similar ethnoracial designations are typically expressed with 0 for non-Hispanic, 1 for Hispanic. A variable such as education, which is typically expressed as ordered categories—less than high school, high school grad, some college, and so on—is expressed here simply as 0 for college graduate or less education, 1 for post-B.A. education. We chose this representation of education because of the pattern of the estimated percent DIY for level of education. The bivariate pattern is:

	Percent DIY
Less than high school	23%
High school grade	24%
Some college	18%
College grad	20%
Post-B.A. education	11%

Overall, the bivariate relationship of DIY to education measured in this way is statistically significant, it is plausible that any increase in education would have some downward effect on DIY, and there may indeed be some downward trend in DIY before the substantial dropoff from college grad to post-college education, where the rate of DIY is cut almost in half—but the decline in DIY is not great until the post-college level. In repeated logistic regression analysis, the full range of levels of education was not clearly related to DIY, once other factors were taken into account, but post-B.A. education defined as below was related to DIY.

Income posed a similar problem of expression. There is not much difference in DIY for different levels of household income until we get to $100,000 or more. We tried the full set of income categories in various analyses and 0, 1 expressions for both "$100,000 or more" and "less than $15,000."

Table 21. Dummy Variables for Logistic Regression—DIY and Predictors

Variables	Values
DIYer	0 = not DIYer, 1 = DIYer
Rural	Percent rural in 1990 (divided by 10 for ease of presentation of logistic regression results: 0 to .99 = 0 to 9.9 percent, 1 to 1.99 = 10 to 19.9 percent, and so on)
Gender	0 = female, 1 = male
Truck ownership	0 = no, 1 = yes
Income	Categories (less than $15,000 to $100,000 or more) *or* 0,1: for example, 0 for less than $100,000, 1 for $100,000 or more
Grad	0= B.A. or less, 1= post-B.A. (other levels no difference)
Age	1 = 18–29 2 =30–39 3 = 40–49 4 = 50–64 5 = 65 and over
Hispanic	0 = no, 1 = yes

Logistic regression works by estimating the "odds ratio" of the relationship between variables. To understand odds ratios, consider odds. We look first at percentages and how they are related to odds. In the bivariate table of DIY and gender, we find the following, based on the interviewed sample (N=1,204):

Table 22. DIY by Gender

DIYer	Male	Female	Total
No	69%	95%	81%
Yes	31%	5%	19%
Total	100%	100%	100%

The odds that a female is *not* a DIYer are 95 to 5, or 19 to 1, or just 19.0. The odds that a male is not a DIYer are 69 to 31, or 69/31 = 2.2 to 1. So the *odds ratio* for DIY and gender is 19 to 2.2: 19/2.2 = 8.6. This odds ratio expresses the much greater likelihood that a woman is not a DIYer compared to the likelihood that a man is not a DIYer.

A characteristic of odds ratios is that they express the difference in the other direction as well: 8.6 is also the odds ratio that expresses the greater likelihood that a man *is* a DIYer compared to the likelihood (in odds) that a woman is a DIYer.

An odds ratio of 1.0 would indicate that the odds of DIY were equal for men and women; in other words, that DIY and gender were not at all related. Odds ratios greater than 1.0 indicate a positive relationship; less than 1.0, a negative relationship.

Turning to the regression results, the Odds Ratio column of the table below gives the ratio of the odds that a person is a DIYer calculated for each of the variables listed. In the regression results, the ratio of the odds that a man is a DIYer to the odds that a woman is a DIYer is 8.79, adjusting simultaneously for the relationships of the other variables with DIY. The 8.79 value is very close to the 8.6 odds ratio from the bivariate table of gender and DIY; in other words, taking other variables into account has had negligible effect on the relationship of DIY and gender. The male-female difference is virtually unchanged even when we take into account urban/rural residence, age, and the other variables in the equation.

The *p*-value calculated for each variable is used to evaluate statistical significance of the odds ratio for the corresponding variable. A *p*-value less than .05 is conventionally taken as indicating statistical significance; that is, signifying that the odds ratio is different for different values of the variable in the population from which the sample was drawn.

The *p*-value is given in the column headed **P>|t|**. The value for gender, 0.000, indicates that the *p*-value is less than 0.0005. This is far smaller than .05, so we conclude that the relationship of gender to DIY is statistically significant—beyond a doubt, men are more likely to change oil than women in the population of California households.

Table 23. Survey Logistic Regression: DIY as a Function of Six Variables (N=1,146)

	Odds Ratio	Standard Error	t	P>|t|	95% Confidence Interval	
Rural	1.193158	.0530738	3.97	0.000	1.09344	1.30197
Gender	8.791825	1.580764	12.09	0.000	6.178335	12.51084
Truck Owner	1.460248	.2762286	2.00	0.046	1.007484	2.116485
Graduate Education	.5506664	.1490462	-2.20	0.028	.323783	.9365332
Age	.7520138	.0486852	-4.40	0.000	.6623093	.853868
Hispanic	1.007315	.2200093	0.03	0.973	.65623	1.546231

The odds ratio for "rural" is 1.19. "Rural" is the percent of a county's population who live outside of urban areas, divided by 10. The odds ratio of 1.19 means that the odds that you change your own oil go up 19 percent for every 10-percent increase in the rural population of your county. If we apply this finding to the whole range from 0 to 100 percent, we discover that the odds that a person in a 100 percent rural county is a DIYer are 6.8 times the odds that a person in an entirely urbanized county—0 percent rural—is a DIYer. Residents of very rural counties are much more likely to be DIYers than residents of urban counties.

In this analysis, residence in more or less rural counties stands for differences between rural areas and rural people, on the one hand, and urban areas and urban people. These differences may be cultural, economic, ideological, or ethnoracial. Further research would be necessary to clarify the differences between urban and rural DIYers and the effects of those differences on DIY and improper disposal. The odds ratio for DIY as a function of percent rural population is highly significant, $p<.0005$: there is no question that something about rural populations affects the rate of DIY.

Except for "Hispanic," all the variables in the logistic regression are statistically significant at the conventional .05 level. We conclude that truck ownership is associated with somewhat greater

likelihood of DIY: the odds that a truck owner is a DIYer are 1.46 times the odds that a vehicle owner who does not own a truck is a DIYer.

It would be a mistake to think of truck ownership as a direct and simple cause of DIY. Owning a truck probably does not have a real effect on DIY. More likely, owning a truck goes together with an inclination for doing things with your hands, like repairing and doing major maintenance on your house and yard. Truck ownership is obviously related to occupation as well.

On the other hand, the percent rural variable may be a proxy for a real cause of DIY—distance from shops that change motor oil and the inconvenience of leaving a vehicle for maintenance in areas with little public transpiration. Or rural residence may be a proxy for lower income and greater income incentive to DIY. DIY may be part of the culture of rural life—of self-reliance, doing things for oneself.

The odds ratio for graduate education and DIY, 0.55, indicates that the odds that a vehicle owner with graduate education will change his/her own oil are only about half the odds that a vehicle owner with less than graduate education will do so. Again, this is not a direct cause so much as an expression of values and inclinations, perhaps income, and perhaps less free time, that might be associated with higher levels of education.[*]

The odds ratio for "Hispanic" is telling. It is almost exactly 1.0, and its *p*-value is far greater than 0.05. What does this mean? It means that once we take into account the other variables that are in the equation and related to DIY, the difference in DIY rate between Hispanics and non-Hispanics vanishes. Even though Hispanics are more likely than non-Hispanics to change their own oil when we examine the bivariate data, the odds ratio for "Hispanic" in the logistic regression drops to 1.0—no relationship between "Hispanic" as such and DIY.

However, Hispanics in California and in the survey also have somewhat lower levels of income, on average, and lower levels of education, than non-Hispanics, and these differences are statistically significant. Taking that information together with the logistic regression, we might suppose that education and perhaps income in effect "carry" the effect of "Hispanic" on DIY. In other words, being Hispanic in California means, for many reasons, having less education and lower income than non-Hispanics; lower education and income might be the reason why Hispanics are more likely to be DIYers.

Further analysis not shown here shows that the odds ratio for "Hispanic" drops almost to 1.0 when *age* is added to the equation. The effect of age on DIY is much stronger than the effect of being Hispanic or income or education, and it is age that mainly "carries" the effect of "Hispanic" on DIY, not income and education. Once we take age into account, being Hispanic is not related to DIY in the logistic regression. Hispanics *are* still more likely to be DIYers than non-Hispanics are. But Hispanics are *not* more likely to be DIY because they are *Hispanic*; they are more likely to be DIY because they tend to be *younger* than non-Hispanics, and younger people, especially in the 18–29 age range, are much more likely to be DIYers.

These results suggest that changing your own oil is a characteristic of youth, gender, and other conditions but not distinctively a characteristic of Hispanics.

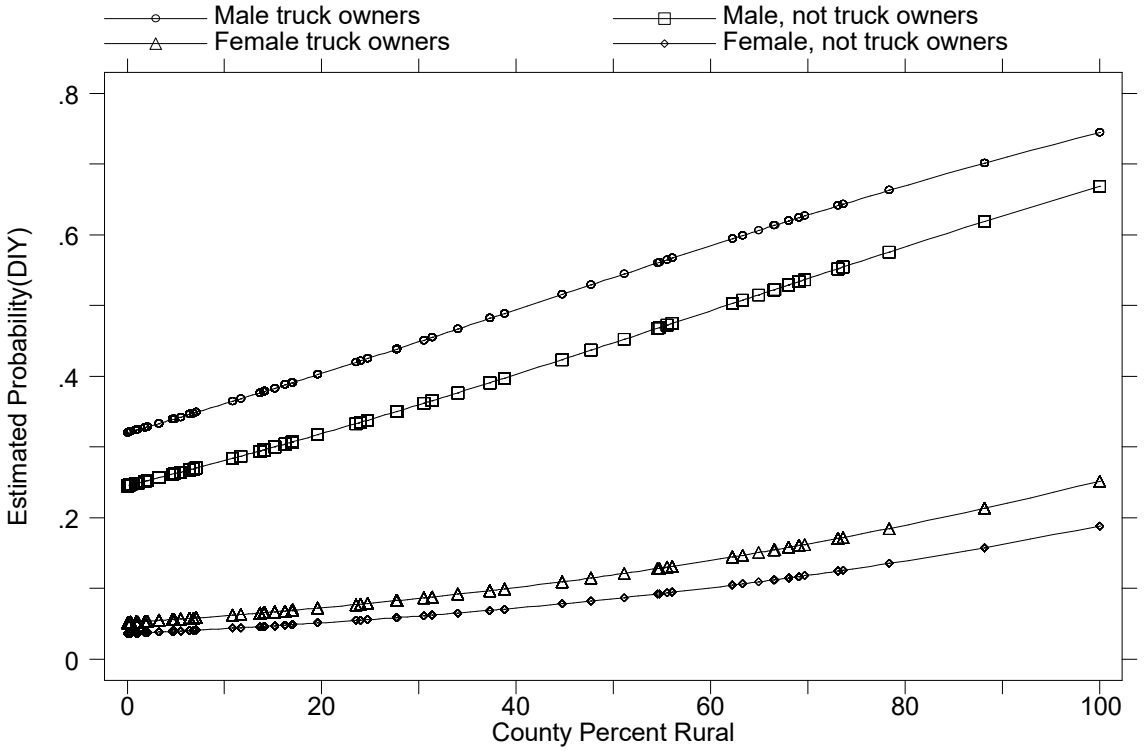
[*] DIY is, as noted, weakly related to income in the bivariate display. Any measure of income inserted into this logistic regression renders coefficients for education *and* for income statistically insignificant. Probably income does have some effect on DIY—the higher the income, the lower the probability of DIY—and in *this* set of regression coefficients, we should regard the odds ratio for education as carrying some of the effect of income as well. The effects of education and income on DIY are confounded with each other—but *neither* has a very large effect on DIY.

Estimated Probabilities

We can calculate estimated probabilities of DIY from the logistic regression coefficients.* Graphs of the estimated probabilities are an easy way to see the effects on DIY of several factors simultaneously.

Figure 16 shows mainly the large difference between men and women in DIY rates and the higher DIY rates in rural counties of California. The top plotted line in Figure 16 shows predicted probabilities of DIY for male truck owners, by county percent rural. Reading off the vertical scale on the left, we can see that the estimated probability that a male truck owner is a DIYer is about .32 in the most urban counties (0 percent rural) and rises to about .74 in the most rural counties (100 percent rural).

Figure 16. Estimated Probability of DIY for Men and Women and Truck Ownership, by County Percent Rural



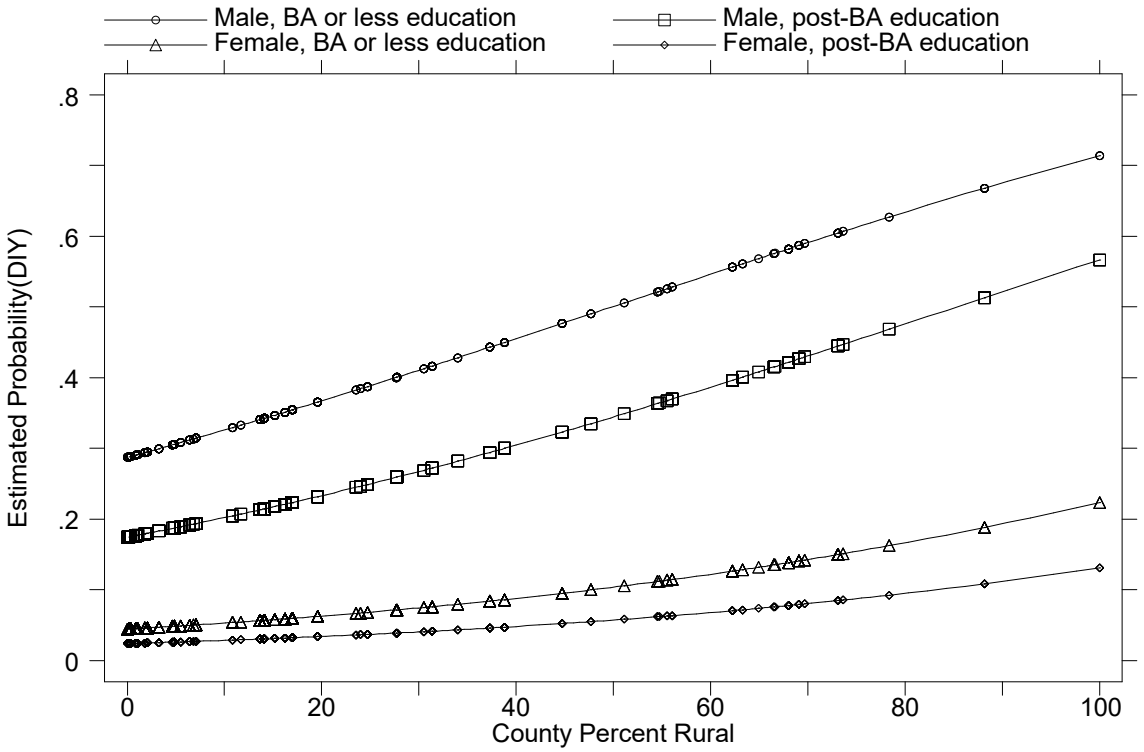
Plotted points are estimated probabilities of DIY for each county based on the logistic regression of DIY on percent rural in counties and on gender, truck ownership, age, and graduate education. For this estimation, graduate education and age were set at their means. From top to bottom, plotted lines are for males who own trucks, males who do not own trucks, and females who own and do not own trucks.
Source: statewide survey; 1990 U.S. Census for county percent rural.

Truck ownership appears to have some effect on probability of DIY for men, about .07 at all levels of percent rural; that is the approximate difference between the estimated probability lines for truck owners and non-truck owners. Truck ownership has less effect on DIY among women, but the effect increases in the most rural counties.

* The coefficients, not shown here, are the basis for the odds ratios presented above.

Figure 17 presents a similar display, this time graphing the estimated probability of DIY for men and women and for post-B.A. and B.A.-or-less education, again by county percent rural. The main effects again are gender and percent rural. For men, post-B.A. education is associated with somewhat lower probability of DIY at all levels of percent rural. For women, the effect of post-B.A. education is smaller, negligible in the most urban counties, where we estimate that very few women change their own oil in any case, increasing in the rural counties.

Figure 17. Estimated Probability of DIY for Men and Women, and by Post-B.A. Education, by County Percent Rural



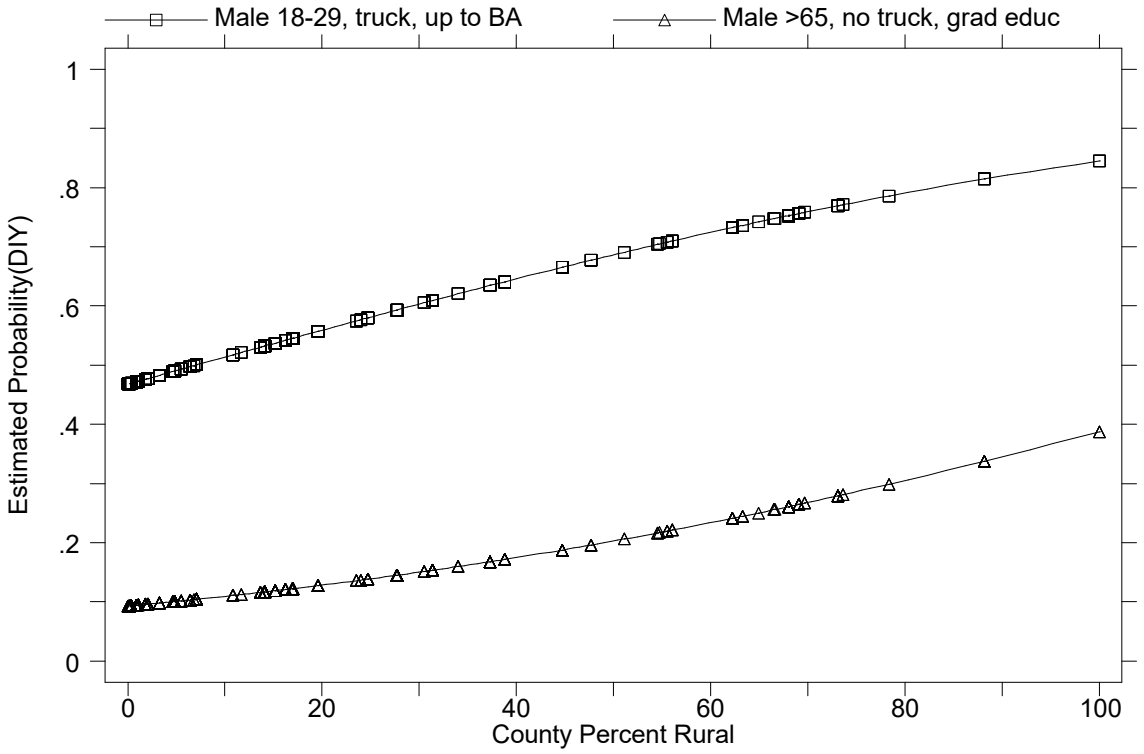
Plotted points are estimated probabilities of DIY for each county based on the logistic regression of DIY on percent rural in counties and gender, truck ownership, age, and graduate education. For this estimation, truck ownership and age were set at their means. From top to bottom, plotted lines are for males with less than graduate education, males with graduate education, females with less than graduate education, and females with graduate education.
Source: statewide survey; 1990 U.S. Census for county percent rural.

Figure 18 graphs the effect of several factors together on estimated probability of DIY. The top line graphs the estimated probability, by percent rural, for young (18–29), truck-owning men with B.A. or less education. The bottom line contains estimated probabilities for the oldest men (65 and older) who do not own trucks and who have graduate level education.

It is striking how much DIY is concentrated in the youngest age group and how much separation we achieve by combining the effects of several factors. Age, truck ownership, and graduate education together make about 0.37 difference in estimated probability of DIY at all levels of county percent rural. The estimated DIY rate for older men with graduate education, not truck owners in cities, is only about 0.10, while the estimated rate for young men with trucks and less education in rural counties is about 0.84. Multivariate analysis permits us to identify subgroups

with much higher levels of the behavior in question—here, DIY—and this information could be very useful for programs that want to reach or influence the behavior of particular groups.

Figure 18. Estimated Probability of DIY for Men Most Likely and Least Likely to DIY, by County Percent Rural



Plotted points are estimates based on the logistic regression of DIY on percent rural in counties and gender, truck ownership, age, and graduate education. The top line shows the estimated probability of DIY for men 18–29, truck owners, with B.A. or less education. The bottom line is the estimated probability of DIY for men over 65, not truck owners, with graduate education.
Source: statewide survey; 1990 U.S. Census for county percent rural.

Summary

Multivariate analysis helps us disentangle relationships among many variables that are confounded with each other. We saw in this illustrative analysis that we achieved a much clearer understanding of the way that being Hispanic in California is implicated in oil-changing DIY. DIY turned out to be not a characteristic of Hispanics generally but a characteristic of young men generally, and Hispanics are simply more likely to be young than other ethnoracial groups are.

Although multivariate analysis is complex, graphic tools can help us display the results in a reasonably straightforward and readable way. The graphical analysis enabled us to see clearly the tremendous effect of age on DIY—the much higher rate of DIY among younger men—and holds the promise of permitting us to locate subgroups where behavior of interest is concentrated.

Focus Groups

Focus group meetings were conducted in spring 2001 with migrant farmworkers in San Marcos, Calif., in Spanish, and with urban independent truckers in San Diego, in English.[*] The groups focused on awareness of used oil collection and recycling; used oil disposal practices; beliefs about used oil; and outreach and messages to promote safe disposal practices.

This section is a brief summary of the main points of the group discussions.

Farmworkers

The six farmworkers who participated in the group all had legal residency in the U.S. and have worked here seasonally as far back as 1953. They grew up on the land in Mexico. They have little formal education but extensive experience with all aspects of agricultural work from southern Mexico to Canada and with many other kinds of work, and they are proud of the knowledge and skills they have accumulated by experience.

The farmworkers change their own oil because it saves them money and also because they like working on their cars.

Recycling

In Mexico, until recently, anyone who changed motor oil just dumped it. Now everyone knows that used oil is not good for plants and the soil and that people are supposed to recycle it. The workers know where used oil collection centers are. They have sometimes been turned away from the centers, and employees have been rude to them. They said they have never been reimbursed for their used oil, but that they should be.

The group observed that the commercial establishments where they have worked are scrupulous about storing their used oil in large drums for pickup. They believe that most business owners obey the law because otherwise the authorities, which are diligent about enforcing the law in the U.S., would fine them. Regrettably, some individuals do not take such care and dispose of oil down storm drains or down the toilet, or by burying it in the ground.

Many people store their used oil and have other uses for it—weatherproofing wood and boots, protecting tools, rubbing into tired muscles, burning it.

The farmworkers said they would feel comfortable saying something if they saw used oil being disposed of improperly.

Re-Refined Oil

Used oil has been "recycled" for a long time in Mexico. However, it was simply filtered and re-packaged for sale. This used oil is not just used (*usado*) but burned, used up (*quemado*). The workers believe that this may still be the case in the U.S., that the lubricating properties of used oil cannot be fully restored by re-refining. Used oil could never be as "potent" as new oil.

[*] Professor Michelle Saint-Germain, Director of the Public Administration Program at CSU-Long Beach, facilitated the groups. This section draws extensively on Professor Saint-Germain's analysis; her words have been incorporated in this summary without quotation. Responsibility for any errors lies with the authors of this report.

The Environment

The farmworkers are very concerned to protect the quality of the soil and the water. They have a respectful attitude toward "Mother Earth." They have noticed a decline in environmental quality, especially in Mexico but in the U.S. as well.

Messages to Promote Recycling

After discussion, the group developed an understanding that encapsulates a message. Our food comes from the earth, and if the earth becomes contaminated, so will our food. The earth belongs to everybody, and everybody is connected through the earth.

Recommendations

- Pay people to bring their oil in.
- Establish curbside pickup of used oil.
- Deliver messages about recycling in person; for example, at work sites. Personal contact is important for believability.
- Radio and television are also possibilities, but print media are less useful, both because of low literacy levels and because of lack of knowledge of the person behind the words. The personal integrity of the author or bearer of the message is very important.

Urban Independent Truckers

The group meetings took place on the premises of a large trucking company. The five truckers who participated were reluctant to be interviewed, refused to allow recording, and were eager to end the discussion. They were pressed for time and suspicious of anything having to do with government.

The independent truckers own their own rigs, which are a major investment. They think that independent truckers as a group are not disposing of their used oil improperly because they seldom if ever change their own oil themselves. They would rather have experienced mechanics take care of their trucks, and they are on the road as much as the law allows, often 10–12 hours per day. They have little time to work on their trucks.

The truckers thought that people who drive smaller trucks or vans for business purposes, delivery people and small haulers and the like, would be more likely to change their own oil.

Findings and Recommendations

Findings

1. *Where are the DIYers and improper disposers*? Most DIYers and most improper disposers are located in the densely populated, highly urbanized regions of California. Rates of DIY and rates of improper disposal are greater in rural areas, but the numbers are in the cities. Sixty percent of DIYers live in the Bay Area or Southern California Coastal regions; 89 percent live in these regions plus the Central Valley and Southern California Inland.

2. *Who are the DIYers*? Men 18–44 comprise the largest single group of DIYers: 49 percent, but men of all ages up to 65 are a major part of the DIY total. Eighty-seven percent of California DIYers are men; 81 percent are men between 18 and 64 years of age.

3. *What predicts DIY*? People are more likely to change their own oil if they are male, young, live in rural areas, and own trucks; and if they have household incomes under $100,000 and B.A. or less education. DIY is most strongly associated with age and gender: men are much more likely be DIYers than women, and DIY declines somewhat with age, especially age 65 and over. Residents of more rural counties are more likely to DIY. Education, income, and truck ownership are only weakly related to DIY.

4. *Are improper disposers different*? This initial analysis found almost no demographic differences between improper and proper disposers, and no significant differences in their media use and leisure activities. For the most part, to reach improper disposers you have to reach DIYers.

5. *Young drivers*. DIY rates are highest in the youngest age group (18–29), suggesting that new drivers are plausible targets for outreach.

6. *Newcomers are different*. However, immigrant and migrant-worker newcomers are much more likely to report improper disposal than immigrants or migrants who have lived in California 15 years or more, and more likely than DIYers who were born in the U.S.

7. *Convenience makes a difference*. Convenience has a major impact on proper disposal of used oil. DIYers who live farthest from collection centers are considerably more likely to dispose of used oil improperly, and improper disposers were more likely than other DIYers to say that closer collection facilities and curbside pickup would make DIYers more likely to recycle their used oil.

8. *Awareness of environmental impact*. This survey found that awareness of specific environmental impacts of used oil is *not* related to DIYers' disposal behavior. The migrant workers focus group said that everyone already knows that used oil should be recycled. Perceived convenience of recycling *is* related to disposal behavior. Actual convenience and perception of convenience are more important than awareness of specific impacts of used oil. This suggests that future endeavors should be geared toward making recycling as convenient as possible for California DIYers, in conjunction with efforts on a local level to inform DIYers of the most convenient ways to recycle oil, perhaps changing their awareness of the convenience of proper disposal.

9. *Focus on DIYers, improper disposers, and newcomers*. Continued funding for educational outreach in local areas with large numbers of DIYers and improper disposers and of newcomers is likely to be necessary to sustain the current rate of recycling in such areas. Most DIYers in the state are concentrated in the highly urbanized areas of greatest

population—the Bay Area and Southern California Coastal regions—in spite of the fact that these areas have the lowest rates of DIY. Migration and immigration are also higher in the Bay Area and Southern California. This means that the population of DIYers is changing too, with new DIYers constantly arriving from other states and countries. Many are from countries where used oil disposal is not regulated. To maintain the rate at which oil is currently being taken to collection centers will necessitate continuous outreach effort in urban areas and in the rural areas with the largest flows of new immigrants and migrant workers.

10. *Does curbside pickup yield higher rates of used oil recycling*? The statewide survey data suggest that curbside pickup might yield substantially higher rates of used oil recycling than certified collection centers can achieve.

11. *Better survey methods*. New methods were developed (a) to make it easier for survey respondents to report improper disposal and (b) to permit estimation of improper disposal even when respondents report proper disposal. These methods were successful in producing substantially greater reporting and higher estimates of improper disposal than other recent surveys in California. Additional research is advisable to fully validate the new methods of estimation.

12. *Multivariate analysis*. An illustrative multivariate analysis of DIY showed conclusively that DIY is much more closely related to age, gender, and rural residence than to education, income, and truck ownership. The initial look at the data had suggested that Hispanics were more likely to DIY than other groups, but once we take these other factors into account, we find no differences in DIY between ethnoracial groups, a finding that has implications for outreach. Hispanics still need to be reached because they comprise a large group of DIYers reached with different means and media, but Hispanics need not be disproportionately targeted.

Recommendations for Outreach Efforts

1. *Outreach to DIYers*. PRI did not find significant differences between proper and improper disposers in most demographics, media use, or leisure activities. Therefore, outreach efforts targeted at DIYers in general—men, especially younger men—should reach most improper disposers.

2. *Target newcomers*. Newcomers are different—substantially more likely to dispose improperly. Even if they do not constitute a large fraction of all improper disposers, they might be worth targeting because of their high rate of improper disposal.

3. *Target new drivers*. Like newcomers to the U.S., new drivers are newcomers to the standards and facilities for recycling. The DIY rate is highest among men 18–29, suggesting that new drivers and young men generally should be targeted for outreach.

4. *Target Hispanics*? While Hispanics were not found to be significantly higher in DIY than other ethnoracial groups in the survey, they still comprise about one-fourth of DIYers statewide, and up to 40 percent in the Southern California Coastal region. In addition, a substantial part of immigrant and migrant newcomers to California are Hispanic, and the English language remains a barrier for some Hispanics. For these reasons, some outreach specifically targeted toward Hispanics and Spanish speakers, especially newcomers, is warranted even though the survey showed that Hispanics do not contribute disproportionately to illegal disposal. Outreach to other newcomers is also needed.

5. *Media*. Media use patterns uncovered by the survey indicate that the largest audiences of DIYers are for morning and afternoon radio and for news and movies during prime time. Cost

and cost-effectiveness of environmental messages using these media are issues beyond the scope of this study.

6. *Alternative approaches*. However, research with household hazardous waste campaigns in San Francisco suggests that other media of communication such as street signs can be more effective and much more cost-effective than the traditional electronic and print mass media.[*,14] The migrant farmworkers who participated in a focus group for this project strongly recommended a personal, face-to-face approach to their population, with the integrity and credibility of the person a fundamental issue. The Board should also consider ethnic media in non-English languages, which have grown very rapidly in recent years, as ways of reaching newcomers. Some alternative approaches have already been implemented by some local programs, and the alternative approaches generally deserve continuing attention by program developers and the Board, especially for groups that are set apart by language and culture and are more likely to trust communications within the group than from outside.

7. *Reaching DIYers at events*. DIYers report frequently participating in athletic, volunteer, and community activities, especially activities involving families. While this survey did not record the number of children in DIY households, more than half reported households of 3 or more, and several mentioned that all of their activities involve their children. Events at local community centers or recreational facilities may be effective venues for reaching DIYers.

Recommendations for Research

It will remain difficult to accurately estimate improper disposal among DIYers with surveys, in spite of the enhancements developed in this project. Still, surveys remain the most useful and cost-effective method for obtaining oil consumption, disposal, and demographic data about California's DIY population.

1. *Additional in-depth analysis*. Additional analyses of the survey data should be carried out beyond the scope of this initial report. Questions that require more analysis continue to be raised and will be raised in the future as a broader audience of local program people engage with these findings. Data on particular kinds of events DIYers attend should be coded and analyzed in the next phase of research.

2. *Alternative measures of improper disposal*. Follow-up research on the statewide data should be carried out in order to investigate thoroughly properties of the alternative measures of improper disposal developed for this survey.

3. *If not awareness of specific impacts, what*? We found no relationship between awareness of specific impacts of improper disposal and disposal practices. If awareness of impacts is not important in encouraging proper disposal practices, what is? Future research should assess alternative hypotheses about the motivational and informational determinants of commitment to proper disposal.

4. *Improving the statewide survey*. Before the next statewide survey, further methodological research should be conducted to validate the methods developed for this survey and to continue the development of best survey participation and question strategies.

5. *Future local surveys*. Local waste management programs that conduct surveys to assess used oil disposal should utilize the methods developed for the statewide survey, particularly the

[*] A survey for the San Francisco Water Pollution Prevention Program. Of the households that learned anything from a campaign involving three different media, 51 percent learned only from street signs.

neighbors-disposal-first method and the alternative measures of disposal practices. These improvements should first be subjected to further scrutiny and validation.

6. *Other data collection methods*. Further research should be conducted on face-to-face data collection methodology at community events, auto parts stores, and recreational facilities; and on observational methods of collecting data that do not rely on surveys.

7. *Shade tree mechanics*. Disposal practices of shade tree mechanics (STMs) and more focused study on the characteristics of vehicle owners who use shade tree mechanics may prove useful to inform outreach efforts to STMs, who appear to be disproportionately comprised of low-income Hispanics.

8. *Curbside pickup*. Further study of the implementation and engineering of curbside pickup, barriers to its adoption by localities, and its impact on disposal behavior is recommended. Even though localities have not applied in recent years for grants to implement curbside pickup programs, the survey indicates that curbside pickup achieves higher collection rates than collection centers do and perhaps higher rates than collection centers can achieve. In spite of the apparent success of the certified collection centers, implementing curbside programs at least in urban areas may still prove to be the most effective method of increasing recycling among the largest number of DIYers. Where curbside pickup of used oil is in place, it is widely used and is likely to decrease the rate and amount of oil improperly disposed. More research should be done to evaluate local curbside recycling programs and their impact on improper disposal compared to localities without curbside programs.

9. *Using aggregate data to project used oil collection*. How much used oil can eventually be collected through the certified collection center program? As it seeks the most effective ways of increasing the collection of used oil, the CIWMB should support a small research project using existing aggregate data on trends in used oil collection and in the establishment of certified collection centers. The increase in used oil recycling achieved by establishing certified collection centers and conducting outreach to the public may be tapering off. The annual rate of increase in used oil collected through the centers may be declining. This might suggest a declining rate of return on the Board's efforts to get people to take their used oil to collection centers. Whether this is happening and how soon it will happen should be examined. A modest research effort could develop a mathematical model to fit trends in used oil collection and make projections of collection through the centers in future years. This information would be useful to the CIWMB as it seeks the best ways to increase legal disposal and recycling.

Endnotes

[1]Deen & Black Public Relations, "Used Motor Oil Public Education Campaign Telephone Survey, Summary of Findings Presented to the California Integrated Waste Management Board," 1994. Meta research carried out the statewide survey under subcontract to Deen & Black.

[2] Ibid.

[3] John Rogers and Tom Greenfield, "Are Estimates of the Concentration of Alcohol Consumption Affected by Undercoverage? Evidence from Five Pooled U. S. Surveys," *Contemporary Drug Problems*, Vol. 27, 2000, pp. 367–381.

[4] Victor Corral-Verdugo, "Dual Realities of Conservation Behavior: Self-reports vs. observations of Re-use and Recycling," *Behavior Journal of Environmental Psychology*, Vol. 17, 1997, pp. 135–145; K. Barker et al., "Comparison of Self-Reported Recycling Attitudes and Behaviors with Actual Behaviors," *Psychological Reports*, Vol. 75, 1994, pp. 571–577.

[5] Gerardo Marín and Barbara Van Oss Marín, *Research with Hispanic Populations*, Sage Publications, Inc., Newbury Park, Calif., 1991, p. 105.

[6] Jennifer Sherman et al., *Finding Invisible Farmworkers: The Parlier Survey*, California Institute of Rural Studies, April 1997.

[7] Linda M. Ghelfi and Timothy S. Parker, "A County-Level Measure of Urban Influence," Rural Economy Division, Economic Research Service, U.S. Department of Agriculture. ERS Staff Paper No. 9702. February 1997. Cited February 7, 2001 in: http://usda.mannlib.cornell.edu/data-sets/rural/97002/README.TXT.

[8] Marín and Marín, p. 107.

[9] The response rate of 38 percent cited at the end of the footnote is telephone response rate #3 in American Association for Public Opinion Research, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, Ann Arbor, Mich., AAPOR, 2000.

[10] California Integrated Waste Management Board, Used Oil Annual Recycling Report 2000. www.ciwmb.ca.gov/UsedOil/ RateInfo/Annual.htm (October 21, 2001).

[11] Ibid.

[12] Ibid.

[13]http://www.reducewaste.org/frame.htm (October 22, 2001).

[14] Public Research Institute with Public Affairs Management, *Educating the Public About the Use and Safe Disposal of Household Toxic Products: A Survey of San Francisco Households*. A Report for the San Francisco Water Pollution Prevention Program, 1996, pp. 32–33.