PEDAKSI: METHODOLOGY FOR COLLECTING DATA ABOUT SURVEY NON-RESPONDENTS

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ABSTRACT

The effects of unit non-response on survey errors are of great concern to researchers. However, direct assessment of non-response bias in survey estimates is rarely possible. Attempts are often made to adjust for the effects of non-response by weighting, but this usually relies on the use of frame data or external population data, which are at best modestly correlated with the survey variables. This paper reports the development of a method to collect limited survey data from non-respondents to personal interview surveys and a large-scale field test of the method on the British Crime Survey (BCS). The method is shown to be acceptable and low cost, to provide valid data, and to have no detrimental effect on the main survey. The use of the resultant data to estimate non-response bias is illustrated and some substantive conclusions are drawn for the BCS.

Key words: Unit non-response, bias, validity, survey of non-respondents, British Crime Survey

1. Introduction

This paper describes a methodology for the collection of key survey data from non-respondents to personal interview surveys and subsequent assessment of non-response bias. The methodology is known as Pre-Emptive Doorstep Administration of Key Survey Items (PEDAKSI). The outcomes of a large-scale field test of the PEDAKSI methodology are reported and discussed.

We first discuss the need for effective methods of assessing non-response bias and then describe the PEDAKSI methodology. The field test is then described and its outcomes documented in terms of ease of implementation, cost, impact on the main survey, and estimates of non-response bias. The final section of the paper draws some conclusions and outlines potential implications for survey design and implementation.

2. The Need for Non-Response Bias Assessment Methods

The control of total survey error is an important issue for any survey. Survey error can be defined simply as the (expected value of the) difference between a survey estimate and the true value of the parameter being estimated. Even using this restrictive definition, survey error has many components, however (Groves, 1989). The components can be divided up into those which are systematic (biases) and those which are random (variance). It is often assumed, at least implicitly, that the major source of survey error is random sampling variance. Many surveys calculate and publish estimates of standard errors that take account only of sampling variance. In practice, there are also other sources of variance (e.g. interviewer variance, coder variance) and there are various potential sources of bias (Lessler and Kalsbeek, 1992).

The bias and variance components of survey error differ in at least one important respect: bias acts independently of sample size, whereas variance is inversely proportional to sample size[1]. The consequence of this is that variance may tend to be the dominant component of survey error for surveys with relatively small samples, whereas bias could well be the dominant component for surveys with large samples. An important source of bias in survey estimates is non-response (Groves and Couper, 1998; Groves et al, 2001). The nature and magnitude of non-response bias can usually only be assessed by indirect methods that rely upon strong assumptions (Little and Rubin, 1986). Adjustment for the effects of unit non-response bias is typically made by weighting based upon frame or population data. Such approaches can only ever correct for that proportion of non-response bias that is explained by the weighting classes. They therefore rely upon an assumption of strong correlation between the classes and the survey measures, as well as requiring correlation between the classes and response propensity. In practice, correlations are often rather modest.

Many survey researchers are consequently wary of the ability of standard weighting techniques to correct adequately for unit non-response bias. They remain concerned about likely residual non-response bias in survey estimates and hanker for direct ways of measuring the bias. Direct measures of bias in the survey variables (as opposed to auxiliary variables) can only be made by collecting data directly from non-respondents. Surveys of non-respondents were first proposed half a century ago (Hansen and Hurwitz, 1946; Hansen, Hurwitz and Madow, 1953, pp 473-475; Durbin, 1954) and many attempts have been made to carry them out. The usual design is to sub-sample the non-responding cases and issue these to experienced interviewers or supervisors[2] (e.g. Martin et al, 1988, pp. 69-70). However, studies carried out in this way typically suffer (not surprisingly) from high non-response rates and are also rather expensive to carry out as they attract fixed costs associated with setting up a stand-alone field exercise as well as considerable marginal costs associated with locating, contacting

[1] Sample size is the number of data units (households or individuals) in the case of sampling variance, the number of interviewers in the case of interviewer variance and the number of coders in the case of coder variance.

[2] Variations on the method include an attempt by Whitehead et al (1993) to collect limited socio-demographic data from all sample members in advance of the main survey field work.

and persuading sample members to respond. In addition, the time-lag between the original survey fieldwork and the survey of non-respondents, inherent in this approach, can cause problems, for example if the survey questions are time-sensitive or if sample members move in the interim.

We describe here a methodology that overcomes these limitations of the standard approach to surveys of non-respondents. The methodology was tested on the BCS, a survey which has a very large sample size and for which bias may therefore constitute the dominant component of survey error. Non-response is likely to be an important source of bias. (As an attempt to represent the resident household population of England and Wales, the BCS can be assumed to be free of sampling bias.) The survey thus provides a powerful test of the proposed methodology. The aim is to demonstrate the feasibility of the proposed data collection methods and to assess the utility of the data obtained.

3. PEDAKSI Methodology

Kulka *et al* (1982) proposed the designation of a number of survey items as "key items." In a field experiment, these were identified to interviewers (by a simple graphic on the questionnaire) so that they could concentrate on these items if an interview had to be rushed or if a respondent refused to give a full interview. The aim was to reduce item non-response and to reduce edit failures. Kulka and his colleagues found that item non-response was reduced for the key items (but increased for some other items) and that unit non-response was reduced too. The PEDAKSI methodology can be viewed as an extension of the idea of Kulka *et al* (1982). It too is based on identifying a limited number of key items. But it differs from Kulka's methods in that a separate instrument is developed, formal rules are adopted for the instrument's administration, additional auxiliary data are also collected, and analysis methods are specified.

The PEDAKSI methodology is simple in its conception, though a number of complexities lie beneath the surface. We shall come to those in a minute. The basic idea is that the survey interviewer, having made contact with a sample member, should ask a small number of key survey items as soon as it becomes apparent that an interview is not going to be achieved at that visit to the address, even though it might still be possible to achieve the full interview at a later visit. This is done by administering a Key Items Form (KIF). The KIF is therefore the central component of the PEDAKSI method. This approach should maximise the proportion of sample members for which at least the KIF is administered. Of course, the KIF will be administered in many cases where the reason for an interview not being possible at that time is not specifically expected to lead to an ultimate survey non-response. These include cases where a randomly-selected individual is not home at the time and cases where the respondent prefers to make an appointment for another occasion. It could be argued that in these types of situations it is not necessary to administer the KIF, but we believe that it is effective to do so, as the cost is low and *some* of these cases *will* end up as unit non-respondents.

At the end of the survey field work period, KIF data should have been obtained for a substantial proportion of survey non-respondents (as well as for some respondents). Survey estimates can therefore be made for non-respondents (for statistics based upon the KIF items) and compared with the survey estimates for respondents (from the questionnaire data). This comparison provides a direct assessment of non-response bias. However, the assessment relies on two assumptions. These must be tested before we can proceed to the stage of claiming that we have estimates of survey non-response bias. These tests constitute the complexities to which we referred earlier. The first assumption is that survey non-respondents who provide KIF data are representative of all survey non-respondents. The second assumption is that the KIF provides valid measures of the questionnaire items. These two assumptions and methods for testing them are discussed in sections 3.1 and 3.2 below.

3.1 Non-Response to the KIF

In just the same way that we were worried about survey non-response bias in the first place, we should be worried about KIF non-response bias. We therefore need to assess this as best we can, by analysis of relevant auxiliary variables. Thus, the collection of those auxiliary variables is an integral part of the PEDAKSI method. We suggest that there are three main sources of auxiliary data that should be considered:

- the sampling frame;
- geographically-referenced or other data that can be linked to the sample;
- interviewer observation data.

In many situations, the sampling frame can provide useful information for the assessment of non-response bias. This is typically true, for example, when the frame is a population register or an administrative list of some kind. Any information that is likely to be correlated with response propensity and/or survey items should be captured at the time of sample selection. There may be other information that could be linked to sample records, either at the individual case level or via geographical identifiers. Common examples are small area data from a recent population census and consumer marketing data. But regardless of the availability of auxiliary information from the sampling frame or via linkage, it is always possible on face-to-face interviewer-administered surveys to collect information by interviewer observation. Furthermore, the nature of this information can be tailored towards the particular survey and the particular needs of the researcher. In the context of a PEDAKSI study, resources should be devoted to the development of a simple and practical instrument for interviewers to record their observations with respect to a small set of items that are expected to be related to the key survey items and also to response propensity. An example is described in section 4 below. The interviewer observation data could also be used for direct estimation of the overall survey non-response bias (as they should not suffer from nonresponse to the extent of the KIF data), but these estimates will only be in terms of observable classification variables rather than key survey variables. The extent of their utility will therefore depend on the correlation between the interviewer observation variables and the key survey variables.

Having collected appropriate auxiliary data, from whatever source, KIF respondents should be compared with other survey non-respondents in terms of these items. If evidence of non-response (to the KIF) bias is found, it may be desirable to perform some corrective weighting before then making the assessment in terms of KIF items of survey non-response bias.

3.2 Validity of KIF items

To provide useful estimates of non-response bias, the KIF items should obtain the same answers as would have been obtained by the equivalent questionnaire items. In other words, the KIF items should be valid measures of the questionnaire items. (This is a separate issue from whether the questionnaire items are themselves valid measures of the underlying concepts.) The PEDAKSI method produces a sub-sample of respondents who provide both KIF and questionnaire data. These cases, while by no means a random subset, allow some assessment of the validity of the KIF implementation of the survey items, by micro-comparisons of the responses to the two instruments.

However, this test must also take into account the fact that neither the questionnaire measures nor the KIF measures will themselves be perfectly reliable (in other words, some respondents might give different answers to the same question on different occasions). The result of this unreliability is that a simple validity coefficient will be attenuated. Consequently, we should incorporate an estimate of the reliability of each of the two items into any estimate of a validity coefficient, as follows (Streiner and Norman, 1989, p.123):

$$r_{XY'} = \frac{r_{XY}}{\sqrt{r_{XX} \times r_{YY}}}$$

Where $r_{XY'}$ is our estimate of the correlation between X, the questionnaire item and Y, the KIF item; r_{XY} is the observed correlation between the two items; and r_{XX} and r_{YY} are respectively the reliability coefficients of the two items. The PEDAKSI method alone provides no direct estimates of r_{XX} and r_{YY} (this would additionally require repeat measures of the same item administered to the same respondents), but provides bounds. An illustration of how these can be used appears in section 5.4 below.

4. Design of the Field Test

The PEDAKSI method was tested on one annual round of the BCS (starting sample 22,170 addresses. The BCS sample design consisted at the first stage of the stratified selection of 800 postal sectors - small geographical areas, each containing around 2,500 resident households on average. Within each of these sample areas, a random sample of 27 or 30 addresses (depending on the sampling stratum) was selected. Further details of the BCS sample design can be found in Hales and Stratford (1997). A random 199 of the 800 BCS sample areas were allocated as the “experimental sample” where the PEDAKSI method would be implemented. The BCS research team was concerned that the application of the KIF might, in some cases, jeopardise the interviewer’s chances of subsequently obtaining a full interview (see section 5.3 below). It was for this reason that use of the form was restricted to approximately one quarter of the sample areas.

A KIF was developed, consisting of a two-sided single sheet of A4 paper containing thirteen questions. Six of these questions were household victimisation screener questions from the main BCS questionnaire. The screener questions are the key BCS items as they are the basis upon which estimates of crime victimisation rates are constructed. The other seven KIF questions were classification items. The KIF is reproduced as appendix A to this paper.

Auxiliary data was obtained from two sources – small area data collected at the sampling stage and interviewer observation data.

The small area data consisted of a widely-used general-purpose commercial classification of small areas known as "ACORN"[3], plus the four variables that were used for stratifying the sampling frame of postal sectors: region, population density (persons per hectare), socio-economic group profile (proportion professional or managerial) and ethnic minority concentration (proportion non-white). These items were recorded for every sampled address.

The interviewer observation data consisted of a page of items administered as part of the sample record documentation[4]. These items concerned the nature of the sampled address/ dwelling, the presence of visible security devices and perceived ethnicity. Some of the items were included because they were found on previous rounds of the BCS to be good predictors of crime victimisation, while others were predicted by the developing theories of survey non-response (Groves and Couper, 1998) to be related to response propensity. The page of items is reproduced as appendix B to this paper.

5. Results of the Field Test

5.1 Collecting the Interviewer Observation Data

The interviewer observation data proved easy to collect. This was expected, as similar data (though not exactly the same items) had been collected on past rounds of the BCS. Amongst the core sample (n = 22,170), item non-response rates were generally around 2% or less. The sole exception was an item about perceived ethnic group of

[3] A Classification of Residential Neighbourhoods (Collins, 1994). ACORN is owned and marketed by CACI Ltd.
[4] The data were initially recorded on a paper document, the "Address Record Form", and then entered by the interviewer in the administration block of the BCS CAPI program.

the occupants, which obtained an item non-response rate of 76%. However, it was mainly responding cases for which the interviewers did not record an answer for this item (perhaps because they knew that the questionnaire included an ethnic group question and hence thought that the KIF item was superfluous in the case of respondents); the item non-response rate was only 9% amongst non-respondents. Recording the data was seen by interviewers as a fairly quick and unproblematic task.

5.2 COLLECTING THE KIF DATA

The KIF was completed at 25% of non-responding addresses in the KIF sample - 210 cases (see figure 1). While this is not a particularly high response rate, it represents data relating to a substantial proportion of the survey non-respondents. There is also reason to believe that it might be possible to improve upon this response rate if the exercise were repeated in the future. Due to an administrative error, at the early survey briefings there was some confusion about which interviewers should use the KIF and in which circumstances. Though this was subsequently rectified, it is certain that there were some sample addresses at which an opportunity to apply the KIF was missed. Furthermore, the BCS (after considerable field effort) achieved a high response rate of 83.5%. Consequently, the survey non-respondents might be considered particularly “difficult” (to contact, to persuade or to interview). A survey with a lower response rate might have more success with the KIF. It is also worth noting that the BCS design (see Lynn and Elliot, 2000) over-samples inner-city areas, where response rates are lower than elsewhere.

Further evidence on likely KIF response rates is provided by Doyle and Farrant (1999). They report a study carried out on twelve consecutive months of the UK Family Resources Survey, a continuous survey with an eligible sample size of around 2,875 households per month. The study applied a form which was in some ways similar to the KIF described above. However, it differed in two important respects. First, it included only classification items. Second, administration was only attempted when a household refused the survey interview. Doyle and Farrant achieved a response rate of

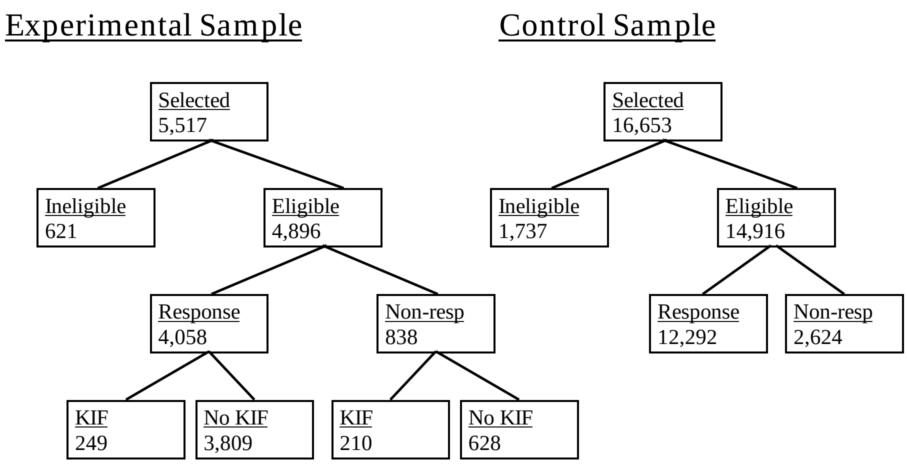
33% amongst refusing households (equivalent to 26% of all non-responding households). But the response rate was 41% in the first month and then gradually declined to 26% in the fourth month. After area field managers and interviewers were reminded of the continuing importance of the form, the response rate then rose again, averaging around 33.5% over the remaining months. This suggests that the training and motivation of interviewers is likely to be an important factor influencing the response rate to a KIF.

The KIF was also completed at 6% of responding addresses (249 cases). These cases are utilised in section 5.4 in the assessment of the validity of the KIF implementation of the survey items.

5.3 THE EFFECT OF THE NON-RESPONSE FORM ON SURVEY RESPONSE

One potential concern is that administration of the KIF, particularly at addresses where it would be possible to make subsequent attempts to achieve an interview, might depress the survey response rate. There was a feeling that having answered a few questions about experiences of crime, reluctant respondents might feel that they had "done their bit" and therefore feel even less inclined to give a full interview. However, these concerns appear to be unfounded. The final survey response rate was 82.9% amongst the experimental sample, and 82.4% amongst the control sample (see figure 1). It should be noted that the allocation of sample areas to the two treatment groups was random within strata, providing samples that are balanced by sampling strata. Furthermore, no significant differences were observable between the two samples in terms of the auxiliary data described in section 4 above.

Figure 1: Completion of the Key Items Form



5.4 THE VALIDITY OF THE KIF DATA

This can be assessed by comparing the KIF and interview data for the 249 sample members who provided responses to both instruments. The first two columns of table I show the mean number of occurrences of each crime for each data collection instrument. There is a suggestion that for some of the screener questions there was a tendency to report more occurrences of the crime on the KIF than in the questionnaire. For one item, the direction of the difference is reversed. The table also displays the observed correlations between the KIF and questionnaire items (r_{XY}). The validity coefficient for the KIF items must lie between the observed correlation and unity. An estimate of the validity coefficient ($r_{XY'}$) is presented, under the assumption that the reliability coefficient for both the KIF item and the corresponding questionnaire item equals the mean of its range of possible values[5].

5 In practice this range is not great. For example, for burglary the range is from 0.877 to 1.000. Published studies of the reliability of survey items have typically estimated reliability coefficients of between 0.7 and 1.0 for various survey variables (Bushnell, 2000), with the highest values relating to fairly easily accessible, factual information (age, sex) and the lower values common for attitudinal variables and complex or immemorable behavioural items (number of occasions a

It can be seen that all but one of these items show reasonably high validity. The exception is the item “break-in with damages”, for which there were no occurrences reported on the KIF amongst this set of respondents. This lack of variation means we have no information on reliability or validity (because correlation is zero). The two other items with relatively low validity appear to be “attempted burglary” and “vehicle theft” with coefficients perhaps in the region of 0.8. In general, then, we can conclude that the KIF appears to have produced valid measurement of the corresponding questionnaire items.

5.5 Non-response bias to the KIF

In order for the KIF data to provide useful information about survey non-response bias, it is necessary for the KIF respondents to be representative of all survey non-respondents. The characteristics of these two groups are compared in table II. For brevity, the proportions in only one or two categories of each auxiliary variable are presented.

particular product used in a particular time period). It seems likely that the crime screener questions would fall somewhere between these extremes, perhaps around 0.9, but with higher reliability perhaps to be expected for rarer, more memorable, events than for more common events.

Table I. Validity and Reliability of the KIF items

Variable	$\bar{x}$	$\bar{y}$	C_{xy}	r_{xy}	$\min(r_{XX})$	r'_{XY}
Victimisation "Screener" Items (rate per 1,000 households per year)						
1.Burglary	44	32	0.98	0.877	0.877	0.934
2.Break-in with damages	16	0	0.98	0.000	*	*
3.Attempted burglary	68	48	0.96	0.639	0.639	0.780
4.Vehicle theft	64	63	0.98	0.643	0.643	0.783
5.Theft from vehicle	234	183	0.93	0.774	0.774	0.873
6.Vehicle damage	229	298	0.88	0.877	0.877	0.934
Demographic Items (mean)						
7.Number of adults in household	2.04	2.06	0.96	0.993	0.993	0.996
8.Total number of persons in household	2.60	2.64	0.96	0.994	0.994	0.998

$\bar{x}$ is the observed mean of x, the questionnaire measure, unweighted;

$\bar{y}$ is the observed mean of y, the KIF measure, unweighted;

C_{xy} is the coefficient of agreement between x and y – the proportion of cases for which x=y.
r_{xy} is the observed correlation between x and y;
$\min(r_{XX})$ is the minimum possible value of the reliability coefficient under the assumption that $r_{XX} = r_{YY}$;
r'_{XY} is the estimated validity of y, under the assumption that $r_{XX} = r_{YY} = (1 + \min(r_{XX}))/2$.
Estimated rates for items 1 to 3, 7 and 8 are based on all households who responded to both the KIF and the questionnaire (n=249); the estimates for items 4 to 6 are based on all of those households who reported on either or both instruments that someone in the household had owned or had use of a motor vehicle at some time since 1 January 1995 (n=192). These estimates should not be treated as estimates of actual crime rates, as the classification of crimes can only be done with reasonable accuracy after asking detailed follow-up questions. It is rather the relative differences between the two data collection modes that are of interest here.

Table II. Characteristics of three response groups

	Survey respondents	Survey non-respondents		
		KIF respondents	KIF non-respondents	Control sample
<u>Interviewer observation</u>	%	%	%	%
Dwelling type: detached house	20.0	14.3	14.0	13.0
Dwelling type: flat	14.7	11.9	25.0	23.7
Entryphone at address	7.7	7.1	13.4	14.0
No visible security device at address	70.9	80.5	79.5	78.7
Burglar alarm at address	17.4	10.5	8.8	11.9
Houses in area mainly in good condition	59.5	53.8	48.6	51.8
Address in better external condition than others in the area	13.4	9.5	7.0	7.2
<u>Census/ small area data</u>				
Region: London	14.9	13.8	27.1	26.1
Region: South west England	8.7	5.7	5.9	5.6
Densely populated area [a]	17.0	22.4	29.9	26.0
Ethnic minority area [b]	17.1	17.1	27.4	27.6
Low social status area [c]	20.2	22.4	22.2	23.1
Less prosperous areas [d]	25.5	26.7	28.3	29.7
n	*16,350*	*210*	*628*	*2,624*

[a] Population density of the sample area (postcode sector) is 50 persons per hectare or more
[b] 10% or more of households in the sample area (postcode sector) have a non-white head of household
[c] Less than 25% of persons of working age in the sample area (postcode sector) are classified as professional or managerial
[d] ACORN categories 13 to 17 inclusive

In general, it appears that KIF respondents have characteristics that lie somewhere between those of the survey respondents and those of the other survey non-respondents. In some respects (presence of security devices, house condition, social status of area), the characteristics of KIF respondents are very similar to those of other survey non-respondents, but in others (presence of an entryphone, proportion living in an ethnic minority area) they are similar to those of survey respondents. It should be noted that apparent differences in the regional distribution of the subgroups are not significant, due to the clustered nature of the sample producing large design effects.

There is of course also strong correlation between some of the variables presented in table II. A binomial logistic regression model was fitted to the data for all experimental sample BCS non-respondents, the dependent variable being whether or not the KIF was completed. The only significant predictors were presence of an entryphone and ethnic minority density (table III). Weights were calculated for KIF respondents as the reciprocals of the model predictions of response propensities. These weights should help to control for non-response bias in completion of the KIF when KIF respondents are compared with survey respondents as a means of estimating survey non-response bias (see section 6 below).

Table III. Binomial logistic regression model to predict propensity for survey non-respondents to complete the KIF[a]

Parameter	B	S.E.	P
Presence of entryphone:			.144
No	0.541	0.301	.072
(Reference category: yes)			
Proportion ethnic minority:			.003
0.01 – 0.0299	-0.606	0.216	.005
0.03 – 0.0999	-0.234	0.221	.289
0.10+	-0.764	0.236	.001
(Reference category: less than 0.01)			
Constant	-1.194	0.326	.0002

[a] Dependent Variable coded 1 if KIF respondent, 0 if KIF non-respondent. Hence, model predicted values represent probability of completing KIF conditional upon failing to respond to the survey. N=838.

6. Estimates of non-response bias

In this section, we estimate the magnitude and direction of survey non-response bias in key survey items by comparing survey respondents and non-respondents who completed the KIF. Estimates of bias are presented for the six victimisation screener questions and seven classification items that were asked on the KIF. The validity of the KIF items as measures of the questionnaire items is assumed (see section 5.4. above). It is also assumed that the KIF respondents are representative of all survey non-respondents. Thus, to control for bias in response to the KIF, the KIF respondents were weighted using the non-response weights described in section 5.5 above. In fact, weighted and un-weighted results were virtually identical: none of the estimates of bias presented below in table IV changed by more than 0.001. We therefore present here only the unweighted results.

Table IV presents mean crime victimisation rates for both respondents and non-respondents, as measured by the screener questions, along with their standard errors. There is no obvious pattern of differences between respondents and non-respondents. Non-respondents report lower levels of victimisation for three items, with no significant difference for the other three. However, for each item the data have very skewed distributions, with the majority of sample members taking the value zero. A very small proportion of the survey respondents account for a large proportion of all occurrences of victimisation. For example, 0.7% of respondents account for 19.1% of all the reported occurrences of theft from a vehicle. And just two respondents (0.01%) account for 13% of all the attempted burglaries reported. Means can therefore be misleading, due to their high sampling variance and asymmetrical margins of error. Consequently, table IV also shows the proportion of sample members who reported one or more occurrence of each crime. Comparing these proportions limits the influence of outlying values amongst the respondents.

While tending to reduce the magnitude of apparent differences between respondents and non-respondents, the overall pattern is similar to that presented by the comparison of means. Non-respondents appear to experience fewer burglaries and attempted burglaries than respondents and, possibly, fewer occurrences of damage to motor vehicles (the statistical significance is borderline for this latter variable). Differences are not statistically significant for the other three crimes.

A number of potential sociological explanations for the observed differences in crime rates are suggested by the analyses presented in section 5.5 above. Non-respondents may tend to live in less desirable properties and properties where entry is more difficult, factors which might suppress the level of burglaries. Questions were not asked about the age or type of motor vehicles, but differences may exist there too. These differences may also be directly related to the survey response process. Anecdotal interviewer reports repeatedly suggest that the experience of crime is itself an important motivation for agreeing to be interviewed on the BCS. In other words, people who have been victims are generally pleased to have the opportunity to tell someone of their experiences[6]. However, none of these tentative hypotheses have been formally tested. The only conclusion that can be safely drawn from the data is that there is no evidence that non-respondents experience <u>higher</u> levels of crime than respondents. It also appears that non-respondents have a smaller average household size to respondents and are less likely to own a motor vehicle.

[6] An alternative hypothesis, that there may be deliberate under-reporting on the KIF as a means of “getting rid of” the interviewer by showing that the sample member has nothing interesting to report, is not supported by the findings of table I.

Table IV: Reported Victimisation Rates (Respondents and Non-Respondents) [a]

	Mean (standard error)		Proportion reporting one or more occurrence		Estimated non-response bias[b]
	Respondents	Non-Respondents	Respondents	Non-Respondents	
1. Burglary	0.043	0.014	0.035	0.011	+0.004
	(0.002)	(0.010)	(0.002)	(0.008)	
2. Break-in with damages	0.006	0.011	0.004	0.011	-
	(0.001)	(0.007)	(0.001)	(0.007)	
3. Attempted burglary	0.057	0.017	0.040	0.017	+0.004
	(0.006)	(0.009)	(0.002)	(0.009)	
4. Theft of a vehicle	0.031	0.050	0.027	0.041	-
	(0.002)	(0.023)	(0.001)	(0.014)	
5. Theft from vehicle	0.134	0.134	0.099	0.102	-
	(0.004)	(0.040)	(0.002)	(0.021)	
6. Vehicle damage	0.211	0.115	0.134	0.097	-
	(0.008)	(0.034)	(0.003)	(0.021)	
7. Vehicle ownership	0.733	0.620			+0.019
	(0.003)	(0.034)			
8. Household size	2.426	2.182			+0.042
	(0.011)	(0.081)			
9. Adults in household	1.905	1.754			+0.026
	(0.007)	(0.032)			
Base [c]	*16,350*	*203*	*16,350*	*203*	

[a] Estimates in this table are based on data that has been weighted to correct for differences in selection probabilities (inner-city over-sampling and sub-selection at multi-household addresses).

[b] Non-response bias is estimated as the difference between the estimate for respondents and the estimate for all sample members combined, but only if the difference in the estimates for respondents and non-respondents is significant (P<0.05): for variables 1 to 6, the estimate applies to a proportion, for variables 7 to 9 it applies to a mean.

[c] The bases shown apply to items 1, 2, 3, 7, 8 and 9. Items 4, 5 and 6 are based only upon those households who reported ownership or use of a motor vehicle of some kind.

In addition to providing direct estimates of non-response bias in a small set of key survey variables (the main purpose), the PEDAKSI method can also provide direct estimates of bias in the auxiliary variables. This is particularly useful in helping to derive a non-response weighting strategy for the survey and also for comparison with non-response bias observed on other surveys. Response rates for various sub-categories of the sample are presented in tables V and VI. A logistic regression model to predict survey response was also fitted to the data and is summarised in table VII. It is clear that the responding sample is biased in terms of many of the auxiliary variables. Many of the bivariate differences in response rate noticeable in tables V and VI carry through to the model, though a few do not. Notably, region is not a significant predictor of response rate once the model has controlled for the other auxiliary variables. A particularly strong predictor of response rate is population density. There are theoretical reasons why this should be the case (Groves and Couper, 1998, pp 176-177) and other studies have found a similar empirical relationship (e.g. Brehm, 1993; Lynn et al, 2001; Smith, 1983; Steeh, 1981). Other good predictors include the interviewer-observed measures regarding the general condition of houses in the area, and external condition of the sampled property relative to others in the area. Propensity to respond to the BCS is lower the worse the general condition of houses in the area and is lower at sampled addresses that are perceived by interviewers to be in worse condition than others in the area. Reduced response propensity is also associated with the presence of an entryphone, burglar alarm, security gates or security patrol. Some of these security devices may present physical barriers to the survey interviewer, either in terms of gaining access to the respondent (security patrol) or in terms of communication with the respondent (entryphone). It is interesting to the note that the effect of a burglar alarm is the reverse of that observed in the bivariate analysis. Response rates were higher at addresses with a burglar alarm, but after controlling for dwelling type, population density and the other co-variates in the model, burglar alarms are associated with a reduced response propensity.

Table V: Response rates for sample categories defined by interviewer observation variables

	Response rate (%)	n
Dwelling type:		
Detached house	87.7	3,724
Semi-detached house	84.9	6,179
End terrace	84.1	1,598
Mid-terrace	81.9	4,470
Maisonette	78.0	387
Purpose-built flat	74.8	2,674
Converted flat/ rooms	76.0	584
Unable to code	50.6	172
Entrance type:		
Separate accommodation	84.1	16,228
Shared accommodation with separate entrance	79.0	1,141
Shared accommodation with shared entrance	73.8	2,443
Entryphone at address:		
Yes	73.3	1,729
No	83.5	18,059
Number of floors in building (flats):		
Less than five	76.6	3,031
Five or more	69.6	546
Visible security at address:		
None	80.6	14,380
One or more devices	87.9	5,408
Burglar alarm	88.1	3,233
Security gate over front door	80.9	178
Bars/ grilles on windows	86.1	223
Security patrol	70.5	207
Condition of houses in area:		
Mainly good	84.6	11,495
Mainly fair	81.0	7,483
Mainly bad	73.6	656
Mainly very bad	70.8	89
External condition of property relative to others in the area:		
Better	89.7	2,445
About the same	82.7	15,892
Worse	72.6	1,338

Table VI: Response rates for sample categories defined by frame/ small area variables

	Response rate (%)	n
Region:		
North	84.9	1,332
Yorks and Humberside	82.3	1,992
North west	80.4	2,505
East Midlands	84.4	1,498
West Midlands	82.8	2,060
East Anglia	89.1	743
South east	85.1	3,785
South west	87.9	1,616
Wales	88.9	958
London	73.4	3,323
Population density (persons per hectare):		
< 5.0	86.8	4,121
5.00 – 19.99	84.7	4,747
20.00 – 34.99	83.5	3,720
35.00 – 49.99	81.3	3,523
50.00+	75.2	3,701
Proportion of households with non-white head:		
< 0.006	85.3	3,247
0.006 – 0.0099	85.3	3,533
0.01 – 0.0299	83.7	5,200
0.03 – 0.0999	83.3	4,098
0.1 +	75.1	3,734
Proportion of adults classified as socio-economic group “managers and professional”		
< 0.25	80.6	4,099
0.25 – 0.2999	83.3	3,644
0.30 – 0.3499	82.4	4,128
0.35 – 0.3999	83.2	3,366
0.40 +	83.2	4,575

Table continued on next page

Table VI continued

ACORN (selected groups):		
Affluent greys, rural communities (gp. 2)	90.4	333
Affluent executives, family areas (4)	87.5	662
Well-off workers, family areas (5)	86.0	1,074
Prosperous pensioners, retirement areas (3)	79.5	522
Better-off executives, inner-city areas (8)	75.9	675
Council estate residents, high unemployment (15)	75.0	824
Multi-ethnic, low-income areas (17)	69.9	569

Table VII: Binomial logistic regression model to predict propensity for survey response [a]

Parameter	B	S.E.	P
Dwelling type:			.000
Semi-detached house	0.060	0.066	.367
Mid-terrace	0.097	0.074	.189
End terrace	0.030	0.092	.744
P-B flat/maisonette	0.289	0.087	.001
Converted flat/bedsit	0.167	0.123	.176
Unable to code	1.582	0.168	.000
(Reference category: detached house)			
Whether dwelling in better or worse condition than others in area:			.000
Worse	1.043	0.093	.000
About the same	0.533	0.071	.000
(Reference category: better)			
Population density (persons per hectare):			.000
5 - 19.99	0.127	0.067	.059
20 - 34.99	0.169	0.074	.022
35 - 49.99	0.270	0.076	.000
50+	0.429	0.084	.000
(Reference category: < 5)			

Table continued on next page

Table VII continued

Parameter	B	S.E.	P
Condition of most dwellings in area:			.000
Mainly fair	0.109	0.043	.012
Mainly bad	0.380	0.099	.000
Mainly very bad	0.631	0.244	.010
(Reference category: mainly good)			
Proportion of non-white household heads:			.031
0.01 - 0.0299	0.035	0.055	.522
0.03 - 0.0999	-0.032	0.061	.604
0.10+	0.162	0.071	.023
(Reference category: < 0.01)			
No entryphone:	-0.278	0.076	.000
(Reference category: entryphone)			
No visible security devices	0.697	0.080	.000
(Reference category: 1+ devices)			
Burglar alarm	0.333	0.095	.001
(Reference category: no alarm)			
Security gate(s) on door(s)	0.415	0.205	.043
(Reference category: no security gates)			
Security patrol	0.731	0.175	.000
(Reference category: no security patrol)			
ACORN group:			.001
Affluant rural areas	-0.401	0.199	.044
Prosperous retirement areas	0.220	0.128	.085
Family areas	-0.099	0.092	.286
Better-off metropolitan areas	0.083	0.096	.386
Middle-aged home owners	-0.095	0.083	.254
Skilled manual home owners	0.161	0.084	.056
New home owners	-0.025	0.089	.778
Less well-off areas	-0.084	0.081	.297
Lowest income areas	-0.053	0.097	.585
(Reference category: affluant suburban)			
Constant	-2.829	0.141	.000

[a] Dependent variable coded 1 if non-respondent, 0 if respondent. Hence, model predicted values represent probability of not responding to the survey. N=19,763 (49 cases excluded from the analysis due to missing values on one or more variables).

The details of the model and the observed relationships will not be discussed further here. The brief outline in the previous paragraph is intended simply to demonstrate that the data collected by the PEDAKSI method provide powerful information for the analysis of survey non-response. Models of the sort presented in table VII could of course be used as the basis for a non-response weighting adjustment if desired.

7. Conclusions

The PEDAKSI methodology has been shown to be feasible, cheap, and informative. Furthermore, it does not appear to have any detrimental effect on the main survey. The resultant data provide valid measures of a small set of key survey items for a proportion of the survey non-respondents. Consequently, the data can be used to make direct estimates (for key survey estimates) of non-response bias. The methodology also produces data necessary to check the validity of the KIF items (KIF data for a proportion of survey respondents) and the representativeness of KIF respondents (auxiliary data for all sample members). These data can be used to make appropriate statistical adjustments to the PEDAKSI estimates of non-response bias if necessary. The auxiliary data can also be used to develop survey non-response weights (for unit non-response) and can be useful for imputation (for item non-response) too (De Leeuw, 2001).

It is suggested that interview surveys for which estimates of non-response bias would be useful should consider adopting PEDAKSI methodology. The key components that require advance planning are the collection of appropriate interviewer observation data and the implementation of a KIF. Both of these data collection instruments should be tailored to the specific survey. Thus, it is important that the PEDAKSI methodology should be considered from a very early stage of the survey design and planning. The collection of appropriate data from the sampling frame or via linkage should also be considered at the sampling stage. Later, once the data have been collected, appropriate analysis is required. No specialist knowledge or software is needed, only standard techniques as outlined in this paper. However, the data collected by PEDAKSI could also be used for more advanced analysis of survey non-response and this is to be encouraged. Indeed, we would also encourage researchers to document and archive any data collected by PEDAKSI so that it may be available to methodologists wishing to carry out secondary analysis.

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BRITISH CRIME SURVEY

Key Items Form

0. ENTER SERIAL NUMBER: [ ][ ][ ] [ ][ ] [ ] [ ]

1. I'd just like to ask you six quick questions about things which may have happened over the 13-14 months since the first of January 199X, in which you may have been the victim of a crime.

   Since the first of January 199X, has anyone got into your *house/flat* without permission and stolen or tried to steal anything? (How many times?)

   IF NONE CODE 00

   Burglary

   INCLUDE PREVIOUS ADDRESSES **WRITE IN NUMBER OF TIMES** [ ][ ]

2. *(Apart from this)*, in that time did anyone get into your *house/flat* without permission and cause damage? (How many times?)

   Break-in with damage

   INCLUDE PREVIOUS ADDRESSES **WRITE IN NUMBER OF TIMES** [ ][ ]

3. *(Apart from this)*, in that time have you had any evidence that someone had tried to get in without permission to steal or cause damage? (How many times?)

   Attempted burglary

   INCLUDE PREVIOUS ADDRESSES **WRITE IN NUMBER OF TIMES** [ ][ ]

4. Has anyone now living in this household owned or had the regular use of a car, van, motorcycle or other motor vehicle at any time since the first of January 199X?

   Yes 1 **ASK Q.5-7**

   No 2 **GO TO Q.8**

5. Since the first of January 199X, have you, or has anyone in your household had their car, van, motorcycle, or other motor vehicle stolen or driven away without permission? (How many times?)

   Vehicle theft

   WRITE IN NUMBER OF TIMES [ ][ ]

6. And *(apart from this)*, since the first of January 1995 has anyone in your household had anything stolen off their vehicle or out of it - parts of the vehicle, personal possessions or other things? (How many times?)

   Theft from vehicle

   WRITE IN NUMBER OF TIMES [ ][ ]

7. And *(apart from this)*, in that time has anyone had their vehicle tampered with or damaged by vandals or people out to steal? (How many times?)

   Vehicle damage

   WRITE IN NUMBER OF TIMES [ ][ ]

Appendix A: Key Items Form (KIF)

ALL

8. Could you just tell me how many people there are altogether in your household - including any children or babies?

TOTAL NUMBER IN HOUSEHOLD: [ ][ ]

9. And how many of those are people aged 18 or over?

NUMBER OF ADULTS AGED 18+: [ ][ ]

10. And of those aged 18 or over, how many are <u>men</u>, and how many are <u>women</u>?

NUMBER OF MEN: [ ][ ]

NUMBER OF WOMEN: [ ][ ]

11. Could you tell me your own age?

WRITE IN AGE: [ ][ ]

Or code: Refused 97

12. Finally, could you please tell me which of these groups best describes you?

White	1
Black - Caribbean	2
Black - African	3
Black - Other: ______________	4
Indian	5
Pakistani	6
Bangladeshi	7
Chinese	8
Other ethnic group: ______________	9
(Refused)	0

13. INTERVIEWER: THE PERSON WHO ANSWERED THESE QUESTIONS ...

... WAS THE PERSON SELECTED FOR INTERVIEW;	1
... WAS NOT THE PERSON SELECTED FOR INTERVIEW.	2
(NO SELECTION OF PERSON TO INTERVIEW WAS MADE)	3

14. Interviewer Name ... ... and Number

[ ] [ ][ ][ ][ ][ ][ ]

Appendix B: Classification Items Obtained for all Sample Cases by Interviewer Observation

ALL RESIDENTIAL ADDRESSES (CONTACTS AND NON-CONTACTS – INCLUDING VACANTS)

17. Does the address have an entryphone?

Yes	1
No	2

18. Which of the following are visible at the sampled address?

CODE ALL THAT APPLY

Burglar alarm	1
Security gate over front door	2
Bars/grilles on any windows	3
Other security device(s)	4
Estate/block security lodge/guards	5
None of these	0

INTERVIEWER ASSESSMENTS:

19. Are the houses/flats in this immediate area in a good or bad physical state?

Mainly good	1
Mainly fair	2
Mainly bad	3
Mainly very bad	4

20. Is the sampled house/flat in a better or worse condition outside than the others in this area?

Better	1
Worse	2
About the same	3
Does not apply	4

21. Do you know or think that the occupants are probably…

… white	1
… black	2
… Asian	3
… Other: ___________________	4
Don't know	5

22a. SAMPLED DWELLING IS:

IF NO DWELLING SELECTED, CODE FOR ADDRESS

Whole house:– detached	1
Semi-detached	2
mid-terrace	3
end terrace	4
Maisonette	5
Flat:– purpose-built	6
converted	7
Rooms, bedsitter	8
Unable to code	9

IF FLAT ETC (5-7 AT a.) ANSWER b-e. OTHERS - END

b. CODE TYPE OF FLAT ETC:

Self-contained	1
Not self-contained	2
Don't know	8

c. BUILDING HAS:

Fewer than 5 floors	1
5 floors or more	2
Unable to code	3

d. FLOOR LEVEL OF MAIN ACCOMMODATION:

Basement/semi-basement	1
Ground floor/street level	2
First floor	3
2nd/3rd floor	4
4th – 9th floor	5
10th floor or higher	6

e. BUILDING HAS:

Common entrance: lockable	1
Common entrance: not lockable	2
No common entrance	3