

EVALUATING QUESTIONNAIRE DESIGN: DATA ADJUSTMENT IN THE DIARY OPERATIONAL TEST

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The Bureau of Labor Statistics (BLS) in collaboration with the Census Bureau, began testing new formats for the BLS Consumer Expenditure Diary Survey in 1985 to increase collection and improve estimates. Two of the diaries were research diaries, the Nonspecific Test diary and the Specific Test diary. One control diary and the BLS production subsample were also used. The diaries were placed with different respondents in 22 self representing PSUs^{1/}. The test was administered for a six month period and each consumer unit^{2/} surveyed was asked to participate for two weeks. All of the diaries have two components - The Household Characteristics Questionnaire and The Diary Instrument kept by respondents. Each of The Household Characteristics Questionnaires are interview administered and collect information concerning income, demographics and household composition. The Diary Instrument is left with the respondent to record all purchases for a seven day period. Business expenses and expenditures for persons away from home overnight are not collected. At the end of the seven day period, the interviewer reviews the Diary with the respondent and interviews for select often omitted items. A second Diary is left to record expenditures for an additional seven days. The interviewer returns, reviews the second diary and interviews for the same often omitted items.

Upon completion, the surveys are reviewed in the Census regional offices and then sent to a central location for coding. After the Census Bureau completes their review and initial editing of the data, it is sent to the Bureau of Labor Statistics for additional processing, analysis and review.

The Diary Instrument portion of each of the surveys was examined to determine and compare the level of BLS data adjustment performed in each. The four diaries are the Production Test Diary, Control Test Diary, Nonspecific Test Diary and Specific Test Diary. They differ in format and in the amount of structure. The Production Test Diary is unstructured and is a replica of the current diary survey used at the Bureau of Labor Statistics. Respondents record the item purchased and the cost under five categories- A) Food at Home, B) Meals Away from home 3) Food as Gifts, D) Clothing and E) All Other purchases. In addition, to the item and the cost, the two food sections require the respondent to record the number of cans, bottles etc ..., the net weight and the packaging of each item purchased. The Clothing section of the Production Test diary requires the respondent to provide the age and sex for whom each item was purchased and whether it was purchased for someone outside of the consumer unit. The "All other purchases" section also requires the respondent to record whether the item was bought for someone outside the consumer unit. The Meals section requires the respondent to record the type and cost of the meal, (breakfast, lunch, dinner or snack), to indicate whether or not alcohol was included and to record separately the cost of any alcohol purchased.

The Control Test Diary is also identical to current production diary used at the Bureau of the Labor Statistics but it has a different Household Characteristics Questionnaire than the Production Test Diary.

The Nonspecific Test Diary is more structured than the current diary format. Fairly specific categories (Housekeeping supplies, smoking supplies, vegetables etc...) are listed within the five sections used in the Production and Control diaries. Examples are provided within each subdivision of the Nonspecific to aid reporting. Reports under the "Food at home" and "Food as Gifts" sections do not require the respondent to record the number of cans or the net weight. There is no separate clothing section. Clothing purchases are collected in the "All other purchases" section. Respondents are not required to record whether the purchase was for someone outside the consumer unit. The Meals section is identical to the Meals section in the Production and Control test diaries.

The Specific Test Diary is the most structured. Items are listed for the respondent under category headings (i.e., - cereal, canned ham and peanut butter). Respondents mark an "X" for those items purchased on a given day and the cost. No additional information is asked for the Food at Home, Food as Gift and All other purchases sections. There is no clothing section in the Specific. The Meals section is expanded to collect the type of alcoholic beverage(s) purchased (beer, wine and other alcohol) with or without meals. Purchased items that are not listed in the Diary for the respondent to mark, are collected in open "other item" sections and require the respondent to record the item purchased, the cost and the packaging of the item.

Data Adjustment

Data adjustment in all four diaries is performed to correct records and create values to replace missing data. These adjustments occur when respondents omit information or when responses are inconsistent. The created values are derived from actual reported values. All appropriate information must be on a record before a Universal Classification Code (UCC)^{3/} can be assigned to an expenditure and final estimates calculated. The Nonspecific and Specific Test diaries require the respondent to furnish less additional information and offer more structure for recording expenditures. Therefore the amount of data needing some form of adjustment should be less for these diaries than in the Production or Control. The Specific Test Diary is the most structured and so could be expected to require the smallest amount of data adjustment of all the test diaries. Parallel methods of data adjustment were performed in the test diaries whenever possible. The processing of data for all four diaries followed current Consumer Expenditure (CE) processing procedures and used current CE production data adjustment methods. Some modifications were made to allow for the

processing of the different formats in the test diaries. Data adjustment for all four test diaries fall under four stages-I Screens, II Monitor, III Imputation and IV Allocation.

I. Screens

The screens procedure is the initial review of data to verify outlier expenditures. Keying and coding accuracy for these high expenditures are reviewed. High values are also verified to determine whether they are in the scope of the diary e.g., business expenses. Values that are out of scope are deleted.

II. Monitor

Monitor is an editing and coding program which assigns UCC's to reports that contain all required information. Records which are inconsistent, incomplete or have errors are data adjusted or outputted for manual data adjustment by Monitor. The Specific Test Diary did not require Monitor because possible items were supplied with the Specific format therefore line numbers could be directly assigned to UCC's.

III. Imputation

Data is imputed for attribute fields when information has not been properly supplied by the respondent. The Consumer Price Index (CPI) requires all information to classify final estimates. The following fields are imputed when needed: 1) The package type of an item in the food sections, 2) The age and sex for whom items were purchased in the Clothing section, 3) The alcohol yes/no question and the alcohol cost field in the Meals section, 4) The determination of whether items in the Clothing section and all items in the "All Other Purchases" section were purchased for someone outside the Consumer Unit (gift).

IV. Allocation

Allocation in all four test diaries, is performed when a report is not specific enough to be assigned a UCC even after imputation. The dollar amount reported is divided amongst specified components of an item code. Once a report such as "beef" has a package type, the expenditure is allocated to all types of "beef" under the selected package type (ground beef chuck roast, sirloin steak, other steak and other beef). A UCC can then be assigned to each of the components.

The Screens and Monitor stages of data adjustment correct inconsistencies due to respondent and keyer error. The data is enhanced by these stages of data adjustment. The Specific and Nonspecific test diaries had the greatest percentage of errors in Screens in comparison with the Production and Control. The increase in coding and keying errors in the Nonspecific and the Specific was due, in part, to inexperience with the new formats on the part of coders and interviewers.

Monitor outputs inconsistencies in the data. The reduction in the amount of information required of the respondent led to fewer inconsistencies in the Specific and Nonspecific test diaries. The structure in the Specific also led, in part, to fewer zero cost

reports. Respondents were more inclined to record a cost using the Specific format. The Specific did have more alcohol reporting inconsistencies. These alcohol reporting errors were due, in part, to the expanded alcohol format in the Specific, which required additional information on the part of the respondent. Respondents were required to supply the total cost and the cost and the type of alcohol purchased.

Imputation and allocation are data adjustment procedures which substitute values for missing data. These methods, especially allocation, can affect means and reduce the integrity of the data. Imputation is performed for attribute information. Records are imputed based on the reporting patterns generated from similar correctly reported data. Imputation reinforces the existing reporting patterns. The probability that a record is imputed to a particular information type is based on and increases dependent on, how often that information type is reported. The smaller the amount of imputed records, the more reporting patterns reflect actual buying distributions. The Specific Test diary required the smallest amount of, imputation. It was only performed in the Meals section. This lower amount of imputation was due in part to the format of the Specific which pre-data adjusted records by providing respondents with possible items. The Nonspecific required the second smallest amount of imputation. Imputation was performed in the food section at home for packaging as well as the meals section. There was not a lot of difference in the amount of package type imputation between the three diaries even though the Specific and Nonspecific required less knowledge of each of the food purchases. The Production and Control required imputation not only for packaging type and the alcohol yes/no question but also for the age and sex for whom a clothing item was purchased and whether the clothing item was a gift and the gift determination was required for all other purchases. Estimates more accurately reflect actual buying habits in the two more structured diaries (The Specific and Nonspecific) which both required less imputation than the unstructured diaries.

The Specific yields a more accurate reflection of those items that were listed on that diary. The Specific had the smallest amount of allocation (1.1%). This was due, in part, to the structure of the Specific diary. Respondents were supplied items, so reports had the required level of specification. The Nonspecific had the greatest amount of allocation (3.7%). This was also due, in part, to the format. The category headings which listed groups of items. This encouraged less specific responses, in the Nonspecific, than in the other three diaries. Means in the Nonspecific diary, at the UCC level, are more distorted by allocation than in the other three diaries.

The differences in the formats of the diaries did produce varying amounts of data adjustment, The more structured diaries had fewer respondent errors and therefore less data adjustment was required as was expected. The differences in the amount of data adjustment between the four were not dramatic. Only

a small percentage of data in all four diaries required any data adjustment. The disparity in amounts of adjustment was due in part to the following:

- 1) The amount of structure in each diary.
- 2) Processing specifications. Time and programming constraints created a few differences in processing. For example, The Specific test Diary listed possible food at home items. Respondent marked the items purchased. No additional information was requested. The Specific also had an "open food section" for respondents to record items which were not listed. This section required additional information but it was not imputed, when not supplied (package type). All reports were assigned an appropriate UCC.
- 3.) Differences in reporting patterns may account for some of the differences in the collected data.

Percentage of Data Adjustment by Type of Data Adjustment.

	Production	Control	Non-specific	Specific
Screens (error percentage from the 1% selected for review)	17.3%	16.6%	25.0%	18.3%
Monitor	1%	1%	2%	2%
Imputation (all types)	3%	3%	2%	2%
Number of records after processing	101757	83140	78519	31176

The increased structure of the Nonspecific and Specific led to fewer inconsistencies in the data and fewer imputations. Respondents were required to furnish less information so there were fewer possible reporting errors. The increased structure also appeared, in part, to reduce the total number of reports. The data in the more structured diaries may yield a more accurate reflection of the buying habits, for those items listed as examples in the Nonspecific and those items provided in the Specific. The more structured diaries required the respondent to provide less additional information such as the package type of food purchases or the age and sex for whom clothing was purchased. This reduction in the amount of information provided reduces the types of data collected. The Specific and Nonspecific produce much less data on gift purchasing behavior. Apparel purchases are not emphasized. The Production and Control have separate sections which collect clothing expenditures. Information on the age and sex for whom clothing items were purchased is not collected at all in the Specific and Nonspecific test diaries.

Respondents are more encouraged, by the formats of the Specific and Nonspecific, to report the given items but fewer additional types of items were

reported in these diaries. There were fewer total reports in the Specific (31,176) and Nonspecific (78,519) compared with the Production (101,757) and Control (83,140). The format of the Production and Control also appeared to have encouraged a greater variety and number of expenditures because respondents reporting was not as structured. Respondents were not as encouraged to report certain items and perhaps were more inclined to report all purchases made which would yield better estimates of consumer buying habits. This reduced structure in the Production and Control did, in part, increase the percentage of keyer and respondent errors in these diaries because the respondent was required to provide more information. The difference in the amount of data adjustment between the diaries may not be significant, however. The amount of data adjustment required did vary but those differences in data adjustment were not large. Perhaps more significant is the reduction in the number of records in the more structured diaries, especially in the Specific Test Diary.

^{1/} PSUs in Sample for the Diary Operational Test

PSU	Name	BLS Area Code
6160	Philadelphia	A102
1120	Boston	A103
6280	Pittsburgh	A104
1600	Chicago	A207
2160	Detroit	A208
7040	St. Louis	A209
1680	Cleveland	A210
5120	Minneapolis	A211
5080	Milwaukee	A212
1640	Cincinnati	A213
3760	Kansas City	A214
8840	Washington, D.C.	A315
1920	Dallas	A316
0720	Baltimore	A317
3360	Houston	A318
0520	Atlanta	A319
5000	Miami	A320
4480	Los Angeles	A421
7360	San Francisco	A422
7600	Seattle	A423
7320	San Diego	A424
6440	Portland	A425

^{2/} Consumer Unit is an individual or group of individuals which act as a single economic unit related by blood, adoption, marriage, or rely exclusively on each other for major expenses.

^{3/} Universal Classification Code (UCC) is the lowest level of detail for publishing data.

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