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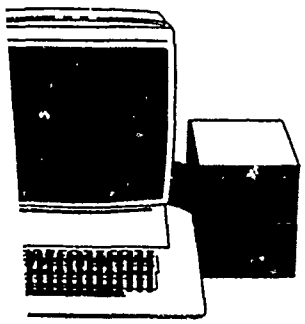

# A GUIDE TO HANDLING BIOMEDICAL DATA*

by

Richard See

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# A GUIDE TO HANDLING BIOMEDICAL SURVEY DATA*

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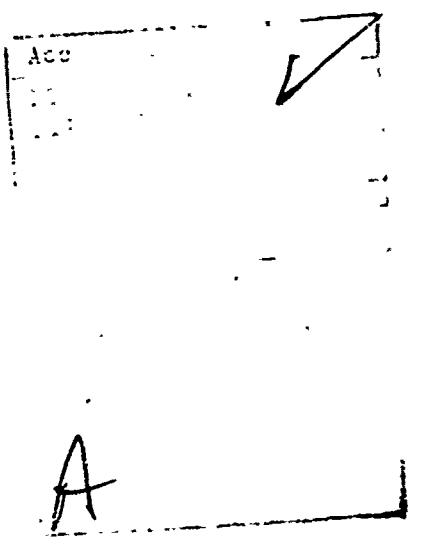


## I. Importance of Proper Data Handling Procedures in Medical Research

Almost all medical research today involves the gathering, processing, analysis, and presentation of data. In some studies the data may be incidental and limited in quantity. In others, they may be voluminous and critical to the entire project. In particular, epidemiological studies "are concerned with explaining the occurrence of disease in human populations and with exploiting explanations discovered for the development of methods to protect man against disease." (1) Medical surveys are a key step in most epidemiological studies and usually involve large amounts of data. For this reason the discussion which follows will focus on the role of data handling in medical surveys in order to illustrate typical procedures which may be used to help ensure the validity of the data and the conclusions drawn from them.

Successfully completing a research project is like walking a mountain path. There are many points at which one may fall off the path, or lose one's way but perhaps only a few ways to reach the goal. Almost all medical investigators are aware of the need for maintaining the proper level of scientific methodology with regard to the purely medical aspects of their project. For, if not, their project would probably not have been approved to begin with. Many researchers, however, become less careful when it comes to handling the data. They may hand over most of the data to an assistant or clerk, or else to a computer center, with only limited instructions as to what to do. The same scientist who checks and double-checks the medical aspects of the project may assume that the data will take care of themselves. However, people responsible for computer work have come to know the danger of such an assumption.

In the computer field, and in engineering in general, where things must work properly, or not at all, the tendency for things to go wrong is widely recognized. This tendency is often referred to humorously as "Murphy's Law" and is widely acknowledged by computer professionals. What is involved here, of course, is the level of complexity of computers and data processing has reached the point where the probability of at least one aspect failing is very large. This "law" will undoubtedly come to be better known among medical scientists as they become accustomed to the difficulties that can and will arise in handling large amounts of data.

What are the possible consequences of improper handling of data? First, improper data handling may invalidate an entire project. If this is discovered early enough, it may be possible to go back and remedy the damage by correcting the data, or by collecting a new set of data.

If errors or problems with the data are discovered too late, the entire project may be aborted, due to the impossibility, in many cases, of going back to undo the damage. Worst of all, for the medical profession, improper handling of the data may render the results of the project invalid, without this coming to the attention of the investigator, who may assume that all is well. In some cases, invalid results may be so difficult to identify that they may be published and mislead the medical community. It is to avoid such problems and misfortunes that everyone involved in medical research should become familiar with proper methods of data handling.

## II. Role of Computer in Handling Survey Data

### A. Functions

1. Record Keeping. One of the ways a computer can be of great help in research is in record keeping. Handwritten records may be hard to read, hard to duplicate, and easily misplaced. If research data can be maintained in a computer system or on punched cards, printed output can be produced which can be stored in several places and in many forms for safety and for dissemination. In many cases, this ability of the computer to serve as a "printing press" for the dissemination of data can be its most valuable function. It should be noted that local officials cooperating in medical surveys often appreciate receiving clear computer printouts of the results, especially when promptly received, and that this is one way in which the survey team can partially repay the personnel who cooperated on the local level. This courtesy helps to assure future cooperation in case further surveys are needed.

2. Error Checking The use of a computer can facilitate error checking and correction, thru listing and tabulation of the raw data. It can also eliminate recopying of data, which so easily leads to new errors. With a computer, such transfers of data from one form to another can be made mechanically, with no further addition of error.

3. Statistical Analysis. Once the data have been entered into a computer system or onto punched cards it becomes possible to carry out repeated statistical analyses without further manual handling of the data. Many programs are available for this purpose in a variety of computer languages.

4. Tables and Graphs. After the research has been completed and is ready for publication or reporting, the computer can again be of assistance in preparing tables and graphs. Many modern computers can produce tables and graphs of sufficiently high quality as to be suitable for publication without further work.

### B. Patterns of Computer Utilization

1. Direct Use of Computer by Researcher. If a researcher (a) has a computer available, (b) knows how to use it, (c) has statistical programs available, or can write them himself, (d) can enter the data himself, and (e) understands enough statistics to be able to properly interpret the results, then he should be able to do his data analysis with the aid of the computer without help from anyone else. However, it is rare that all of these conditions are satisfied at once, in a single person. Assuming that a computer is available, the researcher may need assistance in any one of the four other areas from (b) to (e). He may need someone to operate the computer for him, or to prepare programs for him. If he cannot type, he will need someone to keypunch the data on punch cards or to enter the data directly, using a terminal. If he doesn't understand the statistical results, he will need to consult a statistician before he can interpret them.

2. Use of a Computer Center. If the researcher has a computer center available which can assist him, he may be able to get the needed data processing work done for him, up to the point of obtaining some statistical output from the computer. If he understands statistics and can tell the computer center personnel exactly what he needs, and can interpret the final results, he can then make good use of the computer. However, unless the computer center is familiar with statistical work and has the necessary programs, he will probably find it very difficult to get the necessary work done in a satisfactory manner.

3. Cooperation with Statistician. Unless the researcher has a background in medical statistics, cooperation with a statistician is essential to the success of any project involving extensive data analyses. The statistician should be able to help with the entire project, from the design through to the final conclusion. The statistician will also be able to ensure the integrity of the data by checking for completeness and accuracy at each stage. For successful data processing and analysis, the statistician must be able to work with the computer center in order to obtain the desired results. Often, special computer programs are needed. Even if the statistician cannot himself do computer programming, thanks to his mathematical training he will be able to collaborate with a computer programmer to make sure that the correct statistical manipulations are performed and that the results are meaningful.

C. Criteria for Deciding to Use Computer

1. Personnel. Persons having all of the capabilities mentioned above must be available before a decision can be made to use a computer. The following skills must be available: Data Entry Operator (keypunch or terminal), Computer Programmer (if needed programs are not available), Computer Operator, and Statistician. In addition, someone must be given the responsibility for overseeing the proper flow of the data from step to step, and the statistician should ideally play this role. If he does not, then either the researcher or someone he appoints must take this responsibility, or else the whole project may fail.

2. Volume of Data. As a rule, if more than 100 cases are to be included in a study and several variables are involved, the use of a computer should be considered. Even with fewer cases, if there are very many variables, or if a great deal of repetitive analysis is required, the use of a computer may be advantageous. However, one should not use a computer without adequate justification, because of the considerable cost of preparing the data for use by the computer, which may exceed the advantage gained, in some cases.

3. Planning for Computer Use. Computers and computer personnel are a resource, and, like any resource, are limited. Therefore, it is important to plan from the very beginning of a project for the use of data processing, if it is justified. Normally, before a research project can be carried out, a plan, or a proposal, must be prepared covering all anticipated costs and resources needed. In particular, data processing costs and resources which will be needed must also be included in any research plan or proposal. To show that such plans are realistic it is necessary (a) to show why a computer

is needed, (b) what resources will be required, and (c) to indicate their availability and cost, including personnel, equipment, programs, and supplies.

## III. Stages of a Medical Survey Project

### A. Goal Formulation and Planning

Before any scientific project is carried out, its goals must be thought out and clearly stated. One of the reasons why a clear statement of project goals is important is that the organization providing the support for the project must evaluate the probable value of achieving the stated goals and compare this with the estimated total cost. Although many of the judgments in such an evaluation are subjective, they nevertheless permit a comparison of competing projects and may lead one project to be supported rather than another.

### B. Planning and Proposal Preparation

A medical survey is nonexperimental and observational in nature. Therefore, the timing and the selection of the population to be surveyed are of great importance, because there is little or no room for flexibility or revision of procedures once the data gathering has begun. Usually, the purpose of a survey will be to learn more about a particular disease or diseases and the design of the study will depend heavily on what is already known about the disease, its identification, and any variables believed to be related to its occurrence. At this stage it should already be possible to estimate the number of cases to be observed and the number of variables to be recorded. Therefore, it should also be possible at this time to decide whether or not the use of computer will be required for the volume of data involved. If it is determined, for example, by means of statistical estimates of sample size and the number of variables required, that a computer should be used to assist in the processing of the data, then this justification should be included in any plan or proposal which is developed for the project. Even if the amount of data required is small, the complexity of the data processing required may be sufficient to justify the use of a computer.

### C. Study Design

From the point of view of the data processing work, the important steps in the study design are the following:

1. Definition of Case. (What constitutes an individual?)
2. Identification of Case. (Procedure for assigning ID numbers, or identification numbers.)
3. Identification of Variables to be Recorded in the Field.
4. Identification of Variables to be Recorded after Survey (Laboratory Results).
5. Specification of Statistical Procedures to be Used in Analyzing Data.
6. Forms Design.
7. Practical procedures for data recording, data entry on forms, data entry (keypunching), data checking (verification of correctness ofdata entry), checking for internal consistency (examination of outliers and statistical abnormalities).

Economy in data gathering is just as important as completeness. No important variables should be overlooked, but at the same time, each variable to be recorded should be scrutinized to make sure that it is really necessary. Previous studies in similar locations or a pilot study in the same area, if necessary, can help in deciding just what variables should be recorded.

D. Carrying Out the Survey

If the planning for the data gathering has been done well, the data collection during the survey will proceed smoothly and accurately. The assignment of case identification numbers (IDNO) for each case will have been clearly arranged and each record and sample (blood, stool, etc.) will be identified with the same IDNO. Advance arrangement with local officials will have been made to obtain accurate population data, including occupation, ethnic origin, and family membership, if relevant. If the entire population is not going to be surveyed, then the statistical sampling procedures must be worked out in advance.

If needed, ecological information on various aspects will also be obtained at the time of the survey, or in advance, if possible. It is often impossible or impractical to obtain some of this information after leaving the survey area. Exact geographical coordinates of the locations surveyed should be established with the aid of maps brought with the survey team. Topographical maps, used at the survey site, are preferable to aid in the establishment of the exact location and the correct altitude above sea level in meters. Accurate place names and names of administrative districts, such a country, and smaller, should be determined and recorded while at the survey site. Weather data, if appropriate for the study should be obtained locally or at nearby administrative centers, and should include seasonal changes. Texts on epidemiology may be consulted to help identify key items of information and to make sure that no necessary information is overlooked (1, 2, 3).

For more ambitious surveys, many types of information may be gathered in order to better understand the transmission of disease in an area. These may include information on vectors, such as mosquitoes, other hosts, such as rats, and patterns of local agriculture, industry, and migration. If such kinds of information are needed, special plans need to be made by specialists in each field.

IV. Codesheets

A. Investigator's Codesheet

Once the overall design of the study has been completed, the investigator will begin to think about the specific elements of data he will need to collect, as outlined above, under Study Design (III. C.). He then should gather these data elements together in the form of a codesheet, which lists all the variables to be recorded and the values they may take on. Assuming that data processing with the aid of punch cards is planned, the investigator may need to think about several types of records, such as those gathered in the field, as contrasted with those created in the laboratory after the survey. Thus, the codesheet may be divided into two or more "record types".

However, if there are not too many variables, it is advantageous and economical to try to put all of the data for each case on a single punch card of 80-columns, i.e. a single record type.

B. Illustrative Example

In order to clarify the nature of the codesheet and the subsequent data processing steps, a Field Study conducted by David T. Dennis will be used as an example (4). In the example given on the following three pages, his hand-prepared codesheet is given. Under "Code No." he has listed the columns on an 80-column form and on the 80-column punch card that will be used for each variable. For example, a 4-digit IDNO is specified in order to leave plenty of room for expansion. This IDNO will be recorded in the first four columns of a form and on the punch card, so 1-4 is specified. For each variable its name and possible values are then indicated, as for Sex in column 9, 1 = male and 2 = male. It is always necessary to anticipate the possible unavailability or loss of information, and the value 9 = unk ("unknown") has been specified to cover this. It is good practice to use the highest possible number of a variable to indicate this unknown value. Thus an unknown age would be coded as "99". Since unknown values are commonplace, statistical programs must be able to accommodate them and a statistical program which cannot accept such unknown values is of little use in survey work.

Some computer programs for statistical analysis permit each variable to be identified with a short name of, say, 5 to 6 letters. For this reason the "Code Name" at the right of each variable has been indicated.

CODE SHEET RECTYPE 1

TDS KUALA KOYAN

| Code No. | Information | Code Name |
|---|---|---|
| 1-4 | Registration No. (1001-1250) | REGNO |
| 5, 6 | House No. (01-30) | HSENO |
| 7, 8 | Age (year) (00-90, 99 = unk) | AGE |
| 9 | Sex (1 = male; 2 = female; 9 = unk) | SEX |
| 10 | Relationship to Head of Household<br>1 = HH<br>2 = wife<br>3 = child<br>4 = parent<br>5 = sibling<br>6 = other<br>7 = friend<br>9 = unk | RELHH |
| 11, 12 | Years in village (00-90; 99 = unk) | YRSIN |
| 13, 14 | Years out (00-90; 99= unk) | YROUT |
| 15 | Healthy? 1 = yes<br>2 = no<br>9 = unk | HELTY |
| 16 | Bathe River? 1 = yes<br>2 = no<br>9 = unk | BATRI |
| 17 | Wash clothes in River? 1 = yes<br>2 = no<br>9 = unk | WASRI |
| 18 | Drink from River? 1 = yes<br>2 = no<br>9 = unk | DNKRI |
| 19 | Fish in River? 1 = yes<br>2 = no<br>9 = unk | FSHRI |
| 20 | Sick in belly? 1 = yes<br>2 = no<br>9 = unk | SCKBL |
| 21 | Bloody diarrhoeae? 1 = yes<br>2 = no<br>9 = unk | BLDDR |
| 22 | Groin/Axilla pain? 1 = yes<br>2 = no<br>9 = unk | KELP |

| Code No. | Information | | Code Name |
|---|---|---|---|
| 23 | Groin/Axilla abscess? | 1 = yes<br>2 = no<br>9 = unk | KELAB |
| 24 | Swollen extremity? | 1 = yes<br>2 = no<br>9 = unk | SWNEX |
| 25 | Scrotal swelling? | 1 = yes<br>2 = no<br>9 = unk | SCRSW |
| 26 | Scrotal pain? | 1 = yes<br>2 = no<br>9 = unk | SCRPN |
| 27 | Chyluria? | 1 = yes<br>2 = no<br>9 = unk | CHUIA |
| 28 | Malaria? | 1 = yes<br>2 = no<br>9 = unk | MALIA |
| 29 | Elephantiasis? | 1 = yes<br>2 = no<br>9 = unk | ELEPH |
| 30 | Lymphoedema? | 1 = yes<br>2 = no<br>9 = unk | OEDEM |
| 31 | Scarring? | 1 = yes<br>2 = no<br>9 = unk | SCAR |
| 32 | Hydrocoele? | 1 = yes<br>2 = no<br>9 = unk | HYCLE |
| 33 | Thickened epididymis | 1 = yes<br>2 = no<br>9 = unk | THKEP |
| 34 | Elephantiasis Scrotum Breat? | 1 = yes<br>2 = no<br>9 = unk | SCBRE |
| 35 | Hackett Spleen (1-5 ps; 0-5; 9=unk) | | SPLN |
| 36 | Right liver | 1 = yes<br>2 = no<br>9 = unk | RTLVR |
| 37 | Left liver | 1 = yes<br>2 = no<br>9 = unk | LTLVR |

| | | | |
|---|---|---|---|
| 38 | Abdominal venous dilation | 1 = yes<br>2 = no<br>9 = unk | VENAB |
| 39, 40 | Year (80-85; 99=unk) | | YEAR |
| 41, 42 | Month (01-12; 99 = unk) | MTH | |
| 43, 44 | Village Code No. -01 = Kuala Koyan | | VILNO |
| 45, 46 | Age of infant in months (01-11; 99 = unk) | | INFMTH |
| 47 | Malaria | 0 = neg<br>1 = pos<br>9 = unk | MAL |
| 48 | Species malaria | 0 = neg<br>1 = P.f.<br>2 = P. v.<br>3 = other<br>4 = mixed P.f./P.v<br>9 = unk | SPMAL |
| 49 | Malaria forms 0 = neg 1 = rings only<br>2 = gametocytes only<br>3 = rings and gametocytes 9 = unk | | FMMAL |
| 50 | Filariasis 0 = neg 1 = pos 9 = unk | | FIL |
| 51 | Species filaria | 0 = neg<br>1 = B. malayi subperiodic<br>2 = B. malayi periodic<br>3 = W. bancrofti<br>4 = mixed<br>5 = other | SPFIL |
| 52 - 54 | No. mf/20 ul 000 = neg | 999 = unk | NOMF |
| 55 | Stool for schisto ova | 0 =neg<br>1 = pos<br>9 = unk | SCHIS |
| 56 | Ascaris 0 = neg 1 = pos 9 = unk | | ASC |
| 57 | Trichuris | 0 = neg<br>1 = pos<br>9 = unk | TRICH |
| 58 | HW 0 = neg<br>1 = pos<br>9 = unk | | HW |
| 59 | COPT 0 = neg<br>1 = type 1<br>2 = type 2 | 3 = type 3<br>4 = type 4<br>9 = unk | COPT |
| 80 | Rectype No. 1 | | RETYP |

C. Computer Codesheet

Once the investigator has worked out his hand codesheet, it is in a form which can be entered into some computer programs for statistical analysis. In what follows, a set of computer programs, called a computer package, or system, developed by Richard Kronmal, the University of Washington, Seattle, will be used (5). This set of programs is called the "Conversational Computer Statistical System", abbreviated CCSS.

The hand codesheet for the sample survey being illustrated can either be punched on 80-column cards or entered directly into the computer with the CCSS system. Once it has entered into the computer, the computer version of the codesheet can be listed. The following four pages give the computer form of Dennis' codesheet, produced by the CCSS system.

RECORD TYPE 1

PAHANG MALAYSIA FILARIASIS DENNIS

| COLUMNS | NUMBER | NAME | VALUES OR RANGE |
|---|---|---|---|
| 1- 4 | 1 | REGNO | 1001- 1250 |
| 5- 6 | 2 | HSENO | 1- 30 |
| 7- 8 | 3 | AGE | 0- 90<br>..... 99=UNKWN |
| 9- 9 | 4 | SEX | 1= MALE<br>2=FEMALE<br>..... 9=UNKWN |
| 10- 10 | 5 | RELHH | 1= HH<br>2= WIFE<br>3= CHILD<br>4=PARENT<br>5=SIBLNG<br>6= OTHER<br>7=FRIEND<br>..... 9=UNKWN |
| 11- 12 | 6 | YRSIN | 0- 90<br>..... 99=UNKWN |
| 13- 14 | 7 | YROUT | 0- 90<br>..... 99=UNKWN |
| 15- 15 | 8 | HELTY | 1= YES<br>2= NO<br>..... 9=UNKWN |
| 16- 16 | 9 | BATRI | 1= YES<br>2= NO<br>..... 9=UNKWN |
| 17- 17 | 10 | WASRI | 1= YES<br>2= NO<br>..... 9=UNKWN |
| 18- 18 | 11 | DNKRI | 1= YES<br>2= NO<br>..... 9=UNKWN |
| 19- 19 | 12 | FSHRI | 1= YES<br>2= NO<br>..... 9=UNKWN |
| 20- 20 | 13 | SCKBL | 1= YES<br>2= NO<br>..... 9=UNKWN |

| | | | | |
|---|---|---|---|---|
| 21- 21 | 14 | BLDDR | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 22- 22 | 15 | KELPN | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 23- 23 | 16 | KELAB | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 24- 24 | 17 | SWNEX | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 25- 25 | 18 | SCRSW | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 26- 26 | 19 | SCRPN | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 27- 27 | 20 | CHUIA | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 28- 28 | 21 | MALIA | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 29- 29 | 22 | ELEPH | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 30- 30 | 23 | OEDEM | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 31- 31 | 24 | SCAR | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 32- 32 | 25 | HYCLE | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 33- 33 | 26 | THKEP | 1= YES<br>2= NO<br>..... | 9=UNKWN |
| 34- 34 | 27 | SCBRE | 1= YES<br>2= NO | |

| | | | |
|---|---|---|---|
| | | | ..... 9=UNKWN |
| 35- 35 | 28 | SPLN | 0- 5 |
| | | | ..... 9=UNKWN |
| 36- 36 | 29 | RTLVR | 1= YES<br>2= NO |
| | | | ..... 9=UNKWN |
| 37- 37 | 30 | LTLVR | 1= YES<br>2= NO |
| | | | ..... 9=UNKWN |
| 38- 38 | 31 | VENAB | 1= YES<br>2= NO |
| | | | ..... 9=UNKWN |
| 39- 40 | 32 | YEAR | 80- 85 |
| | | | ..... 99=UNKWN |
| 41- 42 | 33 | MONTH | 1- 12 |
| | | | ..... 99=UNKWN |
| 43- 44 | 34 | VILNO | 1= KUALA |
| 45- 46 | 35 | INFMTH | 0- 11 |
| | | | ..... 99=UNKWN |
| 47- 47 | 36 | MAL | 0= NEG<br>1= POS |
| | | | ..... 9=UNKWN |
| 48- 48 | 37 | SPMAL | 0= NEG<br>1= P.F.<br>2= P.V.<br>3= OTHER<br>4= MIXED |
| | | | ..... 9=UNKWN |
| 49- 49 | 38 | FMMAL | 0= NEG<br>1= RINGS<br>2=GAMETO<br>3= MIXED |
| | | | ..... 9=UNKWN |
| 50- 50 | 39 | FIL | 0= NEG<br>1= POS |
| | | | ..... 9=UNKWN |
| 51- 51 | 40 | SPFIL | 0= NEG<br>1=SUBPER<br>2=PERIOD<br>3=BANCRO<br>4= MIXED<br>5= OTHER |

| | | | |
|---|---|---|---|
| | | | ..... 9=UNKWN |
| 52- 54 | 41 | NOMF | 0- 998 |
| | | | ..... 999=UNKWN |
| 55- 55 | 42 | SCHIS | 0= NEG |
| | | | 1= POS |
| | | | ..... 9=UNKWN |
| 56- 56 | 43 | ASC | 0= NEG |
| | | | 1= POS |
| | | | ..... 9=UNKWN |
| 57- 57 | 44 | TRICH | 0= NEG |
| | | | 1= POS |
| | | | ..... 9=UNKWN |
| 58- 58 | 45 | HW | 0= NEG |
| | | | 1= POS |
| | | | ..... 9=UNKWN |
| 59- 59 | 46 | COPT | 0= NEG |
| | | | 1= TYPE1 |
| | | | 2= TYPE2 |
| | | | 3= TYPE3 |
| | | | 4= TYPE4 |
| | | | ..... 9=UNKWN |
| 80- 80 | 47 | RT | 0= RT1 |

## V. Data Recording

### A. Preparatory Work and Form Design

The codesheet should be carefully checked by everyone involved to see that the necessary variables and their proper ranges have been included. When in doubt it is best to allow one more digit that can be used in case of need for a variable. In general, for surveys, one might as well allow 4 digits for the identification number, in case the number exceeds 999.

Age of young children is often a problem and the solution in the codesheet example in the previous section illustrates a good practical solution, namely, record age in full years for everyone. Then, record age in months from 0 to 11, or higher, for infants. Note that months should be coded as unknown = 99 for all adults, to avoid confusion when looking at the variable INFMTH (Age of infant in months). This was not done in the sample, but was taken care of by noting that no child in this particular survey was less than one month old. In the present case, the unknown value for INFMTH could better have been taken as 0. This kind of change in the codesheet after preliminary processing is quite common.

Another comment on unknown values that should be made is that "unknown" to the statistician merely means unavailable. For example, an age could have been known, but then blurred to become unreadable. The CCSS system used in the example, as well as many others, permit only 1 unknown value for a variable. However, some investigators feel the need to indicate in detail the reason why each missing or unavailable value is not present. For example, when blood samples are used up before all testing is completed, the comment is then QNS = Quantity Not Sufficient. If the investigator really wishes to record this information, he should be encouraged to use an additional variable rather than try to use 2 or more "unknowns" for the same variable.

Once the codesheet has been well worked out, a form should be designed which will permit easy and accurate recording of the data in the field. It is often helpful to have the identification numbers printed on the forms in advance. A decision must be made as to the type of form to be used. For some basic population data, it may be desirable to record 30 to 40 cases per sheet. However, for other types of data, it may be best to record all the data on a single case on one sheet.

B. Log Books

On field studies log books are often used. In this case the format of the data recorded should be drawn in columnar form in the log book before the study is carried out. Log books, if bound, have the advantage that they form a single unit, so that individual sheets will not be lost. On the other hand, they are harder to work with after the field study is completed. Photocopying machines may be used to copy data from log books for further processing, but if the writing is not clear, or if the format is not well laid out, the copy may be illegible. The choice will depend on the situation and on the nature of the data to be gathered.

## VI. Data Transcription

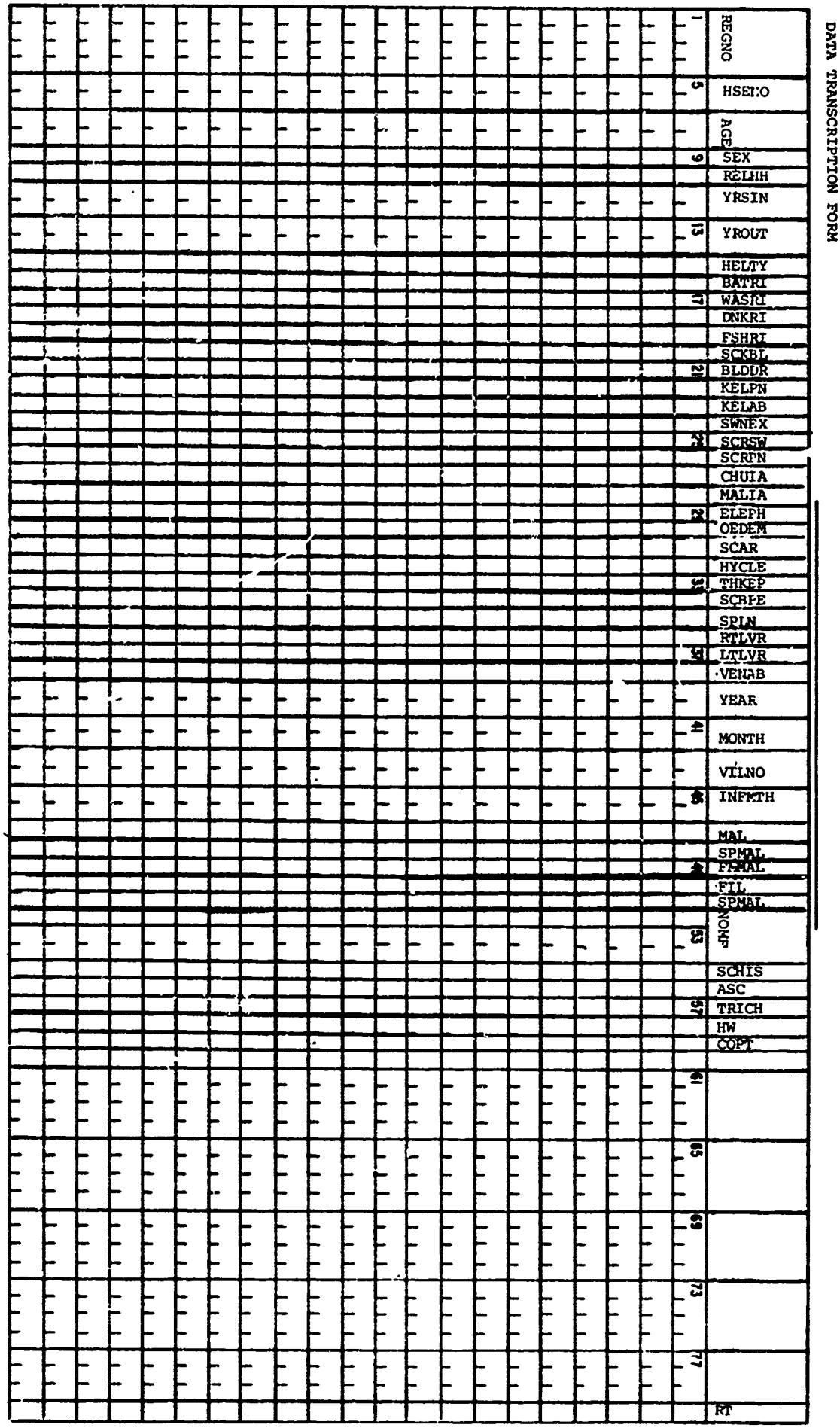
### A. Form Design

Assuming that a computer is to be used to process the data, it will usually be necessary to transcribe the data from the field log or from the field data sheets onto special sheets used for data entry. Since the data entry operator will normally have no understanding of the meaning of the data, he or she will be simply transferring numbers, or even digits from the sheets presented into a data processing medium. 80-column punch cards are usually used to record the data for computer use. Therefore, a form with 80 columns must be used to transcribe the data for the punching or entry by the operator. Each line of the 80-column form will represent a case, and there may be 20 or more lines or cases per sheet. If possible, vertical lines should be drawn on the 80-column sheet indicating where each variable starts and ends. The variable name should be indicated at the top of the sheet, over the columns assigned to the variable in the codesheet. The illustration on page 19 shows the design of a data transcription form for the illustrative example.

### B. Transcription

Someone familiar with the data and its significance should transcribe it from the field data sheets or from the field logs onto the data transcription form. The transcription should be checked as it is done and made as free from error as possible. In particular, blanks should not be left where the unknown codes for variables specify something else. Many computer statistical systems are based on the FORTRAN language, which has the peculiarity that a blank is interpreted as 0 (Zero), which may have a different meaning entirely.1

DATA TRANSCRIPTION FORM



## VII. Data Entry

If punch cards are to be used to enter the data, the keypunch operator will operate the keyboard of the keypunch to prepare 80-column punch cards by typing from the data transcription form (80-column form). It is best that the keypunching be done in a mechanical manner, without any changes or judgments being introduced in the process. However, a highly trained and experienced keypuncher may be able to identify errors and inconsistencies in the data and should then call these to the attention of the investigator by noting the questionable item on the form, even though typing it exactly as transcribed.

Depending on the skill and error rate of the keypunching personnel, it may be desirable to verify the punching immediately, before computer processing. Some modern keypunch machines are dual purpose and also permit a verification process in which all of the material is retyped by another operator, preferably, and the machine compares the typing with the characters already punched in the card. Errors encountered are recorded by a system of notches on the edge of the card. There are also separate machines for verifying card punching accuracy.

For computers using direct data entry through a keyboard, there will be no punched cards and no verification will be possible outside the computer. In this case, the verification must all take place at a later stage.

## VIII. Data Presentation and Checking

### A. 80-Column List

After the data have been punched on 80-column cards, the cards should be read into the computer and listed in a solid block format, exactly mirroring the digits on the data transcription form. The purpose of this "80-column" listing is to permit the careful checking of all of the data at this stage by comparing the listing with the data as transcribed. In the illustration on the following page the 80-column listing has been made with the additional printing of the variable names, vertically, to save space. A FORTRAN program is available from NAMRU-2 which does this automatically from the cards used to list the computer codesheet. Once this 80-column listing has been thoroughly corrected and relisted, it should be saved as part of the records of the survey, since, if the cards are lost, they can readily be repunched from this listing.

It should be emphasized that the 80-column list is not intended for use in data analysis, since it is extremely hard to read the values of the individual variables from such a list. The 80-column listing for the sample Field Study follows.

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```
R   H A SRY Y HBWDFSBKKSSSCMEOSHTSSRLVY M V I MSFFSN  SATHC
E   S G EER R EAANSCLEEWCCHALECYHCPTTEE O I N APMIPO  CSRWO
G   E E XLS O LTSKHKDLLNRRULEDACKBLLLNA N L F LMMLFM  HCI P
N   N    HI U TRRRRBDPAESPIIPERLERNVVAR T N M  AA IF  I C T
O   O    HN T YIIIILRNBXWNAAHM EPE RRB  H O T  LL L   S H
                                        H
```

```
10010164111648211112222222212229990222800501000000000001119
10020122131606111112222222222229990222800501000000000001111
10030116261006111119222222222222220122800501000000000000119
10040101260100212121292222212222220222800501000000000099999
10050143170142111112292222222222993222800501000000100101119
10060223110221111112221222212212990222800501000001200500110
10070223220221111112212222212222223222800501000000000001100
10080207130205111192222222212222920222800501000000000099990
10090203130201111122222222212222223222800501000111000000110
10100345110540111112222222222222299022800501000000000001110
10110340220535111112222222222222222222280050100001900020l110
10120312130507111119299999999999999999800501000099999999999
10130307130502211129299222212222922222800501000000000001110
10140304130400212122992222122229242228005010011100000l1110
10150301230100212129292222122221202228005010012100000001000
10160442110834111112222222212229990222800501000000000000111
10170428220820211122222222212222220122800501000000000099990
10180409230801211122299222212222220222800501000000000000112
10190407230700211122299222212222222222800501000000000000112
10200404230400212122992222122229232228005010011200000011l0
10210402130200212129299222122229202228005010011200000099990
10220401130100212129299299212222220122800501000000000099999
10230555112728111122222222212222920112800501000000C0099990
10240655112728122222212122212212922222800501000000000099990
10250651222724122221211222212212220222800501000000000099990
10260605160500222221222222122229902228005010000000000099990
10270729112900122222222222212222992228005010000000000001110
10280723220815122222222222212222220222800501000000000001119
10290704130400122222222222212222990222800501000000000000110
10300830110921122222212222212222992222800501000120000501110
10310826220917122222222222212222220222800501000000000001119
10320842260834222222222222212222990222800501000000000001110
10330810230901122222222222212222222222800501000000000001100
10340805130500222221222222122229232228005010000000000001110
10350803230300122222222222222222220222800501000000000001110
10360801230100122222122222222222222222800501001130000000009
10370860140951222222211222212222990222800501000000000001110
10380958111938111112122222212229990121800501000000000001110
10390943221924111112222222222222290222800501000000000001110
10400913231300122222222222222222223222800501000000000001110
10410911131100999999999999999999999980050199999999999999
10420907230700122222222222222222220122800501000000000001119
10430906230600122221222222922222222222800501000000000000100
10440904230400222221222222222222220122800501000000000001110
10450946160442122222222222222222220222800501000001200201100
10460936260432122222211222222212220222800501000001900100110
10470912260408122222212222912222223222800501001110000101110
10480909160405122222222222212222220222800501000000000101110
10490907160403122222222222212222220222800501000000000100110
10500906260402122222222222212222220222800501000000000001110
```

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```
R    H A SRY Y HBWDFSBKKSSSCMEOSHTSSRLVY M V I MSFFSN  SATHC
E    S G EER R EAANSCLEEWCCHALECYHCPTTEE O I N APMIPO  CSRWO
G    E E XLS O LTSKHKDLLNRRULEDACKBLLLNA N L F LMMLFM  HCI P
N    N    HI U TRRRRBDPAESPIIPERLERNVVAR T N M  AA IF  I C T
O    O    HN T YIIIILRNBXWNAAHM EPE RRB  H O T  LL L   S H
                                          H

105109042604001222222222221222222022280050100000000099990
105209022602001222222222221222222022280050100000000000100
105309011601011222222222222222222022280050100000000001000
105410511103481222222222221221299022280050100000000001110
105510502203471222222222222222222022280050100000000001010
105610162303131222222222222222222022280050100000000001110
105710112303081222222222222222222022280050100000000001110
105810081303052222222222222212222992222800501000000000001110
105911421105371222222112222122122232298005010000012014011110
106011312205261222222222222212222201128005010000000000001110
106111551405502111122222222222222201228005010000000000001110
106211101305051222221222222222222212280050100000000001100
106311082305031222221222222222222022280050100000000001110
106411171704132111112222222122222202228005010000012007999 0
106511192710091111122222222222222212280050100000012007011 9
106611022302001121222992222122222232280050100999999999999 9
106712401199992222229999999999999999980050100000000001112
106812172202151222222222222122222202280050100000000150111 0
106912062306001222222222291222222022280050100000000000011 0
107012042304001222299222222922222022280050100000000001110
107112031303001222299999999999999999980050100000000099990
107212011301001222299999999999999999980050100999999999999 9
107313212207141222222222222222222112280050100000009990111 0
107413222604181222222222222222222012280050100000009990111 0
107513061306002222222222221222222022280050100000009990111 9
107613032303001222292222222222222022280050100000009999999 0
107713011301001222222222222122222022280050100999999999999 9
107813021602001222222222222222222022280050100000000009999 0
107913281328001222222222221222299022280050100999999999999 9
108013172317001222222222222229222022280050100000000000111 0
108113112311002222222222222122222222280050100113000000110 0
108213571120371222222222222122229922280050100000000000111 0
108314421130121222222222222222292022280050100000000000111 0
108414382230081222222222222222222022280050100000000000111 0
108514031303001222222222222222222022280050100999999999011 9
108615291102272222211122221222222022280050100000011025010 0
108715312202291222221222221222222022280050100999999999011 9
108815071302051222221222222222229222280050100000000000111 0
108915062302041222222222221222222222280050100000000000110
109015001300002222222222221222292022280050109999999999999 9
109115102601091222222222222222222022280050100000000009999 0
109216481410381222222111222222222022280050100000000000110
109316482210381222222222221222222012280050100000000000110
109416112311001222222222222222222012280050100000000000110
109516071307009999999999999999999998005010000000009999 0
109616031303001222222222222122222211228005010000000000110
109716021302002222222222221222222022280050100000000001109
109816421610321222222222222122229932280050100000000001119
109916352610251222222222222122222012280050100000000001119
110016461610361222222221222121222222280050100999999999999 9
```

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```
R·   H A SRY Y HBWDFSBKKSSSCMEOSHTSSRLVY M V I MSFFSN   SATHC
E    S G EER R EAANSCLEEWCCHALECYHCPTTEE O I N APMIPO   CSRWO
G    E E XLS O LTSKHKDLLNRRULEDACKBLLLNA N L F LMMLFM   HCI P
N    N    HI U TRRRRBDPAESPIIPERLERNVVAR T N M  AA IF   I C T
O    O    HN T YIIIILRNBXWNAAHM EPE RRB  H O T  LL L    S H
                                         H
```

```
11011622261012122222222222299999999998005010000000000000110
11021641269999122222222222229999999999800501009999999999999
11031741110734122222222222212222993222800501000000000001110
11041830299999999999999999999999999999980050100000190049999O
11051805299999999999999999999999999999980050100000000000111C
11061803299999999999999999999999999999980050100000000099990
11071856113026122222111222212222994222800501000000000001112
11091840193010122222222222222212220222800501000000000000110
11101825260421222222222222222222220122800501001110000000110
11111803160300122222222222212222922222800501000000000001119
12501555243025222222222222222222222222280050100999999999999
```

K. Data Count

Even if the 80-column listing is checked very carefully, it is still possible that some typing or keypunching error could be missed. Therefore, it is useful at this stage to have some kind of analysis, or tabulation, of the characters that have been punched in each of the 80 columns of the punch card.

Since the data format is fixed by the codesheet, every column of the data transcription form and of the punched cards is assigned a specific function. For example, in the sample Field Study data, columns 7 and 8 are used for the age of each case. Therefore, column 7 should contain only the 10-digit, or decade, of the age of eah case, and column 8 should contain all the single digit values. Thus, if there is no one in a survey with age over 69, then the values 7 and 8 should not occur in column 7 of any card. A 9 might occur in column 7 only if some case had unknown age, in which case 99 would be used. In the present example there were no unknown ages, so no 7's, 8's, or 9's should occur in column 7. We would expect in a sample of the present size that ages might well occur ending in all possible digits from 0 to 9, and that is actually the case, as we will see.

A program is in use at NAMRU-2 which prints both the 80-column list and a "data count" table showing all of the characters occuring in each of the 80 columns. The table was named DATAC, and a program of that name was contributed to NAMRU-2 by the University of Washington for use with CCSS. The DATAC program has been modified by NAMRU-2 to print the variable names at the starting column of each variable. Thus, AGE would automatically be printed with column number 7 in the DATAC table. The NAMRU-2 DATAC table is given on the following 2 pages for the sample Field Study.

The DATAC table has two functions: (1) additional checking of the data as punched, and (2) preliminary data analysis. The method of checking has already been illustrated with AGE above. The columns are listed vertically, instead of horizontally, in the DATAC table to overcome problems of space. Thus, the seventh row of the table is labelled "7AGE". (This means that the "age" field begins in column 7.) In the columns from 0 to 9 are tabulated the number of times each character occurred in column 7, say. Thus, by looking at row 7 in the table we can see that 46 cases had age from 0 to 9, 16 cases had age from 10-19, and so on. Only 2 cases were punched as having age in the range 60-69. Thus we have in effect obtained a histogram on age with 10 year intervals. This illustrates the use of DATAC for preliminary analysis. The fact that there are no punches from 7 to 9, or alphabetic punches, or even blanks, is a helpful check for correctness of the punching. Other checking is done in a similar manner.

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| COL NAME | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | BLNK | ALPH | TOTL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1REGNO | 0 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 2 | 99 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 3 | 18 | 12 | 10 | 10 | 10 | 11 | 10 | 10 | 10 | 10 | 0 | 0 | 111 |
| 4 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 11 | 0 | 0 | 111 |
| 5HSENO | 53 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 6 | 5 | 13 | 10 | 16 | 10 | 8 | 14 | 4 | 15 | 16 | 0 | 0 | 111 |
| 7AGE | 46 | 16 | 13 | 7 | 17 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 111 |
| 8 | 11 | 18 | 15 | 14 | 7 | 10 | 12 | 11 | 8 | 5 | 0 | 0 | 111 |
| 9SEX | 0 | 56 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 10RELHH | 0 | 17 | 14 | 46 | 4 | 0 | 23 | 3 | 0 | 4 | 0 | 0 | 111 |
| 11YRSIN | 78 | 17 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 12 | 15 | 12 | 14 | 12 | 15 | 11 | 5 | 9 | 6 | 12 | 0 | 0 | 111 |
| 13YROUT | 61 | 10 | 15 | 12 | 6 | 2 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 14 | 43 | 9 | 8 | 4 | 7 | 10 | 5 | 6 | 11 | 8 | 0 | 0 | 111 |
| 15HELTY | 0 | 79 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 16BATRI | 0 | 29 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 17WASRI | 0 | 22 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 18DNKRI | 0 | 29 | 77 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 111 |
| 19FSHRI | 0 | 16 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 111 |
| 20SCKBL | 0 | 4 | 92 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 111 |
| 21BLDDR | 0 | 11 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 111 |
| 22KELPN | 0 | 11 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 111 |
| 23KELAB | 0 | 7 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 111 |
| 24SWNEX | 0 | 3 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 111 |
| 25SCRSW | 0 | 0 | 101 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 111 |
| 26SCRPN | 0 | 0 | 101 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 111 |
| 27CHUIA | 0 | 0 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 111 |
| 28MALIA | 0 | 62 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 111 |
| 29ELEPH | 0 | 0 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 111 |
| 30OEDEM | 0 | 1 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 31SCAR | 0 | 7 | 92 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 111 |
| 32HYCLE | 0 | 0 | 96 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 111 |
| 33THKEP | 0 | 1 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 111 |
| 34SCBRE | 0 | 0 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 111 |
| 35SPLN | 66 | 2 | 19 | 11 | 2 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 36RTLVR | 0 | 18 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 37LTLVR | 0 | 2 | 98 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 38VENAB | 0 | 1 | 98 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 111 |
| 39YEAR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 0 | 0 | 111 |
| 40 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 41MONTH | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 42 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 43VILNO | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 44 | 0 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| 45INFMTH | 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 111 |
| 46 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 111 |
| 47MAL | 92 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 48SPMAL | 90 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 111 |
| 49FMMAL | 88 | 6 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 111 |
| 50FIL | 89 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 111 |
| 51SPFIL | 90 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 111 |
| 52NOMF | 95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 111 |
| 53 | 92 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 111 |
| 54 | 80 | 5 | 2 | 0 | 2 | 4 | 0 | 2 | 0 | 16 | 0 | 0 | 111 |
| 55SCHIS | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 111 |
| 56ASC | 20 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 111 |
| 57TRICH | 5 | 78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 111 |
| 58HW | 14 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 111 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59COPT | 78 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 111 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |
| 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111 | 0 | 111 |

## IX. Statistical Analysis

### A. Listings and Summary Statistics

In order to produce a readable listing of the data for the use of the investigator several things are necessary. First, the variables must be properly spaced. Second, leading zeros must be suppressed, so that age 4 is not printed as 04. Third, each variable should be clearly indicated at the top of the column, using the alphabetic name in the codesheet. Fourth, unknown values according to the codesheet should be replaced by the notation UNKWN, or equivalent for each unknown occurrence of a variable. Fifth, the alphabetic values specified in the codesheet for any variable should be substituted for the numeric values, as FEMALE in place of 2, for example. All of these changes are automatically made by the CCSS system, as can be seen in the following listing of the sample Field Study data. (It should be noted that in the CCSS system, the values of a variable must be either all numeric, or all with alphabetic conversion. It is not possible to specify 0-80 numeric, but 88 = MISSNG and 99 = UNKWN, for example. The UNKWN is always possible, for unknown values, but it is not possible to mix the continuous range 0-80 with the discrete value 88 in the CCSS codesheet.)

Summary statistics for all variables can be produced automatically for all of the data at the time a listing is made. Summary statistics for our sample data follow the CCSS listing. For each variable a number of quantities are given. The sequential number of the variable is given first, followed by its name. Next, the maximum value of each variable (HIGH) and the minimum value (LOW) are given. The number of cases for which each variable is known is then given (KNOWN CASES). This is simply the total number of cases, less the number of cases for which that variable was UNKWN. Finally, the MEAN and S.D. are given. These can be used in statistical analyses. The COEF VAR is simply the S.D. divided by the MEAN then multiplied by 100. It may be helpful in comparing the variation of variables with markedly different means.

One of the most important functions of the listing and summary statistics is for the further checking of the accuracy of the data. Here, errors which arose at a very early stage, such as the copying from a log book, may be found. An unusually large S.D. or COEF.VAR may also be a clue to an error, or outlier. Unexpected HIGH and LOW values may also point to errors and should be checked.

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| REGNO | HSENO | AGE | SEX | RELHH | YRSIN | YROUT | HELTY | BATRI | WASRI | DNKRI |
|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | 1 | 64 | MALE | HH | 16 | 48 | NO | YES | YES | YES |
| 1002 | 1 | 22 | MALE | CHILD | 16 | 6 | YES | YES | YES | YES |
| 1003 | 1 | 16 | FEMALE | OTHER | 10 | 6 | YES | YES | YES | YES |
| 1004 | 1 | 1 | FEMALE | OTHER | 1 | 0 | NO | YES | NO | YES |
| 1005 | 1 | 43 | MALE | FRIEND | 1 | 42 | YES | YES | YES | YES |
| 1006 | 2 | 23 | MALE | HH | 2 | 21 | YES | YES | YES | YES |
| 1007 | 2 | 23 | FEMALE | WIFE | 2 | 21 | YES | YES | YES | YES |
| 1008 | 2 | 7 | MALE | CHILD | 2 | 5 | YES | YES | YES | YES |
| 1009 | 2 | 3 | MALE | CHILD | 2 | 1 | YES | YES | YES | YES |
| 1010 | 3 | 45 | MALE | HH | 5 | 40 | YES | YES | YES | YES |
| 1011 | 3 | 40 | FEMALE | WIFE | 5 | 35 | YES | YES | YES | YES |
| 1012 | 3 | 12 | MALE | CHILD | 5 | 7 | YES | YES | YES | YES |
| 1013 | 3 | 7 | MALE | CHILD | 5 | 2 | NO | YES | YES | YES |
| 1014 | 3 | 4 | MALE | CHILD | 4 | 0 | NO | YES | NO | YES |
| 1015 | 3 | 1 | FEMALE | CHILD | 1 | 0 | NO | YES | NO | YES |
| 1016 | 4 | 42 | MALE | HH | 8 | 34 | YES | YES | YES | YES |
| 1017 | 4 | 28 | FEMALE | WIFE | 8 | 20 | NO | YES | YES | YES |
| 1018 | 4 | 9 | FEMALE | CHILD | 8 | 1 | NO | YES | YES | YES |
| 1019 | 4 | 7 | FEMALE | CHILD | 7 | 0 | NO | YES | YES | YES |
| 1020 | 4 | 4 | FEMALE | CHILD | 4 | 0 | NO | YES | NO | YES |
| 1021 | 4 | 2 | MALE | CHILD | 2 | 0 | NO | YES | NO | YES |
| 1022 | 4 | 1 | MALE | CHILD | 1 | 0 | NO | YES | NO | YES |
| 1023 | 5 | 55 | MALE | HH | 27 | 28 | YES | YES | YES | YES |
| 1024 | 6 | 55 | MALE | HH | 27 | 28 | YES | NO | NO | NO |
| 1025 | 6 | 51 | FEMALE | WIFE | 27 | 24 | YES | NO | NO | NO |
| 1026 | 6 | 5 | MALE | OTHER | 5 | 0 | NO | NO | NO | NO |
| 1027 | 7 | 29 | MALE | HH | 29 | 0 | YES | NO | NO | NO |
| 1028 | 7 | 23 | FEMALE | WIFE | 8 | 15 | YES | NO | NO | NO |
| 1029 | 7 | 4 | MALE | CHILD | 4 | 0 | YES | NO | NO | NO |
| 1030 | 8 | 30 | MALE | HH | 9 | 21 | YES | NO | NO | NO |
| 1031 | 8 | 26 | FEMALE | WIFE | 9 | 17 | YES | NO | NO | NO |
| 1032 | 8 | 42 | FEMALE | OTHER | 8 | 34 | NO | NO | NO | NO |
| 1033 | 8 | 10 | FEMALE | CHILD | 9 | 1 | YES | NO | NO | NO |
| 1034 | 8 | 5 | MALE | CHILD | 5 | 0 | NO | NO | NO | NO |
| 1035 | 8 | 3 | FEMALE | CHILD | 3 | 0 | YES | NO | NO | NO |
| 1036 | 8 | 1 | FEMALE | CHILD | 1 | 0 | YES | NO | NO | NO |
| 1037 | 8 | 60 | MALE | PARENT | 9 | 51 | NO | NO | NO | NO |
| 1038 | 9 | 58 | MALE | HH | 19 | 38 | YES | YES | YES | YES |
| 1039 | 9 | 43 | FEMALE | WIFE | 19 | 24 | YES | YES | YES | YES |
| 1040 | 9 | 13 | FEMALE | CHILD | 13 | 0 | YES | NO | NO | NO |
| 1041 | 9 | 11 | MALE | CHILD | 11 | 0 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1042 | 9 | 7 | FEMALE | CHILD | 7 | 0 | YES | NO | NO | NO |
| 1043 | 9 | 6 | FEMALE | CHILD | 6 | 0 | YES | NO | NO | NO |
| 1044 | 9 | 4 | FEMALE | CHILD | 4 | 0 | NO | NO | NO | NO |
| 1045 | 9 | 46 | MALE | OTHER | 4 | 42 | YES | NO | NO | NO |
| 1046 | 9 | 36 | FEMALE | OTHER | 4 | 32 | YES | NO | NO | NO |
| 1047 | 9 | 12 | FEMALE | OTHER | 4 | 8 | YES | NO | NO | NO |
| 1048 | 9 | 9 | MALE | OTHER | 4 | 5 | YES | NO | NO | NO |
| 1049 | 9 | 7 | MALE | OTHER | 4 | 3 | YES | NO | NO | NO |
| 1050 | 9 | 6 | FEMALE | OTHER | 4 | 2 | YES | NO | NO | NO |
| 1051 | 9 | 4 | FEMALE | OTHER | 4 | 0 | YES | NO | NO | NO |
| 1052 | 9 | 2 | FEMALE | OTHER | 2 | 0 | YES | NO | NO | NO |
| 1053 | 9 | 1 | MALE | OTHER | 1 | 1 | YES | NO | NO | NO |
| 1054 | 10 | 51 | MALE | HH | 3 | 48 | YES | NO | NO | NO |

PAHANG MALAYSIA 1GO

| REGNO | HSENO | AGE | SEX | RELHH | YRSIN | YROUT | HELTY | BATRI | WASRI | DNKRI |
|---|---|---|---|---|---|---|---|---|---|---|
| 1055 | 10 | 50 | FEMALE | WIFE | 3 | 47 | YES | NO | NO | NO |
| 1056 | 10 | 16 | FEMALE | CHILD | 3 | 13 | YES | NO | NO | NO |
| 1057 | 10 | 11 | FEMALE | CHILD | 3 | 8 | YES | NO | NO | NO |
| 1058 | 10 | 8 | MALE | CHILD | 3 | 5 | NO | NO | NO | NO |
| 1059 | 11 | 42 | MALE | HH | 5 | 37 | YES | NO | NO | NO |
| 1060 | 11 | 31 | FEMALE | WIFE | 5 | 26 | YES | NO | NO | NO |
| 1061 | 11 | 55 | MALE | PARENT | 5 | 50 | NO | YES | YES | YES |
| 1062 | 11 | 10 | MALE | CHILD | 5 | 5 | YES | NO | NO | NO |
| 1063 | 11 | 8 | FEMALE | CHILD | 5 | 3 | YES | NO | NO | NO |
| 1064 | 11 | 17 | MALE | FRIEND | 4 | 13 | NO | YES | YES | YES |
| 1065 | 11 | 19 | FEMALE | FRIEND | 10 | 9 | YES | YES | YES | YES |
| 1066 | 11 | 2 | FEMALE | CHILD | 2 | 0 | YES | YES | NO | YES |
| 1067 | 12 | 40 | MALE | HH | UNKWN | UNKWN | NO | NO | NO | NO |
| 1068 | 12 | 17 | FEMALE | WIFE | 2 | 15 | YES | NO | NO | NO |
| 1069 | 12 | 6 | FEMALE | CHILD | 6 | 0 | YES | NO | NO | NO |
| 1070 | 12 | 4 | FEMALE | CHILD | 4 | 0 | YES | NO | NO | NO |
| 1071 | 12 | 3 | MALE | CHILD | 3 | 0 | YES | NO | NO | NO |
| 1072 | 12 | 1 | MALE | CHILD | 1 | 0 | YES | NO | NO | NO |
| 1073 | 13 | 21 | FEMALE | WIFE | 7 | 14 | YES | NO | NO | NO |
| 1074 | 13 | 22 | FEMALE | OTHER | 4 | 18 | YES | NO | NO | NO |
| 1075 | 13 | 6 | MALE | CHILD | 6 | 0 | NO | NO | NO | NO |
| 1076 | 13 | 3 | FEMALE | CHILD | 3 | 0 | YES | NO | NO | NO |
| 1077 | 13 | 1 | MALE | CHILD | 1 | 0 | YES | NO | NO | NO |
| 1078 | 13 | 2 | MALE | OTHER | 2 | 0 | YES | NO | NO | NO |
| 1079 | 13 | 28 | MALE | CHILD | 28 | 0 | YES | NO | NO | NO |
| 1080 | 13 | 17 | FEMALE | CHILD | 17 | 0 | YES | NO | NO | NO |
| 1081 | 13 | 11 | FEMALE | CHILD | 11 | 0 | NO | NO | NO | NO |
| 1082 | 13 | 57 | MALE | HH | 20 | 37 | YES | NO | NO | NO |
| 1083 | 14 | 42 | MALE | HH | 30 | 12 | YES | NO | NO | NO |
| 1084 | 14 | 38 | FEMALE | WIFE | 30 | 8 | YES | NO | NO | NO |
| 1085 | 14 | 3 | MALE | CHILD | 3 | 0 | YES | NO | NO | NO |
| 1086 | 15 | 29 | MALE | HH | 2 | 27 | NO | NO | NO | NO |
| 1087 | 15 | 31 | FEMALE | WIFE | 2 | 29 | YES | NO | NO | NO |
| 1088 | 15 | 7 | MALE | CHILD | 2 | 5 | YES | NO | NO | NO |
| 1089 | 15 | 6 | FEMALE | CHILD | 2 | 4 | YES | NO | NO | NO |
| 1090 | 15 | 0 | MALE | CHILD | 0 | 0 | NO | NO | NO | NO |
| 1091 | 15 | 10 | FEMALE | OTHER | 1 | 9 | YES | NO | NO | NO |
| 1092 | 16 | 48 | MALE | PARENT | 10 | 38 | YES | NO | NO | NO |
| 1093 | 16 | 48 | FEMALE | WIFE | 10 | 38 | YES | NO | NO | NO |
| 1094 | 16 | 11 | FEMALE | CHILD | 11 | 0 | YES | NO | NO | NO |
| 1095 | 16 | 7 | MALE | CHILD | 7 | 0 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1096 | 16 | 3 | MALE | CHILD | 3 | 0 | YES | NO | NO | NO |
| 1097 | 16 | 2 | MALE | CHILD | 2 | 0 | NO | NO | NO | NO |
| 1098 | 16 | 42 | MALE | OTHER | 10 | 32 | YES | NO | NO | NO |
| 1099 | 16 | 35 | FEMALE | OTHER | 10 | 25 | YES | NO | NO | NO |
| 1100 | 16 | 46 | MALE | OTHER | 10 | 36 | YES | NO | NO | NO |
| 1101 | 16 | 22 | FEMALE | OTHER | 10 | 12 | YES | NO | NO | NO |
| 1102 | 16 | 41 | FEMALE | OTHER | UNKWN | UNKWN | YES | NO | NO | NO |
| 1103 | 17 | 41 | MALE | HH | 7 | 34 | YES | NO | NO | NO |
| 1104 | 18 | 30 | FEMALE | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1105 | 18 | 5 | FEMALE | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1106 | 18 | 3 | FEMALE | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1107 | 18 | 56 | MALE | HH | 30 | 26 | YES | NO | NO | NO |
| 1109 | 18 | 40 | MALE | UNKWN | 30 | 10 | YES | NO | NO | NO |

PAHANG MALAYSIA 1GO

| REGNO | HSENG | AGE | SEX | RELHH | YRSIN | YROUT | HELTY | BATRI | WASRI | DNKRI |
|---|---|---|---|---|---|---|---|---|---|---|
| 1110 | 18 | 25 | FEMALE | OTHER | 4 | 21 | NO | NO | NO | NO |
| 1111 | 18 | 3 | MALE | OTHER | 3 | 0 | YES | NO | NO | NO |
| 1250 | 15 | 55 | FEMALE | PARENT | 30 | 25 | NO | NO | NO | NO |

PAHANG MALAYSIA 1GO

| REGNO | FSHRI | SCKBL | BLDDR | KELPN | KELAB | SWNEX | MALIA | OEDEM | SCAR | THKEP |
|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | YES | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1002 | YES | NO | NO | NO | NO | NO | NO | NO | NO | UNKWN |
| 1003 | YES | UNKWN | NO | NO | NO | NO | NO | NO | NO | NO |
| 1004 | NO | YES | NO | UNKWN | NO | NO | YES | NO | NO | NO |
| 1005 | YES | NO | NO | UNKWN | NO | NO | NO | NO | NO | UNKWN |
| 1006 | YES | NO | NO | NO | YES | NO | YES | NO | YES | UNKWN |
| 1007 | YES | NO | NO | YES | NO | NO | YES | NO | NO | NO |
| 1008 | UNKWN | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1009 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1010 | YES | NO | NO | NO | NO | NO | NO | NO | NO | UNKWN |
| 1011 | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1012 | YES | UNKWN | NO | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1013 | NO | UNKWN | NO | UNKWN | UNKWN | NO | YES | NO | NO | UNKWN |
| 1014 | NO | NO | NO | UNKWN | UNKWN | NO | YES | NO | NO | UNKWN |
| 1015 | NO | UNKWN | NO | UNKWN | NO | NO | YES | NO | NO | YES |
| 1016 | YES | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1017 | YES | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1018 | NO | NO | NO | UNKWN | UNKWN | NO | YES | NO | NO | NO |
| 1019 | NO | NO | NO | UNKWN | UNKWN | NO | YES | NO | NO | NO |
| 1020 | NO | NO | NO | UNKWN | UNKWN | NO | YES | NO | NO | UNKWN |
| 1021 | NO | UNKWN | NO | UNKWN | UNKWN | NO | YES | NO | NO | UNKWN |
| 1022 | NO | UNKWN | NO | UNKWN | UNKWN | NO | YES | NO | NO | NO |
| 1023 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1024 | NO | NO | NO | YES | NO | YES | YES | NO | YES | UNKWN |
| 1025 | NO | YES | NO | YES | YES | NO | YES | NO | YES | NO |
| 1026 | NO | NO | YES | NO | NO | NO | YES | NO | NO | UNKWN |
| 1027 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1028 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1029 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1030 | NO | NO | NO | YES | NO | NO | YES | NO | NO | UNKWN |
| 1031 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1032 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1033 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1034 | NO | NO | YES | NO | NO | NO | YES | NO | NO | UNKWN |
| 1035 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1036 | NO | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1037 | NO | NO | NO | YES | YES | NO | YES | NO | NO | UNKWN |
| 1038 | YES | NO | YES | NO | NO | NO | YES | NO | NO | UNKWN |
| 1039 | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1040 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1041 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1042 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1043 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1044 | NO | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1045 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1046 | NO | NO | NO | YES | YES | NO | NO | NO | YES | NO |
| 1047 | NO | NO | NO | YES | NO | NO | YES | NO | NO | NO |
| 1048 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1049 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1050 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1051 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1052 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1053 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1054 | NO | NO | NO | NO | NO | NO | YES | NO | YES | UNKWN |

PAHANG MALAYSIA 1GO

| REGNO | FSHRI | SCKBL | BLDDR | KELPN | KELAB | SWNEX | MALIA | OEDEM | SCAR | THKEP |
|---|---|---|---|---|---|---|---|---|---|---|
| 1055 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1056 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1057 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1058 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1059 | NO | NO | NO | YES | YES | NO | YES | NO | YES | NO |
| 1060 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1061 | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1062 | NO | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1063 | NO | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1064 | YES | YES | NO | NO | NO | NO | YES | NO | NO | NO |
| 1065 | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1066 | NO | NO | NO | UNKWN | UNKWN | NO | YES | NO | NO | NO |
| 1067 | NO | NO | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1068 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1069 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1070 | NO | UNKWN | UNKWN | NO | NO | NO | NO | NO | NO | NO |
| 1071 | NO | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1072 | NO | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1073 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1074 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1075 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1076 | NO | UNKWN | NO | NO | NO | NO | NO | NO | NO | NO |
| 1077 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1078 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1079 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1080 | NO | NO | NO | NO | NO | NO | NO | NO | UNKWN | NO |
| 1081 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1082 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1083 | NO | NO | NO | NO | NO | NO | NO | NO | NO | UNKWN |
| 1084 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1085 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1086 | NO | YES | YES | YES | NO | NO | YES | NO | NO | NO |
| 1087 | NO | NO | YES | NO | NO | NO | YES | NO | NO | NO |
| 1088 | NO | NO | YES | NO | NO | NO | NO | NO | NO | UNKWN |
| 1089 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1090 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1091 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1092 | NO | NO | NO | YES | YES | YES | NO | NO | NO | NO |
| 1093 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1094 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1095 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1096 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1097 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1098 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1099 | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| 1100 | NO | NO | NO | NO | NO | YES | YES | YES | NO | NO |
| 1101 | NO | NO | NO | NO | NO | NO | NO | UNKWN | UNKWN | UNKWN |
| 1102 | NO | NO | NO | NO | NO | NO | NO | UNKWN | UNKWN | UNKWN |
| 1103 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1104 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1105 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1106 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1107 | NO | NO | YES | YES | YES | NO | YES | NO | NO | UNKWN |
| 1109 | NO | NO | NO | NO | NO | NO | NO | NO | YES | NO |

PAHANG MALAYSIA 1GO

| REGNO | FSHRI | SCKBL | BLDDR | KELPN | KELAB | SWNEX | MALIA | OEDEM | SCAR | THKEP |
|---|---|---|---|---|---|---|---|---|---|---|
| 1110 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 1111 | NO | NO | NO | NO | NO | NO | YES | NO | NO | UNKWN |
| 1250 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

PAHANG MALAYSIA 1GO

| REGNO | SPLN | RTLVR | LTLVR | VENAB | INFMTH | MAL | SPMAL | FMMAL | FIL | SPFIL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1001 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1002 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1003 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1004 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1005 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | SUBPER |
| 1006 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | POS | PERIOD |
| 1007 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1008 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1009 | 3 | NO | NO | NO | 0 | NEG | P.F. | RINGS | POS | NEG |
| 1010 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1011 | 2 | NO | NO | NO | 0 | NEG | NEG | RINGS | UNKWN | NEG |
| 1012 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | UNKWN | UNKWN | UNKWN |
| 1013 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1014 | 4 | NO | NO | NO | 0 | POS | P.F. | RINGS | NEG | NEG |
| 1015 | 0 | NO | NO | NO | 0 | POS | P.V. | RINGS | NEG | NEG |
| 1016 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1017 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1018 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1019 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1020 | 3 | NO | NO | NO | 0 | POS | P.F. | GAMETO | NEG | NEG |
| 1021 | 0 | NO | NO | NO | 0 | POS | P.F. | GAMETO | NEG | NEG |
| 1022 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1023 | 0 | YES | YES | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1024 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1025 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1026 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1027 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1028 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1029 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1030 | 2 | NO | NO | NO | 0 | NEG | P.F. | GAMETO | NEG | NEG |
| 1031 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1032 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1033 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1034 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1035 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1036 | 2 | NO | NO | NO | 0 | POS | P.F. | MIXED | NEG | NEG |
| 1037 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1038 | 0 | YES | NO | YES | 0 | NEG | NEG | NEG | NEG | NEG |
| 1039 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1040 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1041 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1042 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1043 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1044 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1045 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | POS | PERIOD |
| 1046 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | POS | UNKWN |
| 1047 | 3 | NO | NO | NO | 0 | POS | P.F. | RINGS | NEG | NEG |
| 1048 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1049 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1050 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1051 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1052 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1053 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1054 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |

PAHANG MALAYSIA 1GO

| REGNO | SPLN | RTLVR | LTLVR | VENAB | INFMTH | MAL | SPMAL | FMMAL | FIL | SPFIL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1055 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1056 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1057 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1058 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1059 | 3 | NO | NO | UNKWN | 0 | NEG | NEG | NEG | POS | PERIOD |
| 1060 | 0 | YES | YES | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1061 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1062 | 2 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1063 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1064 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | POS | PERIOD |
| 1065 | 2 | YES | NO | NO | 0 | NEG | NEG | NEG | POS | PERIOD |
| 1066 | 3 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1067 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1068 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1069 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1070 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1071 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1072 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1073 | 1 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1074 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1075 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1076 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1077 | 0 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1078 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1079 | 0 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1080 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1081 | 2 | NO | NO | NO | 0 | POS | P.F. | MIXED | NEG | NEG |
| 1082 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1083 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1084 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1085 | 0 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1086 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | POS | SUBPER |
| 1087 | 0 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1088 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1089 | 2 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1090 | 0 | NO | NO | NO | 9 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1091 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1092 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1093 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1094 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1095 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1096 | 1 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1097 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1098 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1099 | 0 | YES | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1100 | 2 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1101 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1102 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |
| 1103 | 3 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1104 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | POS | UNKWN |
| 1105 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1106 | UNKWN | UNKWN | UNKWN | UNKWN | 0 | NEG | NEG | NEG | NEG | NEG |
| 1107 | 4 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1109 | 0 | NO | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |

PAHANG MALAYSIA 1GO

| REGNO | SPLN | RTLVR | LTLVR | VENAB | INFMTH | MAL | SPMAL | FMMAL | FIL | SPFIL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1110 | 0 | YES | NO | NO | 0 | POS | P.F. | RINGS | NEG | NEG |
| 1111 | 2 | NC | NO | NO | 0 | NEG | NEG | NEG | NEG | NEG |
| 1250 | 2 | NO | NO | NO | 0 | UNKWN | UNKWN | UNKWN | UNKWN | UNKWN |

PAHANG MALAYSIA 1GO

| REGNO | NOMF | ASC | TRICH | HW |
|---|---|---|---|---|
| 1001 | 0 | POS | POS | POS |
| 1002 | 0 | POS | POS | POS |
| 1003 | 0 | NEG | POS | POS |
| 1004 | 0 | UNKWN | UNKWN | UNKWN |
| 1005 | 1 | POS | POS | POS |
| 1006 | 5 | NEG | POS | POS |
| 1007 | 0 | POS | POS | NEG |
| 1008 | 0 | UNKWN | UNKWN | UNKWN |
| 1009 | 0 | NEG | POS | POS |
| 1010 | 0 | POS | POS | POS |
| 1011 | 2 | POS | POS | POS |
| 1012 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1013 | 0 | POS | POS | POS |
| 1014 | 0 | POS | POS | POS |
| 1015 | 0 | POS | NEG | NEG |
| 1016 | 0 | NEG | POS | POS |
| 1017 | 0 | UNKWN | UNKWN | UNKWN |
| 1018 | 0 | NEG | POS | POS |
| 1019 | 0 | NEG | POS | POS |
| 1020 | 0 | POS | POS | POS |
| 1021 | 0 | UNKWN | UNKWN | UNKWN |
| 1022 | 0 | UNKWN | UNKWN | UNKWN |
| 1023 | 0 | UNKWN | UNKWN. | UNKWN |
| 1024 | 0 | UNKWN | UNKWN | UNKWN |
| 1025 | 0 | UNKWN | UNKWN | UNKWN |
| 1026 | 0 | UNKWN | UNKWN | UNKWN |
| 1027 | 0 | POS | POS | POS |
| 1028 | 0 | POS | POS | POS |
| 1029 | 0 | NEG | POS | POS |
| 1030 | 5 | POS | POS | POS |
| 1031 | 0 | POS | POS | POS |
| 1032 | 0 | POS | POS | POS |
| 1033 | 0 | POS | POS | NEG |
| 1034 | 0 | POS | POS | POS |
| 1035 | 0 | POS | POS | POS |
| 1036 | 0 | NEG | NEG | NEG |
| 1037 | 0 | POS | POS | POS |
| 1038 | 0 | POS | POS | POS |
| 1039 | 0 | POS | POS | POS |
| 1040 | 0 | POS | POS | POS |
| 1041 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1042 | 0 | POS | POS | POS |
| 1043 | 0 | NEG | POS | NEG |
| 1044 | 0 | POS | POS | POS |
| 1045 | 2 | POS | POS | NEG |
| 1046 | 1 | NEG | POS | POS |
| 1047 | 1 | POS | POS | POS |
| 1048 | 1 | POS | POS | POS |
| 1049 | 1 | NEG | POS | POS |
| 1050 | 0 | POS | POS | POS |
| 1051 | 0 | UNKWN | UNKWN | UNKWN |
| 1052 | 0 | NEG | POS | NEG |
| 1053 | 0 | POS | NEG | NEG |
| 1054 | 0 | POS | POS | POS |

PAHANG MALAYSIA 1GO

| REGNO | NOMF | ASC | TRICH | HW |
|---|---|---|---|---|
| 1055 | 0 | POS | NEG | POS |
| 1056 | 0 | POS | POS | POS |
| 1057 | 0 | POS | POS | POS |
| 1058 | 0 | POS | POS | POS |
| 1059 | 14 | POS | POS | POS |
| 1060 | 0 | POS | POS | POS |
| 1061 | 0 | POS | POS | POS |
| 1062 | 0 | POS | POS | NEG |
| 1063 | 0 | POS | POS | POS |
| 1064 | 7 | UNKWN | UNKWN | UNKWN |
| 1065 | 7 | POS | POS | POS |
| 1066 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1067 | 0 | POS | POS | POS |
| 1068 | 15 | POS | POS | POS |
| 1069 | 0 | POS | POS | POS |
| 1070 | 0 | POS | POS | POS |
| 1071 | 0 | UNKWN | UNKWN | UNKWN |
| 1072 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1073 | UNKWN | POS | POS | POS |
| 1074 | UNKWN | POS | POS | POS |
| 1075 | UNKWN | POS | POS | POS |
| 1076 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1077 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1078 | 0 | UNKWN | UNKWN | UNKWN |
| 1079 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1080 | 0 | POS | POS | POS |
| 1081 | 0 | POS | POS | NEG |
| 1082 | 0 | POS | POS | POS |
| 1083 | 0 | POS | POS | POS |
| 1084 | 0 | POS | POS | POS |
| 1085 | UNKWN | POS | POS | NEG |
| 1086 | 25 | POS | NEG | NEG |
| 1087 | UNKWN | POS | POS | NEG |
| 1088 | 0 | POS | POS | POS |
| 1089 | 0 | NEG | POS | POS |
| 1090 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1091 | 0 | UNKWN | UNKWN | UNKWN |
| 1092 | 0 | NEG | POS | POS |
| 1093 | 0 | NEG | POS | POS |
| 1094 | 0 | NEG | POS | POS |
| 1095 | 0 | UNKWN | UNKWN | UNKWN |
| 1096 | 0 | NEG | POS | POS |
| 1097 | 0 | POS | POS | NEG |
| 1098 | 0 | POS | POS | POS |
| 1099 | 0 | POS | POS | POS |
| 1100 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1101 | 0 | NEG | POS | POS |
| 1102 | UNKWN | UNKWN | UNKWN | UNKWN |
| 1103 | 0 | POS | POS | POS |
| 1104 | 4 | UNKWN | UNKWN | UNKWN |
| 1105 | 0 | POS | POS | POS |
| 1106 | 0 | UNKWN | UNKWN | UNKWN |
| 1107 | 0 | POS | POS | POS |
| 1109 | 0 | NEG | POS | POS |

PAHANG MALAYSIA 1GO

| REGNO | NOMF | ASC | TRICH | HW |
|---|---|---|---|---|
| 1110 | 0 | NEG | POS | POS |
| 1111 | 0 | POS | POS | POS |
| 1250 | UNKWN | UNKWN | UNKWN | UNKWN |

PAHANG MALAYSIA 1GO

| NUMBER | NAME | HIGH | LOW | KNOWN CASES | MEAN | S.D. | COEF.VAR |
|---|---|---|---|---|---|---|---|
| 1 | REGNO | 1250 | 1001 | 111 | 1057.279 | 36.745 | 3.475 |
| 2 | HSENO | 18 | 1 | 111 | 10.063 | 4.854 | 48.243 |
| 3 | AGE | 64 | 0 | 111 | 21.225 | 18.724 | 88.218 |
| 4 | SEX | 2 | 1 | 111 | 1.495 | 0.502 | 33.584 |
| 5 | RELHH | 7 | 1 | 107 | 3.345 | 1.759 | 52.592 |
| 6 | YRSIN | 30 | 0 | 106 | 7.877 | 7.967 | 101.143 |
| 7 | YROUT | 51 | 0 | 106 | 13.226 | 15.521 | 117.352 |
| 8 | HELTY | 2 | 1 | 106 | 1.254 | 0.437 | 34.890 |
| 9 | BATRI | 2 | 1 | 106 | 1.726 | 0.447 | 25.944 |
| 10 | WASRI | 2 | 1 | 106 | 1.792 | 0.407 | 22.732 |
| 11 | DNKRI | 2 | 1 | 106 | 1.726 | 0.447 | 25.944 |
| 12 | FSHRI | 2 | 1 | 105 | 1.847 | 0.361 | 19.544 |
| 13 | SCKBL | 2 | 1 | 96 | 1.958 | 0.200 | 10.257 |
| 14 | BLDDR | 2 | 1 | 102 | 1.892 | 0.31 | 16.474 |
| 15 | KELPN | 2 | 1 | 91 | 1.879 | 0.32 | 17.443 |
| 16 | KELAB | 2 | 1 | 94 | 1.925 | 0.263 | 13.707 |
| 17 | SWNEX | 2 | 1 | 102 | 1.970 | 0.169 | 8.616 |
| 18 | SCRSW | 2 | 2 | 101 | 2.000 | 0.000 | 0.000 |
| 19 | SCRPN | 2 | 2 | 101 | 2.000 | 0.000 | 0.000 |
| 20 | CHUIA | 2 | 2 | 99 | 2.000 | 0.000 | 0.000 |
| 21 | MALIA | 2 | 1 | 102 | 1.392 | 0.490 | 35.243 |
| 22 | ELEPH | 2 | 2 | 99 | 2.000 | 0.000 | 0.000 |
| 23 | OEDEM | 2 | 1 | 100 | 1.989 | 0.100 | 5.025 |
| 24 | SCAR | 2 | 1 | 99 | 1.929 | 0.257 | 13.354 |
| 25 | HYCLE | 2 | 2 | 96 | 2.000 | 0.000 | 0.000 |
| 26 | THKEP | 2 | 1 | 68 | 1.985 | 0.121 | 6.108 |
| 27 | SCBRE | 2 | 2 | 79 | 2.000 | 0.000 | 0.000 |
| 28 | SPLN | 4 | 0 | 100 | 0.809 | 1.203 | 148.578 |
| 29 | RTLVR | 2 | 1 | 100 | 1.819 | 0.386 | 21.215 |
| 30 | LTLVR | 2 | 1 | 100 | 1.979 | 0.140 | 7.106 |
| 31 | VENAB | 2 | 1 | 99 | 1.989 | 0.100 | 5.050 |
| 32 | YEAR | 80 | 80 | 111 | 80.000 | 0.000 | 0.000 |
| 33 | MONTH | 5 | 5 | 111 | 5.000 | 0.000 | 0.000 |
| 34 | VILNO | 1 | 1 | 111 | 1.000 | 0.000 | 0.000 |
| 35 | INFMTH | 9 | 0 | 110 | 0.081 | 0.858 | 1048.808 |
| 36 | MAL | 1 | 0 | 100 | 0.079 | 0.272 | 340.824 |
| 37 | SPMAL | 2 | 0 | 100 | 0.109 | 0.345 | 313.723 |
| 38 | FMMAL | 3 | 0 | 99 | 0.181 | 0.577 | 317.837 |
| 39 | FIL | 1 | 0 | 98 | 0.091 | 0.290 | 316.082 |
| 40 | SPFIL | 2 | 0 | 97 | 0.123 | 0.462 | 373.676 |
| 41 | NOMF | 25 | 0 | 95 | 0.957 | 3.476 | 362.890 |
| 42 | SCHIS | 0 | 0 | 83 | 0.000 | 0.000 | 0.000 |
| 43 | ASC | 1 | 0 | 83 | 0.759 | 0.430 | 56.686 |
| 44 | TRICH | 1 | 0 | 83 | 0.939 | 0.239 | 25.472 |
| 45 | HW | 1 | 0 | 83 | 0.831 | 0.376 | 45.318 |
| 46 | COPT | 2 | 0 | 84 | 0.119 | 0.450 | 378.022 |
| 47 | PT | 0 | 0 | 111 | 0.000 | 0.000 | 0.000 |

The Summary Statistics just presented may be useful for error checking, but they do not by themselves permit much statistical analysis. In order to be able to perform various statistical tests it is essential to be able to obtain such Summary Statistics for various selected groups. For example, we may wish to compare young with old, males with females, sick with well, and so on. CCSS and many other systems permit selection of groups within the data by means of logical criteria as, for example, SEX = 1 (male). We may also specify logical combinations such as "Males under 40" or "Males who have had malaria", and so on.

To illustrate the listing of Summary Statistics for subgroups, the next 2 pages give statistics for all variables for the "LOCAL" residents, as contrasted with the "MIGRANT" group. For a first experiment, LOCAL was defined to be those with years residing elsewhere (YROUT) equal to 0, i.e. YROUT =0. This even includes the baby as a LOCAL. MIGRANT is then defined to be all those who have spent at least 1 year outside the village, i.e. YROUT 0. A comparison of the 2 sets of statistics may show some interesting differences. For example, one immediately obtains the percentage 37.8% unhealthy for the locals as opposed to 18.8% "unhealthy" among those who have been outside the village 1 year or more. A test could, of course, be performed if desired, to determine statistical significance.

As another illustration, Summary Statistics for those who have had malaria (MALIA = 1) are given. In these data, we see that the Hackett Spleen value ranges from 0 to 4, with an overall mean of 0.81. For the MALIA+ cases, however, the mean of SPLN = 0.97, contrasting with the mean for the MALIA- cases (not shown) of 0.55. Again, a statistical test may be used to determine significance of this difference.

Such statistics for different groups are frequently used for a t-test between two groups or for analysis of variance among many groups. CCSS does not automatically perform these tests, but they can be done on a calculator once the basic means and S.D.s have been found by CCSS. Some other systems may perform these tests automatically. However, there are good reasons for not providing too many tests automatically. The chief problem is that the investigator may too easily accept a value as significant when the test is not even appropriate. This is a good argument in favor of not automatically providing such information. One should consult a statistician before jumping to conclusions. One of the greatest hazards is that of looking at test after test until one is finally found which is theoretically significant. However, if the non-significant tests are taken into account, then the result will usually turn out to be non-significant overall. (Ignoring this problem results in one of the more common fallacies in statistics, discussed by I. J. Good, International Encyclopedia of Statistics, 1978, page 341, "Statistical Fallacies".)

LOCAL 7E0

| NUMBER | NAME | HIGH | LOW | KNOWN CASES | MEAN | S.D. | COEF.VAR |
|---|---|---|---|---|---|---|---|
| 1 | REGNC | 1111 | 1004 | 39 | 1055.820 | 28.855 | 2.732 |
| 2 | HSENO | 16 | 1 | 39 | 10.025 | 4.307 | 42.961 |
| 3 | AGE | 29 | 0 | 39 | 5.820 | 6.500 | 111.682 |
| 4 | SEX | 2 | 1 | 39 | 1.487 | 0.506 | 34.049 |
| 5 | RELHH | 6 | 1 | 39 | 3.410 | 1.163 | 34.115 |
| 6 | YRSIN | 29 | 0 | 39 | 5.820 | 6.500 | 111.682 |
| 7 | YROUT | 0 | 0 | 39 | 0.000 | 0.000 | 0.000 |
| 8 | HELTY | 2 | 1 | 37 | 1.378 | 0.491 | 35.670 |
| 9 | BATRI | 2 | 1 | 37 | 1.783 | 0.417 | 23.396 |
| 10 | WASRI | 2 | 1 | 37 | 1.972 | 0.164 | 8.332 |
| 11 | DNKRI | 2 | 1 | 37 | 1.783 | 0.417 | 23.396 |
| 12 | FSHRI | 2 | 2 | 37 | 2.000 | 0.000 | 0.000 |
| 13 | SCKBL | 2 | 1 | 30 | 1.966 | 0.182 | 9.283 |
| 14 | BLDDR | 2 | 1 | 34 | 1.882 | 0.327 | 17.373 |
| 15 | KELPN | 2 | 2 | 27 | 2.000 | 0.000 | 0.000 |
| 16 | KELAB | 2 | 2 | 29 | 2.000 | 0.000 | 0.000 |
| 17 | SHNEX | 2 | 2 | 35 | 2.000 | 0.000 | 0.000 |
| 18 | SCRSW | 2 | 2 | 34 | 2.000 | 0.000 | 0.000 |
| 19 | SCRPN | 2 | 2 | 34 | 2.000 | 0.000 | 0.000 |
| 20 | CHUIA | 2 | 2 | 33 | 2.000 | 0.000 | 0.000 |
| 21 | MALIA | 2 | 1 | 35 | 1.342 | 0.481 | 35.863 |
| 22 | ELEPH | 2 | 2 | 34 | 2.000 | 0.000 | 0.000 |
| 23 | OEDEM | 2 | 2 | 35 | 2.000 | 0.000 | 0.000 |
| 24 | SCAR | 2 | 2 | 34 | 2.000 | 0.000 | 0.000 |
| 25 | HYCLE | 2 | 2 | 35 | 2.000 | 0.000 | 0.000 |
| 26 | THKEP | 2 | 1 | 25 | 1.959 | 0.200 | 10.204 |
| 27 | SCBRE | 2 | 2 | 31 | 2.000 | 0.000 | 0.000 |
| 28 | SPLN | 4 | 0 | 35 | 0.828 | 1.248 | 150.643 |
| 29 | RTLVR | 2 | 1 | 35 | 1.857 | 0.355 | 19.117 |
| 30 | LTLVR | 2 | 2 | 35 | 2.000 | 0.000 | 0.000 |
| 31 | VENAB | 2 | 2 | 35 | 2.000 | 0.000 | 0.000 |
| 32 | YEAR | 80 | 80 | 39 | 80.000 | 0.000 | 0.000 |
| 33 | MONTH | 5 | 5 | 39 | 5.000 | 0.000 | 0.000 |
| 34 | VILNO | 1 | 1 | 39 | 1.000 | 0.000 | 0.000 |
| 35 | INFMTH | 9 | 0 | 38 | 0.236 | 1.459 | 616.441 |
| 36 | MAL | 1 | 0 | 32 | 0.187 | 0.396 | 211.497 |
| 37 | SPMAL | 2 | 0 | 32 | 0.218 | 0.490 | 224.385 |
| 38 | FMMAL | 3 | 0 | 32 | 0.375 | 0.870 | 232.178 |
| 39 | FIL | 0 | 0 | 32 | 0.000 | 0.000 | 0.000 |
| 40 | SPFIL | 0 | 0 | 32 | 0.000 | 0.000 | 0.000 |
| 41 | NOMF | 0 | 0 | 30 | 0.000 | 0.000 | 0.000 |
| 42 | SCHIS | 0 | 0 | 24 | 0.000 | 0.000 | 0.000 |
| 43 | ASC | 1 | 0 | 24 | 0.708 | 0.464 | 65.549 |
| 44 | TRICH | 1 | 0 | 24 | 0.916 | 0.282 | 30.799 |
| 45 | HW | 1 | 0 | 24 | 0.708 | 0.464 | 65.549 |
| 46 | COPT | 2 | 0 | 25 | 0.079 | 0.399 | 499.999 |
| 47 | RT | 0 | 0 | 39 | 0.000 | 0.000 | 0.000 |

MIGRANT 760

| NUMBER | NAME | HIGH | LOW | KNOWN CASES | MEAN | S.D. | COEF.VAR |
|---|---|---|---|---|---|---|---|
| 1 | REGNO | 1250 | 1001 | 72 | 1058.069 | 40.567 | 3.834 |
| 2 | HSENO | 18 | 1 | 72 | 10.083 | 5.156 | 51.134 |
| 3 | AGE | 64 | 1 | 72 | 29.569 | 17.878 | 60.461 |
| 4 | SEX | 2 | 1 | 72 | 1.500 | 0.503 | 33.567 |
| 5 | RELHH | 7 | 1 | 68 | 3.308 | 2.031 | 61.397 |
| 6 | YRSIN | 30 | 1 | 67 | 9.074 | 8.526 | 93.963 |
| 7 | YROUT | 51 | 1 | 67 | 20.925 | 14.823 | 70.839 |
| 8 | HELTY | 2 | 1 | 69 | 1.188 | 0.393 | 33.145 |
| 9 | BATRI | 2 | 1 | 69 | 1.695 | 0.463 | 27.334 |
| 10 | WASRI | 2 | 1 | 69 | 1.695 | 0.463 | 27.334 |
| 11 | DNKRI | 2 | 1 | 69 | 1.695 | 0.463 | 27.334 |
| 12 | FSHRI | 2 | 1 | 68 | 1.764 | 0.427 | 24.215 |
| 13 | SCKBL | 2 | 1 | 66 | 1.954 | 0.209 | 10.738 |
| 14 | BLDDR | 2 | 1 | 68 | 1.897 | 0.306 | 16.137 |
| 15 | KELPN | 2 | 1 | 64 | 1.828 | 0.380 | 20.800 |
| 16 | KELAB | 2 | 1 | 65 | 1.892 | 0.312 | 16.509 |
| 17 | SWNEX | 2 | 1 | 67 | 1.955 | 0.208 | 10.657 |
| 18 | SCRSW | 2 | 2 | 67 | 2.000 | 0.000 | 0.000 |
| 19 | SCRPN | 2 | 2 | 67 | 2.000 | 0.000 | 0.000 |
| 20 | CHUIA | 2 | 2 | 66 | 2.000 | 0.000 | 0.000 |
| 21 | MALIA | 2 | 1 | 67 | 1.417 | 0.496 | 35.047 |
| 22 | ELEPH | 2 | 2 | 65 | 2.000 | 0.000 | 0.000 |
| 23 | OEDEM | 2 | 1 | 65 | 1.984 | 0.124 | 6.249 |
| 24 | SCAR | 2 | 1 | 65 | 1.892 | 0.312 | 16.509 |
| 25 | HYCLE | 2 | 2 | 61 | 2.000 | 0.000 | 0.000 |
| 26 | THKEP | 2 | 2 | 43 | 2.000 | 0.000 | 0.000 |
| 27 | SCBRE | 2 | 2 | 48 | 2.000 | 0.000 | 0.000 |
| 28 | SPLN | 4 | 0 | 65 | 0.799 | 1.188 | 148.560 |
| 29 | RTLVR | 2 | 1 | 65 | 1.799 | 0.403 | 22.395 |
| 30 | LTLVR | 2 | 1 | 65 | 1.969 | 0.174 | 8.837 |
| 31 | VENAB | 2 | 1 | 64 | 1.984 | 0.125 | 6.299 |
| 32 | YEAR | 80 | 80 | 72 | 80.000 | 0.000 | 0.000 |
| 33 | MONTH | 5 | 5 | 72 | 5.000 | 0.000 | 0.000 |
| 34 | VILNO | 1 | 1 | 72 | 1.000 | 0.000 | 0.000 |
| 35 | INFMTH | 0 | 0 | 72 | 0.000 | 0.000 | 0.000 |
| 36 | MAL | 1 | 0 | 68 | 0.029 | 0.170 | 578.727 |
| 37 | SPMAL | 1 | 0 | 68 | 0.058 | 0.237 | 402.973 |
| 38 | FMMAL | 2 | 0 | 67 | 0.089 | 0.336 | 375.490 |
| 39 | FIL | 1 | 0 | 66 | 0.136 | 0.345 | 253.589 |
| 40 | SPFIL | 2 | 0 | 65 | 0.184 | 0.555 | 301.165 |
| 41 | NOMF | 25 | 0 | 65 | 1.399 | 4.137 | 295.534 |
| 42 | SCHIS | 0 | 0 | 59 | 0.000 | 0.000 | 0.000 |
| 43 | ASC | 1 | 0 | 59 | 0.779 | 0.418 | 53.617 |
| 44 | TRICH | 1 | 0 | 59 | 0.949 | 0.221 | 23.344 |
| 45 | HW | 1 | 0 | 59 | 0.881 | 0.326 | 37.004 |
| 46 | CORT | 2 | 0 | 59 | 0.135 | 0.471 | 348.016 |
| 47 | RT | 0 | 0 | 72 | 0.000 | 0.000 | 0.000 |

MALIA + 21E1

| NUMBER | NAME | HIGH | LOW | KNOWN CASES | MEAN | S.D. | COEF.VAR |
|---|---|---|---|---|---|---|---|
| 1 | REGNO | 1111 | 1001 | 62 | 1049.548 | 32.102 | 3.058 |
| 2 | HSENO | 18 | 1 | 62 | 9.096 | 4.871 | 53.548 |
| 3 | AGE | 64 | 0 | 62 | 21.580 | 19.921 | 92.312 |
| 4 | SEX | 2 | 1 | 62 | 1.403 | 0.494 | 35.243 |
| 5 | RELHH | 7 | 1 | 62 | 3.112 | 1.802 | 57.907 |
| 6 | YRSIN | 30 | 0 | 62 | 7.693 | 7.841 | 101.927 |
| 7 | YROUT | 51 | 0 | 62 | 13.870 | 15.780 | 113.768 |
| 8 | HELTY | 2 | 1 | 62 | 1.354 | 0.482 | 35.603 |
| 9 | BATRI | 2 | 1 | 62 | 1.677 | 0.471 | 28.095 |
| 10 | WASRI | 2 | 1 | 62 | 1.790 | 0.410 | 22.923 |
| 11 | DNKRI | 2 | 1 | 62 | 1.677 | 0.471 | 28.095 |
| 12 | FSHRI | 2 | 1 | 61 | 1.885 | 0.321 | 17.046 |
| 13 | SCKBL | 2 | 1 | 58 | 1.931 | 0.255 | 13.236 |
| 14 | BLDDR | 2 | 1 | 62 | 1.903 | 0.298 | 15.661 |
| 15 | KELPN | 2 | 1 | 52 | 1.826 | 0.382 | 20.909 |
| 16 | KELAB | 2 | 1 | 54 | 1.907 | 0.292 | 15.339 |
| 17 | SWNEX | 2 | 1 | 62 | 1.967 | 0.178 | 9.052 |
| 18 | SCRSW | 2 | 2 | 61 | 2.000 | 0.000 | 0.000 |
| 19 | SCRPN | 2 | 2 | 61 | 2.000 | 0.000 | 0.000 |
| 20 | CHUIA | 2 | 2 | 60 | 2.000 | 0.000 | 0.000 |
| 21 | MALIA | 1 | 1 | 62 | 1.000 | 0.000 | 0.000 |
| 22 | ELEPH | 2 | 2 | 62 | 2.000 | 0.000 | 0.000 |
| 23 | OEDEM | 2 | 1 | 62 | 1.983 | 0.127 | 6.401 |
| 24 | SCAR | 2 | 1 | 62 | 1.919 | 0.274 | 14.302 |
| 25 | HYCLE | 2 | 2 | 59 | 2.000 | 0.000 | 0.000 |
| 26 | THKEP | 2 | 1 | 35 | 1.971 | 0.169 | 8.574 |
| 27 | SCBRE | 2 | 2 | 45 | 2.000 | 0.000 | 0.000 |
| 28 | SPLN | 4 | 0 | 62 | 0.967 | 1.305 | 134.883 |
| 29 | RTLVR | 2 | 1 | 62 | 1.870 | 0.337 | 18.064 |
| 30 | LTLVR | 2 | 1 | 62 | 1.967 | 0.178 | 9.052 |
| 31 | VENAB | 2 | 1 | 61 | 1.983 | 0.128 | 6.454 |
| 32 | YEAR | 80 | 80 | 62 | 80.000 | 0.000 | 0.000 |
| 33 | MONTH | 5 | 5 | 62 | 5.000 | 0.000 | 0.000 |
| 34 | VILNO | 1 | 1 | 62 | 1.000 | 0.000 | 0.000 |
| 35 | INFMTH | 9 | 0 | 62 | 0.145 | 1.143 | 787.400 |
| 36 | MAL | 1 | 0 | 56 | 0.107 | 0.312 | 291.287 |
| 37 | SPMAL | 2 | 0 | 56 | 0.160 | 0.416 | 259.326 |
| 38 | FMMAL | 3 | 0 | 56 | 0.232 | 0.632 | 272.331 |
| 39 | FIL | 1 | 0 | 56 | 0.089 | 0.287 | 322.264 |
| 40 | SPFIL | 2 | 0 | 56 | 0.125 | 0.469 | 375.620 |
| 41 | OMF | 25 | 0 | 55 | 1.345 | 4.406 | 327.495 |
| 42 | SCHIS | 0 | 0 | 46 | 0.000 | 0.000 | 0.000 |
| 43 | ASC | 1 | 0 | 46 | 0.760 | 0.431 | 56.680 |
| 44 | TRICH | 1 | 0 | 46 | 0.956 | 0.206 | 21.555 |
| 45 | HW | 1 | 0 | 46 | 0.826 | 0.383 | 46.390 |
| 46 | CORT | 2 | 0 | 46 | 0.152 | 0.514 | 338.423 |
| 47 | RT | 0 | 0 | 62 | 0.000 | 0.000 | 0.000 |

B. Tables

In the analysis of survey data, we are often more interested in counts of cases falling into certain categories than in continuous measurements. For example, we may wish to find out if older persons show more evidence, or more often show evidence, of disease than younger persons. We therefore count the numbers of sick and well in both the young and the old age groups. Such counting is done automatically by CCSS and other computer systems in the form of tables.

The simplest form of table is the histogram, which is just a one-dimensional table, or a single column of cells, with counts in each cell. Since these are so simple, they are usually produced with a pictorial representation of bars, to make the presentation more graphic. With a histogram one must specify the intervals, as, for example, age intervals, into which the data are to be classified and counted, as age 0-9, 10-19, 20-29, and so on. One must also specify the subgroup for which the data are to be counted, if desired. For example, a histogram of age for males only could be produced.

CCSS also has a BARGRAPH option which records all of the codes for a variable which occur in the desired subgroup and counts how many times each code occurs.

By all odds the most useful table is the two-way table, with rows and columns, and counts in each cell. Here, one must specify (1) the row intervals and variable, (2) the column intervals and variable, and (3) the subgroup desired. On the following pages are first, a 2-way table showing the age/sex breakdown of the study population, and second, a table showing the Malaria positives by age.

A convenient addition to the 2-way table is a set of percent tables, showing the percentages for each table by (1) row, (2) column, and (3) over all cells.

For 3-way and higher dimensional tables, CCSS provides what are called Nested Tables, which is one big table displaying all combinations of the specified variables and intervals. NAMRU-2 uses, instead, a true 3-way tabling program in its own package called PORTSTAT. Tables up to 8 x 8 x 8 are produced with this program.

PAHANG MALAYSIA 1GO

| | | SEX MALE | FEMALE | TOTAL | UNKWN |
|---|---|---|---|---|---|
| | 0- | 25 | 21 | 46 | 0 |
| | 10- | 4 | 12 | 16 | 0 |
| | 20- | 5 | 8 | 13 | 0 |
| AGE | 30- | 1 | 6 | 7 | 0 |
| | 40- | 12 | 5 | 17 | 0 |
| | 50- | 9 | 3 | 12 | 0 |
| | TOTAL | 56 | 55 | 111 | ***** |
| | UNKWN | 0 | 0 | ***** | 0 |

CASES IN TABLE= 111 KNOWNS + 0 UNKNOWNS

CHI SQUARE = 14.48607638 DEG. FREEDOM = 5.

ROW PERCENT TABLE FOR...TABLE 1

PAHANG MALAYSIA 1GO

| | | SEX | | |
|---|---|---|---|---|
| | | MALE | FEMALE | TOTAL |
| AGE | 0- | 54.34 | 45.65 | 100.00 |
| | 10- | 25.00 | 75.00 | 100.00 |
| | 20- | 38.46 | 61.53 | 100.00 |
| | 30- | 14.28 | 85.71 | 100.00 |
| | 40- | 70.58 | 29.41 | 100.00 |
| | 50- | 75.00 | 25.00 | 100.00 |
| | TOTAL | 50.45 | 49.54 | 100.00 |

COL PERCENT TABLE FOR...TABLE 1

PAHANG MALAYSIA 1GO

| | | SEX | | |
|---|---|---|---|---|
| | | MALE | FEMALE | TOTAL |
| AGE | 0- | 44.64 | 38.18 | 41.44 |
| | 10- | 7.14 | 21.81 | 14.41 |
| | 20- | 8.92 | 14.54 | 11.71 |
| | 30- | 1.78 | 10.90 | 6.30 |
| | 40- | 21.42 | 9.09 | 15.31 |
| | 50- | 16.07 | 5.45 | 10.81 |
| | TOTAL | 100.00 | 100.00 | 100.00 |

TOTAL PERCENT TABLE FOR...TABLE 1

PAHANG MALAYSIA 1GO

| | | SEX | | |
|---|---|---|---|---|
| | | MALE | FEMALE | TOTAL |
| AGE | 0- | 22.52 | 18.91 | 41.44 |
| | 10- | 3.60 | 10.81 | 14.41 |
| | 20- | 4.50 | 7.20 | 11.71 |
| | 30- | 0.90 | 5.40 | 6.30 |
| | 40- | 10.81 | 4.50 | 15.31 |
| | 50- | 8.10 | 2.70 | 10.81 |
| | TOTAL | 50.45 | 49.54 | 100.00 |

PAHANG MALAYSIA 1G0

| | | NEG | MAL POS | TOTAL | UNKWN |
|---|---|---|---|---|---|
| AGE | 0- | 36 | 5 | 41 | 5 |
| | 10- | 13 | 2 | 15 | 1 |
| | 20- | 11 | 1 | 12 | 1 |
| | 30- | 6 | 0 | 6 | 1 |
| | 40- | 15 | 0 | 15 | 2 |
| | 50- | 11 | 0 | 11 | 1 |
| | TOTAL | 92 | 8 | 100 | ***** |
| | UNKWN | 0 | 0 | ***** | 0 |

CASES IN TABLE= 100 KNOWNS + 11 UNKNOWNS

CHI SQUARE = 4.34451104 DEG. FREEDOM = 5.

ROW PERCENT TABLE FOR...TABLE 2

PAHANG MALAYSIA 1GO

| | | MAL | | |
|---|---|---|---|---|
| | | NEG | POS | TOTAL |
| | 0- | 87.80 | 12.19 | 100.00 |
| | 10- | 86.66 | 13.33 | 100.00 |
| AGE | 20- | 91.66 | 8.33 | 100.00 |
| | 30- | 100.00 | 0.00 | 100.00 |
| | 40- | 100.00 | 0.00 | 100.00 |
| | 50- | 100.00 | 0.00 | 100.00 |
| | TOTAL | 92.00 | 8.00 | 100.00 |

COL PERCENT TABLE FOR...TABLE 2

PAHANG MALAYSIA 1GO

| | | MAL | | |
|---|---|---|---|---|
| | | NEG | POS | TOTAL |
| | 0- | 39.13 | 62.50 | 41.00 |
| | 10- | 14.13 | 25.00 | 15.00 |
| AGE | 20- | 11.95 | 12.50 | 12.00 |
| | 30- | 6.52 | 0.00 | 6.00 |
| | 40- | 16.30 | 0.00 | 15.00 |
| | 50- | 11.95 | 0.00 | 11.00 |
| | TOTAL | 100.00 | 100.00 | 100.00 |

TOTAL PERCENT TABLE FOR...TABLE 2

PAHANG MALAYSIA 1GO

| | | MAL | | |
|---|---|---|---|---|
| | | NEG | POS | TOTAL |
| | 0- | 36.00 | 5.00 | 41.00 |
| | 10- | 13.00 | 2.00 | 15.00 |
| AGE | 20- | 11.00 | 1.00 | 12.00 |
| | 30- | 6.00 | 0.00 | 6.00 |
| | 40- | 15.00 | 0.00 | 15.00 |
| | 50- | 11.00 | 0.00 | 11.00 |
| | TOTAL | 92.00 | 8.00 | 100.00 |

In the statistical analysis of tables of counts, or contingency tables, the chi-squared test is often used. The CCSS system, therefore, gives the chi-squared value for each table, if desired. Some computer systems give other statistics. However, such statistics should not be used without a careful analysis of the problem to see if the test is actually appropriate. For paired data, for example, in a 2 x 2 table the chi-squared test is not appropriate, and McNemar's test should be used (9).

For the chi-squared test with a 2 x 2 table, the Yates Correction is often used, but examination of hundreds of cases in the range where this correction would be needed indicates that this correction is almost always over-conservative. For practical work, the following alternative to the Yates Correction is preferable. Use the chi-squared without the correction if the total number of cases is 40 or more. If there are fewer cases, or if the result is borderline, use Fisher's Exact Test. Fisher's test has the advantage of being usable either as a one-sided test, in case only one direction of variation is possible, or as a two-sided test, in which case the simplest approach is to double the one-sided value.

In the statistical analysis of survey data, we are frequently faced with possible simultaneous interaction among 3 or more variables. If the analysis is done for all possible pairs of variables involved, say 3 pairs for a total of 3 variables, interactions among all three variables may be masked, or confounded. Examples occur in which no pairwise chi-squared value is significant, yet the 3-way interaction is highly significant. A practical method for testing such interactions for significance is that of Lancaster (7). It has the disadvantage of being biased if the data are highly skewed. For example, in a 2 x 2 x 2 table of sex, age, and health counts, if there are disproportionally many old females and young males in the sample, so that the AGE x SEX 2 x 2 table is highly significant, the method may give a biased value for the 3-way interaction. Nevertheless, the Lancaster method is a highly useful and practical tool and may be applied to many dimensions.

Where the skewing of the data may cast doubt on the multi-dimensional chi-squared analysis, the log-linear method may be used to test for significance of higher interactions (8). Programs are available at NAMRU-2 and elsewhere to carry out this type of analysis.

Regression methods are sometimes applied to count data, possibly because powerful programs for multiple regression are widely available. It is possible to apply them to tables of count data, but this is less natural than the direct approach to discrete data described above.

C. Scattergrams

In survey data, continuous variables, like age, are still often conveniently treated as discrete, by breaking the age into groups, such as YOUNG (0 - 19) and OLD (20+). The reason for this is two-fold. First, the other variables under study may be discrete, as SICK vs. WELL. Second, and more fundamentally, we must be careful to consider just what question we are asking, before we carry out a statistical test and get an answer. Otherwise, we may get the answer to the wrong question. If we really want to know what the effect is of, say, 1 more year of age, as a matter of intensity, then we should, of course, treat the variable as continuous and use methods, such as regression, to study it. However, such data as age are often either highly inaccurate or of little importance compared to the category such as YOUNG vs. OLD. Therefore, the discrete variable approach should be seriously considered in the analysis of survey data before turning to continuous methods.

When we are interested in the analysis of continuous data such as fever temperature, or worm counts (usually taken as the Logarithm), the first step should be to prepare a scattergram showing the interaction between the two variables. CCSS does this automatically and also prints the linear regression equation and the correlation coefficient. Scattergrams should also be prepared for various subgroups if the effects seem to vary with subgroups. Where we are really concerned with quantitative change, as opposed to qualitative, discrete, change, then multiple regression methods may be appropriate.

On the following page there is a scattergram produced by CCSS which shows the interaction between the variables AGE and SPLN (Spleen), restricted to the group with a positive spleen. The correlation coefficient R = 0.11 is not significant and it appears that there is no particularly strong relationship between age and spleen size for this group.

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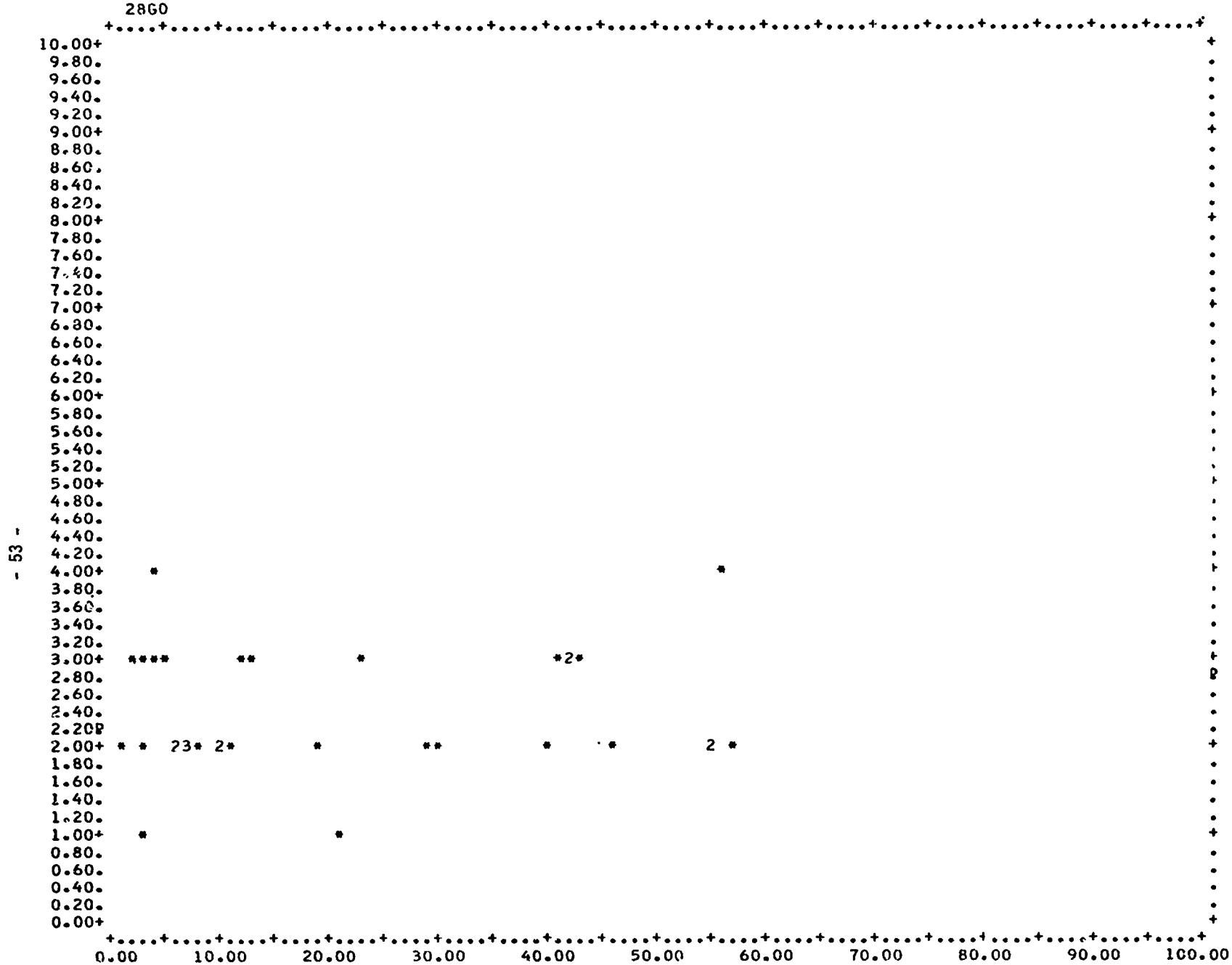
SCATTERGRAM

PLOT 1.SPLEEN + 34 POINTS HORIZ. AXIS= AGE VERT. AXIS= SPLN




Y= 2.3823+ 0.0041(X- 21.2058)
R= 0.1147 XSD= 19.0673 YSD= 0.6969 SYX= 0.7030

## X. Integrating Statistical Analysis and Data Processing within the Research Process

The statistician, computer personnel, and investigators should form a team to analyze the data if the research program involving survey data is to succeed. If there is a weakness at any point the entire project may be jeopardized. If the points covered in sections I, II, and III of this Guide are followed, the conditions are then favorable for a successful project. In particular, the statistician and the computer personnel must be brought into the project at the beginning, because it is often impossible to salvage a project which has started from the wrong foundation.

## XI. Pitfalls to be Avoided

As pointed out in Section I of this Guide, carrying out a research project is "like walking a mountain path", for it is easy to lose one's way at any point. Once the study design has been fixed, procedures must be set up to catch errors at every point, as has been stressed in this Guide. A pilot study is very valuable when possible, to provide insight into the reasonableness of the assumptions and the data gathering procedures. In any case the statistician should check the data at various stages to ensure that nothing goes wrong, so as to avoid the consequences of Murphy's Law, stated earlier: "If anything can go wrong, it will!"

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Handling Biomedical Data
Guide

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This special publication is a guide to handling biomedical data collected during surveys and in carrying out certain biomedical investigations. The system has been used extensively by NAMRU-2 and has been found to be highly successful. Information is presented on the various stages in data processing inlcuding, codesheets, data recording transciption, data entry, presentation and checking and statistical analysis. Certain pitfalls to be avoided are also presented.

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