The Demographic and Health Surveys (DHS) Project

Past, Present and Future

1. Introduction

In this paper we briefly will go over the genesis of the Demographic and Health Surveys (DHS) project, discuss its general approaches and content and major changes that have taken place in these over the years. The final section explores possible future changes in approaches and content that could be beneficial to the program and to data users at large.

2. Long history of USAID-supported surveys

The DHS survey program is the brainchild of USAID and receives most of its support from USAID, although donors like UNICEF, the World Bank, DFiD, UNFPA and others also have provided significant funding for DHS activities over the years.

The roots of the DHS program go back to the World Fertility Survey (WFS) and Contraceptive Prevalence Surveys (CPS) programs that existed respectively from 1972 to 1984 and from 1976 to 1984. The WFS was funded about equally by UNFPA and USAID, aside from receiving more limited contributions from the Governments of Great Britain, The Netherlands and Japan. The project office was based in London, UK and was headed up by the International Statistical Institute, based in The Hague, the Netherlands.[1] The CPS was entirely funded by USAID and the project office was headed up by the Westinghouse Corporation and was located in the USA.

While not directly funded by USAID, the Latin American comparative surveys on urban and rural fertility (PECFAL), carried out by the Latin American Demographic Center (CELADE) in Santiago Chile between 1965 and 1972, were in turn a forerunner of the WFS. Many of the approaches used in the WFS drew on the approaches followed for these surveys.

The WFS was a program for comparative research on fertility and mortality as well as on some aspects of child health. The program executed 41 national-level surveys in developing countries, and provided limited support for 17 surveys in Europe, in collaboration with the United Nations' Economic Commission for Europe. In addition, the WFS had a large program for analysis and capacity building.

The CPS program was more narrowly focused on fertility and family planning and resulted in 36 national-level surveys worldwide.

[1] The World Fertility Survey, Final Report. International Statistical Institute, Voorburg, The Netherlands

In 1984 USAID decided to merge the WFS and CPS programs into the new DHS program that was established in that year. Initial funding came solely from USAID. The DHS program is now in its 25th year and data have been collected in 80 countries and through more than 250 surveys of women, men and facilities (www.measuredhs.com).

3. Key approaches in the DHS program

a. Sample coverage

From early on it was decided that DHS surveys should be national in scope so that the resulting data carry real weight for national-level and regional policy making. The only exception to this was an early survey in Ondo State (Nigeria). In some other countries particular areas that could not be covered for security reasons were excluded, but an attempt was made to cover as much of each country as possible.

The decision to go for national-level surveys has been a good one and has improved the chances of data use for policy and program purposes significantly. Data for only a small part of a country just do not carry enough weight at the level of a country, mainly because they do not represent the country as a whole. Thus they are more easily dismissed if there are findings that are not in line with expectations.

b. Sample selection

True probability sampling through a two-stage cluster design is the typical approach for a DHS sample. The absence of updated census information in many countries is one of the potential pitfalls to this approach. For this reason, DHS uses sample selection and updating procedures prior to the fieldwork that ensure proper representation of all households and individuals under study. Special listing teams are sent out to list all the households currently located in selected areas and sample households are selected at the central level from this updated list to ensure that every household in a country has an appropriate chance of being selected for the survey.

DHS has insisted on doing the listing prior to the fieldwork for interviewing and to carry it out by listing staff who are independent from the field interviewers. The main reason for this approach is the notion that interviewers should be assigned specified households so that they have no role in the selection of these households. This in turn is based on the well-founded fear that selection of households in the field by the interviewers would lead to biases through the exclusion of difficult to reach or "undesirable" households. Some exceptions were made, particularly in countries where access is so difficult and transportation so expensive that the cost of two separate visits becomes prohibitive. In these instances, listing was carried out as part of the fieldwork, e.g. Guyana 2009.

The cost of a separate listing operation is substantial and there have been calls for changing this approach. Sampling experts also have developed new listing approaches that would make listing easier and

supposedly also make it more likely that listing can be conducted by interviewers during one and the same field visit, without causing substantial biases and for less cost.[2]

New technology also has been used to list households on an electronic device that provides the GPS readings of the household location and that can be used to randomly select in the field from among listed households by "pooling" all the listings in one file and then making a selection and guide the interviewers back to the selected households.[3]

Why have these approaches not as yet been used in DHS surveys? The main reason is that both these alternative approaches still contain the possibility for interviewers to totally omit households that they feel are difficult to reach or "undesirable". Major field supervision and checking would be necessary to avoid sample biases. In addition, the GPS approach implies physically visiting each household/dwelling and is also affected by the difficulties in properly receiving GPS signals in wooded or mountainous areas or dense urban areas with high buildings etc.

The listing of households prior to the interview by distinct listing teams can be done faster than taking the GPS reading of each household/dwelling, because for the listing it is not actually necessary to physically visit each household/dwelling and the necessary information can be obtained from third parties. E.g. a lonely house on a high hill with no good access can easily be listed by a lister who is just listing households (including the family name of the occupants, if necessary), but to take its GPS reading and potentially come back for interview later on if the household is actually selected would be very cumbersome.

In short, the DHS approach is to take sample selection responsibility out of the hands of interviewers to avoid bias. That the fear of bias is well-founded can actually be demonstrated by data from the DHS itself, as will be seen in the section on data quality. In quite a few countries, it can be shown that interviewers manipulated the selection criteria for the individual and child interviews to reduce their workloads.

Nonetheless, the cost of separate listing prior to sample selection of households is a major issue and continuous attention should be paid to potential new procedures that could cut the cost of sampling without increasing sampling error. This is an area where an expert group to review current approaches and results could be very beneficial.

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[2] Anthony G. Turner, Robert J. Magnani and Muhammad Shuaib; A not Quite as Quick but Much Cleaner Alternative to the Expanded Programme of Immunization (EPI) Cluster Survey Design. *International Journal for Epidemiology, Vol. 25, No.1, 1996*

[3] Jodi L. Vanden Eng, Adam Wolkon, Anatoly S. Frolov, Dianne J. Terlouw, M. James Eliades, Kodjoh Morgah, Vincent Takpa, Aboudou Dare, Yao K. Sodahlon, Yao Doumanou, William A. Hawley, and Allen W. Hightower; Use of handheld Computers with Global Positioning Systems for Probability Sampling and data Entry in Household Surveys. *American Journal of Tropical Medicine and Hygiene, 77(2), 2007, pp 393-399*

c. Sub-national coverage

A particular characteristic of our times is the decentralization of power and services that is occurring in many countries with the support of international donors and programs. This decentralization in turn leads to requests for data at the sub-national level which oftentimes means very large samples, depending on how many sub-national levels are involved.

Sub-national data are clearly necessary. The continuous question will be whether the cost of collecting data at a certain small geographical level is actually a good investment and whether the data for the required sub-national activities are actually used for program and policy purposes.

Supposing that these data are indeed required and used everywhere, the DHS has tried to reduce the cost burden by limiting the number of sub-national areas for which data will be made available and by arguing that the situation in contiguous areas with similar geographic and economic characteristics is also likely to be similar and can be dealt with by providing the data for a somewhat larger but relatively homogeneous area.

The increase in sample sizes that are being requested and implemented is easily demonstrated in the table below which, just as an illustration, provides sample sizes over time for a number of countries.

Table 1: Sample sizes for selected countries by year of survey (standard DHS surveys and samples of women 15-49 only)

COUNTRY	**YEAR**					
Burkina Faso	**1993**	**1998**	**2003**	**2009**		
Sample size	*6,354*	*6,445*	*12,477*	*20,000*		
Malawi	**1992**	**2000**	**2004**	**2009**		
Sample size	*4,850*	*13,220*	*11,698*	*25,000*		
Egypt	**1988**	**1992**	**1995**	**2000**	**2005**	**2008**
Sample size	*8,911*	*9,864*	*14,779*	*15,573*	*19,474*	*16,527*
Bolivia	**1989**	**1994**	**1998**	**2003**	**2008**	
Sample size	*7,923*	*8,603*	*11,187*	*17,654*	*16,939*	
Colombia	**1986**	**1990**	**1995**	**2000**	**2005**	
Sample size	*5,329*	*8,644*	*11,140*	*11,585*	*41,344*	

In many other countries it has been possible to maintain sample sizes relatively well so far. For instance, in Bangladesh the sample size for women 15-49 increased only from 9,640 in 1993 to 10,996 in 2007.

d. Field work approach

Organization of the fieldwork

From the very beginning of the program, the DHS survey program adopted a similar approach to fieldwork and supervision than was followed for the WFS and that could count on 12 years of applied experience in 41 settings in the developing world.

This approach consists of working in teams of 4-5 interviewers, each with two supervisory staff, a field supervisor in charge of all the team's logistics and supervision and a field editor in charge of editing all the questionnaires as they are produced by the interviewers, while still in the cluster where interviews took place. In addition, the team of supervisors is charged with work assignments and maintaining equity in those assignments in terms of terrain difficulty, numbers of interviews etc. It is also charged with supervision of the sample implementation procedures through spot-checking on households and women who were selected in the sample.

This team approach was adopted for a number of reasons:

- To facilitate cost-effective transportation to and in the field
- To enhance the possibility of close supervision
- To create a team feeling and enhance personal security in the field
- To allow quick in-out work in each cluster, so as to prevent as much as possible that the survey work itself has an effect on future answers because some respondents have already spoken with people who already have been interviewed prior to being interviewed themselves.

This basic approach has not changed over the years and is still being followed, with some exceptions. For instance, in Peru the current DHS is a continuous survey and staff needs to be located in the areas where interviewing takes place. As the number of interviews in each round is relatively small, there are no teams. There are also countries with some other variations or differences in team composition and task assignments.

Types of interview medium

Until recently, most interviews that took place were based on the paper-and-pencil method (PAPI), where interviewers ask predefined questions and record the answer in a paper questionnaire. With the advent of new technologies, different ways of asking the questions and recording the responses are being introduced.

Interviews done with the aid of a laptop computer are being done frequently nowadays and the last DHS survey in Colombia (over 40,000 respondents) was done with this medium (CAPI). Other DHS surveys such as those in Lesotho and Albania are being done using smaller devices such as personal digital assistants (PDAs). Other surveys have used cell phones (although these not yet in the DHS).

The advantages of using electronic means of data collection and recording are multiple:

- Physical questionnaire length becomes relatively unimportant, as it is all electronic and invisible. What counts is the number of questions that are actually asked of each respondent
- Training on questionnaire application by the interviewers should be much easier, as should interviewing itself
- Skip patters and back-references can be built into the questionnaire so that questions can be tailored exactly to each specific respondent, without the need for the interviewer to make wording choices. For instance: a question like "How many (more) children would you like to have?" can be divided into two questions: "How many children would you like to have?" for those who as yet do not have any children and: "How many **more** children would you like to have?" for those who already have children. Also, names of people can be brought into questions using information already provided etc. The system will bring up the right question
- Multiple language versions can be made available on the same machine, thus increasing the likelihood that interviews are conducted in the appropriate language
- Interviews can be recorded to allow supervision of the interviewing process without actually having to attend the interview
- Data can be made available to the central level immediately and accumulation of results and even tabulations over the course of the field work period becomes very easy and even can be made available nearly instantaneously in the case of the use of cell phones
- There will be no security issues with rooms full of questionnaires that are sometimes kept for years

Some of the possible disadvantages are:

- The need for specialized software. This disadvantage has been overcome through the development of multiple data processing approaches. There is a version of the CSPro (Census and Survey Processing) software that is specifically adapted for use with laptops or PDAs and that can also run on certain cell phones. Multiple other systems are in use by other organizations
- Data management becomes much more complicated and the field interviewers and supervisors need to be trained extensively in how to save and accumulate data without breaking promises of confidentiality and in how to transfer them to the central level without losing data or corrupting the information
- Use of advanced electronic equipment in the field can pose a potential security risk due to theft, either by outsiders or by the staff. In the DHS experience, this is a problem but it is not of such an extent that these new approaches should not be adopted
- Dealing with the lack of availability of electricity, although different battery options are available to overcome this
- More up-front work prior to field work. However, this could also be seen as an advantage in terms of probably getting things done more quickly overall

One approach to electronic data collection is the Audio Computer Assisted Self Interview (ACASI). This type of interview has most often been used to provide an opportunity for a respondent to record an answer without anyone else knowing what that answer was, at the time of the interview. This approach has been found very useful for obtaining information on highly confidential or controversial topics, such as sexual behavior and abortion[4] [5].

However, there is also a quite different rationale for using the audio feature of this approach. One of the main confounding variables in a large survey is the interviewer. Not all interviewers are equally good and ask the questions equally well. The opportunity to have all interviews done by one and the same interviewer becomes a possibility through using the audio capacity of the electronic data collection medium. All questions can at least be asked once through the electronic medium for each respondent (Equivalent to being done by the same interviewer; the person providing the reading of the questions as recorded on the electronic medium). The interviewer just directs the speed of the interview, provides clarifications where necessary and records the answers. This approach is therefore somewhat different from the ACASI approach. In combination with the ACASI approach, the interviewer could be asked to personally record the answers to certain question that are of a sensitive nature.

Overall, the use of electronic means to collect data needs to be encouraged as much as possible. There are bound to be further mega-improvements in the technology and equipment in the near future, and continuous change in interviewing procedures will be necessary to stay abreast of developments and to use the most cost-effective and efficient means of data collection. Again, this is an area where an international expert working group could be very beneficial in helping define the best approaches.

Types of surveys

The DHS typically has included cross-sectional surveys of households, women, men and facilities, that are repeated on a more or less pre-determined schedule of either three or five years between surveys. In addition most surveys are actual DHS surveys while others are specialized surveys such as the AIS (AIDS Indicator Survey) and the MIS (Malaria Indicator Survey). The latter two surveys are of much more recent origin than the DHS surveys and are typically applied in selected countries where HIV or malaria are real problems.

Unless specifically indicated otherwise, in what follows the surveys that are generally referred to are the basic DHS surveys. Most countries carry out these surveys only every five years, due to the cost involved.

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[4] **Hewett, Paul C.**, **Barbara S. Mensch**, Manoel C. de A. Ribeiro, Heidi E. Jones, **Sheri A. Lippman**, **Mark R. Montgomery**, and Janneke H.H.M. van de Wijgert. "Using sexually transmitted infection biomarkers to validate reporting of sexual behavior within a randomized experimental evaluation of interviewing methods," *American Journal of Epidemiology* 168(2): 202–211.

[5] **Mensch, Barbara S.**, **Paul C. Hewett**, Richard Gregory, and Stephane Helleringer. "Sexual behavior and STI/HIV status among adolescents in rural Malawi: An evaluation of the effect of interview mode on reporting," *Studies in Family Planning* 39(4): 321–334.

Some countries where more funds are available do surveys typically every three years. In any case, the DHS never has advocated surveys with intervals of less than three years because of the probable lack of measurable change. Facility surveys and AIS or MIS surveys are less common than DHS surveys. For a listing of all DHS surveys and documentation go to: http:// www.measuredhs.com.

In all cases, there is a considerable period in-between surveys when no information is available on most of the indicators that are targeted in the surveys. To overcome this problem in a cost-effective manner and to improve capacity building, a continuous survey was planned for Peru and is currently taking place there.

The continuous survey

The continuous survey has as its main purpose to provide the country with data about every three months, by distributing the interviews across time. For instance, instead of doing interviews in 30,000 households every five years, interviews are done with 6,000 households every year, distributed relatively equally across 3 quarters of each year. This means that about 2,000 cases are available each of these three quarters to provide quarterly information for those variables that can reasonably be measured by a sample of that size. Accumulation of the samples over time provides more cases and allows the calculation of indicators for which larger sample sizes are required.

The last quarter of the year is generally used for planning the new rounds in the next year, often with sample variations and potentially different questionnaire content, and for re-training of staff.

One of the additional reasons to go for a continuous survey had to do with capacity building. The long term capacity of organizations is greatly enhanced if people have permanent jobs in those organizations. By designing a system where interviewers work full-time throughout the year out of regional offices, it becomes possible to retain trained people long term.

Thus, the continuous survey allows more regularity in data availability and is an excellent tool for personnel recruitment and retention.

However, a pre-condition of running an efficient and cost effective continuous survey is the existence of a mature implementing agency such as a National Statistical Office, that has appropriate branches and staff all across the country and thus provides an appropriate infrastructure for absorbing the staff assigned to the continuous survey and provides adequate measures of oversight. The poorest countries typically do not have these conditions and aiming for a continuous survey in countries without appropriate infrastructure may actually be counterproductive in terms of survey quality, which is in a high degree determined by the quality and training of the staff that is employed on the survey.

4. Questionnaire content

The content of the core DHS questionnaires has undergone huge changes over the years, both in terms of the number of questions and the topics covered. In terms of topics covered, the survey has migrated from

being mostly family planning and maternal and child health related to include questions on women's status, HIV/AIDS, malaria and a score of other issues.

The growth in size can be demonstrated by the following table:

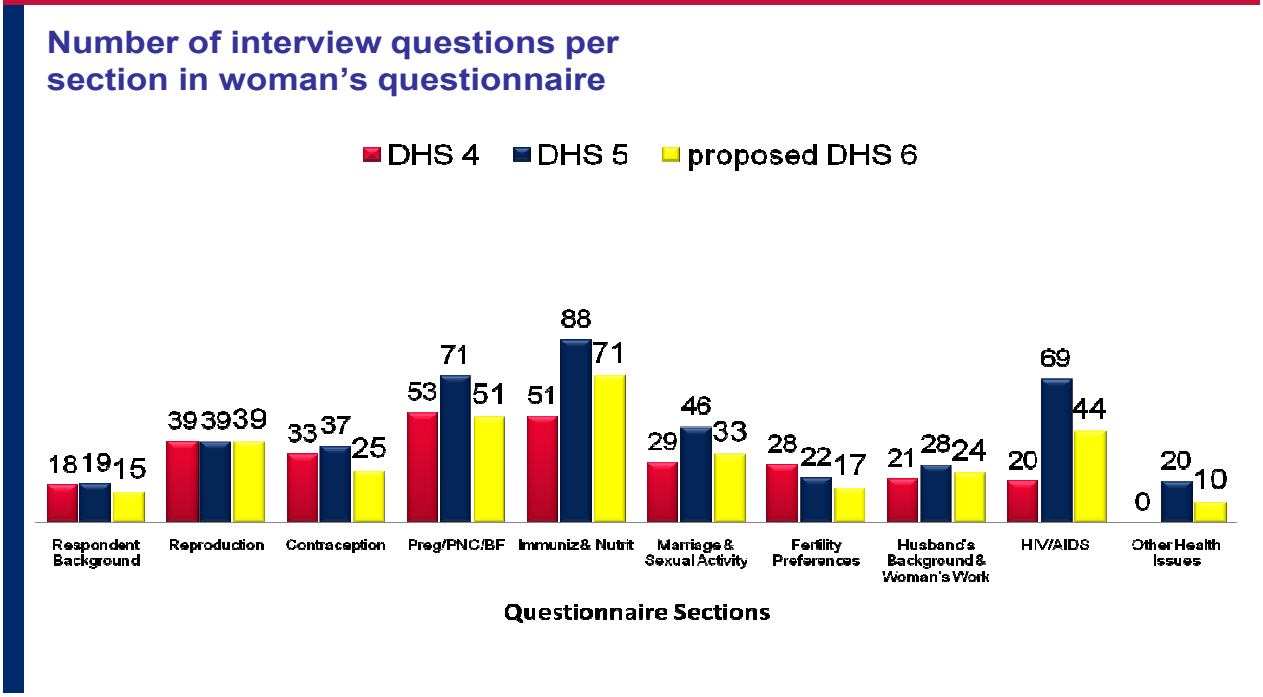
Table 2. Number of questions in DHS questionnaires by stage an type of questionnaire		
Stage/Type	**Women's questionnaire**	**Men's questionnaire**
DHS 1	205	26
DHS 2	266	64
DHS 3	258	70
DHS 4	292	192
DHS 5	439	202
DHS 6 (Proposed)	329	163

As can be noted, the questionnaires that are proposed for the current stage of the survey program will contain less questions than those for the prior stage. The main reason is that interview length was becoming a problem and is likely to be a continuing concern in any case as shown in the graph 1 below.

In DHS5 only about 1 in 3 women's interviews could be completed within 45 minutes. Considering that most of the short interviews are those with very young, single women or married women without any children, the burden of the interviewing time is very high for those women with children, particularly for those with children under 5 years of age.

The following graphic shows the changes over time in the various sections of the woman's questionnaire over the last three rounds of the DHS:

Graph 1. Trend in number of questions per section



Over time, most of the changes in content took place in the sections dealing with child health and nutrition, HIV/AIDS and other health issues. Major increases in the number of questions for certain sections such as immunization and nutrition and HIV/AIDS took place for DHS 5. Preparations for DHS 6 aim to curtail these increases as much as possible and to return to a questionnaire that is closer in size to DHS4. Of course, decisions about the inclusion or exclusion of questions are very difficult as there is a constituency for the promotion of most questions. The relevance and precision of certain indicators that are to be measured by the questions are some of the criteria employed to help decide ultimate core questionnaire content.

Dealing with the size of the core questionnaire is crucial, as this questionnaire only embodies the questions that should be common across countries during the different stages of the DHS. Country-specific questionnaires most often contain questions on additional topics through the use of modules such as those on domestic violence or maternal mortality, as well as selected other questions. Thus, at the country level, size of the questionnaire is most often a greater problem than just the size of the core questionnaire, because questionnaires for specific countries often contain many additions to the core that are of particular interest

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5. Data quality issues

Data on mortality/fertility, sexual behavior and others such as domestic violence etc. can be subject to considerable measurement errors and avoiding these errors is at the root of the DHS data collection system, through the provision of extensive documentation and training and quality controls.

Nonetheless, errors do of course occur and given the difficult field situations in which data collection often takes place, this is not surprising and some of it may be unavoidable. For instance, the well known tendency of respondents to report ages that finish in "0" or "5" can significantly affect age reporting. The intimate nature of some questions on sexual behavior may well cause some respondents to report something other than the truth etc. For a thorough description of all potential survey errors see Robert Groves 2004 [6].

Errors emanating from the respondent can have multiple sources, including interviewer behavior, but are most often difficult to deal with due to the potential effects of educational level, memory lapses, willingness to spend enough time on the interview etc. Indeed it is quite amazing that individual response rates for women in DHS surveys mostly are well over 95%, which attests to great willingness to answer to a lengthy and often difficult interview.

Dealing with possible respondent error is strongly linked to training of interviewers and is a main topic during the training for DHS surveys which is very thorough and generally takes 3-4 weeks to complete, including extensive practice interviews in the office and in the field. Spending even more time on training will be quite difficult and potentially counterproductive due to boredom among part of the contingent of trainees and other factors.

The errors that we want to call attention to here are errors that are clearly emanating from the interviewer and that require the interviewer to report data that were not as such provided by the respondents. The most obvious such data are those completed interviews that were actually done without a respondent. While in DHS surveys individual interviewers have been caught doing this and have been fired for it, enough field checks seem to be in place to keep these occurrences to a minimum, but little or nothing is known about the potential magnitude of this problem. It is generally accepted, however, that this problem is minimal, as it is difficult to falsify an entire questionnaire and any culprits seem generally to be caught early on.

The issue that is of most interest for this paper is the adjustment of responses to the needs of the interviewer. We will demonstrate this problem through three sets of data:

- The age distribution of women 10-24 years of age
- The age distribution of women age 40-54
- The age distribution of children 0-9 years of age

[6] Robert Groves: Survey Errors and Survey Costs. 2004

The reason that these three series of data are important is that the age of the respondent and the age of their children are important selection criteria in the interviewing process.

A DHS survey starts out with a household interview in which information is obtained about the sex and age of all household members and visitors. In these households, typically all women age 15-49 are eligible for individual interview (except in cases where the domestic violence module is used and when only one woman (age 15-49) per household is selected for the individual interview).

When women who responded to the household interview are classified by age, it can be observed that there are relatively more women age 10-14 than 15-19 and more are reported to be age 50-54 than age 45-49. The following tables were presented in an extensive report on data quality prepared by Thomas Pullum[7]. Table 3 clearly shows that in a number of countries there was significant displacement of women towards the 10-14 years age category, which made them ineligible for interview.

Table 3 Household surveys with strongest evidence of downward age transfers for younger women

Country	Median year of survey	Estimated percentage of women 15-19 misreported at 10-14	Observed number				Estimated "true" number	
			Age 5-9	Age 10-14	Age 15-19	Age 20-24	Age 10-14	Age 15-19
Benin	1996	11.2	2240.8	1787.3	1139.8	1067.0	1643.6	1283.5
Burkina Faso	1993	12.1	2879.8	2394.2	1465.9	1265.0	2193.0	1667.1
Burkina Faso	1999	10.1	2610.2	2350.3	1522.6	1228.9	2178.3	1694.6
Ghana	1993	17.8	1742.0	1479.0	842.0	861.0	1296.2	1024.8
Ghana	1998	14.1	1602.5	1482.5	949.1	924.9	1326.8	1104.7
Kenya	1993	16.1	3409.5	3110.4	1838.7	1709.5	2758.0	2191.1
Kenya	1998	13.3	2754.0	2996.9	1965.0	1638.0	2695.3	2266.7
Kyrgyzstan	1997	11.1	971.0	1050.4	740.5	640.1	957.6	833.3
Madagascar	1992	10.7	2105.3	2060.1	1431.9	1286.7	1889.0	1603.0

[7] **Pullum, Thomas W**. 2006. *An Assessment of Age and Date Reporting in the DHS Surveys, 1985-2003.* Methodological Reports No. 5. Calverton, Maryland: Macro International Inc.

Malawi	1992	14.8	1909.9	1899.4	1160.8	987.9	1697.5	1362.6
Malawi	2000	11.7	4859.1	4355.4	2991.6	3043.9	3959.3	3387.7
Mali	1996	11.6	4234.7	3353.3	1996.4	1649.7	3091.7	2258.0
Mali	2001	15.4	5476.2	4754.2	2738.2	2403.4	4257.2	3235.2
Mozambique	1997	12.5	3297.6	3068.1	2018.8	1883.4	2780.2	2306.7
Nigeria	1990	19.7	3973.9	3258.6	1733.0	1760.4	2832.4	2159.2
Uganda	1995	10.3	3142.4	2519.9	1672.8	1613.9	2328.2	1864.5
Uganda	2001	12.0	3121.3	2723.9	1734.2	1555.6	2486.6	1971.5
Zambia	1998	16.1	3442.8	3825.7	2462.7	2303.7	3354.5	2934.0

Note: The table lists surveys for which the estimated percentage of women 15-19 misreported at 10-14 is greater than 10.

Table four shows the same phenomenon with respect to moving women out of the highest eligible age range.

Table 4 Household surveys with strongest evidence of upward age transfers for older women

Country	Median year of survey	Estimated percentage of women 45-49 misreported at 50-54	Observed number				Estimated "true" number	
			Age 40-44	Age 45-49	Age 50-54	Age 55-59	Age 45-49	Age 50-54
Burkina Faso	1993	32.0	521.1	394.1	730.9	435.9	579.2	545.8
Cameroon	1991	27.3	323.0	221.7	365.6	255.7	305.1	282.2
Comoros	1996	20.4	212.0	219.0	313.0	173.0	275.0	257.0
Ghana	1993	20.6	433.0	337.0	444.0	257.0	424.4	356.6
Kenya	1993	28.5	684.7	452.9	722.7	428.7	633.6	542.0
Madagascar	1992	21.8	550.9	355.7	474.6	309.8	454.8	375.4
Namibia	2000	22.5	697.4	465.8	621.6	369.2	601.1	486.3
Niger	1992	27.6	544.9	354.2	551.3	334.7	489.4	416.0
Nigeria	1990	28.8	887.8	642.0	1051.7	603.5	901.2	792.4

Senegal	1993	21.5	619.0	398.0	542.0	387.0	506.7	433.3
Togo	1998	21.4	693.7	583.9	854.4	569.0	742.9	695.4
Uganda	1995	31.3	430.4	290.6	510.7	307.2	423.2	378.2
Zimbabwe	1999	21.3	512.2	399.5	537.3	309.0	507.8	429.1

Note: The table lists surveys for which the estimated percentage of women 45-49 misreported at 50-54 is greater than 20.

As Pullum says: "There are several reasons to expect a higher probability of transfers across age 50 than across age 15. First, because of improvements in education, birth registration, and greater use of age in everyday life, age is better documented and more accurately known for younger cohorts. Second, it is generally harder to estimate the age of someone who is older than someone who is younger. Third, any motivation for interviewers to reduce their workload by displacing potential respondents will be greater for older women, because much more of the questionnaire, in particular a longer birth history, will apply to them"[8].

These age distributions do not typically respond to reality and are the result of women being classified in age groups that ensure that they are not actually eligible for individual interview. Although digit preference has an effect as well, it is clear that this distribution is largely an artifact of the interviewer making women younger or older to ensure that they do not need to be interviewed. It could be argued that these are clear cases of data falsification. However, it may also be cases where the responses to the age questions are not necessarily clear and the interviewer feels justified recording a particular age, rather than probing further on an age that is reported by the respondent. This does not change the fact that some of the ages are wrong and that they are clearly wrong because the interviewer did not make enough effort to obtain the correct age.

Curtis[9] reported on issues in the estimation of infant and child mortality emanating from deficient data, possibly caused by a tendency among interviewers to omit dead children and/or displace children out of the eligible calendar period for which detailed questioning on health issues for each child under a certain age (5 or 3 years of age) needed to take place.

The evidence points overwhelmingly to the interviewer, as the main cause for deficiencies in data quality regarding age and date reporting, caused by the fact that age of both the woman and her small children became important determinants of the number of questions that will need to be asked of every woman.

Manipulation of the age of a relatively small number of women or children can cause significant distortions in indicators, particularly where infant and child mortality and the age at death of small children are concerned. The data seem to indicate that in the large majority of cases interviewers are doing a good job, but that there are instances during the fieldwork period that interviewers seem to deal loosely with criteria that determine eligibility of one kind or another. The effect accumulates very slowly

[8] **Pullum, Thomas W**. 2006. Op.cit..

[9] Curtis, Sian L. 1995. *Assessment of the Quality of Data Used for Direct Estimation of Infant and Child Mortality in DHS-II Surveys.* Occasional Papers No. 3. Calverton, Maryland: Macro International Inc.

over time until at the end, and over all interviewers combined, it becomes a true problem in a number of countries. This in turn means that traditional ways of detecting errors and omissions through the checking of questionnaires and periodic quality tables are not very effective, as some problems only will become apparent when it is already too late.

This brings us to the question of how to deal with data problems related to displacement of ages of women and children and omission of dead children.

From all internal discussions and review of analyses of data quality, it has become clear that problems of data quality do exist in spite of all the training and quality control procedures that were instituted to avoid quality problems as much as possible.

The precise cause of many data quality problems cannot be identified exactly as there are no firm benchmarks to which to compare variations. A good example would be the proportion of women who had pre-marital sexual relations or multiple partners. However, as for as the reporting of ages of women and small children, there are expected relationships and orders of magnitude and it is possible to determine whether an age distribution seems to be largely correct or not. If it is not, the next question is, how did this occur? Respondent errors certainly can have played a role, but it is most likely that deliberate manipulation of dates and ages by the interviewer to reduce workload is the main cause of the problems that are found in these data.

This means that something can be done about this problem, or at least tried. The crux of the matter is that interviewers are made aware that the quality of their work can objectively be judged, maybe less as the work of an individual than the work of a team of interviewers, so that there are more observations. Based on this knowledge, different types of incentive programs should be envisioned to reward interviewers who clearly did not take any shortcuts and to penalize those that do.

One way this could be achieved is through a substantial bonus at the end of the fieldwork, on top of more limited routine pay, so that there is a real monetary incentive not to take these shortcuts. Other approaches should also be discussed and tried, so that ultimately proven systems to increase data quality can be implemented. Variations in approaches across countries should be expected.

Discussion on this has taken place over the years, but so far the notion that incentive programs may have their own negative effects has prevailed. It will be a crucial challenge for the DHS surveys of the future to improve interviewer performance and to institute systems that also can provide enough motivation to annul or diminish the negative effects of growing questionnaire size.

6. Data processing

Data processing has been a key concern of the DHS program from the beginning. In the early 80's DHS subcontractor SERPRO developed the Integrated System for Survey Analysis (ISSA) that would run on the then emergent personal computers. With the advent of Windows a new system was necessary and in collaboration with Subcontractor SERPRO and with the U.S. Bureau of the Census new software was developed called CSPro (Census and Survey Processing). This new software provides facilities for data entry and editing, a "click and drag" tabulation feature and the possibility to run it on a laptop or PDA (Personal Digital Assistant). It can also run on certain cell phones.

Key to the DHS data processing activities always has been the notion that clean data should be available shortly after the end of fieldwork, so that tabulation and report writing are not delayed because of DP issues.

In Peru, Albania, and Lesotho the new CSPro system is currently used for data collection using PDAs. The advantages of this system will be that largely clean data are available when the interview is finished, that actual interviewing will be much facilitated through the use of the PDA, as the software will take care of skips, checks and back-references, as noted earlier. On the other hand, interviewers and supervisors have to learn to use the equipment for data storage and the downloading of the information collected. This will require significant up-front training. However, as was seen with cell phones, technology is easily and widely adopted by populations worldwide and this is going to work in favor of electronic data collection.

While there are all kinds of ethical issues to be dealt with, the use of PDAs or laptops for actual field interviewing has many advantages, as mentioned before and can facilitate supervision as GPS readings can be taken at the place of interview, interviews can easily be recorded etc. Thus, more tools can be made available for effective supervision.

Clearly, paper-and-pencil interviews are well on the way out and should be replaced as soon as possible by interviews done using PDAs, cell phones or equivalent equipment. That is not to say this will be equally easily accomplished in every country, but I believe it should be a goal at least.

7. Data archiving

One of the most important features of the DHS program is that the data generated by the program are made freely available to all responsible users with the agreement of the countries that the data pertain to. This has been a tremendously valuable feature and the conversion of all data into recode files, the development of the STATcompiler and other approaches have helped to make DHS data as widely available as possible. This in turn has made these data into one of the major tools that are used by analysts worldwide and has contributed greatly to the accumulation of knowledge about the population and health situation in developing countries.

Key to the archiving work was to plan for it right from the outset and make the production of user-friendly data files a key component of the program. The willingness of countries to share their data widely was another major factor.

8. The future

The future of DHS surveys is of course in the hands of the donors, particularly USAID. It is unlikely that many such surveys would be carried out without the donor support that the program is enjoying today.

There are a number of issues that should be considered for the future, both immediate and more long-term:

1. Sampling options. An expert review of field sampling approaches should be organized, to ensure that sampling strategies are still on target and if not, to make appropriate changes

2. It is clear that the technology to use cell phones for complicated survey research will soon be there (it already is, but with some limitations of screen size etc.) and should be adopted wherever possible as it will greatly facilitate data production and supervision and probably quality

3. The use of the audio feature of a data collection medium should be explored, to unify the survey by making sure that all interviewees are asked the appropriate questions at least once by one and the same interviewer. This would ensure proper formulation and reading of all questions to all respondents (within a language category). This option would be a move away from cell phones to other media that allow this option. Pro's and con's to be discussed to guide the decision

4. Training for surveys is very long and seems to be increasing. Improved training tools need to be developed to promote efficiency and ultimately, data quality

5. In tandem with the improvement in technologies, the use of distance learning techniques and teleconference technologies should be increased to facilitate work in all countries but specially in those where less than usual technical assistance is necessary

6. More international workshops should be organized where experts in different topics explore DHS data and find their strengths and weaknesses as well as the main lessons that can be learned from the data, at a global and a country level. These should not be training workshops but workshops where real experts come together and work together with a view to advance knowledge

7. The availability of large, nationally representative samples of households and individuals provides numerous opportunities for collecting additional health and other information that may not as yet be available at the national level or is not measured properly, as it is.

A good example of what is possible is the collection of data on HIV infection through the testing of blood samples from men and women in the DHS samples. Having these data for a nationally representative sample of the population has allowed proper estimation of the levels of HIV infection, rather than estimation through indirect techniques. This has probably turned out to be one of the most important contributions of the DHS program. While the use of indirect techniques to estimate HIV prevalence often has provided estimates that were quite close to the population-based estimates, overall, the population-based data have led to a downward adjustment of the previously existing estimate of people living with HIV of about 18% in 2007.

Aside from HIV testing, DHS surveys have already included testing for many other diseases and conditions, particularly anemia, and syphilis. Other testing also has already taken place in selected countries, including testing for Vitamin A, Hepatitis B, Lipids, Gonorrhea, HSV-2, Diabetes, Malaria and others. The experience that has been gained in the collection and use of biomarkers and the future availability of nationally representative samples could be put to very good use for the collection of data on a number of diseases and conditions for which economical rapid testing techniques are available, so that generating the necessary data can be affordable.

Possible diseases and conditions that could be included in the testing in future surveys are listed in the table below:

Table 5. Potential biological and clinical data collection by age group in surveys.

Tests	Age group			
	< 5	**5-14**	**15-59**	**60+**
		Infectious diseases		
HIV (DBS)	*	*	*	*
Syphilis			*	
Urinary Chlamydia,			*	
Urinary Gonorrhea			*	
Hepatitis B		*	*	*
HSV-2			*	*
Measles	*	*		
Tetanus and diphtheria	*	*	*	
Malaria	*	*	*	*
		Nutrition		
Anthropometry	*	*	*	*
Anemia	*	*	*	*
Vitamin A	*	*	*	*
Folate	*	*	*	*
Urinary iodine	*	*		
		Chronic / Non Comm. Diseases		

Blood pressure		*	*
Diabetes (fasting)		*	*
Lipids (fasting)		*	*
Intoxication			
Lead	*	*	
Other			
Respiratory peak flow	*	*	*
Grip strength			*
Other performance tests	*	*	*

Measurement for a number of these requires equipment that can be used in the field with immediate results and without taking a biological sample such as blood or urine. This is the case for anthropometry, blood pressure, respiratory peak flow, grip strength and other performance tests. The main cost of these tests is the purchase of equipment and the training of interviewers or field technicians to perform these measurements accurately.

Others can be done on the basis of dried bloodspots (DBS) that can be collected through a finger prick, such as the test for HIV, Hepatitis B, HSV-2, measles, malaria, vitamin A and diabetes. Testing for tetanus and diphteria as well as folate can possibly be done on DBS. However, testing for syphilis, lipids and lead, require a sample of whole blood. In addition, blood for testing for diabetes and lipids needs to be collected after fasting from the night before the blood is drawn. Testing for chlamydia and gonorrhea requires a urine sample.

Thus there are issues to be dealt with that have serious logistical and fieldwork implications such as the number of DBS samples that can reasonably be obtained through a finger prick, the collection of whole blood and urine samples as well as ensuring fasting for blood that will be used to test for diabetes and lipids. Ethical issues regarding the returning of test results to the individuals concerned and potential treatment options also need the attention of an Institutional Review Board and will affect what can actually be accomplished.

Especially in countries with increasing life expectancy there will be an increased need for information on the prevalence of chronic diseases, and depending on the methods available to do rapid testing, more chronic diseases could be added to the above.

One of the main issues in the continuing development of the DHS surveys has been the inclusion of more and more information in the questionnaires. It is clear that any information on the diseases and conditions in the table above would need to be accompanied by adding pertinent questions in the questionnaire to provide further context for the findings of the biomarker testing. Thus, adding further testing would have

implications for questionnaire length and the number of tests that could be included would be limited because of that and other reasons.

On the other hand, there are few things more clear-cut than physical proof of the existence of a disease or a condition and knowing the specific disease burdens in a population should be of enormous benefit to countries where such information is not known at this time.

Thus, where the DHS program already encompasses surveys such as the standard DHS, health facility surveys, AIDS Indicator Surveys and Malaria Indicator Surveys it might make sense for some countries to add a Health Examination Survey which would consist mostly of the above measurements and pertinent questionnaire information.

8. Finally, more can always be done but we should not forget the contribution that the DHS has already made in many areas, such as fertility and mortality, domestic viol, HIV and malaria and these contributions should continue in the future.