DEMOGRAPHIC RESEARCH
A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 55, ARTICLE 6, PAGES 201–222
PUBLISHED 29 JULY 2026
https://www.demographic-research.org/Volumes/Vol55/6/
DOI: 10.4054/DemRes.2026.55.6

Interview

A personal perspective on the history of the World Fertility Survey and The Demographic and Health Surveys Program: An interview with Tom Pullum

Tom Pullum

Sara Yeatman

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Demographic Research: Volume 55, Article 6
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Abstract

BACKGROUND
We take for granted that there are data on critical topics such as health and mortality, fertility, and social processes across the globe. For over 50 years, the World Fertility Survey program (1972–1984) and its successor, The Demographic and Health Surveys Program (1984–present), filled in essential gaps in human knowledge.

OBJECTIVE
I interviewed Tom Pullum to better understand the history and evolution of the WFS and DHS, including why they were introduced, how they worked, and how they changed over time.

CONTRIBUTION
We contribute to the documentation of the history of international collaboration that for half a century has produced representative and standardized estimates of population and health indicators for many parts of the globe. In the telling, we recall the history of the effort, its trials and tribulations, as well as its tradeoffs, limitations, and the oft-hidden excitement and messiness of demographic measurement.

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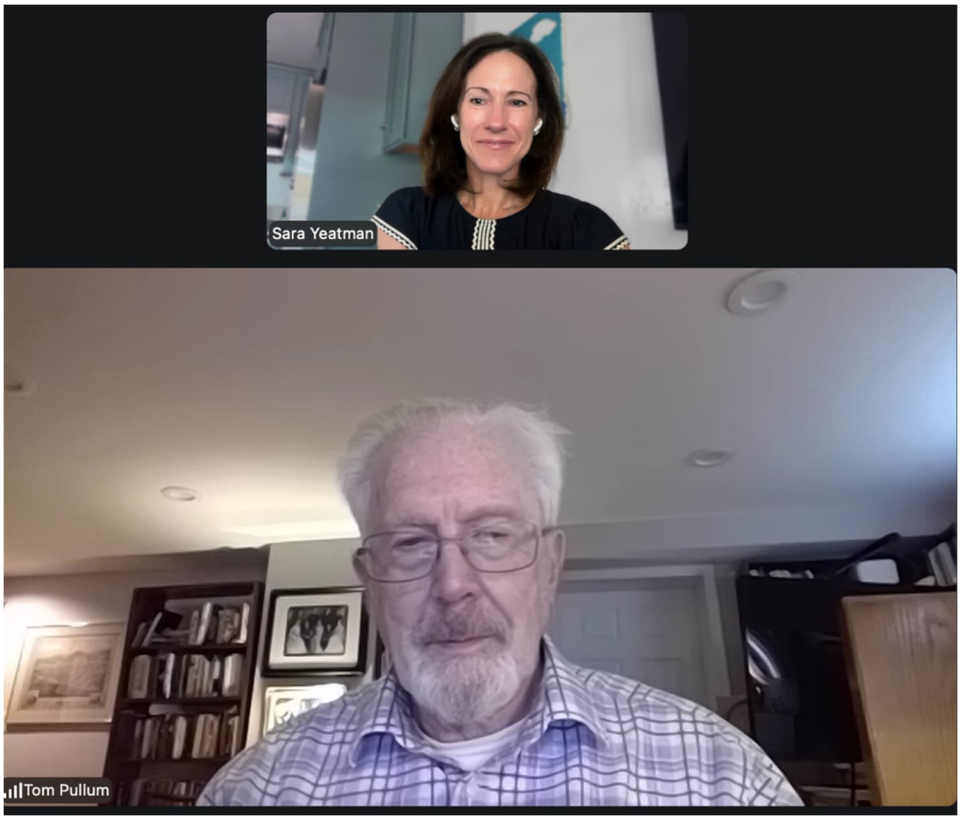

(Sara and Tom during an online conversation, July 7, 2026)

1. Introduction

The World Fertility Survey (WFS) and The Demographic and Health Surveys Program (DHS) revolutionized the collection of population-level data on fertility, children's health, and a range of other topics. From 1972 through the present, the programs collected vital data on people's health and sociodemographic lives across low- and middle-income countries in Latin America and the Caribbean, Africa, Asia and the Pacific, and Eastern Europe.

As you will see in the interview below, demographers from across the globe contributed to the survey programs. Few contributed as much, or as long, as Tom Pullum. He worked on the WFS in its early years, served as Director of Research for the DHS for over a decade, and continues in the role of Senior Researcher for the program. This

interview with Tom Pullum developed over a period of a few months in early 2026, through email, a Zoom conversation, and iterative sharing, editing, and fact-checking with others who were there.

2. Beginnings

SY: ***Can you start by explaining what the World Fertility Survey was and how it began?***

TP: To begin with some context, my connection with the WFS and DHS has extended across more than 50 years, from 1973 to the present. At different times I was a consultant or a staff member or simply an enthusiastic user/consumer. What may be unique about my connection, in addition to its long duration, is that I was always engaged with the management of the project, the staff, and the data. Other people were more involved than I was at specific times and in specific ways but not over such a long duration. My comments will reflect my own experience. During most of this interval, I was based primarily at American universities but had multiple consultancies with the WFS/DHS and used DHS data in my teaching and research. I joined the DHS staff in 2011, retired as director of research and analysis in 2022, and continue (in 2026) to work part-time.

From my perspective, the WFS and DHS were a single continuous activity, led by the United States Agency for International Development (USAID). I believe that most users, even many of the most sophisticated users, do not fully appreciate the fundamental and essential role of USAID in developing and maintaining that activity. Thanks to USAID, the program has provided detailed demographic and health information for approximately a hundred countries in more than 450 surveys, with value not only for the participating countries but also for the global monitoring of change in a diverse set of indicators.

The WFS officially began in 1972 and ended in 1984. It was created primarily by Reimert (Rei) Ravenholt (1925–2020), a medical doctor and CDC-trained epidemiologist who was the founding director (1966–1979) of the Office of Population at USAID. The origin story is that he asked Charles Westoff, who at the time was Director of the Commission on Population Growth and the American Future (as well as a professor at Princeton University) how he would recommend assessing and maximizing the impact of a large tranche of new funding for international activities in support of family planning. This objective implied a departure from the dominant type of demographic survey in low- and middle-income countries, which had large samples and short questionnaires and were primarily designed to measure levels of fertility and mortality with indirect estimation. Westoff has described a conversation on a shuttle flight from Washington DC to New York, during which he recommended the creation of an international survey program to

measure desired, as well as actual, levels of fertility. The WFS and DHS may well be a consequence of that conversation.

From the beginning, the emphasis was on direct estimation of demographic outcomes. All surveys had full birth histories, including questions about the survival of each child. There were questions about past and present contraceptive use and fertility preferences. The content was broader than contemporary KAP (knowledge, attitudes, and practices of contraception) surveys.

The data were generally collected by national statistical offices whose usual main activity was to conduct censuses. The early 1970s was a time of intense concern about high levels of population growth and USAID was very active in the promotion of smaller families and specific methods of family planning, but the implementation of the surveys was kept separate from advocacy and activities to promote contraception.

The WFS was funded almost entirely by USAID but was structured as a partnership with three other well-established non-political entities. Nominally, the funding was 49% from USAID and 51% from UNFPA (now known as the United Nations Population Fund). UNFPA was substantively involved and enabled surveys in countries that were less friendly with the United States, but the UNFPA funding was a pass-through from USAID. To further distance the program from the United States government, it was contracted to the International Statistical Institute (ISI), an association of national statistical offices based in the Hague in the Netherlands. The fourth partner was the International Union for the Scientific Study of Population (IUSSP), which was a source of technical support.[3]

SY: ***How did your involvement with the WFS begin?***

TP: My initial consultancy with the WFS was during the summer of 1973. I represented the IUSSP on the basis of my experience with the 1968 National Demographic Survey of the Philippines and a nomination from Mercedes Concepcion (https://en.wikipedia.org/wiki/Mercedes_Concepcion). She was the founding director of the Population Institute of the University of the Philippines (UPPI) and later was president of the IUSSP. I had visited UPPI during 1971–1972 after completing my PhD at the University of Chicago. My first task at the WFS was to work with Ronald Freedman – who was much senior to me – on a prototype of a standard tabulation plan plus an inventory of definitions, issues, and potential interpretations related to the indicators and tables. The document eventually appeared as Guidelines for the First Country Report.

[3] Most publications included this paragraph: "The WFS is being undertaken, with the collaboration of the United Nations, by the International Statistical Institute in cooperation with the International Union for the Scientific Study of Population. Financial support is provided principally by the United Nations Fund for Population Activities and the United States Agency for International Development."

SY: ***What were the early days working for the WFS like?***

TP: During that summer, Charles Westoff and Norman Ryder were also in London, working on the core questionnaire, using the questionnaire for the U.S. National Fertility Survey as a starting point. Ansley Coale (there was a Princeton mafia), John Blacker, and other notables visited the small office on Berners Street, just off Oxford Street. In 1974, the project moved to Grosvenor Gardens House (https://en.wikipedia.org/wiki/Grosvenor_Gardens_House) near Victoria Station, and expanded in that space until the end of 1984.

The first director of the WFS was Sir Maurice Kendall (1907–1983, https://en.wikipedia.org/wiki/Maurice_Kendall), a leading British statistician with entrepreneurial and administrative experience. He turned 65 in 1972 and was open to a change of direction, but he refused to move or commute to The Hague, so the project was based in London for its duration. Sir Maurice developed a structure and internal culture which I believe were key to the success of the larger activity of both the DHS and the WFS. He retired from the WFS for health reasons late in the 1970s. After he retired, the ISI provided a series of short-term directors, of whom the most effective was Dirk van de Kaa (https://en.wikipedia.org/wiki/Dick_van_de_Kaa). During the final years, the project was largely managed by the Deputy Project Director, V.C. Chidambaram ('Chid').

From the very beginning, the WFS had a Technical Advisory Group (TAG) consisting of an international group of very senior people who periodically met in person in London. A member I especially enjoyed meeting was Jack Harewood, a demographer from Trinidad and Tobago, which was selected for one of the first surveys. The TAG had global representation, although, as might be expected, membership was weighted toward North America and Europe and toward men.

Sir Maurice was a very non-directive director: His strength was in putting together a combination of capable and self-motivated permanent staff and temporary consultants and providing a structure within which they had autonomy and room for initiative. From the beginning, five groups were clear: design and sampling specialists, survey managers ('country coordinators'), data processing staff, researchers, and a publications team. There was constant interaction within and between groups.

Communication was facilitated by morning coffee and afternoon tea (or was it the other way around?) in a staff room. All were expected to participate. Lunch was typically in groups in local restaurants or pubs. There were frequent office parties (partly reflecting the youthfulness of the staff), funded by Sir Maurice using proceeds from his lecture tours. I remember several gatherings at his home.

The WFS was an exciting and inspiring place to work. Pervasive congeniality and mutual respect were fostered by Sir Maurice, his senior administrative staff, and also by

USAID. Rei Ravenholt was a frequent visitor, as was Richard Cornelius, the project monitor. Both of them were enthusiastic and supportive and on personal terms with the staff.

Technically, the WFS was innovative in many ways. It always had a core group of staff and visitors who were demographers and statisticians. Chris Scott was the sampling statistician. German Rodriquez, Rod Little, and Colm O'Muircheartaigh were among the statisticians. John Cleland, John Hobcraft, John Casterline, and Shea Rutstein were among the demographers. Judith Rattenbury was a superb head of the data processing team. Beverly Rowe designed the original standard recode file. Trevor Croft was a young programmer who went on to have a major role at the DHS. Toward the end of the project, Fatima Juarez, Trudy Harpham, and Iqbal Shah worked at the WFS. The country coordinators included Vijay Verma and Martin Vaessen, later the longest-serving director of the DHS. This list is far from complete. Ian Pool, from New Zealand, was an early fellow demographer with whom I shared an office during the summers of 1974 and 1975, and Peter McDonald visited from Australia several times. Susheela Singh was on the staff and has had a long and distinguished post-WFS career. There were frequent seminars by external TAG members or experts such as Leslie Kish.

Every WFS survey was a collaboration with the in-country implementing agency. Following every visit to a country, a trip report was required to document what was done. Trip reports were widely read and discussed by other staff and helped the USAID monitor to track project activity. Every survey was followed by an in-country conference at which the main results were presented. If possible, ministers or other high-ranking officials (in Nepal, a princess) participated. Every survey produced standard recode files. The DHS maintained these features but the WFS originated them.

The WFS developed software to calculate standard errors of indicators, adjusted for the design effect. It also developed software to edit, and impute or reconcile, dates and ages in the birth histories and elsewhere in the data. The DHS continued and expanded these innovative data processing practices. There was virtually an obsession with data quality.

Definitions of indicators and computing routines were developed that continue to be used until the present day, although some indicators have certainly changed. For example, the WFS included union histories so that 'marital' fertility rates could be calculated, but subsequently those histories and rates were dropped, largely because of difficulties with the terms 'union' and 'marital.' The reports included a multiple-category summary of previous and current contraceptive use, but it was cumbersome and did not survive the WFS.

The WFS began at a time when surveys were funded mainly for data collection, but often with insufficient support for subsequent data processing and analysis. I had witnessed this firsthand with the 1968 National Demographic Survey of the Philippines,

which I mentioned earlier. Far too often, indicators and tabulation plans would be designed after, rather than before, the questionnaire design or data collection. Survey results tended not to see the light of day. The WFS was a break from this common pattern, especially with the release of standard recode files. Dissemination and public access were not nearly as easy as today, but the follow-through on such a large scale was unprecedented.

At the beginning of the WFS, data processing was primitive by modern standards. Computer hardware was limited to mainframe computers, typically some version of an IBM 360, with peripherals such as keypunch machines, card readers, reel-to-reel tape drives, and impact line printers. Software was mostly limited to early versions of Minitab and SPSS. I was a heavy user of Fortran to write my own programs; professional programmers used C. German Rodriguez, and then I, were early users of GLIM (https://en.wikipedia.org/wiki/GLIM_(software)). By the end of the WFS it had mainframe computers for processing the surveys, but for further analysis there were several workstations (I believe the model was HP9845, or something similar). At the time the technology was 'state of the art' and we never considered it to be primitive. We used typewriters.

The report on each survey was described as 'The First Country Report' because of the expectation that there would be subsequent in-depth or comparative analyses. There were several series of additional reports, including Scientific Reports, Technical Bulletins, Comparative Reports, and Illustrative Analyses. The Technical Bulletins and Illustrative Analyses were explicitly intended to promote and facilitate research by other investigators.

I spent about three years in total with the WFS between the summer of 1973 and the summer of 1984, including the academic years 1976–1977 and 1983–1984. During 1976–1977, Chid handed over to me the final activities of the Sri Lanka survey, specifically the preparation of the First Country Report for that survey. I made three or four trips to Colombo, where I worked with the in-country survey manager, Dallas F.S. Fernando. This report deviated significantly from the outline of the Guidelines document. I wanted to demonstrate that the Guidelines document was intended more for reference than as a rigid format for all countries to follow. However, for better or worse, the final reports for WFS surveys – and even more for DHS surveys – became very similar to one another. Different numbers, of course, but the same structure and much the same text.

Another unusual feature of the WFS was the archiving and accessibility of the data files and publications. After the WFS ended, the files were maintained by German Rodriguez for many years at the Office of Population Research at Princeton University. Today all WFS products are easily accessed through the DHS website.

3. The shift from the WFS to the DHS

SY: ***How and why did the WFS end and the DHS begin?***

TP: The final contract between USAID and the ISI ended late in 1984, I believe formally on September 30. It was clear even a year in advance that USAID wanted a major redesign of the project and it would continue in some form, but not as a contract with the ISI.

The staff perceived two areas where USAID was dissatisfied. First, it was impractical and generally undesirable for such a large project to be based outside the United States. I believe that by 1984 it was less useful than it had been in 1972 for the U.S. government, as the true source of funding, to be masked by the involvement of UNFPA, ISI, and the IUSSP. It was clear that the follow-on to the WFS would be located in the vicinity of Washington DC.

The second issue was USAID's clear dissatisfaction with the length of time between the completion of fieldwork and the completion of the survey report. This continues to be an issue with DHS surveys.

My last major activity with the WFS, in 1983–1984, was an exploration of this second issue. After breaking the problematic time interval into components, I found that an average of a full year of delay could be attributed to editing. For some selected surveys, I went back to the data files as they existed before editing and re-calculated some indicators and some illustrative regressions directly from those raw data files, omitting the cases or values that required editing. I found that the differences between the edited and unedited estimates were always small compared to sampling error. This analysis was carried out with Trudy Harpham and Nuri Ozsever (Pullum, Harpham, and Ozsever 1986).

During the final year there was a symposium in London (April 24–27, 1984) that reviewed the project's contributions and included presentations by many external experts as well as WFS staff. I prepared a paper summarizing the WFS's methodological contributions. These papers were the basis of a volume published in 1987 (Cleland, Scott, and Whitelegge 1987).

The real strength of the WFS was its staff. There was internal talk of the staff banding together under a consortium with American universities and/or the Population Council. This did not happen, but the Research Triangle Institute (RTI) put together a bid (unsuccessfully) for the new contract, under which the RTI would maintain an office near Washington DC and most staff would remain in Europe. During the final months some staff, especially those who did not see themselves moving to the U.S., started looking for other positions, for example at UN agencies (Chid lined up a job with FAO in Rome) or British universities (John Hobcraft shifted to the LSE).

The transition from the WFS to the DHS happened on October 1, 1984, the start of the 1985 federal fiscal year. There was an extension of WFS, in The Hague with the ISI Research Centre, during which Vijay Verma, John Cleland, Trevor Croft, and Nuri Ozsever continued with the data archive. The Centre was intended to be more than an archive. It coordinated a series of in-depth provincial surveys in China but failed to generate stable funding.

The new project was won by a research division of Westinghouse Corporation and was located in Columbia, Maryland, a suburb between Washington DC and Baltimore. The first director was Robert Lapham. I visited the DHS a couple of times during his brief tenure, but unfortunately, he died much too young. His family established an award that the Population Association of America continues to give in alternate years to a person who exemplifies the application of demography to policy.

The new contractor hired several former WFS staff, mostly Americans, such as Shea Rutstein. It hired Annie Cross, who had worked on the Contraceptive Prevalence Surveys, a USAID-funded program of KAP surveys that was essentially folded into the DHS along with the WFS. Other staff, such as Fred Arnold, Ann Way, and Sunita Kishor, were hired in the 1980s and early 1990s and remained with the DHS for decades.

Bob Lapham was succeeded by Martin Vaessen, who had been one of the most successful country coordinators with the WFS. Martin was the director for about half of the total duration of the DHS. He was followed by Ann Way and then Sunita Kishor. Ann and Sunita had been DHS staff for many years before becoming directors, and their experience included the management of specific surveys as well as substantive specialization in survey topics. During most of the history of the DHS, the position of deputy director, who managed survey operations, was held by only Jerry Sullivan, Annie Cross, Bernard Barrere, and Livia Montana. There were other staff who committed the majority of their careers to the project, such as Guillermo Rojas (Data Processing).

The management of the DHS was very successful, no matter how you measure success. In my view, the continuity of staff and leadership contributed greatly to this success. There was a deep institutional memory and a sense of mission. The number of staff steadily increased, to a maximum of about 80, but the organizational chart continued to be relatively flat, with much the same subdivisions as the WFS throughout – with exceptions as noted below. A technical advisory group was maintained for a few years but was dropped in the 1990s.

Martin Vaessen, Shea Rutstein, and Trevor Croft were most responsible for the continuity with the WFS. Trevor has had great responsibility for all aspects of data processing and data archiving, defined very broadly. He led the introduction of CAPI, which I describe below. He contributed to the Multiple Indicators Cluster Survey (MICS) program at UNICEF and its harmonization with the DHS. He is the only person from the WFS who continues fulltime on the DHS staff today.

SY: ***How did the DHS operate?***

TP: The contractor for the DHS has always been a U.S.-based for-profit company. The company has changed over time but only because of corporate mergers, acquisitions, or divestitures. Briefly, Westinghouse sold its research division to a company called Macro Systems, which became ORC Macro and then Macro International. Macro International was bought in turn by ICF International (later just ICF) in 2009. The office moved from Columbia to Beltsville, MD in 1994 and then to Rockville, MD in 2014. The composition of the staff was unaffected by these corporate changes.

The DHS continued through a series of nine 5-year contracts, each of which was preceded by an RFP (a Request For Proposals from USAID), a proposal from the contractor at the time, and a competitive review based on responsiveness to the RFP and the proposed budget.[4] The DHS continued as a USAID project, but somewhat more as a partner of USAID than is typical for USAID contracts. It is fair to say that the DHS had more autonomy than other USAID projects with which I had contact.

Under a series of titles (CTO, for Cognizant Technical Officer, was my favorite), someone in the Office of Population and Reproductive Health (PRH) has always served as the monitor of the DHS. During the final 20 years or so, this supervisory role was expanded to include a second person from PRH and representatives of other topics in the Bureau for Global Health (GH) that were included in the surveys, such as maternal and child health, nutrition, malaria, and HIV/AIDS. The members of the USAID management team, as this group was called collectively, were engaged and accessible. The DHS had a parallel management team and twice a month the two teams had a video call to review the status of the ongoing surveys and other activities. I was on these calls for about ten years.

The DHS had a sharp division between 'core funding' and 'field support.' The initiative and the budget for each survey came from the USAID Mission in the country, and that budget was restricted to activities directly related to that survey. It could not be used to fund any headquarters activities that extended beyond that survey. USAID Washington funded 'core' activities. This division made it difficult to fund country-specific workshops and further analysis if not explicitly included in the original budget for the survey. Core activities were budgeted in an annual workplan, with charge codes in a matrix of activities and offices within USAID.

Some desirable innovations were bypassed because of this budget structure. As an example, the research staff were uniquely positioned to do trend analyses for countries with a history of multiple surveys or comparative analyses within geographic regions, but such analyses were rare because they did not fit into the structure. As another example, many users wanted to apply multilevel modeling but needed to separate the sample

[4] I do not know whether there were actually competing bids for all nine phases of the DHS.

weights into components for households and for clusters. We described how to do this in a methodological report. The natural next step would have been for DHS staff to apply the procedure to all (or most) of the surveys and to upload files with these weights, which users could have merged with the standard recode files. This task would have required little staff time but did not fit into the matrix of activities and offices for core support.

For about 15 years, ending in 2010, USAID sponsored a larger initiative known as the MEASURE project ('MEASURE' was a long acronym). This was a coordination of five distinct activities through three contracts and two inter-agency agreements. The DHS, MEASURE Evaluation (based at the University of North Carolina), and dissemination through the Population Reference Bureau (PRB) were funded with contracts. The International Programs Center at the U.S. Census Bureau and a demographic survey program at the Centers for Disease Control and Prevention (CDC) were also part of the MEASURE project. They were funded through inter-agency agreements. Some rounds of the DHS during this interval were labelled 'MEASURE DHS.' During this period, I participated in several reviews of USAID agreements with the Census Bureau and CDC and was in a position to compare their activities with those of the DHS. I was also on a team which carried out a mid-term review of the DHS in the early 1990s.

As part of the MEASURE collaboration, the Census Bureau and the DHS developed CSPro (Census and Survey Processing System), a statistical package for data entry, editing, and tabulation (https://www.census.gov/data/software/cspro.html). Thanks to the international activities of the U.S. Census Bureau, CSPro is said to be used in the national statistical offices of more than 160 countries. It continues to be the primary package used by the DHS, although it lacks the capacity to apply statistical estimation procedures.

The DHS worked closely with its MEASURE partners. The director of MEASURE Evaluation for most of its duration was Siân Curtis, who was formerly on the DHS staff. For several years, ICF was a subcontractor for MEASURE Evaluation. There was good communication with the CDC, whose Reproductive Health Surveys complemented those of the DHS. The CDC surveys tended to be in Latin America and Eastern Europe, in countries where the CDC was more welcome than USAID, and were more flexible in terms of topics and specific questions. There continues to be informal communication between the PRB and the DHS, which is the source of many estimates at PRB's online Data Center.

Other collaborations were developed. I have mentioned the MICS surveys conducted by UNICEF (https://mics.unicef.org/surveys), which complement DHS surveys with a flexibility and a reach beyond even the CDC surveys. There was frequent communication between the two programs, in part to maintain comparability and in part to avoid a country scheduling a DHS survey and a MICS survey too close together, which

would waste resources. Countries tended to sort themselves into one survey program or the other, but some countries participated in both programs.

The IPUMS (https://www.ipums.org/) program at the University of Minnesota, with support from the U.S. National Institutes of Health, was able to incorporate DHS surveys. IPUMS-DHS made the DHS data files much easier to use for certain purposes by harmonizing the coding of many variables that vary across surveys in the original DHS data files. As examples, source of drinking water, type of sanitation, facilities for childbirth or health treatment, types of foods, and other classifications can be difficult to track over time or compare across countries. The modified files are an important mechanism for promoting further analysis of the data. IPUMS and the DHS are in structured, regular contact up to the present.

4. Changes over time: Foci, questionnaires, and processes

SY: ***How has the focus of the DHS changed over time?***

TP: The DHS expanded its scope in several ways. In addition to the Standard DHS surveys, the DHS conducted many Malaria Indicator Surveys (MIS) and AIDS Indicator Surveys (AIS), which included extensive questions on knowledge and practices that may increase risk or mitigate risk, and blood tests to estimate the prevalence of malaria or HIV. After about 2018 the DHS stopped doing AISs. The funding for such surveys shifted to the CDC and the PHIA (Population-based HIV Impact Assessment) program. The separation was welcomed by DHS staff because of an onerous testing protocol. The DHS continues to conduct MISs. These surveys have abbreviated birth histories, limited to the five previous years, and contain relatively little information about maternal and child health.

Other kinds of biomarkers and tests were added to the DHS surveys. Anthropometry, the measurement of the height and weight of children under 5 (and sometimes women age 15–49), was added to assess levels of stunting, underweight, overweight, and wasting. Initially, these measurements were part of the survey of women, but they were shifted to the household survey so that all children in the household would be measured, including those whose mother had died or was living elsewhere. Generally, these children are more likely to be malnourished. The initial child growth standards were those developed by CDC, but after the World Health Organization (WHO) prepared standards in 2005 using a large international dataset of well-nourished children, the DHS shifted to the WHO standard for all reports. The recode files include Z-scores for both standards.

Blood samples for children age 6–59 months, women, and occasionally men, were added to estimate anemia levels from WHO thresholds for hemoglobin concentrations,

with adjustments for altitude and (for adults) for smoking. These standards have evolved. A current issue is whether accurate measurement of hemoglobin concentration is possible with capillary blood or requires venous blood, regardless of the difficulty of implementation in the field. The Nigeria 2018 survey included testing for sickle cell anemia, the only survey to do so. A few surveys, for example in Egypt, have included testing for hepatitis C. The DHS has discouraged testing if the national prevalence is believed to be less than 2%. A few surveys, notably in Rwanda and Tanzania, have included testing for certain micronutrients, with CDC protocols and participation by CDC experts.

The blood pressure of adult women and men is commonly measured to estimate the prevalence of hypertension, although the DHS does not make a medical diagnosis. Normally, three measurements are taken: the estimate is the average of the second and third measurements. A module for chronic diseases includes questions about whether the respondent has ever been diagnosed or treated for hypertension, diabetes, or specific types of cancer.

Biomarkers have been a valuable addition to the program but have involved many complications. Special equipment and supplies are required, and sometimes these are delivered late or are delayed by customs inspections. If fieldwork is delayed for other reasons, supplies may be past their expiration date by the time they are needed. Countries virtually always mandate that blood samples be analyzed at in-country laboratories, requiring additional contracts and monitoring for quality control. Sometimes these laboratories lack sufficient capacity to analyze the samples and the survey report is delayed. Each fieldwork team, which usually consists of five or six workers, must include a biomarker specialist, who requires special training even if they already have health-related experience.

DHS surveys usually include interviews with men, but often in only a subsample of households. The age range extends beyond age 49 because there is particular interest in linking women with their partners, who are typically a little older. The standard recode files include a men's file and a couple's file, which can be used to compare the woman's and the man's responses on fertility preferences and contraceptive use.

From the beginning, as with the WFS, all DHS surveys have included full birth histories with questions about child survival. Around 2000, questions were added to the household survey about the survival and coresidence of the mother and father for all children in the household aged 0–14. Soon afterwards, to become consistent with the UNICEF definition of children, the age range was expanded to 0–17.

Under-5 mortality has declined markedly in most countries, but most of the decline has been after the first month. This has led to an increased focus on the identification of stillbirths and early neonatal deaths, which may be confounded with each other at delivery. Beginning with DHS-8 in 2018, all standard surveys have included full

pregnancy histories (the recode files still include a reduction to the format of birth histories). Pregnancy outcomes include births, stillbirths, miscarriages, and abortions. Pregnancy histories require additional structure in the interview and additional questions about the length of the pregnancy and evidence of life, as well as additional subsequent editing. Without pregnancy histories and unless special questions were included, stillbirths could only be crudely identified from the contraceptive calendar.

Fertility before age 18 has also declined markedly in most countries, and this has increased the focus on births that occur below age 15. The DHS has been able to incorporate estimates of under-15 fertility into the reports without expanding the samples or adding questions. The age range of eligibility for the survey of women is 15–49, but birth histories include births before 15 and pregnancy histories include pregnancies before 15. The final reports now provide estimates of under-15 fertility and pregnancy rates.

One of the most important modules, added in the 1990s, is the sibling histories that are used to estimate adult and maternal mortality. Respondents are asked to list all their sisters and brothers (with the same mother) and their survivorship. If a sister died at age 12 or later the respondent is asked whether the death occurred while she was pregnant, or at delivery, or postpartum. Until about 2018, these deaths were classified as maternal. Subsequently, to become consistent with WHO definitions, they were re-categorized as pregnancy-related. Questions were added on whether any deaths were due to accident or violence. Deaths that were reported to be pregnancy-related but not due to accident or violence were categorized as maternal. DHS data on adult mortality (as well as fertility and under-5 deaths) have been important inputs to estimates by the UN Population Division in World Population Prospects. DHS data are also used for the WHO's estimates of maternal mortality, but the only input to the WHO model is the proportion of all-cause deaths (to women age 15–49) that are maternal deaths.

Several other optional modules have been developed, typically in consultation with existing reference groups or experts, and updated over time. The domestic violence module has been widely included in the surveys of women and sometimes in the surveys of men. A disability module for household members aged 5 and above can be included in the household survey. A handful of surveys have included questions about recent deaths in the household as part of the household survey, as an alternative to the sibling histories for estimating recent mortality.

Working with the World Bank, a health expenditures module was developed for inclusion in the household survey. Because of the potentially large number of questions about in-patient care, out-patient care, pharmaceuticals, and insurance, this module is typically administered to a subsample of households and a subsample of household members.

The core questionnaire for the household survey includes many questions about household assets, broadly defined. These include WASH (water, sanitation, and hygiene) questions on source of drinking water and type of sanitation, classified by the WHO, in ways that have changed over time, as improved or unimproved. Together with questions about a range of possessions, adapted to the country's context, the information about assets is consolidated with a continuous scale that also appears in the form of quintiles. The household Wealth Index is one of the most powerful covariates in the tabulation plan for most outcomes. Because the composition of assets is strongly associated with type of residence, around 2015 the DHS introduced separate constructions for urban and rural areas. There has been considerable effort by non-DHS researchers to extend the construction to a multi-dimensional form and to abbreviate the number of variables that go into the principal components analysis.

Probably the most significant areas of growth in DHS topics have been maternal and child health (MCH) and nutrition. The WFS included relatively little on either topic. Some extensions apply to all births in the past five years, some to surviving children, some to surviving children who are currently living with the mother, and some to just the most recent birth. One way to moderate the impact of additional questions on the length of the interview is to limit the subpopulation to which they refer.

After gradual additions over time, the questionnaire now provides a very complete description of antenatal care, the place and circumstances of the delivery, and postnatal care. For the child, there is detailed information on the timing of all immunizations, symptoms of illness (diarrhea, fever, cough) in the past two weeks, and the type of treatment for such illness.

There is very detailed information on the nutrition of the child and the mother, including specific types of food and liquids in the past 24 hours and supplements such as iron and iodized salt. The lists of specific foods are adapted to the country context but they are classified in groups established by the WHO. The standard report includes complex indicators related to exclusive breastfeeding, diversity of foods, etc.

For all of its breadth and depth, DHS data collection has a huge remaining blind spot: children age 5–14, whose health and well-being are almost completely overlooked. For them, the only individual-level outcome that is measured is schooling. This omission speaks to the priorities of the community that uses and constructs indicators, rather than to the DHS itself.

Over the course of the DHS, external analysis was promoted by successive revisions of the Guide to DHS Statistics (https://www.dhsprogram.com/Data/Guide-to-DHS-Statistics/index.cfm).

Each 5-year USAID contract required the inclusion of subcontractors. During the final years there were always six or seven subcontractors, supplying staff members who

had expertise in data processing, communications, capacity building, and analysis. They were an important mechanism for quickly replacing or adding staff when necessary.

SY: ***How has data collection/data entry changed over time?***

TP: During the WFS and into the beginning of the DHS, questionnaires were printed, interviewers wrote on the questionnaires with pencils, keypunch operators punched the responses onto Hollerith cards, and the cards were fed into a reader for digital storage on magnetic tapes. Data entry during fieldwork has completely transformed, so that all surveys are now done with computer-assisted personal interviewing (CAPI) using tablets. Skips and filters and prompts are automated. Because the data entry includes some automated editing, there is less information about the incidence of illegal or inconsistent responses, but the software tracks changes made in the field during the course of the interview. It also includes frequent time stamps, so it is possible to identify and check suspicious data, such as implausibly short interviews. Recent improvements make it much easier for field supervisors and survey managers to monitor the data collection. Various fieldwork indicators are calculated and flagged in color, on a dashboard, if they are outside specified ranges.

Two other important expansions of the types of data included in the project during the final 20 years must be mentioned: the addition of geographic information in a Spatial Data Repository and the SPA (Service Provision Assessment) surveys.

The use of spatially structured data began with the DHS routinely recording the GIS coordinates of the approximate center of each cluster. In order to maintain confidentiality, the coordinates then had to be displaced within a modest radius, on average larger in rural areas than in urban areas, retaining the placement within the same unit at the second administrative level. Cluster-level linkage was then possible for any available source of geographic information. The GIS team put together a file of such data for each survey, and users had the potential ability to link to other sources. Considerable effort went into the construction of Bayesian surfaces, on country maps, for major outcomes.

During the 1990s there was considerable programmatic interest in describing the service environment from the users' perspective. For a potential user to adopt a specific method of contraception, for example, the method has to be available within some distance or travel time. Early surveys on service availability evolved into SPA surveys with their own sets of reports. There were several successful efforts to link DHS and SPA surveys in order to identify barriers to more effective treatment for child illness and other outcomes that benefit from access to facilities.

The SPA surveys were exceedingly complex. They had to adapt to each country's hierarchy of public and private facilities, from hospitals down to pharmacies or even lower-level sources of pharmaceuticals and advice. They included interviews with staff

and clients, observations of interactions, and checks on training and the presence of specific equipment and supplies. The sampling frame was often a problem because of the lack of up-to-date lists of lower-level facilities, particularly private facilities. The analysis was complex because of the different units of analysis and the adoption of an enormous tabulation plan to satisfy special interests. Regardless of the potential value of the SPA surveys, I personally do not believe they should have been part of the DHS contract.

SY: ***How were the data used and shared?***

TP: I will comment on three related activities of the DHS: dissemination, capacity building, and further analysis. Collectively, all three are aspects of data utilization. The first two activities were relatively minor in the WFS and at the beginning of the DHS but expanded dramatically. The third, further analysis conducted by the staff, was a relatively minor activity within the DHS, and may never have returned to the level that prevailed during the final years of the WFS. I will describe them in terms of three teams of staff.

The dissemination team was the face of the DHS for much of its non-technical audience, ranging from journalists to those elusive 'policy-makers'. They packaged the results into flyers, organized the national in-country conference that followed the release of each final report, organized workshops for journalists, maintained the website and a presence on social media, and so on. This team had, for me, an unexpectedly high level of involvement in preparing the proposals for contract renewals, but that was because of their genuine communication skills. They were good at perceiving what 'the client' (that is, USAID) wanted. Their training and expertise were in communication, per se. Day-to-day they blended with the publications team.

Capacity building or strengthening was always an important objective of the program, but during the final ten years or so, USAID was more explicit about this goal. Mechanisms were added to assess more objectively the needs of the implementing agencies and to determine how the DHS could strengthen their capacity. A variety of workshops were conducted, mainly related to data processing and further analysis, incorporating adult learning techniques and before/after assessments.

The DHS had always conducted in-house research beyond the final reports, such as comparative reports and data quality analyses, but for many years this was an occasional activity. Beginning around 2008, USAID mandated that the DHS should hire more staff and scale up the production of research reports, and that is the context in which I joined the staff. My main involvement was as director of research and analysis from 2011 to 2022. Further analysis encompassed a broad set of reports prepared by staff (and occasionally by consultants)[5] after the release of the standard recode files, which coincided with the release of the final report and the in-country dissemination conference.

[5] The range of reports was substantial (https://dhsprogram.com/publications/publications-by-type.cfm).

Our team worked directly with the USAID management team to specify each year's list of reports. We would propose topics, but (appropriately, considering the source of funding) most topics and all final decisions came from USAID. Additional activities included responding to special requests from USAID or other agencies, responding to queries on the user forum that were related to analysis, running the faculty fellows' program, and giving analysis-related workshops. We prepared Stata programs (then translated to SPSS and R) for the indicators and standard tabulation plan, which are available on the DHS GitHub site (https://github.com/DHSProgram).

5. The future of the DHS program

SY: ***What is the current status of the DHS program?***

TP: Not so good, as has been suggested by my use of the past tense above. The final 5-year contract with USAID, labelled DHS-9, began in September 2023. Virtually all USAID programs and contracts, including DHS, were terminated early in 2025, a little more than a year into DHS-9. In quick succession, in late January/early February, there was a 90-day pause in funding, followed by a 'stop work' order, followed by the abrupt and total cancellation of the contract. On a larger scale, the USAID management team and USAID itself abruptly ended. Most importantly, the USAID programs to support global health and nutrition abruptly ended. The end of USAID support for the DHS was a relatively small piece of an enormous cataclysm.

This came at a time of peak productivity at the project. Some DHS-8 data collection had been delayed by Covid-19, and the delayed surveys were still in the data processing phase. New data collection was ongoing. Agreements for new surveys in several participating countries had been completed. A relatively large number of final reports and analysis reports were in progress. This situation was devastating for DHS staff, of course. Some new staff had been recruited for DHS-9. Sunita Kishor was on the verge of retiring and handing the directorship over to someone else. Many of the implementing agencies' in-country staff were terminated, including interviewers and drivers in the field.

Fortunately, some surveys (in Guinea, Ethiopia, Timor Leste, Zambia and elsewhere) had technical-assistance funding from outside USAID. Work on these surveys, and the staff doing that work, could continue and they formed the basis of the current team. ICF had the capacity and the willingness to retain some core staff, the DHS website, STATcompiler, and the archives. If the DHS had been contracted to a firm that was smaller or more dependent on a portfolio of vulnerable contracts with the U.S. government, survival would have been even more problematic.

Data processing and data collection resumed around July 2025, thanks to support from the Gates Foundation. Surveys that were close to completion restarted, but a few surveys that had not started fieldwork did not resume or resumed with alternate plans and other funding (e.g. the Philippines). Currently, the Gates Foundation has committed funding for the DHS through mid-2028 for most of the pre-existing activities other than capacity strengthening and further analysis, and is back in the field with new surveys. There are approximately thirty staff members, including some (such as myself) who are part-time. ICF is taking the lead in trying to identify additional and continuing funding.

SY: ***If you were to rebuild the DHS again, how would you do it? What do you see as the essential pieces?***

TP: The first question is whether there continues to be a need for population-based household surveys. I strongly believe the correct response is 'yes', but the question must be taken seriously. For at least the past fifteen years or so, there has been a search for alternatives to household surveys or face-to-face interviews, using community respondents, cell phones, or other mechanisms to estimate fertility and mortality rates, contraceptive prevalence, and some other outcomes. These alternatives are promising in terms of cost and rapidity but do not approach the breadth or depth of DHS surveys.

I can distinguish between two core products of the DHS surveys. The first consists of point estimates of a huge number of demographic and health indicators, a function that is captured by STATcompiler (https://www.statcompiler.com/en/), a huge database of pre-calculated estimates for all surveys. These estimates are required for monitoring progress toward the Sustainable Development Goals (SGDs) and for a wide range of health and development indicators. STATcompiler also disaggregates by selected covariates. For example, the under-5 mortality rate from a survey can be disaggregated by the child's sex, birth order, the length of the preceding birth interval, the mother's age group at the child's birth, her education, urban/rural residence, the household wealth quintile, and region (administrative level 1). Alternative methods of data collection could not possibly provide this kind of depth. STATcompiler also provides breadth, with indicators ranging across all the topics I mentioned earlier. It provides tools for graphs and tabulations to describe trends and make cross-national comparisons.

For me, the second principal product of the program has been accessible standard recode files. Microdata files are the basis of STATcompiler and everything in the final reports; obviously, the indicators on STATcompiler would not exist without them. What matters here is that these files are (a) accessible and (b) in a standard format. Such files can readily be used in the broader research community, not just within the DHS, to conduct further research. Thousands of researchers have downloaded DHS data files and have produced thousands of publications on a huge range of topics, some of which are

marginal to the original intent of the program but are theoretically or methodologically innovative.

I believe that the only way to generate the two main products I have described is with a program of large household surveys. I hope that as a minimum there will continue to be sufficient coordination and standardization to maintain and grow the database and the library of accessible standard recode files. The key indicator reports, final reports, and all the other products and activities I have described above are important, but they are enhancements.

A second basic question concerns governance, by which I mean the administrative and funding structure within which the activities are housed. For me, the DHS was a global good that was created and sustained by USAID. Over time, the participating countries and many donors made major contributions, but USAID's commitment to core funding, coordination, standardization, and public access was crucial. I don't know how that can be replaced.

For the future, I would retain as much as possible of the structure that existed before the cataclysm, but everything is subject to re-examination. For example, is it necessary to have a for-profit contractor? I can imagine a headquarters within a government agency (as with CDC's Reproductive Health Surveys) or an international agency (as with MICS) or a university (as with IPUMS). It is not necessary for the project to retain its identification with the United States if it is no longer funded by the U.S. government. As far as I am concerned, it could relocate anywhere.

The inevitable question is where does the funding for core support and field support (both are needed) come from? Despite generous current support from the Gates Foundation, it is unreasonable to expect foundations to fund the project long-term. The search for donors is underway. At the same time, the project is necessarily designing strategies to reduce the cost of DHS surveys while maintaining data quality.

If the search for long-term replacement funding is successful, my next concern is that the reconstruction of DHS might be derailed by people on the donor side who have excellent intentions but want to rush too rapidly into a reliance on AI. I see a role for AI, but it should be used cautiously and incrementally and not just as a mechanism to reduce staffing costs. The innovations that I have described could not have happened without the passion and expertise of real people – far more people than I have been able to acknowledge in this interview.

6. Acknowledgements

Many thanks to Trevor Croft, John Cleland, and Madeleine Short Fabic for very helpful comments on an earlier draft.

References

Cleland, J., Scott, C., and Whitelegge, D. (1987). *The World Fertility Survey. An assessment.* Oxford: Oxford University Press.

Pullum, T.W., Harpham, T., and Ozsever, N. (1986). The machine editing of large-sample surveys: The experience of the World Fertility Survey. *International Statistical Review/Revue Internationale de Statistique* 54(3): 311–326. doi:10.2307/1403061.