Reinventing VITAL

SYNOPSIS

VITAL STATISTICS OFFERS a case study in the potential of new information technology and reengineering to achieve better public sector performance.

New technology—notably the shift from a paper to an electronic process for recording vital events and transmitting the data to public agencies—is creating opportunities to produce more timely, accurate, and useful information. The furthest advanced innovation is the electronic birth certificate.

At the same time, changes in welfare policy and health care—including efforts to establish paternity at the time of birth and to improve health care outcomes—are creating pressures for more policy-relevant data about vital events. In addition, the rise of integrated health plans and health information networks is radically altering the organizational context of vital statistics.

On the basis of a State-by-State survey of vital statistics officials, the authors estimate that at the end of 1994, 58 percent of all births in the United States were being recorded on an electronic birth certificate and communicated to a public agency electronically. Nearly all respondents reported that the electronic birth certificate brought improvements in both timeliness and accuracy of data.

Achieving the full promise of the new technology, however, will require more fundamental changes in institutions and policies and a reconceptualization of the birth certificate as part of a broader perinatal information system.

ILLUSTRATION BY VICTOR JUHASZ

Paul Starr, PhD
Sandra Starr, MS, MPH

Statistics

The Impact of Changes in Information Technology, Welfare Policy, and Health Care

The vital statistics system, one of the oldest sources of health data, is now on the threshold of a new era as a result of the information revolution, new Federal laws regarding welfare and paternity, and the rise of integrated health plans and other changes in the structure of health care.

The information revolution is not merely a matter of the advent of new technology. In recent years, many businesses have redesigned their organizations to achieve drastically reduced error rates, faster turnaround on customer orders, quicker time-to-market for new products, and other improvements in performance. Such efforts typically use computers and electronic communication to accelerate the flow of information, cut redundant tasks, and reorganize production processes—in some cases, eliminating whole layers of activity. This movement often goes by the name of "reengineering," a term introduced by Hammer and Champy (*1*). The same ideas, often combined with a focus on "customer service" or "service to the citizen," have also shaped recent efforts to reinvent government (*2–4*).

The U.S. vital statistics system is one aspect of government ripe for reinvention. Consider the difference in timeliness between today's data about commercial transactions and government data about births, deaths, marriages, and divorces. Virtually all major retail chains now have point-of-sale terminals that generate information literally overnight on sales by store and product. As a result, firms can respond quickly to shifts in demand, change orders to suppliers, and cut costs on unsold inventory. Federal Express and other delivery services receive world-wide real-time information on the status of deliveries typed or scanned in by personnel along the route and radioed back to managers. Financial markets are so thoroughly wired that they generate data almost instantaneously.

Births, deaths, marriages, and divorces are hardly less important to society than the sale of toothpaste, dispatch of an overnight letter, or purchase of a share of stock. Yet data on vital events take a lot longer to travel from their point of origin to relevant decision makers. The Federal Government reports national birth and mortality statistics with a lag of 12 to 15 months after the close of a year. Some registration areas commonly take two to three years to report final data, though they may provide preliminary surveillance data earlier.

The slow flow of information on vital events greatly reduces its value. For example, if birth certificate data lag by a year or more, they cannot be effectively used to track at-risk infants, guide immunization efforts, or provide quick feedback on institutions or regions with high rates of birth defects. Real-time data on deaths could help spot emerging public health problems and reduce excess costs to the Social Security Administration for unrecoverable payments to deceased beneficiaries.

There is no intrinsic technical reason for slower transmission of data about vital events. The limitations of vital records and statistics arise from institutional barriers to change. Each State runs its own system, although the Federal Government pays a share of the cost. Historically, ever since the development of Registration Areas in the late 19th century, the focus of Federal effort has been to create a more complete and uniform vital statistics system.

The Federal Government does not, however, issue regulations governing State vital records systems, nor does it invest in information technology to improve their operations (as do national companies with local sites or outlets). Rather, under the Vital Statistics Cooperative Program, the National Center for Health Statistics coordinates standardization of certificates and contracts with State and local authorities for the delivery of data. The States and localities do not necessarily provide all the data the Federal Government seeks. And while they are paid only for the data they provide, they do not face any penalties, except delayed payments, for failing to meet Federal deadlines.

During the past 40 years, States have adopted computers to store and tabulate vital records data, and in 1971 the Federal Government began receiving data tapes instead of individual records from the States. Until the early 1980s, however, the technology used to gather and transmit data from their point of origin—paper forms and carbon copies—had not changed in a century. Unlike retail businesses, delivery services, or banks, the various components of the vital statistics system—hospitals, funeral homes, local registrars' offices, State agencies—have not been wired together to capture information at the point of service and relay it quickly to a central point.

Developments in technology and public policy, however, are precipitating change and creating an opportunity to reengineer and reinvent the system. The key technological development is the shift from a paper to an electronic process for recording vital events and transmitting the information to public agencies.

The furthest advanced innovation is the electronic birth certificate (EBC). Use of an electronic death certificate (EDC) is still in an early stage. As in many areas of the economy, electronic recording and communication are not merely efficiency measures; they can fundamentally improve the accuracy, scope, and timeliness of information and hence its relevance for public policy and management. Recent changes in welfare policy and health care have also created a greater demand for policy-relevant data on vital events. As a result, there is pressure to change not only the data-gathering process but also the mission of vital statistics.

The traditional mission of vital records and statistics has involved two principal functions: (*a*) producing, storing, and retrieving legal documents and (*b*) gathering data for statistical reports for State and Federal agencies. The chief "customers" of vital statistics have correspondingly been individual persons in search of documentation and Federal, State, and local governments in search of aggregate data. (Other "customers" include demographic and health researchers and marketing firms, but unlike fee-paying people and revenue-raising governments, they do not pay the bills.) Since vital statistics agencies generally have not been major sources of data for welfare or medical care policy, they have not had strong relationships with welfare or child support enforcement agencies or with health care providers and policy makers.

The advent of electronic information and new pressures to provide policy-relevant information challenge vital statistics agencies to expand their functions and redefine their "customers." But, of course, the appearance of new possibilities and demands does not guarantee that the possibilities will be realized or the demands satisfied. Organizations may lack the capital, incentives, or leadership to make changes. Change in vital statistics is complicated by the number of independent centers of decision-making.

Electronic Birth Certificate

The introduction of the EBC offers a case study in the forces affecting the use of information technology to reengineer and reinvent government. To determine the status of EBC development, we surveyed officials of all States and other registration areas in the United States, excluding Puerto Rico and the Territories. To simplify, we shall refer to these as "State vital statistics officers," although two registration areas, New York City and the District of Columbia, are not States. Four States that reported no plans for an EBC were dropped from the survey; thus the number of areas responding to the full survey was 48.

The survey, carried out by telephone and fax, took place between August and November 1994; the respondents were typically directors of vital records and statistics divisions or of State centers for health statistics. We also reviewed results of such earlier surveys as the 1994 Vital Statistics Automation Survey by the Association of Vital Records and Health Statistics. And we interviewed representatives of EBC software vendors. One of the authors (Sandra Starr) drew on her experience developing an EBC system for New Jersey and introducing it into the State's hospitals.

The traditional birth certificate process. The traditional paper-based birth certificate process usually involves three different organizational settings—the hospital, the local or county registrar, and the State government.

In the hospital or other birthing institution, nurses and

medical record or unit clerks in obstetric wards interview patients and abstract medical records; the information is then typically taken to a station elsewhere in the hospital to be entered on a State-provided, often multi-part form. Depending on State legal requirements, the hospitals may be responsible for collecting as many as three kinds of signatures: from physicians or midwives to certify the birth; from mothers to verify the baby's name; and from putative fathers of children of unwed mothers to certify paternity. Some States require as many as four copies of the paper birth certificate form: one to be kept by the hospital, a second to go to the birth registrar (the registrar in the county or locality where the baby was born), a third to the residence registrar (the local registrar where the family lives), and a fourth to the State.

Especially in States where the copies are on carbon paper, correcting mistakes is time-consuming. The forms are divided into two sections: the basic legal information and the confidential demographic and clinical data. Almost all States do not allow data on the legal portion of the form to be whited out or crossed out; a clerk who makes an error on that portion must retype the entire certificate.

Moreover, the birth certificate is only one of several documents produced at the time of a child's birth that are generally required for hospital licensing and accreditation. The others are the medical records of the mother and the infant and the labor and delivery logs. These documents include many of the same data fields: date of birth, time of birth, sex, birth plurality and order, place of birth, age of mother, name of birth attendant, date of last normal menses, birth weight, cesarean section, previous pregnancy history, pregnancy complications, birth injury, and labor and delivery complications. According to Williams (5), these forms often record contradictory information for the same birth: "the medical record is most accurate and complete, followed by the labor and delivery log, and finally by the birth certificate."

Data from the labor and delivery logs are summarized and in some States sent to health departments, duplicating or contradicting information in the birth certificate. In many States, much of the same information is also abstracted from the medical record and sent to health departments as part of a hospital discharge abstract or uniform bill. Many States have also created separate information systems to track immunizations, inborn errors of metabolism, and birth defects. All these information systems overlap the birth certificate.

The route followed by the paper birth certificate varies among the States. In all States but Connecticut, Massachusetts, and Vermont, the State receives the original. In one-third of the States, the original goes directly from the hospital to the State government agency. The predominant pattern in the remaining States is that the hospital mails the original and all copies of the birth certificate to local or county registrars, who then forward the original to the State. Local registrars screen birth certificates for completeness and often correct inaccurate information about a family's town of residence. A common error, for example, is that families say they live in higher-status communities than their street addresses indicate. The local registrars also often record and transmit to the State changes of legal information, such as a baby's name, which parents may amend weeks or even years after the birth.

At the State level, clerks typically enter the data into dumb terminals linked to minicomputers or mainframes and run batch edits to check for missing information or apparent errors, such as implausible birth weights or Social Security numbers with too many digits. When problems are detected, the State agency sends query letters to the hospitals typically via the local or county registrars.

States send data for a completed month in batches to the National Center for Health Statistics (NCHS) of the Public Health Service. Births that occur in January of a year

The Federal Government reports national birth and mortality statistics with a lag of 12 to 15 months after the close of a year.

NATIONAL CENTER FOR HEALTH STATISTICS

will typically not be reported by NCHS in published reports until two years later. The problem of timeliness is compounded by Federal policy. NCHS does not release final birth data until all registration areas have reported; thus the Federal Government goes "only as fast as the slowest State," according to George Gay, Chief of the Registration Methods Branch of the Division of Vital Statistics, NCHS, (interview, March 17, 1995).

Several endemic problems afflict this paper-based birth certificate system. Besides being slow, the system does not catch mistakes at the point of origin. Clerks in hospitals and local registrars do not have strong incentives to find and correct errors. By the time the State's queries about missing information or apparent mistakes come back to the hospitals, months may have gone by. Hospital personnel, typically in medical records departments, must then locate and search charts and, where necessary, contact the parents, if the family can still be found. Some State vital records offices query hospitals about 20 percent or more of birth records.

These deficiencies in the birth certificate process are a source of both high costs and poor quality. The system involves redundant data entry by hospitals, local registrars, and the State. High error rates in the original forms require much back- and-forth communication and "rework" by hospital personnel, local registrars, and State agencies. These are exactly the kinds of problems in organizational processes that continuous quality improvement and reengineering efforts attempt to resolve.

The promise and development of the EBC. The alternative to the paper birth certificate process is an electronic substitute—the EBC—that is capable, at a minimum, of recording data in a structured format, automatically checking for improbable answers, and producing a file on each birth that can be transmitted electronically to an official agency. An EBC system requires (*a*) a software program that can be run on a personal computer or another computer at the point of service, (*b*) a data dictionary, and (*c*) agreed-upon edits and communication standards. Files may be transferred by disk, magnetic tape, modem (linking the hospital to a county or State computer), or network. Nurses and other hospital personnel must be trained to use the software and to transmit the files, if transmission is not automatic. The State needs to establish procedures to receive the information and integrate it into its vital statistics data base.

The purpose of the EBC is similar to that of other electronic point-of-service information systems. Moving computers from the back offices to front-line workers not only eliminates redundant data entry but also often produces much cleaner information. The EBC aims to cut down on errors by eliminating the need to key the same information twice and by using built-in edits to prevent hospital personnel from skipping fields on the birth certificate or making data entries outside the range of plausibility.

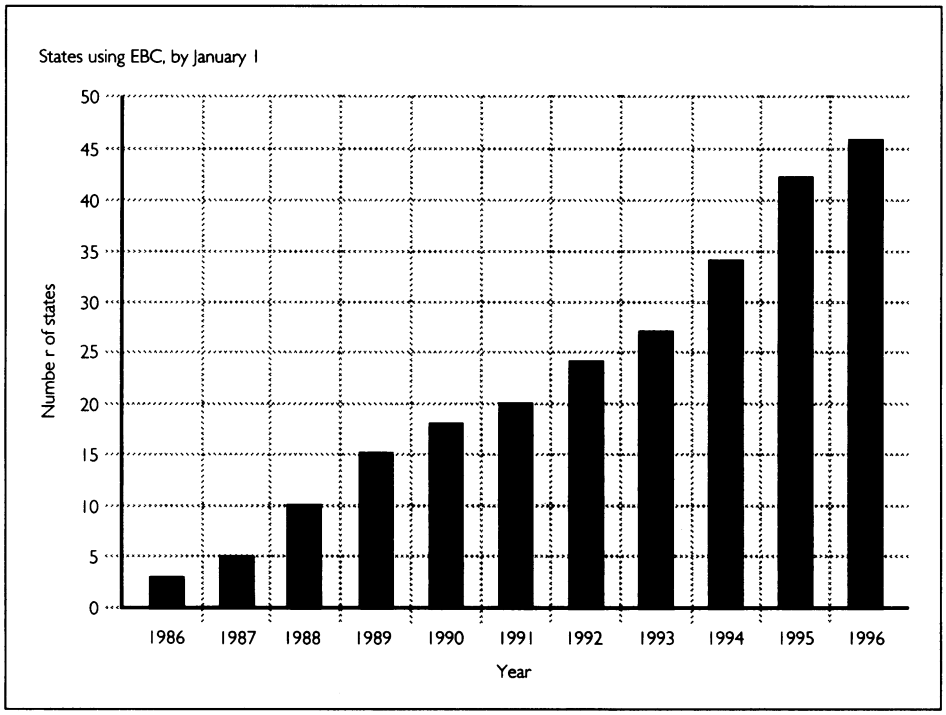
The objectives of a fully reengineered system go further. A single process could generate all the information needed for the birth certificate, medical records, maternity and newborn logs, billing, enrollment in health insurance and Social Security, hearing screening programs, birth defect registries, immunization registries, and other birth-related documentation. This unified process could sharply reduce the time and effort hospital personnel and parents now typically spend on paperwork associated with childbirth. If the hospital or health plan were then able to transmit the various data elements to the appropriate destinations via a computer network, the system could provide up-to-date information on births for a variety of purposes and greatly improve health and social services for infants and children.

The first EBC was the Automated Vital Statistics System (AVSS), developed in 1980 by Ronald Williams and coworkers at the University of California, Santa Barbara, in cooperation with the California Department of Health Services, Santa Barbara County, and the county's director of health care services, Lawrence M. Hart. The original report describing AVSS observed that delays of up to three years in the availability of birth data had led to widespread skepticism about the usefulness of the vital statistics system and "prompted many larger counties to establish their own data processing and analysis capabilities, resulting in much duplication of effort" (*6*).

Curiously, although counties have generally not been innovators in vital statistics, it was a county—not the Federal Government or a State—that provided the initial impetus for developing the EBC. According to Williams, the first public demonstration of the EBC took place on September 30, 1980, at the First National Conference on Perinatal Data Systems in Milwaukee, WI; and the first EBCs were produced at Cottage Hospital in Santa Barbara on September 2, 1981 (letter to the authors, May 17, 1995).

During the 1980s, the EBC spread slowly. Williams's AVSS was adopted first by counties in California and later by the States of Connecticut, Massachusetts, and Rhode Island. Williams did not commercialize AVSS, market it aggressively, or develop the capacity to provide technical support. Perhaps as a result, more States adopted a proprietary software program from Genesis, a firm in Lewiston, PA, that began working on an EBC in 1984. By 1991, 14 States were using its software; then in three years, the number jumped to 32, according to Genesis president Thomas Reese (interview, March 16, 1995). Nationally, according to our survey, 20 States had begun either testing or at least partly implementing an EBC from one of several sources by January 1, 1991; the number of States rose to 27 by the beginning of 1993 and to 34 by 1994 and will hit 46 by January 1, 1996 (figure, page 539).

Several developments may have been responsible for the sharp increase in recent years. By the early 1990s, the EBC was a proven technology. National efforts to increase immunization rates led to more interest in timely birth data. The Social Security Administration (SSA) was also providing grants to some States for the EBC in connection with a voluntary program called "enumeration at birth." Under the



program, States send SSA birth certificate data on magnetic tape that enable the agency to provide Social Security cards for a newborn to any family requesting a card on the birth certificate. No financial support for the EBC came from any Federal program concerned with vital or health statistics.

Impact of the EBC. State-by-State estimates by the respondents to our survey indicate that at the end of 1994, 58 percent of births in the United States were being recorded on an EBC and transmitted to a vital statistics agency electronically. Nineteen States were using an EBC to record more than 80 percent of births. Another 20 were using an EBC for at least some births; only 13 had not yet adopted the EBC at all, and of those only 4 had no plans either to test or implement it (see box, page 540). By January 1, 1997, 37 States expect to have fully implemented EBC programs, and 22 of these expect full implementation to involve participation of more than 90 percent of birthing hospitals. The State-by-State reports indicate that 1,630 birthing institutions now use an EBC and that this number will grow to 2,702 under full implementation—a total that does not count four States, including Florida, where an EBC is being tested but officials could give no estimate of the number of hospitals expected to use it.

Asked to rate the impact of the EBC as positive or negative, officials in the 39 States using an EBC unanimously rated it positive. As expected, most States identified improvements in the timeliness and accuracy of data. Officials in 31 States said the EBC had improved the timeliness of data flowing from hospitals to the State. Officials in 33 States said the EBC had improved the accuracy of data. Twenty-two specifically reported reductions in the query rate (the percentage of records with missing or apparently mistaken information that generate queries by State clerks to hospitals). North Carolina, for example, reported that the query rate had declined from 20 percent to 1 percent of records.

Asked about the impact of the EBC on the cost of vital records collection to the State, officials had no similar consensus. Of the 28 who felt they knew enough to answer the question, 14 said the EBC had lowered costs, 5 said it had increased costs, and 9 said costs were unchanged. Several respondents indicated that costs at the beginning rose because of the required investment but that they declined later. A regression showed no significant relationship, however, between EBC penetration and reported cost impact—that is, States with a higher percentage of births being recorded on the EBC were not more likely to report cost reductions. The five States that reported higher costs, however, had relatively small absolute numbers of hospitals using the EBC. This suggests that there are economies of scale in spreading the costs of changing to an EBC.

Unlike other electronic point-of-service information systems, the EBC has not greatly expanded the information captured for analysis. The reason is that the U.S. Standard Certificate of Live Birth is the model for birth records in nearly all States, and its 1989 revision, which added several items, had to accommodate the predominant paper-based birth certificate process. (Presumably, future revisions will be less constrained.)

In our survey, 22 States did report, however, that the shift to the EBC had occasioned the addition of at least one item to the birth certificate. On introducing the EBC, four States added an item allowing the family to request a Social Security number for the newborn; four added a question about the administration of hepatitis B vaccine. Other items added by more than one State included affidavits of paternity (three States), errors of newborn metabolism (three States), immunization (three States), father's address (two States), health insurance coverage (two States), and and adoption (two States).

We asked respondents to rate the severity of four kinds of problems they may have encountered in planning or implementing the EBC. On a scale of 1 to 5 (where 1 stood for most severe), "training hospital personnel" had the highest average severity rating (3.3), nosing out technical com-

Reported Percentage of Births Recorded on an Electronic Birth Certificate (EBC), by Registration Area, November 1994, and Expected Date of Full Implementation

Areas	Percent implemented	Full implementation[1]
High EBC		
Washington, DC	100	
New Hampshire	100	
Connecticut	100	
Nebraska	99	Fully implemented
Illinois	96	6/1/95
Massachusetts	95	1/1/95
Rhode Island	94	1/1/95
Washington	90	12/1/95
Missouri	90	1/1/95
Maryland	90	2/1/95
California	90	Fully implemented
Kansas	89	Fully implemented
Wisconsin	85	Fully implemented
Virginia	85	1/1/95
Nevada	80	12/1/94
Louisiana	80	1/1/95
Iowa	80	1/1/96
Hawaii	80	1/1/97
Delaware	80	11/1/95
Medium EBC		
Texas	78	6/1/95
Wyoming	75	Fully implemented
Oregon	75	1/1/95
Michigan	75	6/1/96
South Carolina	72	1/1/95
Colorado	70	12/1/95
Indiana	65	12/1/95
Georgia	61	1/1/96
North Carolina	60	6/1/95
New Mexico	58	3/1/96
New York[2]	56	11/1/95
Alaska	55	1/1/95
Mississippi	50	No date given
Low EBC		
Utah	45	Fully implemented
Vermont	25	12/30/95
Maine	25	1/1/95
Minnesota	15	No date given
Idaho	10	7/1/96
Pennsylvania	5	No date given
New York City	1	No date given
No EBC		
Ohio		[no plan]
Oklahoma		[no plan]
South Dakota		[testing]
Kentucky		[no plan]
Arizona		[no plan]
New Jersey		1/1/96
West Virginia		[planning]
Tennessee		[testing]
North Dakota		[planning]
Montana		12/1/95
Florida		[planning]
Arkansas		[testing]
Alabama		[testing]

[1]"Full" implementation may be less than 100 percent because a State did not expect to use the EBC for births in smaller hospitals or for non-hospital births.

[2]Excluding New York City

plications (3.5). Vendor performance (3.8) and legal complications (4.2) were rated least serious. Still, there were five States that rated legal complications a "1" or "2" in severity.

One issue that raises legal complications is the handling of signatures, and one reason that the problem may not be more difficult is that most States are simply requiring a paper birth certificate in addition to an EBC and making no change in requirements for signatures. Fifteen States, however, did report a change in policy regarding signatures; most no longer require physicians to sign birth certificates. Only three States—Washington, Virginia, and Wisconsin—have adopted paperless birth certificate systems. Washington and Wisconsin no longer require any signatures, while Virginia allows the certifier to use an electronic signature.

From Automating to Reengineering

The use of computers in vital statistics initially followed the classic pattern of automating the status quo. Vital statistics automation meant the creation of centralized databases to help agencies to perform their traditional functions. Automation did not change the process at its base—the intake of information in hospitals, funeral homes, and local registrars' offices—nor did it affect the content or uses of the data. Vital statistics information systems were typically islands of automation; there were no standards or links for communicating with the computers of other organizations.

By requiring the development of communication standards and a common data dictionary, the EBC begins to move vital statistics into the era of decentralized computer networks. But, typically, the new systems make the following accommodations to the status quo:

Accommodation 1: Most States continue to demand the paper form. They do not yet trust electronic data or have not been able to modify statutory requirements; in some States, the law still requires signatures in ink. In most States, the birth certificate number is still stamped by hand on the paper copy rather than incorporated into the electronic system. Because the electronic data process is layered on top of the paper process, the various parties cannot fully maximize the opportunities for savings.

Accommodation 2: In many States, the EBC is being used only for hospitals with large volumes of births. Births at other institutions continue to be recorded on paper; the data are then keyed in by local registrars or the State.

Accommodation 3: Electronic communication generally only links hospitals with State offices. States using AVSS are an exception. Developed in California, where counties play a central role in vital statistics, AVSS communicates from hospitals to counties and links counties in a statewide electronic network. In most States, however, local and county registrars do not yet have electronic links that would enable them to upload and download data from statewide

systems, although such networks are under development.

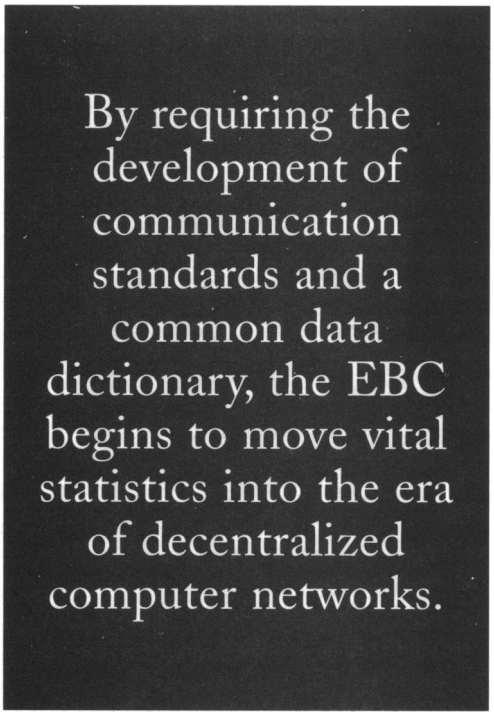
Accommodation 4: States typically have not yet rethought the broader perinatal data system. Hospitals are still entering the same data in birth certificates and other forms produced at the time of a birth; most States and hospitals have yet to develop a single electronic process for entering the data and routing it to the appropriate public agency or private institution.

To take full advantage of the new technology, health care providers and governmental agencies need to move from automating to reengineering their systems. To reengineer the process for intake of data at the point of service, hospitals might follow the example of a hospital in California, San Jose Medical Center, which brought the computer to the bedside and was able to cut two clerical positions by eliminating the back-and-forth communication that typically takes place between floor nurses and clerks entering data (*7*). Since 1993, most AVSS implementations have been on notebook computers, according to Williams (letter, May 17, 1995). Growing use of laptop and palmtop computers should help promote this process. Because the 24-hour hospital stay for childbirth has now become common, hospitals face considerable pressure to organize the birth certificate process more efficiently.

A more advanced form of reengineering the hospital process integrates production of the birth certificate into a hospital's clinical information system (*8*), which would automatically fill in much of the EBC. Parents and clinical personnel would verify most information instead of supplying it. The birth certificate would then be largely a byproduct of the patient record (which would be a byproduct of clinical care), not a special effort.

Lack of clinical information standards—that is, standards for data definitions, fields, and communication protocols—has been the primary impediment to moving automated data into EBCs. Still, some software vendors have begun to develop interfaces between hospital information systems and the EBC. However, even a fully integrated EBC will continue to require participation by clinical personnel. Many observers believe that data collection is more accurate when those who do it understand its purposes and appreciate its usefulness. If the timeliness of birth certificate data can be radically increased and its relevance to improved care clearly demonstrated, there may be a positive effect on the quality of the data as well. As in other areas, data should not only flow into official repositories but make a return trip both to help improve clinical performance and to convince caregivers and administrators that they have a stake in the quality of good information. This is where reengineering meets employee participation and empowerment.

Reengineering data production and distribution also requires the States and the Federal Government to rethink their processes. States could reconceptualize the birth certificate as the foundation of a broader perinatal information system. Data about births would be routed via a secure network to health and welfare agencies authorized to receive the information: vital statistics, health statistics, Medicaid, the Women, Infants, and Children's Program of the Department of Agricultre, metabolic disease screening, immunization registries, welfare, and child support enforcement. Just as the current, somewhat tardy, link to Social Security triggers production of a Social Security card when requested, there could be a link to public and private health insurers for enrollment of eligible newborns (without, of course, transmitting medical information confidentially provided by the mother).



The State would also be electronically linked with local and county offices to enable them to download information to generate documents for consumers, or consumers might be able to obtain such documents directly through an automated service. Several States are developing kiosk computing systems that will allow consumers to order and pay for legal documents from decentralized locations. Whether a comprehensive reorganization taking full advantage of computer communications would leave enough work for local registrar positions as traditionally conceived is an open question. Clearly, a comprehensive networking of State and local information systems for a variety of purposes would eliminate many local positions that now involve passing along and reprocessing information between citizens and State agencies. The rise of distributed computer networks raises fundamental questions about the relationship of localities to States; the uncertain future of the local registrar is only one aspect of that problem.

Improved timeliness of birth data will require changes in organization and policy by both the States and Federal Government. The EBC alone does not necessarily guarantee speedy turnaround of data. In fact, while some States have used the EBC to accelerate the flow of birth data to the Federal Government, there has been no national improvement. Most States still refuse to release birth data

until they receive paper records; some States' staffing and budgetary problems also cause delays. And the slow States set the pace because the Federal Government waits for all areas to report before reporting for the country as a whole.

According to the Chief of the Registration Methods Branch in the Division of Vital Statistics at NCHS, the current lag in release of vital statistics data is "not acceptable to us" or to the public; the agency is now "looking to electronics to redesign the whole system." Instead of receiving data tapes from the States that batch a month's records, the Federal Government wants to move to electronic transmission on a continuous-flow basis. The short-term objective for 1996 is to reduce the lag in birth data from 12 months to 6 months; the long-term objective is to release the data within 90 days or less. Although some States may still have staffing and budget problems, the spread of the EBC may allow NCHS "to bypass the bottlenecks electronically" (interview, G. Gay March 17, 1995).

One way to bypass the bottlenecks would be a computer network that moved data about vital events simultaneously to the States and the Federal Government. In such a system, individual identifiers could still be stripped from the data sent to the Federal Government, and the State could still perform its role of verifying and cleaning up the data and providing amended reports. A national network would not require uniform software but rather common definitions and communication standards. There is no effort at present, however, to take vital statistics to this stage.

Welfare Reform and Birth Certificate Process

While the information revolution has opened new possibilities for improvements in vital statistics, changes in public policy have created new demands for information regarding births. The most important of these demands is for information about the paternity of children of unmarried mothers.

Historically, the establishment of paternity was a criminal proceeding in the United States, and hospitals made little effort to identify unmarried fathers at time of birth. Under State programs in recent decades, hospitals began obtaining acknowledgments of paternity from unmarried fathers, and in 1990 Congress began requiring the States to increase hospital-based efforts to establish the paternity of children of unmarried mothers. The chief pressure for change has come from reformers who want to control welfare costs and to raise the incomes of single-parent families by strengthening child support enforcement.

The number of families with single parents who have never married has grown markedly over the past three decades. Much evidence show that children of single-parent families fare worse later in life. McLanahan (*9*) estimates that they are twice as likely to drop out of school and 1.4 times as likely to be out of school and out of work as children who grow up with two parents. Her research also indicates that diminished economic resources account for about 50 percent of the disadvantage of single parenthood. Single-parent families' high poverty rates might be significantly alleviated if the fathers were to contribute child support. But assuring such contributions is difficult, if not impossible, if paternity is not established in the first place.

Since the 1994 election, Congress has considered proposals that would place an even greater emphasis on paternity establishment. Under legislation passed by the House of Representatives in March 1995, children without legally established paternity would, except in some cases, be disqualified from public assistance unless the mother cooperated in establishing the father's identity.

Hospital-based paternity establishment programs in a few States, particularly Wisconsin and Virginia, have shown that the time of birth is the period of maximum enthusiasm of unmarried fathers for their children. These programs have been able to get 40 percent or more of the putative fathers voluntarily to acknowledge paternity. In an effort to raise paternity establishment rates nationally, the Congress in 1990 required states to develop voluntary, hospital-based paternity establishment programs by January 1995. At the end of 1994, when we surveyed them, all vital statistics offices except one reported developing new relationships with child support enforcement agencies. In fact, many vital records officials were talking to such agencies for the first time to figure out how to meet Federal requirements for hospital-based paternity establishment.

States could either create a new form and new information system for paternity establishment or use the birth certificate process for an affidavit of paternity. Of the States that we surveyed, nine allowed voluntary acknowledgment of paternity through their birth certificates, and 22 reported that their birth certificates record whether an affidavit of paternity exists or has been applied for. In 43 States, the child support enforcement agency asks the hospital to produce a separate paternity acknowledgment form. Thus, rather than integrate data on paternity acknowledgment into a single unified information process, most States were opting as of November 1994 to create new forms and new data systems to correspond with the bureaucratic division of functions.

One further aspect of current changes in social policy may also hold implications for the vital statistics system. Recent proposals and initiatives to disqualify illegal and legal immigrants from a broad array of services suggest that

administrators of schools and public agencies increasingly may be expected to verify the citizenship of students and beneficiaries. This emphasis may generate demands for easier access to official information about who was born in the United States—perhaps to put some birth certificate information online. This may generate a public debate over what individual information on the birth certificate, if any, should routinely be available to public officials.

Impact of Changes in Health Care

Like welfare reform, the restructuring of health care has important implications for vital statistics. The rise of integrated health plans, growing emphasis on accountability for the outcomes of care, and development of health information networks and electronic data interchange are changing the organizational context of the vital statistics process.

The traditional focus of data gathering for birth certificates has been hospitals because they have been the principal record-keeping organizations involved in births. Today, however, health maintenance organizations and other managed care plans are building enterprise-wide information systems to maintain both administrative and clinical data on subscribers receiving care at multiple sites. Linking hospitals with physicians and other providers as well as the plan's own systems, these enterprise networks will increasingly be able to generate data for birth certificates as a byproduct of normal operation. Instead of relying on patient recall for data on prenatal care, they will often be able to produce more accurate histories from encounter data. Unlike the traditional hospital, integrated health plans serve an enrolled population; hence they share with public health agencies an interest in population-based data. Indeed, if the entire population were enrolled in such plans (as might occur someday in a reformed system with universal coverage), the public health statistics system might be built largely on aggregated data from enterprise networks.

Since the 1994 election, Congress has considered proposals that would place an even greater emphasis on paternity establishment.

Even without comprehensive reform, electronic networks are being built in many areas of the country to link payers, plans, providers, and State agencies. One approach, known as the "community health management information system" (CHMIS), calls for developing not only connectivity among health care organizations, but also community-wide or statewide data repositories as part of broader efforts to measure and improve the quality and efficiency of health services. Minnesota and Iowa have passed legislation to create such systems; the John A. Hartford Foundation has provided grants to nonprofit organizations in these and five other states to develop CHMIS.

In still other areas, groups of providers and payers are building community health information networks (CHINs) to achieve connectivity. The CHINs do not typically include the data repositories aimed at achieving greater accountability for performance. However, even CHINs may obviate the need for special communication links to transmit birth certificate data from hospitals and health plans to State agencies. Under Minnesota's reforms, the Minnesota Health Data Institute, a State-recognized nonprofit institution representing purchasers and providers, is developing MedNet, a secure, nonproprietary "network of networks," linking major health plans' enterprise networks and other parties in the system. MedNet will begin transmitting birth certificate data among its initial functions during Phase One (1995–96).

In the State of Washington, a CHMIS demonstration project by another Hartford grantee, the Foundation for Health Care Quality, has used birth certificate data as part of a larger data set to calculate 23 indicators of obstetrical care at each of the State's 76 civilian hospitals. This Statewide Obstetrics Review and Quality System (StORQS) is intended to serve "as a national model for...community-based quality improvement initiatives using a database information 'utility'" (*10*). StORQS is now in its second phase, which includes public release of the data. Because it was undertaken prior to development of an electronic network, however, the project illustrates the problem of timeliness: the data being released in 1995 were from 1992. While a three-year delay may be tolerable for a research study, it is too long to provide guidance for either health care managers or consumers.

In an effort to improve data timeliness and accuracy, the State of Washington's Department of Health (DOH) is undertaking a project known as the Automated Birth Information Dissemination Effort (ABIDE) that aims to establish a birth data collection system needed not only for birth certificates but also newborn screening, child immunization, high-priority infant tracking, birth defects registry, maternal and child health referrals, and perinatal data including the administration of hepatitis B vaccine. Unlike the traditional process, the State's aim is to "develop automated procedures and network capabilities to disseminate appropriate sets of birth data from hospitals or birth centers to the public health laboratory, local health districts, DOH and...other agencies in a manner timely enough to support operational needs" (*11*). This is the kind of comprehensive perinatal data system that many advocates of improved child health have sought.

The lack of such systems in the United States has bottled up data with public health value. In our survey, 40 State vital statistics offices reported producing data for public health followup—16 produced files with individual data, 12 produced only aggregate data, and 11 both aggregate and individual data (1 did not answer). Among the most common uses of the individual data were programs targeted to low birth-weight and high-risk babies. If such efforts are to be effective, however, birth data will have to move faster than it does now. Similarly, public health information systems need to be fundamentally redesigned to promote immunization through such measures as automatically generated reminders to parents. Although information systems alone cannot improve birth outcomes or immunization rates, they can be a key instrument in achieving better results at lower cost through targeted interventions and ongoing monitoring of program performance.

A Reformed Vital Statistics System

In an account of the development of vital statistics in the late 19th and early 20th centuries, the historian James H. Cassedy notes: "Elaborate systems recorded the birth, activities, and death of every pedigreed horse, cow, dog, or cat in the United States, long before people were similarly honored. Individual states often required regular counts of oyster, terrapin, and game, but many never kept records of babies" (*7*). While the United States now does count babies, it uses a system that is still archaic by comparison with those used to track commerce and finance.

New technology and reengineering would help vital statistics cross the threshold into a new era. As an improved system for birth data takes shape, a corresponding effort to improve mortality data is also proceeding. NCHS now has a steering committee on reengineering the death registration system, New Hampshire has an EDC, and new software is being tested in Minnesota and the District of Columbia.

An advanced network for data on births, abortions, and deaths would elevate vital statistics from its relatively passive role of producing documents and aggregate data into a more active force, setting in motion such processes as the start of insurance coverage, opening of an immunization log, and identification of poor outcomes at hospitals. Statistical data would be available on a timely basis to spot problems and improve outcomes. Such a network would reduce the current bureaucratic imperative for each agency to create its own databases and to hoard information. And it would help meet legitimate demands for information needed for welfare, child support, and health policy. Electronic storage and production of documents can also provide at least as good protection of confidentiality as a paper system and better customer service. The reinvention of vital statistics illustrates that even unglamorous measures to reinvent government can accomplish a great deal.

Dr. Starr is professor of sociology at Princeton University. Sandra Starr is director of the Office of Information and Technology Development at the Health Research and Educational Trust (HRET) of New Jersey.

Support for this research was provided by HRET and by the National Institute of Child Health and Human Development of the Public Health Service under Grant No. RO1 HD19375-10 to Professor Sara McLanahan of Princeton. Rona Remstein of HRET conducted the survey for this article.

Readers interested in a copy of the article may download it from the World Wide Web at <http://www.princeton.edu/~starr>.

References

1. Hammer, M., and Champy, J.: Reengineering the corporation. HarperBusiness, New York, 1993.
2. Barzelay, M.: Breaking through bureaucracy. University of California Press, Berkeley, 1992.
3. Gore, A.: Creating a government that works better and costs less: the report of the national performance review. Plume, New York, September 10, 1993.
4. Osborne, D., and Gaebler, T.: Reinventing government. Addison-Wesley, Boston, 1993.
5. Williams, R. L.: Automated perinatal information system. Final Report, Maternal and Child Health Special Project (SPRANS), Community and Organization Research Institute, University of California, Santa Barbara, March 1987.
6. Williams, R. L., Marinko, J. A., and Chen, P. N.: AVSS: An automated vital statistics system. Health Data Systems, Santa Barbara, CA., August 1981.
7. Little, E. K.: Streamlining birth certificate processing with technology. Top Health Information Management 14: 29–36 (1994).
8. Peng, T., et al.: An integrated hospital information system based obstetrical medical record and data base. Proceedings of the Annual Symposium on Computer Applications in Medical Care, (IEEE): 588–602, 1991.
9. McLanahan, S. S.: The consequences of single motherhood. Am Prospect 18: 48–58, summer 1994.
10. StORQS Project Office: StORQS II Project, 1992 Washington State data, final report to the Foundation for Health Care Quality, vol. 1. Seattle, Nov. 1, 1994.
11. Washington Department of Health: Automated birth information dissemination effort (ABIDE)—Project Kickoff. Olympia, Nov. 7, 1994.
12. Cassedy, J. H.: The registration area and American vital statistics: development of a health research resource, 1885–1915. Bull Hist Med 39: 221–231 (1965).