

The Autopsy Crisis Reexamined: The Case for a National Autopsy Policy

ROLLA B. HILL and
ROBERT E. ANDERSON

University of New Mexico, Albuquerque

IN 1950, AUTOPSY PRACTICE REACHED ITS ZENITH IN the United States. Autopsy was conducted on one-half of the patients who died in American hospitals (Roberts 1978). Teaching hospitals took pride in far higher rates—90 percent of deaths was not uncommon. Not only was serious attention to autopsy performance considered to signal a high-quality hospital (MacEachern 1952), but it was also an article of faith that the quality of medical education was greatly influenced by the number of autopsies available for use in teaching; furthermore, the autopsy rate was among the criteria used by top medical students in evaluating candidate hospitals for their internships.

Attending physicians, particularly in teaching hospitals, were driven by an internal code that prescribed autopsy with every death; these clinicians always attended the autopsy, and required their interns and residents to do likewise. Medical students and their teachers followed their patients to the autopsy room, vigorously discussed the findings, compared them with clinical impressions, and regarded the occasion as an important learning experience.

*The Rise and Decline of Autopsy Practice
in the United States*

Fifty years earlier, at the turn of the century, Sir William Osler proclaimed his dependence on autopsy, personally performing nearly 1,000 cases before he arrived at Johns Hopkins, and regularly leading his retinue to the autopsy room to observe and learn. Abraham Jacobi, later president of the American Medical Association, in 1900 stated to an International Congress in Paris that the practice of medicine was “not only diagnosis and autopsy, but the treatment and care of patients” (Jacobi 1900). So highly did his academic colleagues value the autopsy at the turn of the century that it was thought the equal of diagnosis, and Jacobi felt constrained to remind his distinguished audience that treatment and care must not be ignored!

All this took place, however, in major teaching centers. The same attitude was not prevalent in wider medical circles. In 1912 only three major hospitals in the United States autopsied as many as 40 percent of deaths: the Johns Hopkins Hospital and two hospitals associated with the University of California in San Francisco (Oertel and Lewinski-Corwin 1913). Elsewhere in this country the rate was more often 10 to 15 percent, severalfold lower than in the major teaching centers of Canada, Germany, Great Britain, and Austria (Oertel and Lewinski-Corwin 1913).

In the medical centers, nonetheless, physicians pondered carefully the results of autopsies on their own patients. Eventually, major studies of accumulated autopsy records were undertaken, and when premortem diagnoses were compared with postmortem diagnoses, they revealed, in the words of a leader of Boston medicine, a “humiliating proportion of clinical diagnoses discovered to be incorrect at autopsy” (Cabot 1912), a pedagogic revelation that he later formalized in the Weekly Clinicopathological Conferences of the *New England Journal of Medicine*. This led others to press harder yet for more autopsies, and the autopsy rate rose slowly to reach its peak of 50 percent in 1950.

Today, once again, autopsies are uncommon. The national average currently is about 12 percent (Centers for Disease Control 1988) (where it was in 1912), and in many hospitals fewer than 5 percent of deaths are autopsied. Major teaching centers average 31 percent, and only a handful exceed 50 percent (Anderson and Hill 1988). Thus, in a period

of less than 60 years, autopsy practice in the United States has undergone a complete cycle, from an uncommon but prized procedure, to a general standard of quality, and back to a rarity.

Reasons for the Decline, and Its Effect

The reasons for the decline are many (Hill and Anderson 1988), and can be traced to shifts within the larger society, changes in the practice of medicine, and new technology in the field of biomedical science.

First, in society at large, medicine is not the mystery it once was, and physicians are no longer respected and obeyed without hesitation or fear. People are disinclined to take the advice of physicians without considerable discussion. Surviving families are knowledgeable about and concerned with events surrounding death. When the doctor suggests an autopsy, suspicions and fears arise, and *Miranda*-like legal requirements make obtaining consent for an autopsy very difficult.

Second, within the practice of medicine itself, clinicians view death as a failure and do not want to dwell on postmortems and recriminations. Medical educators have lost sight of the usefulness of autopsy in medical education. Autopsy methods have not kept up with the times: quality control is poor, reporting is lengthy and late, and techniques are archaic. Pathologists find more satisfaction and higher financial rewards in operating-room interventions and clinical consultations.

Third, biomedical science and technology have advanced with such breathtaking speed that many clinicians delude themselves into believing that modern scientific technology provides all the answers while autopsy reveals nothing.

Whatever the relative importance of these factors, it is clear that the internal motivations that led to the rise of autopsies are no longer operative.

These three constituencies—society, medical practice, and biomedical science—that provide the major reasons for the decline of the autopsy ironically are the same constituencies that lose thereby. In society, the surviving family loses the opportunity for a meaningful contribution to assuagement of grief; possible information of value regarding infectious disease; death benefits due to occupational or environmental disease; and genetic counseling in cases where a familial disorder may have existed. In a later section, we will explore the losses to society of

accurate vital statistics and quality assurance of medical care. In medicine, pathologists miss the opportunity to be involved in the final grand diagnostic exercise, a matter of scientific interest and social good. Physicians-in-training lose the advantage of learning the anatomic basis of disease, while physicians in practice lose chances to discover new diseases, observe the results of new operations, new procedures, and new therapeutic drugs, and improve their own expertise. Science suffers from the lack of the materials and knowledge for further breakthroughs that autopsies provide.

Medical examiners' offices, where autopsies are required by law, remain a major repository of autopsy practice, and society continues to reap the rewards for justice and law. For the remainder of this article, we will be referring to the medical or hospital autopsy; the forensic autopsy does not need our attention.

Historical Role of Public Policy and the Autopsy

The short-lived autopsy fever in this country was not uniform in the Western world; an examination of other experiences is revealing. For example, at the very dawn of modern autopsy practice, in the late eighteenth century, far-sighted physicians in the court of the Austrian Empire realized the value of public-health surveillance through autopsy. They influenced imperial policy to require autopsy on *all* patients who died in the public hospitals; that policy, or a modification thereof, persists to the present in Austria and in countries of central Europe that derive from the Austrian Empire. As a consequence, physicians and health-policy watchers in Austria, Czechoslovakia, Poland, and Hungary have observed with some bemusement the rise and fall of the autopsy in other countries. Similarly, in the Scandinavian countries there has long been a government policy of presumed consent to autopsy, with right of refusal, which strongly favors autopsy performance, although this is being slightly eroded as a result of recent changes in law (Svendsen and Hill 1987).

In our country, however (and in Great Britain and certain other European countries), there are no requirements, rules, regulations, or laws imposed by external agencies that encourage the performance of autopsies. The high rates of the 1950s were achieved solely through internal

motivation. Governmental involvement in autopsy practice has been limited to two items, neither of which has been helpful. First, each of the several states has enacted consent laws, which vary from being moderately to extremely restrictive (Schmidt 1983). At their most extreme, the rules about who must give consent and under what circumstances virtually guarantee that autopsy permission is unobtainable (Hill and Anderson 1988). Second, the Health Care Financing Administration (HCFA) declared that the autopsy, of no use to the involved patient, is not a medical procedure, and that therefore, under Medicare, pathologists are not eligible for reimbursement for performing autopsies, in the way that surgeons are for removing a cancerous lung. Because an autopsy often requires more time, thought, and skill than a major surgical procedure, pathologists themselves have been less than enthusiastic about pushing for more autopsies.

Thus, in countries where autopsy performance is encouraged by governmental regulation, autopsy practice has remained active (Svensen and Hill 1987). Government is, however, not the only source of policy. In medical practice and education, a number of quasi-public voluntary bodies have provided a considerable measure of regulation. For instance, to the Liaison Committee on Medical Education (a joint program of the American Medical Association and the Association of American Medical Colleges) is given the right to inspect and accredit the medical schools, based on the quality of the education provided. Although for years it inquired into the numbers of autopsies available, there was never any specific requirement for their use in medical education. The Accreditation Council for Graduate Medical Education (formerly the Liaison Committee for Graduate Medical Education) has never had a requirement for autopsies. The Joint Commission on Accreditation of Healthcare Organizations (formerly the Joint Commission on Accreditation of Hospitals) suggested for many years that hospitals should achieve an autopsy rate of 20 to 25 percent on patients dying in their care, but it was not a requirement, and it was removed in the early 1970s when it became clear that hospitals could not achieve that level. The American Medical Association and the Association of American Medical Colleges were mute until very recently. A few years ago the Institute of Medicine brought together a task force for a one-day meeting, and decided that a study should be undertaken to determine *whether* a national policy on the autopsy was appropriate. That study has never been started.

Historical Benefits of Public Policy on the Autopsy

Historically, autopsies, performed as public policy, provided much of the scientific knowledge that underlies modern medicine. In the middle of the eighteenth century Maria Theresa, Archduchess of Austria, after listening to such reformers as Dr. Gerhard von Swieten, made autopsies mandatory for persons dying in the public hospitals of Austria. With this unprecedented measure, she started two critical chains of events that led to modern understanding of disease and public health. One of these received its impetus a few years later when Giovanni Batista Morgagni "convinced the medical profession that advancement of medicine rests in sound clinicoanatomic correlation" with his brilliant pioneering studies of autopsies (Tedeschi 1974). Austria, through its autopsy policy, was prepared to take up this challenge, and Karl Rokitansky was the right man to do it. At the age of 24, in 1827, he became director of the Pathology Institute of the huge Vienna General Hospital, and over the next 33 years he performed or supervised approximately 60,000 autopsies. The result of this monumental feat was no less than a catalog of human disease, a listing that differs remarkably little from the present-day version.

The second set of events made possible by the Austrian autopsy policy had its start in another of Maria Theresa's medical interests, shared by her sons who followed her to the throne: public health measures. Their advisers recognized that autopsies were a key source of valid death statistics, which would allow the development and implementation of rational policies, aimed at specific health hazards. It is not too far fetched to suggest that this approach, which permitted the accumulation of accurate statistics on causes of death, contributed eventually, by clearly identifying the major scourges of the era, to the development of wholesale vaccination, potable water supplies, sewage-disposal systems, and similar broad public-health initiatives.

It is informative to realize that public agencies in this country have never recognized the importance of autopsy data in formulating aspects of health policy. Early on, even medical leaders did not consider autopsy as a potential *public* good: Osler and other proponents of autopsy at the turn of the century emphasized the value *to the individual physicians* of viewing the depredations of disease in their own patients. Even during the heyday of autopsy practice in this country, autopsy

data were not accumulated, analyzed, or used in any systematic manner: the high autopsy rate was achieved by physicians, for their own edification and improvement, through viewing the diseased organs of their own patients. Even today, eminent physicians who bemoan the disappearance of the autopsy do so because autopsy has a "diagnostic yield," that is, it provides value for the physician by correcting diagnoses made incorrectly during life. Organizations in the medical field that are concerned with quality of care and of medical and residency education, cost of care, and distribution of research dollars have not focused on autopsy data as a source of information that they could use in their pursuits.

Public Policy or Private?

If broad policies regarding performance and utilization of autopsies would benefit the public, medical practice, and biomedical science in this country, should they emanate from private constituencies, or should they be introduced as public policy? Organ donation, which is similar in some respects to autopsy, has benefited greatly from a relentless and vigorous effort by the private sector, spearheaded by transplant surgeons, and greatly aided by medical ethicists, medical lobbies, the media, and celebrities. Is it conceivable that such an effort in the private sector could arise with respect to the autopsy, whose benefits are far less immediately recognizable? Or should this country consider a broad, supportive public policy on the autopsy?

Recently, this debate has started in some organizations that are concerned with health policy. The Institute of Medicine, for instance, has taken the position that "the time has come to reexamine the importance of autopsies" with an eye to possible development of a national policy on autopsies (Holden 1985). The Administrator of HCFA has been quoted as "being concerned about the decline in autopsies," and as questioning whether the HCFA should "impose more rigorous requirements for autopsies" (Altman 1988). The Liaison Committee on Medical Education has added a section on autopsies in the materials that they use in examining and accrediting the medical schools of this country. The Association of American Medical Colleges recently convened a working group to study the importance of decreased numbers of autopsies on the education of medical students. The American Med-

ical Association has weighed in with a vigorous formal policy extolling the importance of autopsies.

Autopsy Policy and Societal Good Today

If autopsy policy in Austria greatly influenced the development of modern medicine, and had an impact on the development of public-health measures in the eighteenth and nineteenth centuries, what about the present? Will policy that assures the performance of large numbers of autopsies contribute today, as it has in the past, to the development of medical practice and science, and the improvement of public health?

Medical Practice and Science

The answer to that question for medical practice and science may well be, "Yes, but quite differently than it has in the past." Up to the turn of the century, autopsy contributed immensely to the discovery or characterization of a number of new diseases, but the rate of discovery since then has been slow (Hill and Anderson 1988), and it is not clear that increasing the number of autopsies will speed it up. No doubt diseases will continue to be discovered at autopsy, but that well is now considerably less productive.

On the other hand, as the tools and knowledge base of medicine have become more complex, the solid underpinning that autopsy studies contribute to the understanding of disease processes has gradually failed. For example, geriatric medicine has introduced a new set of problems and variables. Old people are more likely than young to have multiple disease processes, and physicians have not yet developed the skills to know whether a new symptom indicates a new disease or simply an extension of the old disease. Comorbidity is the term used to denote the existence of several diseases in one person. Puzzling interactions between the coexisting diseases produce new manifestations and new complications. Autopsy studies on the aged could do much to unravel the complexities of this problem. Old people also have chronic, irreversible, and progressive diseases, and cumulative effects of long-standing chronic deterioration have not been sorted out through analysis of thousands of cases at autopsy. Unfortunately, the autopsy rate is

lowest in the aged, amounting to 1 to 2 percent of deaths, making it unlikely that the understanding provided by autopsy study will become available.

Another area where careful autopsy studies could help greatly can be found in the complications of therapy by new generations of increasingly powerful, harmful drugs. Aggressive approaches to cancer, for example, involve the use of drugs whose extremely destructive effects fall on healthy as well as cancerous tissues. It is startling to hear that virtually none of the multi-center programs for the evaluation of cancer-treatment regimens included in their protocols a formal strong autopsy program.

Thus, autopsies can again provide medical revelations, as they once did for Rokitansky in Vienna, but they will be different. The value of autopsy to the progress of medicine is changed. The potential contributions of autopsy to public-health policy goals are equally important, specifically with regard to the accuracy of vital statistics and the quality of medical care.

Vital Statistics

The extent to which health policy in the United States is driven by scientific data, as opposed to political considerations, is problematic. Public policy is established by the public, not by scientists. We like to think, however, and will assume in this article, that both scientific data and political realities play major roles. For example, health statistics provided by such agencies as the National Center for Health Statistics (NCHS) indict heart disease as the number-one cause of death; surely, the amount of money appropriated by Congress for the National Heart and Lung Institute (NHLI) to support research in cardiovascular disease is affected as much by those data as by the political clout and persuasiveness of the director of the NHLI and the cardiovascular lobby. Such decisions are of course the result of complex interactions, and we do not wish to oversimplify; the point is that to the extent that data are important in such decisions, to that extent the accuracy of the data is critical.

Data are available for a very large array of diseases and medical conditions, and are widely used in studying the impact of environmental, social, economic, demographic, and other factors on health. The data that specifically reflect health statistics are derived by the NCHS from

death certificates. In this country, after every death, a death certificate is completed by the appropriate physician, and copies make their way to the local, state, and national files (Kircher 1990).

Unfortunately, there is an uninterrupted stream of evidence that death-certificate data are grossly unreliable. Dozens of detailed studies of death-certificate reliability have uncovered major errors in up to 50 percent of cases! (Hill and Anderson 1988). The relevant literature is punctuated by laconic understatements such as "Death certificate diagnoses are insufficiently accurate to permit their use as a reliable indication" of the cause of death (Barclay and Phillips 1962), and "Expectations for the use of mortality data to support detailed studies of health patterns and disease causation from our national death registration system as currently constituted are unrealistic" (Glasser 1981). The outraged editor of a major pathology journal fairly sputtered in indignation, referring to official mortality statistics as a "wonderland" (Wagner 1987). Even the director of the National Center for Health Statistics was recently quoted to the effect that the diagnoses listed on death certificates are "far from perfect" (Altman 1988).

There are many reasons for this lamentable state. Physicians do not view completion of a death certificate as an important task, and in fact doctors often do not understand precisely what is being asked of them (Kircher and Anderson 1987). For example, the meaning of "underlying cause of death," a crucial entry on the certificate, is obscure to most. Few medical schools or residencies provide instruction, and physicians learn to complete a death certificate from others who are equally uninformed. As a result, the certificate is generally dealt with hurriedly and perfunctorily. Even if an autopsy is to be performed, the usual practice is to complete the death certificate before the autopsy results are known—often before the autopsy is started—and only recently have some states introduced a mechanism that makes it easier to correct a flawed death certificate. Furthermore, dozens of studies have revealed that a minimum of 10 to 25 percent of major premortem diagnoses are unequivocally inaccurate (Hill and Anderson 1988). Thus, even with extreme care in completing the death certificate, without autopsy there will be at least 10 to 25 percent major errors.

Sweeping aspects of health policy continue to be based on epidemiologic studies using grossly inaccurate death-certificate data. This practice cries for correction. Policies that lead to more frequent use of autopsy, early and careful completion of autopsy reports, informed

completion of death certificates, and delay in filing certificates until the autopsy results are known would go far to ameliorate the situation (Kircher 1990).

A single example of the problem can be briefly noted. Alzheimer's disease causes progressive senility, primarily in elderly people. A number of putative causative agents—toxic chemicals, viruses, bacteria, vascular diseases—have been implicated and later exonerated. A great many good aluminum cooking pots went to the junkyards when aluminum leached from the pots into the cooking water and eaten with the food was thought to cause Alzheimer's; although this story may not be complete as yet, most studies seem to exonerate aluminum. Yet we do not even know the true incidence of Alzheimer's disease, and estimates of its prevalence vary widely. The term is often used indiscriminately as a diagnostic wastebasket for most forms of senile dementia, which may be due instead to vascular disease, tumors, or other degenerative or infectious diseases. The only certain way to make the diagnosis is by autopsy, and the autopsy rate among the elderly is between 2 and 3 percent (Ahronheim, Bernholz, and Clark 1983; Champion et al. 1986). Thus, it seems unavoidable that we *do not even know* the true extent of the problem, and cannot possibly grapple sensibly with the problems of differential diagnosis.

Quality of Care

We do not offer autopsy as the definitive answer to the search for quality assurance of medical care. There is a tendency to hyperbole among some autopsy proponents, who are convinced at a visceral level that performing autopsies *must* be good for the quality of medical care. For example, one such enthusiast, a distinguished clinical pathologist, published an interesting educational exercise that he had performed, in which he discussed with his fellows and residents each week all autopsied cases, particularly looking at errors of clinical judgment that were uncovered by autopsy, and their relation to laboratory testing. His *assumption*, unfortunately untested, that this process "benefited medical care" was so compelling that he called the autopsy "the ultimate audit" (Gambino 1984). Another equally distinguished physician, an internist in this case, referred to autopsy as "a perpetual cornerstone of the auditing of the quality of medical care" (Goldman 1984). Other respected spokesmen have made similar statements (Burn et al. 1956; Ebert et al.

1974; Emergency Care Research Institute 1984; Landefeld et al. 1988; MacEachern 1952; Pounder et al. 1983; Scottolini and Weinstein 1983).

Although autopsies have the power to audit some aspects of medical care, it is yet to be shown that simply conducting autopsies and publicizing the findings will be of direct benefit to the involved physicians (Saladino 1984). A beneficial effect of autopsies on the quality of care remains a matter of faith. In fact, various observers have pointed out that just performing an autopsy does not bring about improvement in medical care: something must be done with the results that leads to changes in the practice of medicine (King 1973; Saladino 1984). It is extremely difficult to change the behavior of physicians by simply bringing errors or deficiencies to their attention (Institute of Medicine 1976). Eisenberg points out that for such feedback to be effective, specific programs must be designed; such "programs are most likely to be successful if the data are individualized, if doctors are compared with their peers, and if the information is delivered personally by a physician in a position of clinical leadership" (Eisenberg 1986).

Improving the diagnostic abilities of individual physicians through audit of causes of death is just one potential way of affecting the quality of medical care. Other proposals using the autopsy have been made. Concentrating autopsy efforts on certain groups of patients might be expected to provide a particularly high yield. For example, if all patients who died while being administered a new drug were autopsied, the collected findings might be expected to provide early information about its effectiveness, or early warnings about unanticipated effects. Autopsies on all persons who have worked in environments suspected of harboring toxic hazards should quickly provide some information about the danger of those environments. When a new disease is identified and tentatively characterized, autopsies on all patients whose death is suspected to be due to that disease would quickly fill in many gaps of knowledge.

None of this is being done in the United States. Most commonly, the data that come from autopsies are simply lost, or, as Nelson puts it, they become "orphan data" (Nelson 1976). The routine conduct of large numbers of autopsies, performed without clear purpose, and with loss of the resultant information, probably does not have the intrinsic value that has been attributed to it. Some have even called for discontinuing autopsy except in special cases.

We are convinced, however, that if autopsy practice is improved, there remains a great potential for enhancing the quality of medical care. We have focused on one major, specific, and extremely important component of medical care, which is ideally suited for quality assessment by autopsy. We refer to accuracy of diagnosis and the process by which a diagnosis is reached.

Accuracy of diagnosis is by no means the only important factor in the quality of medical care. Therapy, prognosis, patient satisfaction, and outcome are four important others. Effectiveness of therapy may be reflected in autopsy findings, but accuracy of prognosis, patient satisfaction, and outcome are not easily tested at autopsy. In the continuum of medical care, diagnosis is first; therapy is chosen and applied in response to that diagnosis; prognosis is made based on that diagnosis; and the outcome is presumed to result from the interaction of the therapy with the diagnosed disease. Because therapy, prognosis, and outcome all flow from diagnosis, accuracy of diagnosis is clearly critical. Equally important, it can be measured.

A large number of studies over the past several decades have documented the fact that the process of making diagnoses is not infallible. We have already quoted from the first such study (Cabot 1912), whose author found it “humiliating” that so many diagnoses made during life were found to be incorrect at autopsy. In the three quarters of a century since that study, there have been vast changes in medical knowledge, diagnostic modalities, and therapeutic possibilities, yet the percentage of major discrepancies between premortem and postmortem diagnoses has been surprisingly stable: 10 to 30 percent in various studies (Anderson 1984; Battle et al. 1987; Goldman et al. 1983; Hill and Anderson 1988; Landefeld et al. 1988; Pounder et al. 1983). There is no evidence yet that modern technology—CAT scan, MRI, endoscopy—has had a significant effect on the *overall* discrepancy rate, or that massive use of the clinical laboratory has been particularly effective in narrowing the margins of error (Goldman et al. 1983). Evolutionary changes have occurred, and some diseases are more often correctly diagnosed than they were 50 years ago; however, diagnostic ability in other diseases seems to have slipped.

The medical diagnosis is the product of a complex reiterative process of information gathering and analysis (Parrino and Mitchell 1989), which has been called medical diagnostics. We avoid calling it “medical diagnosis” because that is the term used for the end result of the pro-

cess. Medical diagnostics is, then, the technique by which diagnoses are made, and the predictive value of that technique can be measured by the accuracy of the diagnosis. We have studied the accuracy of medical diagnoses in over 50,000 published autopsied patients, and derived sensitivity and specificity of the diagnostic process for 11 specific diseases during the period 1930 to 1977 (Anderson, Hill, and Key 1989). This study has shown that accuracy of medical diagnostics may differ sharply from one disease to another, even among fairly common entities. Fatal pulmonary embolism, for instance, is missed up to 50 percent of the time, whereas fatal leukemia is almost always diagnosed premortem. Furthermore, error rates change, up or down, with time. Gastric carcinoma, peritonitis, and carcinoma of the lung, for example, appear to be less accurately diagnosed than previously, whereas rheumatic heart disease and leukemia are more accurately diagnosed.

In a study of 1,106 autopsies performed over a seven-year period at the Washington, D.C., Veterans Administration Hospital, Gruver and Freis concluded that the most common cause of diagnostic error was an error of omission or error of judgment on the part of the attending physicians (Gruver and Freis 1957). This study, performed during the period 1947 to 1953, antedated many of the modern technological advances, and one might therefore assert that the new technology would overcome the physicians' errors. In fact, however, more recent studies have replicated that finding. For example, a recent study of diagnostic failures in myocardial infarct (Zarling, Sexton, and Milnor 1983) indicated that *too much* reliance on technology can lead the diagnostician astray. In a substantial number of cases in which the history and clinical findings strongly suggested myocardial infarct, but the results of tests were not corroborative, patients died without treatment. The recently publicized failure rate in mammography is yet another case in point. Physicians dismissed patients' reports based on self-examination when mammograms failed to detect lesions. The diagnostic efficacy of properly functioning machines and appropriate testing depends on the judgment, skill, and wisdom of the user.

Although many physicians would like to believe it is not so, medical diagnostics is not perfect, and study of cases in which inaccurate diagnoses were made might be expected to yield clues to better future performance. A simple measure of accuracy of medical diagnostics is not sufficient, however. An inaccurate diagnosis may be reached for one of several different reasons. Gorovitz and MacIntyre have proposed (1976)

a classification of reasons for diagnostic errors; our slight modification of their classification appears in table 1. This classification recognizes errors with the following origins: imperfections and gaps in current scientific medicine; what Gorovitz and MacIntyre term necessary fallibility; physician oversight; and willful acts on the part of the physicians. In a closely reasoned argument, Gorovitz and MacIntyre make a case for the concept of necessary fallibility, a murky area of decision making confounded by the unpredictability of interactions in the patient-physician interchange. Errors are inevitable, they assert, simply because of the fickle nature of the interaction between the ever-changing environment and the uncertainty of the scientific particulars on which a specific prediction is based (Gorovitz and MacIntyre 1976). Quality assessment is most concerned with the third type of error, physician inadequacy, because it is the one most susceptible to improvement.

A second aspect of diagnostic inaccuracy that deserves attention, in addition to the number of errors compared with an acceptable standard, is the question of the magnitude or severity of the error. We have also addressed this aspect, utilizing a modified classification of severity first proposed by Goldman et al. (1983) (table 2). In this scheme, magnitude or severity is related *not* to the degree of error in the process of medical diagnostics, but rather to the magnitude of the real or potential impact of that error on the patient's well-being.

TABLE 1
Types of Medical Error by Cause

| Cause of error | Outcome |
|---|--------------------------|
| Limitations in the current level of medical knowledge | Clearly unavoidable |
| "Necessary fallibility": arising from the fickle nature of the environment and the scientific particulars on which a specific prediction is based | Unavoidable |
| Limitations of knowledge or skill of physician | Remediable |
| Willfulness or malice | Judicial action required |

Source: Modified from Gorovitz and MacIntyre (1976).

TABLE 2
Classification of Diagnostic Discrepancies or Severity of Result

| Class | Description |
|--------------|--|
| <i>Major</i> | |
| 1 | Discrepancy of a primary ^a diagnosis, with adverse impact on the patient's survival |
| 2 | Discrepancy of a primary ^a diagnosis, but with equivocal impact on survival |
| <i>Minor</i> | |
| 3 | Discrepancy of a secondary ^a diagnosis that was not directly related to the cause of death, but either (a) was symptomatic and should have been recognized and treated, or (b) would have eventually affected prognosis |
| 4 | Discrepancy of a secondary ^a diagnosis that could not have been recognized before death |
| 5 | Nondiscrepant diagnosis |

Source: Modified from Battle et al. (1987).

^a Primary diagnoses are those involving the principal underlying causes of death and major contributors thereto, whereas secondary diagnoses are antecedent conditions, related diagnoses, contributing causes, or other important conditions.

Keeping these variables in mind, we have designed a quality-assessment program for medical diagnostics that is not difficult to implement (Anderson, Hill, and Gorstein 1990). For such a program to be credible, however, a number of conditions must be satisfied. Autopsy must be shown to be an accurate, reproducible technique for gathering the appropriate data: that is, the autopsy itself must be controlled for the quality of the accuracy, usefulness, and timeliness of the reporting of the resultant data; there must be appreciation of environmental, demographic, geographic, and similar factors that can influence discrepancy rates; control values or ranges of accuracy for a wide range of diseases must be available; there must be review of the data by an independent body, with recommendations as appropriate; and a mechanism must exist for obtaining a sufficiently representative sample of hospital deaths to permit statistical reliability.

This process makes it possible to go beyond mere assessment of quality and pinpoint specific diagnostic efforts that can be improved. If a given hospital, for instance, has exemplary performance in nearly all di-

agnostic areas, but repeatedly is out of control for diagnosing tuberculosis, specific efforts can be directed to improving these procedures. Equally important, this scheme, being blind to value judgments, uncovers outstanding performance as readily as lapses.

Finally, by providing a scientific basis for a permissible baseline of error in diagnosis for each disease, it opens a window onto new vistas for dealing with the extremely vexing medical-liability insurance problem. Although the question of malpractice generally arises as a result of an unfavorable *outcome*, if the accumulated autopsy data reveal that outcome to be the result of a normative error in diagnosis, the legal position is changed.

Other Values

We have not attempted to discuss all of the potentially important autopsy-related values for society, medicine, and science that impact on public policy. Discovery of "clusters" of occupational or environmental disease, identification of incipient epidemics of infectious disease, evaluation of new diagnostic or therapeutic modalities, and fundamental importance in the education of physicians and other health workers are just a few more. In a sense the autopsy has characteristics of a public good: its benefits are nonappropriable, indivisible, and potentially widely distributed (Nemetz, Ludwig, and Kurland 1987). For all of these reasons, a serious look at the need for public policy is warranted. In the continued absence of a public policy that supports autopsy performance, these benefits will not be realized. Standards, guidelines, and policies will be required to assure that sufficient numbers of autopsies are performed, and the findings of those autopsies put to appropriate use in the service of the public, the doctors, and the scientists.

Implications for Public Policy

During the formulation of these policies, there are a number of issues to address and obstacles to overcome.

1. *Numbers.* The percentage of deaths that are autopsied in this country presently stands at about 12 percent (Centers for Disease Control 1988). These are almost entirely hospital deaths and forensic cases; the rate among those who die quietly outside of hospitals is consider-

ably less. Who gets autopsied is strongly influenced by a variety of pressures—physician enthusiasm or resistance, family feelings—that are very likely to produce a nonrepresentative sample (Wells et al. 1988). For instance, most studies indicate that older people are much less likely to be autopsied than the young; the ratio between males and females is higher than in the general population; ethnic and religious factors are important. A few decades ago, among patients dying in hospitals, blacks were selected for autopsy more frequently than whites, relative to their proportion in the hospital population, but this ratio seems to be reversing. Some of these demographic variables have different influences according to circumstance: recent studies at a limited number of institutions have not detected a bias for autopsy either in demographic characteristics or clinical diagnosis (McFarlane 1987; 1989). In addition, whether such factors as complexity of illness or intensity of care introduce selection bias has not been investigated. Clearly, though, those who are autopsied do not constitute a representative sample of those who die.

In any case, the question remains: if not 12 percent, then how many, and how can they be selected to form a representative group? Unfortunately, there is no easy obvious answer. Different answers could be forthcoming, depending on whether one intends to satisfy the needs of health statistics, quality assurance, medical education, biomedical science, or something else. In the case of medical education, for example, the numbers need to be high, but only at teaching institutions, and whether they are truly representative of the larger population is of little concern. For the production of reliable death statistics, however, the sample must be truly representative of the decedents during that period. A small number of cases, chosen by an appropriate statistical sampling method, might suffice, but at present, in our society, mandatory assignment of decedents to autopsy would not be acceptable. Larger numbers, while they cannot ensure a better sample, make it easier to achieve the objective. An ingenious technique to predict the prevalence of specific diseases in a large population based on the prevalence in an unselected autopsy group has been reported, and may be useful in this regard (McFarlane et al. 1987).

For quality assessment, the sampling method and the number of cases will be dictated by the criteria chosen. The autopsy rate needed for quality-assessment purposes is to some extent driven by the rate of discrepancy between premortem and postmortem diagnoses that is

deemed permissible (Anderson, Hill, and Gorstein 1990). Small numbers are less costly, but magnify small differences between "expected" and "actual" prevalences. A balance between cost and return must be carefully considered.

2. *Consent laws.* Laws in various countries have been recently reviewed (Svendsen and Hill 1987). Laws in countries descending from the Austro-Hungarian Empire have made autopsy performance expected in all deaths in public hospitals, the family ordinarily having little say in the matter. In most of the Scandinavian countries autopsy is expected, but the family must be notified of their right to refuse. In some institutions, autopsy policy is explained in the informative literature that a patient and family receive on admission. In the United States, however, family consent must be sought and received, and in recent years, at the same time that the practice of asking for autopsy has been disappearing, the answer from the family, when asked, has increasingly been "no."

Thus, autopsy can be mandatory, directive, or permissive. Arthur Caplan, of the Center for Biomedical Ethics at the University of Minnesota, has called for a new approach in this country, similar to that for donation of organs. He points out that our present consent laws for autopsy make it purely voluntary for the physician and the family. He suggests a slight modification, namely, "required voluntarism," wherein the relatives or the patients themselves are required to make a legally binding decision for or against autopsy *in advance*, such as a mandatory check-off on the driver's license (Caplan 1984). Because organ-donor cards are already part of our culture, this would not be a wrenching change. Another possibility, requiring more attitudinal changes, has been proposed for organ donation (Matas et al. 1985), and is similar to the modern Scandinavian autopsy system. The proposal is for "routine removal with right of informed refusal"; for autopsy this would mean that unless an individual objected during life, or unless the family objects after being informed, autopsy would be "routine." This is the system in operation in several Scandinavian countries, where it appears to work well (Svendsen and Hill 1987).

One must recognize the possible allegation that routine removal of organs would deprive families of the opportunity to give the organs of their dead relatives as gifts. This gift relationship has been explored in detail in classic writings by Titmuss (1971) and Fox and Swazey (1974), and we have alluded to it with respect to the autopsy (Hill and Ander-

son 1988). It is undoubtedly true that a policy of routine autopsy would deprive people of the right to make the gift of their body, but as Matas et al. point out, that may not be sufficient grounds for denying this opportunity to have many more autopsies (Matas et al. 1985).

There are potential difficulties also in recognizing valid religious and customary objections to dissection after death. As religious beliefs evolve, these restrictions change (Geller 1984), but there remain some large groups (Orthodox Jews and Shiite Muslims, for example) for whom autopsy is forbidden.

3. *Quality of the autopsy.* Earlier in this article we alluded to the disillusionment of many pathologists with autopsy practice, which leads to two problems: (1) footdragging pathologists discourage clinicians from pursuing consent for autopsy from the survivors; and (2) disinterested pathologists perform poor-quality autopsies and create poor reports (Anderson and Hill 1991). The first is the more difficult, but, as we shall discuss, would be alleviated by realistic financial incentives. We have addressed the second in some detail, through the design of a quality-assurance program for the autopsy service (Hill and Anderson 1991).

4. *Cost and reimbursement.* This is a subject that has caused outrage among pathologists. For years, medical practice in this country has been based on fee-for-service: each visit, examination, procedure is billed and paid separately, a tradition that is currently being eroded by various new forms of medical-care delivery. Pathologists are particularly sensitive because fee-for-service is a recent, hard-won prerogative; until the 1960s the pathologist's usual situation was that of a salaried physician, paid as an employee of the hospital. Fee-for-service thus is a recent way of life for pathologists, who have found it to be quite rewarding, compared with the situation as it existed previously (Steinwald 1980).

Autopsy performance is one of the few major activities of pathologists that has experienced trouble changing from salary to fee-for-service. Insurance carriers and Medicare do not provide for a specific fee-for-service payment to pathologists for an autopsy. A common employment pattern for hospital pathologists provides a fixed reimbursement for management and autopsies, while the pathologists bill for other services. These contracts generally require the pathologists to perform all autopsies that come their way for a fixed sum. The payment, considerably less lucrative than that for clinical and surgical pathology,

does not increase with each added autopsy. These and other autopsy-related costs are paid from the general hospital account, and the hospital director therefore views the autopsy service as equivalent to the laundry or cafeteria: a money loser that must be accepted with modest grace, but wouldn't it be wonderful if it would just go away. Some pathologists have instituted a charge to the family—often quite high—that is not covered by insurance, and provides an effective deterrent to autopsy performance. All of the economic forces thus favor the nonperformance of autopsies. One hears frequently in conversations and debates: "If they'll pay for the autopsy, the autopsy rate will rise."

The autopsy problem cannot be solved without solving the reimbursement problem. Autopsies are not cheap—currently, costs are upwards of \$1,000 per case (McKeel 1986; Yesner 1978)—but they are after all only slightly more expensive than an endoscopy, and much less expensive than an appendectomy, let alone open heart surgery. Furthermore, the rewards are potentially distributed much more widely than to a single individual. Public policy must take into account the expense, the need to reimburse both the costs (facilities, equipment, instruments, linen, housekeeping, power, record-keeping, etc.) and the pathologist.

5. *Cost-benefit ratios.* This is a particularly knotty problem that defies quantification. Reduction of diagnostic errors is surely important, but is it important enough to the public to increase the already astronomical cost of dying? Reliability of data for public-health purposes is important, but is it important enough to increase further the already considerable cost of obtaining these statistics? What is the value of a new scientific finding derived from autopsy studies? These and similar questions must be addressed. Our feeling is that great benefits to society, medical care, and biomedical science are worth a great deal of money. Add to these the many other advantages of more and better autopsy services (Hill and Anderson 1988; Nemetz, Ludwig, and Kurland 1987), and the case becomes even more convincing.

6. *Organized medicine.* It is essential that organized medicine be recruited as an ally in the autopsy issue, and there is reason for hope. The leadership of organized medicine has taken strong positions in favor of increased use of autopsies. The House of Delegates of the American Medical Association (AMA) has adopted Substitute Resolution 11(A-84), which reaffirms that autopsies are of great importance, and calls for study of the impact of autopsy on education, research, quality

assurance, and other fields. The AMA's Council on Scientific Affairs presented a "comprehensive review" of autopsy (Council on Scientific Affairs 1987) adopted by the House of Delegates in 1986, which explores many of these issues in some depth. The editor of the *Journal of the American Medical Association* has repeatedly editorialized on the subject, going so far as to "declare war on the non-autopsy" (Lundberg 1983). The House of Delegates of the College of American Pathologists (CAP) has adopted similar resolutions. The National Medical Association has also adopted a resolution calling for a national effort to determine the role of autopsy in medical education and public health. These initiatives must be sustained, and further efforts by these and other organizations encouraged.

Who Should Accept Responsibility?

The climate in this country has moved us closer and closer to national standards for quality of care. When internal policing works, everything is fine. When it does not, the public demands controls. At present, the public perception is that all is not well with American medicine, and external controls are necessary.

Where, then, should the locus of responsibility lie? It is undoubtedly too early to be dogmatic about this, but we find the following scenario attractive: The Institute of Medicine moves ahead with its plan to conduct a major study on the need for a national autopsy policy. If the conclusion of this study is that the rewards of better autopsy practice are great, and a national policy is desirable, the first step is for private-sector regulatory, accrediting, and major professional organizations to undertake to do what they can within their separate purviews. The Liaison Committee on Medical Education can require significant use of autopsy in the education of medical students. The Accreditation Council for Graduate Medical Education can require that residents in all specialties discharge specific responsibilities with respect to autopsies on patients on their services, and that residency programs keep records of these activities. The Joint Commission on Accreditation of Hospitals can require that all accredited hospitals carry on programs for the assurance of the quality of medical diagnostics based on autopsy findings.

The College of American Pathologists' Laboratory Accreditation Program can require evidence that autopsies are performed and reported promptly, correctly, and usefully.

However, all of this will not be enough. The problems of consent, payment, and accuracy of death statistics are not in the private domain. State governments, and even the federal government, control these issues. Governmental agencies, then, will need to be involved. This may be difficult: governmental agencies have not previously entered the health-policy field with laws and regulations regarding the quality of death statistics or the quality of medical care, and it is not self-evident that something as specific as accuracy of medical diagnosis is a key to improved quality of care. However, as the media and consumer groups become increasingly strident in their cries for assurance of quality, the relationship between accuracy of diagnosis and treatment effectiveness or outcome will be able to surface. One consumer publication, the *People's Medical Society Newsletter*, has already called for more autopsies (People's Medical Society 1989), although it did not mention that no autopsy is performed (outside of medical examiners' and coroners' cases) unless the consumer agrees. It is quite possible that governments will respond with action.

With respect to death statistics, the NCHS and the National Committee on Vital and Health Statistics recently convened an invitational meeting to "consider ways to improve the quality of mortality statistics for the United States." The informational material circulated prior to this meeting made the following points:

Physicians are generally not well informed about the importance of accurate reporting.

Physicians often do not understand how to complete appropriately the death certificate, especially in relation to the concepts of underlying and contributory causes.

There are problems with the confidentiality of death certificates . . . that place the physician in a position of having to deal with social pressures not to report sensitive causes [of death], such as AIDS, suicide, substance abuse, etc.

Thus, this governmental agency adds its concerns to those of other public and private organizations. Perhaps there is hope that together they may reach a consensus and provide the impetus for change.

Conclusion

The recent decline in the autopsy rate in many Western countries, including the United States, has had a number of untoward consequences. Many of these have an adverse impact on society as well as medicine. Nations that have retained a high autopsy rate have done so under a public-policy mandate. The time has come in the United States for a public policy to assure that the values to society that potentially derive from a carefully developed autopsy practice will not be lost. Some of the difficulties to be surmounted in order to put such public policy in place include determination of the optimal number of autopsies desired, reform of consent laws, improvement in the quality of autopsy practice, reimbursement of pathologists, and determination of favorable cost-benefit ratios. None of these potential obstacles is insurmountable. The critical need, however, is to get started.

References

- Ahronheim, J.C., A.S. Bernholz, and W.D. Clark. 1983. Age Trends in Autopsy Rates: Striking Decline in Late Life. *Journal of the American Medical Association* 250:1182-86.
- Altman, L.K. 1988. Sharp Drop in Autopsies Stirs Fears that Quality of Care May Also Fall. *New York Times* (July 21).
- Anderson, R.E. 1984. The Autopsy as an Instrument of Quality Assessment: Classification of Premortem and Postmortem Diagnostic Discrepancies. *Archives of Pathology and Laboratory Medicine* 108:490-93.
- Anderson, R.E., and R.B. Hill. 1988. The Autopsy in Academic Medical Centers in the United States. *Human Pathology* 19:1369-71.
- . 1991. Pathologists and the Decline of the Autopsy. *Advances in Pathology*. In press.
- Anderson, R.E., R.B. Hill, and F. Gorstein. 1990. A Model for the Autopsy-based Quality Assessment of Medical Diagnostics. *Human Pathology* 21:174-81.
- Anderson, R.E., R.B. Hill, and C.R. Key. 1989. The Sensitivity and Specificity of Clinical Diagnostics during Five Decades. Toward an Understanding of Necessary Fallibility. *Journal of the American Medical Association* 261:1610-17.
- Barclay, T.H.C., and A.J. Phillips. 1962. The Accuracy of Cancer Diagnosis on Death Certificates. *Cancer* 15:5-9.

- Battle, R.M., D. Pathak, C.G. Humble, C.R. Key, P.R. Vanatta, R.B. Hill, and R.E. Anderson. 1987. Factors Influencing Discrepancies between Premortem and Postmortem Diagnoses. *Journal of the American Medical Association* 258:339-44.
- Burn, C.G., P. Klemperer, H.T. Karsner, M.G. Bohrod, R.N. Barnett, and M. Lev. 1956. The Autopsy (letters in response to I. Starr). *Journal of the American Medical Association* 161:175-77.
- Cabot, R.C. 1912. Diagnostic Pitfalls Identified during a Study of Three Thousand Autopsies. *Journal of the American Medical Association* 59:2295-98.
- Campion, E.W., V.A. Reder, A.G. Mulley, and G.E. Thibault. 1986. Age and the Declining Rate of Autopsy. *Journal of the American Geriatric Society* 34:865-68.
- Caplan, A.L. 1984. Morality Dissected: A Plea for Reform of Current Policies with Respect to Autopsy. *Human Pathology* 15:1105-06.
- Centers for Disease Control. 1988. Autopsy Frequency—United States, 1980-1985. *Morbidity and Mortality Weekly Report* 37:191-94.
- Council on Scientific Affairs. 1987. Autopsy. A Comprehensive Review of Current Issues. *Journal of the American Medical Association* 258:364-69.
- Ebert, R.V., J.D. Porterfield, B.F. Trump, D.M. Angevine, J.M.B. Bloodworth, and A.G. Foraker. 1974. A Debate on the Autopsy: Its Quality Control Function in Medicine. *Human Pathology* 5:605-18.
- Eisenberg, J.M. 1986. *Doctors' Decisions and the Cost of Medical Care*. Ann Arbor, Mich.: Health Administration Press Perspectives.
- Emergency Care Research Institute. 1984. Understanding the Role of the Autopsy in Improving the Quality of Health Care. *Issues in Health Care Technology* 9.14 (September).
- Fox, R.C., and J.P. Swazey. 1974. *The Courage to Fail: A Social View of Organ Transplants and Dialysis*. Chicago: University of Chicago Press.
- Gambino, S.R. 1984. The Autopsy: The Ultimate Audit. *Archives of Pathology and Laboratory Medicine* 108:444-45.
- Geller, S.A. 1984. Religious Attitudes and the Autopsy. *Archives of Pathology and Laboratory Medicine* 108:494-96.
- Glasser, J.R. 1981. The Quality and Utility of Death Certificate Data. *American Journal of Public Health* 71:231-33.
- Goldman, L. 1984. Diagnostic Advances v. the Value of the Autopsy: 1912-1980. *Archives of Pathology and Laboratory Medicine* 108:501-05.
- Goldman, L., R. Sayson, S. Robbins, L.H. Cohn, M. Bettman, and M.

- Weisberg. 1983. The Value of the Autopsy in Three Medical Eras. *New England Journal of Medicine* 308:1000-5.
- Gorovitz, S., and A. MacIntyre. 1976. Toward a Theory of Medical Fallibility. In *Science, Ethics and Medicine*, eds. H.T. Engelhardt and D. Callahan. Hastings-on-Hudson, N.Y.: Hastings Center.
- Gruver, R.H., and E.D. Freis. 1957. A Study of Diagnostic Errors. *Annals of Internal Medicine* 47:108-20.
- Hill, R.B., and R.E. Anderson. 1988. *The Autopsy—Medical Practice and Public Policy*. Stoneham, Mass.: Butterworths.
- . 1991. Pathologists and the Autopsy. *American Journal of Clinical Pathology* 95(suppl1):42-49.
- Holden, C. 1985. IOM Sees Need for Autopsy Policy. *Science* 229:539.
- Institute of Medicine. 1976. *Report of a Study Assessing Quality in Health Care: An Evaluation*. Washington: National Academy of Sciences.
- Jacobi, A. 1900. Medicine and Medical Men in the United States. *Journal of the American Medical Association* 35:425-31.
- King, L.S. 1973. Of Autopsies. *Journal of the American Medical Association* 191:100-1.
- Kircher, T. 1900. The Autopsy and Vital Statistics. *Human Pathology* 21:166-73.
- Kircher, T., and R.E. Anderson. 1987. Cause of Death: Proper Completion of the Death Certificate. *Journal of the American Medical Association* 258:349-52.
- Landefeld, C.S., M-M. Chren, A. Myers, R. Geller, S. Robbins, and L. Goldman. 1988. Diagnostic Yield of the Autopsy in a University Hospital and a Community Hospital. *New England Journal of Medicine* 318:1249-54.
- Lundberg, G.D. 1983. Medical Students, Truth and Autopsies. *Journal of the American Medical Association* 250:1199-1200.
- MacEachern, M.T. 1952. More Autopsies: They Are Vital to Medical Progress. *Hospitals* 26:58-146.
- Matas, A.J., J. Arras, J. Muyskens, V. Tellis, and F.J. Veith. 1985. A Proposal for Cadaver Organ Procurement: Routine Removal with Right of Informed Refusal. *Journal of Health Politics, Policy and Law* 10:231-44.
- McFarlane, M.J. 1987. Absence of Demographic Bias in Selection for Autopsy. *Archives of Pathology and Laboratory Medicine* 111:67-70.
- . 1989. Clinical Diagnosis Is Not a Source of Bias in Selection for Necropsy. *Archives of Pathology and Laboratory Medicine* 113:64-67.
- McFarlane, M.J., A.R. Feinstein, C.K. Wells, and C.K. Chan. 1987.

- The "epidemiologic necropsy." *Journal of the American Medical Association* 258:331-38.
- McKeel, D.W., Jr. 1986. The Autopsy's Untimely Demise. *The Sciences* July:30-34.
- Nelson, A.R. 1976. Orphan Data and the Unclosed Loop: A Dilemma in PSRO and Medical Audit. *New England Journal of Medicine* 295:617-19.
- Nemetz, P.N., J. Ludwig, and L.T. Kurland. 1987. Assessing the Autopsy. *American Journal of Pathology* 128:362-79.
- Oertel, H., and E.H. Lewinski-Corwin. 1913. Report on Post-mortem Examinations in the United States. *Journal of the American Medical Association* 60:1784-91.
- Parrino, T.A., and R. Mitchell. 1989. Diagnosis as a Skill: A Clinical Perspective. *Perspectives in Biology and Medicine* 33:18-44.
- People's Medical Society. 1989. Declining Number of Autopsies. *Newsletter* 8:1 (February).
- Pounder, D.J., M. Horowitz, R. Rowland, and D.P. Reid. 1983. The Value of the Autopsy in Medical Audit; A Combined Clinical and Pathological Assessment of 100 Cases. *Australia and New Zealand Journal of Medicine* 13:478-82.
- Roberts, W.C. 1978. The Autopsy: Its Decline and a Suggestion for Its Revival. *New England Journal of Medicine* 299:332-38.
- Saladino, A.J. 1984. The Efficacy of the Autopsy in Medical Quality Assurance. *Clinics in Laboratory Medicine* 4:165-83.
- Schmidt, S. 1983. Consent for Autopsies. *Journal of the American Medical Association* 250:1161-64.
- Scottolini, A.G., and S.R. Weinstein. 1983. The Autopsy in Clinical Quality Control. *Journal of the American Medical Association* 250:1192-94.
- Steinwald, B. 1980. Hospital-based Physicians: Current Issues and Descriptive Evidence. *Health Care Financing Review* 2 (summer):63-75.
- Svendsen, E., and R.B. Hill. 1987. Autopsy Legislation and Practice in Various Countries. *Archives of Pathology and Laboratory Medicine* 111:846-50.
- Tedeschi, L. 1974. The Pathology of Bonet and Morgagni. A Historical Introduction to the Autopsy. *Human Pathology* 5:601-3.
- Titmuss, R.M. 1971. *The Gift Relationship: From Human Blood to Social Policy*. New York: Pantheon.
- Wagner, B.M. 1987. Mortality Statistics without Autopsies: Wonderland Revisited. *Human Pathology* 18:875-76.
- Wells, R.J., C.S. Landefeld, M-M. Chren, et al. 1988. Diagnostic Yield of the Autopsy (letters). *New England Journal of Medicine* 319: 1095-96.

- Yesner, R. 1978. Medical Center Autopsy Costs. *American Journal of Clinical Pathology* 69:242-44.
- Zarling, E.J., H. Sexton, and P. Milnor, Jr. 1983. Failure to Diagnose Acute Myocardial Infarction: The Clinicopathologic Experience at a Large Community Hospital. *Journal of the American Medical Association* 250:1177-81.

Address correspondence to: Rolla B. Hill, M.D., 2151 Highway 128, Philo, CA 95466.