

**THE SCUDDER ORATION**

**Specialization in surgery—  
Implications for trauma-related disciplines**

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**C**harles L. Scudder, a Boston surgeon (1860-1949),<sup>1</sup> after whom this lecture is named, had incredible wisdom and foresight in the area of "traumatic surgery." He was also a trailblazer (perhaps unknowingly) in the area of specialization in the trauma-related surgical disciplines. Scudder petitioned the College's Board of Regents in May 1922 to address the problem of traumatic surgery in general and fracture care in particular. The College reacted by asking him to chair a committee on the treatment of fractures, which ultimately evolved to the present Committee on Trauma.

Dr. Scudder's inclinations might have been predicted by one of his contemporaries who noted that Dr. Scudder, when he started his practice in 1890, was one of the earliest Boston surgeons to refuse to accept medical patients. The preliminary report of his Committee on Fractures produced general principles for the treatment of all fractures, but it also proposed the following three levels of care that were based on the practitioners' training, experience, and the hospital facility in which he or she worked:<sup>2</sup>

(1) The average general practitioner and those unskilled in surgery as a specialty.

(2) The trained surgeon with the usual facilities afforded by small or cottage hospitals.

(3) The skilled surgical experts with adequate hospital facilities.

Scudder and his committee foresaw the need for specialization in another section of the preliminary report: "The time must soon come when metropolitan hospitals will not be considered satisfactorily organized unless fractures are assigned for treatment to specially equipped wards under the care of surgeons particularly interested in the pathology and treatment of these injuries."<sup>3</sup> Scudder and his committee would be amazed at the evolution of specialization in the trauma-related disciplines and the present state of development of trauma centers.

**Specialization in surgery**

Surgery as a specialty dates to antiquity. The pivotal role of injury in the development of surgery is universally accepted. In his unique approach to the history of surgery, Wangenstein recounts the

important role of wound management, amputations, fractures, and war surgery on the evolution of surgery as the separate branch of medicine that we know today.<sup>4</sup>

Advances due to specialization have drastically changed the management of the multisystem trauma victim. Gone are the days when an omniscient individual surgeon or practitioner did the best he or she could in managing injuries involving the cranial, thoracic, and peritoneal cavities as well as all musculoskeletal trauma. The multisystem trauma patient in 1988 is often cared for by an array of superspecialists, each of whom has contributed to a higher level of care. Neurosurgeons have made use of improved imaging (computed tomography scans and magnetic resonance imaging) and sophisticated monitoring techniques (intracranial pressure monitoring and jugular vein mixed venous oxygen content monitoring) to expedite early accurate operative treatment. Plastic surgeons have revolutionized the closure of all soft-tissue wounds by using microvascular surgical technology.

Ophthalmology	1917
Otolaryngology	1924
<i>Advisory Board for Medical Specialties</i>	1933
Orthopaedic Surgery	1935
Urology	1935
Surgery	1937
Neurological Surgery	1940
Anesthesiology	1941
Plastic Surgery	1941
Thoracic Surgery	1970
<i>American Board of Medical Specialties</i>	1970
Emergency Medicine	1979

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**Table 2**  
**Royal College of Physicians and Surgeons**  
**Specialty Qualifications**

Specialty	Year Approved by Council	First Fellowship	Certification Exams
General Surgery	1929	1931	1946
Ophthalmology	1937	1947	1946
Otorhinolaryngology	1937	1947	1946
Urology	1937	1947	1946
Anesthesia	1942	1951	1946
Neurosurgery	1945	1947	1946
Plastic Surgery	1946	1952	1947
Thoracic Surgery	1946		1950
Cardiovascular-Thoracic Surgery		1962	1972
Pediatric Surgery	1975		1976
*Thoracic Surgery	1976		1979
Emergency Medicine	1980		1983
*Vascular Surgery	1980		1983

(After 1972, there was single exam for certification.)  
\*Certificate of Special Competence based on Prior Certification in General Surgery.

In a previous Scudder Oration, Pruitt stressed the important role of the burn patient as a universal model for the study of injury.<sup>5</sup> This concept has produced dramatic progress in our understanding of the metabolic response to injury and the important role of surgical nutrition, and in the intelligent use of antibiotics and other agents to control sepsis. Vascular surgeons have clarified the role of angiography, complex shunts, simultaneous venous repair, and complete arterial reconstruction in the salvage of major extremity injuries. Orthopaedic surgeons have emphasized early reduction and stabilization of fractures to maximize functional limb salvage and to minimize late respiratory

failure. A whole new array of internal and external fixation devices is available for even the most complex fracture.

General surgeons have taken a leadership role in improving triage and surgical management of the injured patient in the "golden hour" after injury by developing the Advanced Trauma Life Support course. Improved triage combined with prompt, efficient pre-hospital care has been an important factor in lowering mortality from multisystem trauma. Basic observations in the pharmacology of low flow states, the adult respiratory distress syndrome, and immune modulation have seen surgeons take a leadership role in the critical care arena.

At the same time that the trauma-related surgical disciplines have developed, some non-surgical disciplines have made advances that impinge on the care of the injured. The number of "near surgical" procedures carried out by invasive gastroenterologists, cardiologists, and radiologists are increasing on an exponential basis, and they demand our attention. Certificates of added qualification for critical care now exist in medicine, pediatrics, neurosurgery, and surgery. All of these disciplines list the pulmonary and septic sequelae of injury as an important part of their training requirements. Dr. Ward Griffen informed surgeons at the 1987 meeting of the American Association for the Surgery of Trauma in Montreal that more than 3,000 medical intensivists took the examination for a certificate of "added qualification" in 1987.<sup>6</sup>

Specialization has had a major impact on our medical schools. It has in fact been stated that current medical faculties are specialty oriented and driven. Conflicts occur in the curriculum when seven or eight trauma-related disciplines compete for a two-month clerkship or a limited number of didactic lectures in surgery. The medical student is immediately aware of this competition for his or her attention.

Graduate surgical education in the trauma related disciplines has been profoundly affected by the specialization process. There are often demands for eight or nine important specialty rotations in the first two years of core training. These

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early rotations are short and often superficial. They may bear no relationship to the resident's ultimate needs or career goals. The total clinical experience of the senior general surgical resident is declining and is often threatened by an ever-proliferating number of surgical fellowships (in vascular surgery, critical care, endoscopy—just to name a few).

All of us intuitively agree that advances due to specialization have been good for the treatment of the injured patient. Some benefits can be measured in terms of reduced mortality and morbidity. Many changes, however, have occurred imperceptibly and have a profound impact on surgical manpower, care of the injured patient, and on undergraduate and graduate education, some of which we may have overlooked. There are also negative implications to excessive specialization that leads to "fragmentation," an idea that Dr. Alexander Walt has so eloquently recognized in an address to the 1985 Clinical Congress.<sup>7</sup> We must be on guard to recognize and deal with all aspects of specialization.

### Certification

The modern era of surgical specialization in North America is a 20th century development. At the end of the 19th century, 90 percent of physicians were general practitioners. If current trends prevail, almost 100 percent of physicians will obtain some type of specialty board recognition by the end of the 20th century. In 1986, The American Board of Medical Specialties (ABMS) offered more than 70 specialty and subspecialty qualifications and The Royal College of Physicians and Surgeons of Canada (RCPSC) offered 41.<sup>8</sup> To understand the present status of specialization in the trauma-related disciplines, it is useful to examine briefly the history of the certification process in the United States and Canada.

Concern over the quality of and lack of standards for specialty practice was the major impetus for U.S. specialty societies to develop a certification process. The American Ophthalmologic Society lead the way by recommending a training and examination process in 1915. It established the American Board of Ophthalmology, which met in

1916 and was officially incorporated in 1917. The American Board of Otolaryngology followed in 1924, the American Board of Obstetrics and Gynecology in 1930, the American Board of Dermatology in 1932. Coordination of these specialty boards was achieved when the Advisory Board for Medical Specialties was created in 1933 by the American Hospital Association, the Association of American Medical Colleges, the Federation of State Medical Boards, the AMA's Council on Education and Hospitals, and the National Board of Medical Examiners.

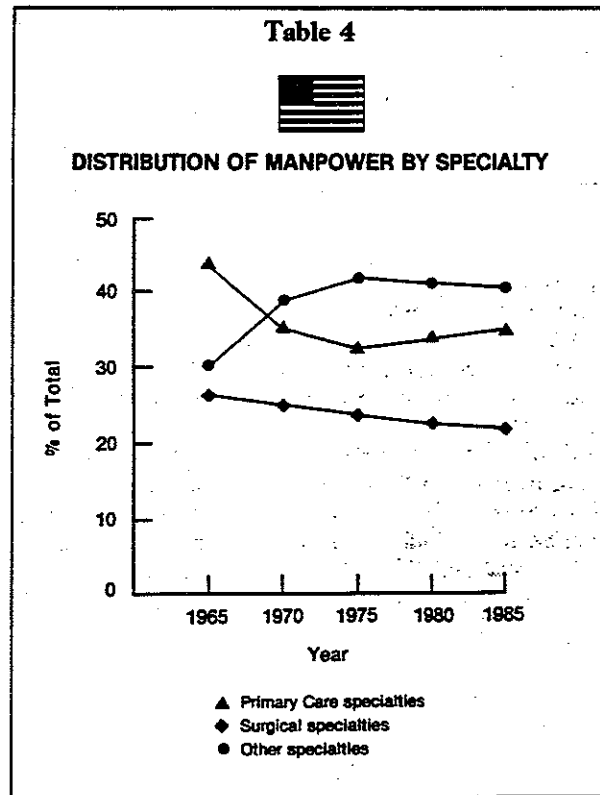
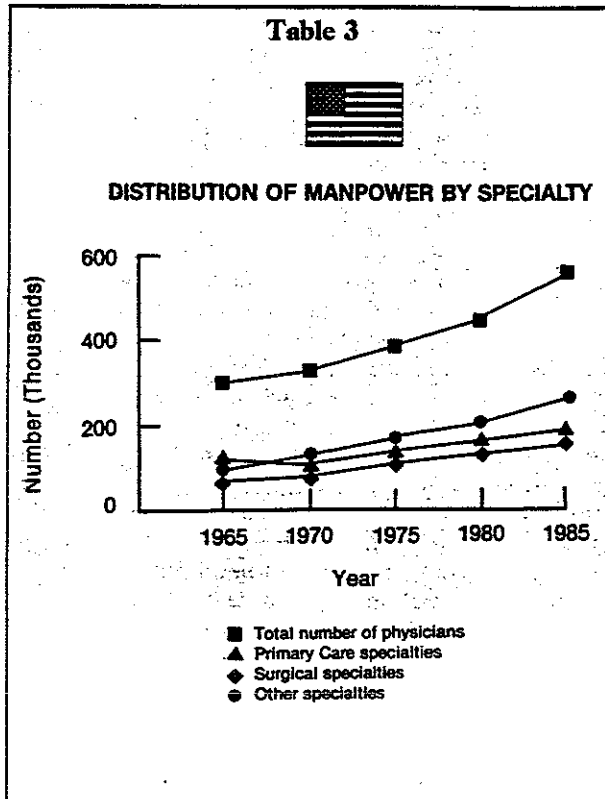
From 1934, new specialties were recognized by the joint efforts of the Advisory Board for Medical Specialties and the AMA Council on Medical Education. This collaborative effort was formalized by the establishment of the Liaison Committee for Specialty Boards (LCSB) in 1948. By this time, 18 specialty boards had been recognized.

The Advisory Board for Medical Specialties functioned as a federation of specialty boards from 1933 to 1970 with a part-time secretariat. The American Board of Medical Specialties was the final outcome; it received recognition, formal financing, and a full-time executive director and secretariat in 1970. Another five specialty boards were recognized between 1969 and 1979, for a total of 23 boards. To meet the challenge of increasing demands for recognition of subspecialties of the primary or conjoint boards, the concept of "special certification" was approved in 1973. There are now 23 member boards of the ABMS that issue general certificates in 32 areas of specialization and certificates of special competence in 34 areas.<sup>9</sup>

A new type of certification was approved in 1985, termed the "Certificate of Added Qualification." The ABMS authorized the American Board of Surgery, the American Board of Plastic Surgery, and the American Board of Orthopaedic Surgery to issue certificates of Added Qualifications in Hand Surgery in 1986. A similar process has been approved in the area of critical care medicine.

Thus, the certification process in the United States was stimulated by autonomous specialty societies to develop a national coordinating

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organization (the ABMS). Certification remains voluntary and independent of state licensing. The chronological development of the certification process for the trauma-related disciplines in the United States is detailed in Table 1 (page 15).

Certification of the specialist in Canada developed almost 20 years later and at a slower pace than in the United States. The Royal College of Physicians and Surgeons of Canada was founded in 1929 by an act of the Canadian Parliament. It is a national organization that develops standards for all medical, surgical, and laboratory specialties. The RCPSC also accredits all training programs, supervises the processing of credentials, and conducts examinations for all specialty certificates.

Originally, two specialty qualifications were offered—Fellowship in Medicine or in Surgery. The Canadian Medical Association requested that the

RCPSC offer certification in seven other specialties. By 1986, there were 41 specialty qualifications in medical, laboratory, and surgical disciplines.

Up to 1972 in most specialties, there were two standards of examination—fellowship and certification. Fellowship was considered the higher qualification. Since 1972, a single examination for certification in each specialty has been held. All previous certified physicians were eligible to apply for membership in the RCPSC as fellows. Certificates of special competence based on prior certification in a primary specialty were first offered in 1975. A chronological sequence of the certification process for trauma-related disciplines is detailed in Table 2 (page 16).

An important development in the accreditation process occurred in the early 1970s when all

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graduate education in Canada was placed under the jurisdiction of the university medical schools. This action first occurred in Quebec in 1970, and the RCPSC subsequently instituted the same policy throughout Canada.

Thus, the RCPSC has become a national organization for certification and accreditation of all specialty disciplines. In addition, it provides a forum for scientific presentations and educational activities for all specialists. It now functions as a combination of the American College of Surgeons, American Board of Medical Specialties, and the Residency Review Committee in Canada.

### Increase in specialists

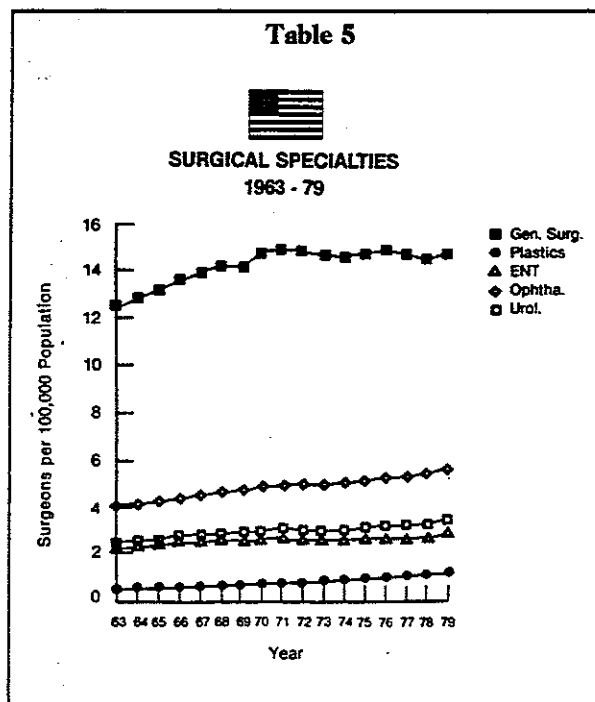
There have been dramatic changes in the number and composition of physicians since the immediate post-war period. While the population in North America has virtually doubled since 1945, the number of specialists has increased by twentyfold. The number of certified surgeons has risen from six per 100,000 in 1945 to 51 per 100,000 in 1985. These astonishing trends reflect the dramatic growth of specialism in medicine as well as the impact of the certification process in North America.<sup>8</sup>

How has the present process of certification affected the number and composition of surgeons in the trauma-related disciplines? Government sources and manpower studies have in fact suggested that there is not only a surplus of physicians but an excess of surgical specialists at the present time. Take a look at data from the AMA in Tables 3 and 4 (page 18).<sup>10</sup> While the absolute number of surgical specialists has increased since 1965, the percentage of surgical specialists related to the total number of physicians has in fact declined. During the period from 1965 to 1985, physicians in "other specialties" (anesthesia, emergency medicine, and others) have increased from 31.9 percent of the total to 41.9 percent of all physicians. The number of primary care physicians (family practice, internal medicine, and general pediatrics) increased from 58 per 100,000 population in 1970 to 81 per 100,000 in 1985, a growth of 39.7 percent. This rate compares to a growth of 28.6 percent in the number of surgical specialists during the same

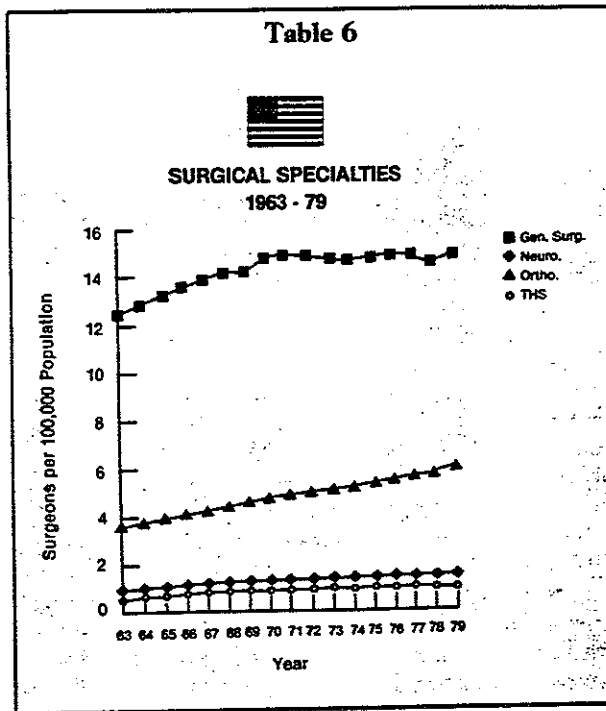
period. Similar trends can be observed in Canada, including an impressive growth in primary care in the Province of Quebec. These data cast doubt on the supposed excess of surgeons.

While the absolute number of surgical specialists has steadily increased since 1945, the process of specialization has resulted in striking change in the composition of surgical specialists in the trauma-related disciplines in the United States. Data compiled by the AMA<sup>11</sup> from 1963 to 1979 (Tables 5 and 6, pages 19 and 20) reveal that all trauma-related disciplines increased modestly in terms of absolute number per 100,000 population; however, orthopaedic surgery increased more than the others. General surgeons peaked in the period from 1970 to 1971 and have plateaued in terms of numbers per 100,000 population. This trend explains the relative stability of all trauma-related surgical disciplines in terms of percentage of total surgeons and the definite, consistent decline in the

Table 5



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percentage of general surgeons (Tables 7 and 8, page 21). Recent data from the American College of Surgeons confirm a continued decline in the number and percentage of general surgeons.<sup>12</sup>

The trend in Canada is even more pronounced, as can be seen in Tables 9-12 (page 22), which show that the growth in the number of general surgeons peaked in 1974 and has declined steadily to 1984.<sup>13</sup>

What has been the impact on our system of graduate education in terms of numbers and composition of surgeons in training? Extremely useful and accurate data on residency numbers are now available from both the ACS (*Longitudinal Study of Surgical Residents 1986/87*)<sup>14</sup> and the Royal College of Physicians and Surgeons of Canada.<sup>15</sup> In the United States from 1969 to 1970, surgical residents made up 40.2 percent of all residents. The percentage dropped to 26.5 percent of the total by 1987. The *Longitudinal Study of Surgical Residents* reveals that the number of residents enrolled in the 10 surgical specialties studied reached a peak in the 1983-84 period at 14,800. The number has declined each year since then, reaching a level of 14,428 in 1986-87. At this rate of decline, the number of all

surgical residencies will fall 18 to 20 percent below the 1990 projections that the Graduate Medical Education National Advisory Committee developed in 1980.<sup>16,17</sup> The overall reduction in the number of surgical residents in Canada is even greater relative to a general reduction in funding of graduate medical education and specific legislated "entrance to specialty" restrictions that favor primary care medical disciplines.

The number and mix of successful certificate recipients in the trauma-related disciplines in Canada and the United States from 1975 to 1984 are seen in Tables 13 and 14 (pages 23 and 24). There was a 30 percent decline in the number of graduating residents in general surgery in Canada from 1975 to 1984. The number of general surgeons who successfully completed training in the United States peaked in the 1980-81 period and has declined over the past four years to a level of 900 per year. More disconcerting is the study on career choices of graduating general surgical residents carried out by Dr. Ward Griffen<sup>18</sup> in the United States and E. J. Hinchey<sup>19</sup> in Canada (Tables 15 and 16, pages 24 and 25). In Canada, only 40 per 133 (33 percent) of the 1985 and 1986 cohort will begin a general surgical practice, while the remainder will pursue further residency training or fellowships. This phenomenon will compound the decline in percentage of total surgeons represented by general surgeons in both countries.

### Regionalization

Concurrent with the evolving trends in specialization has been the emergence of regionalization in improving health care delivery. Changes in number and composition of trauma-related surgeons as a result of specialization will have a profound effect on the ability to regionalize trauma care. Regionalization of medical care has been defined as the process of organizing services to ensure availability of commonly needed services, as well as a rational and economic provision of uncommon, specialized, and expensive services. Lord Dawson of Penn first propounded the concept of regionalization as a means of providing an equitable distribution of hospital services to the entire population.

Dr. Oscar Hampton, when he was Secretary of the ACS Committee on Trauma, was among the first to recognize the importance of regionalization of care and categorization of hospitals to improve

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the outcome of the seriously injured patient. His pioneering efforts led to the "Optimal Guidelines" document developed by the Committee on Trauma, which is firmly based on the principle of regionalization.<sup>20</sup> The positive medical benefits of regionalization are perhaps best demonstrated in the surgical disciplines, according to Luft et al.<sup>21</sup> They examined data on mortality rates for 12 operative procedures of varying complexity in 1,498 hospitals (using the Professional Activities Study data system). There was a clear-cut reduction in mortality along with increased numbers of operations, most significantly in more complex operations such as open heart and vascular surgery. Their data support strongly the concept of regionalization of more complex surgical procedures. Similar evidence showing that mortality decreases when surgical volume increases has not yet been demonstrated for trauma. One would suspect, however, that the challenge presented by severe multisystem injury in terms of rapid assessment and early effective surgical therapy would result in a more startling reduction in mortality as the volume of patients treated increased.

In Canada and some European countries, the

driving force for regionalization has been an economic one. The use of high-cost technology, such as computed tomography scanning and magnetic resonance imaging, has been limited to university hospitals. Similarly, cardiovascular and neurosurgical expertise is highly concentrated in the urban university medical center, a fact that implies that the care of the severely injured must be regionalized to these centers.

Conventional delivery of trauma care is associated with a preventable mortality rate of greater than 40 percent. The institution of regionalized trauma care in both European and North American settings has lowered the preventable death rate to below 10 percent. Perhaps one of the most impressive demonstrations of the value of a regionalized trauma system comes from Orange County.<sup>22</sup> Cales did a retrospective analysis of trauma deaths related to motor vehicle accidents in Orange County before and after implementation of a regionalized trauma system. The proportion of potentially salvageable deaths dropped from 34 percent (20/58) to 15 percent (9/60) after implementation. Seven of the nine potentially salvageable deaths occurred in 13 patients treated in non-

Table 7



### SURGICAL SPECIALTIES 1963 - 79

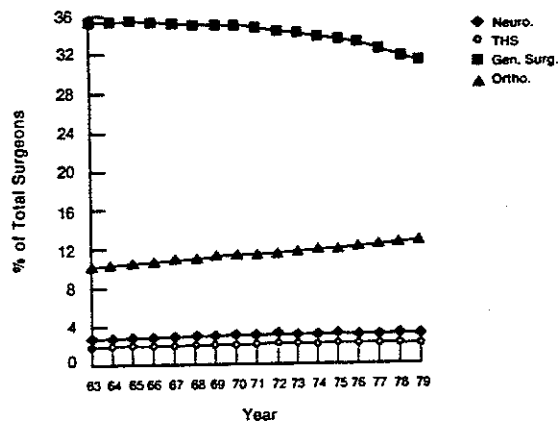
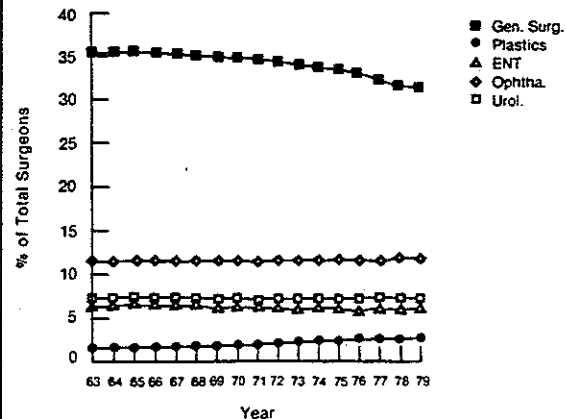


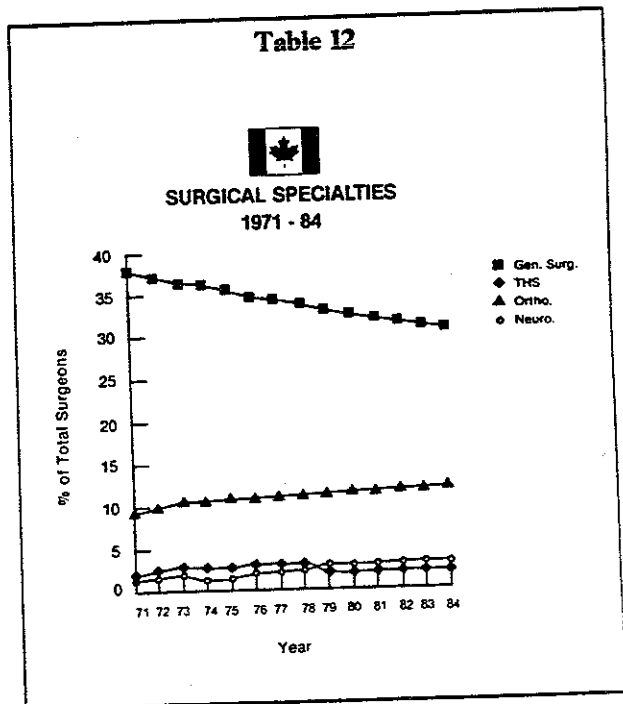
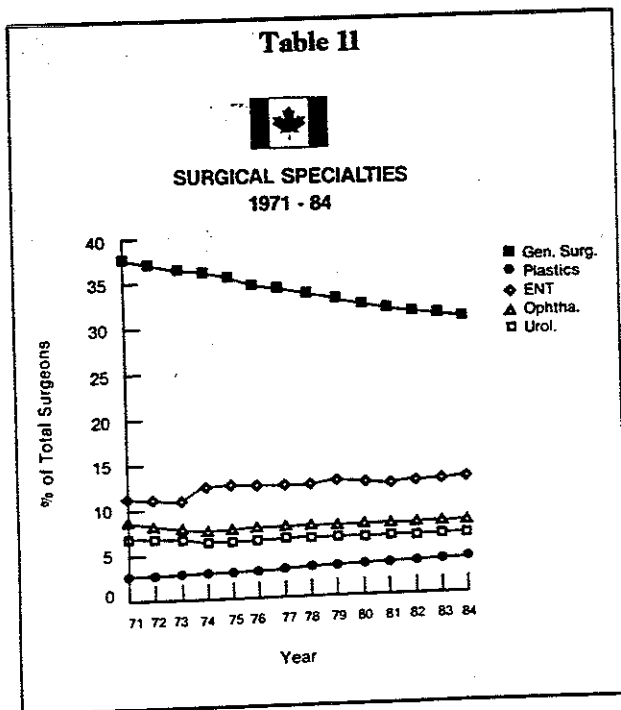
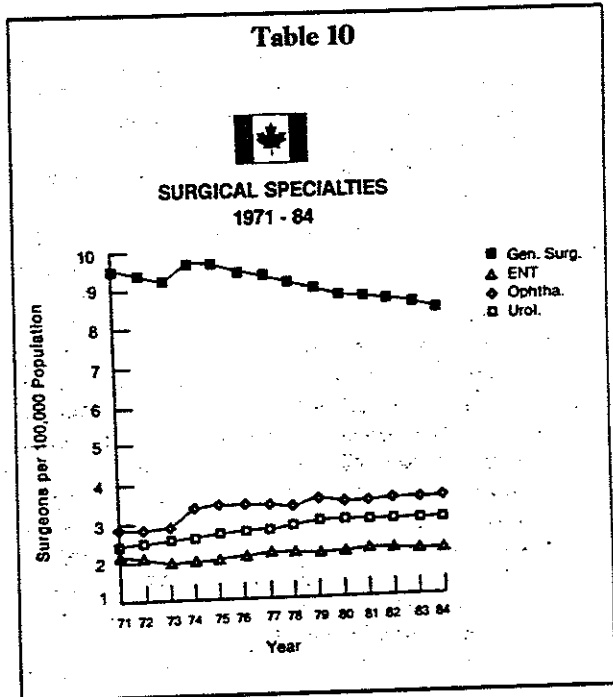
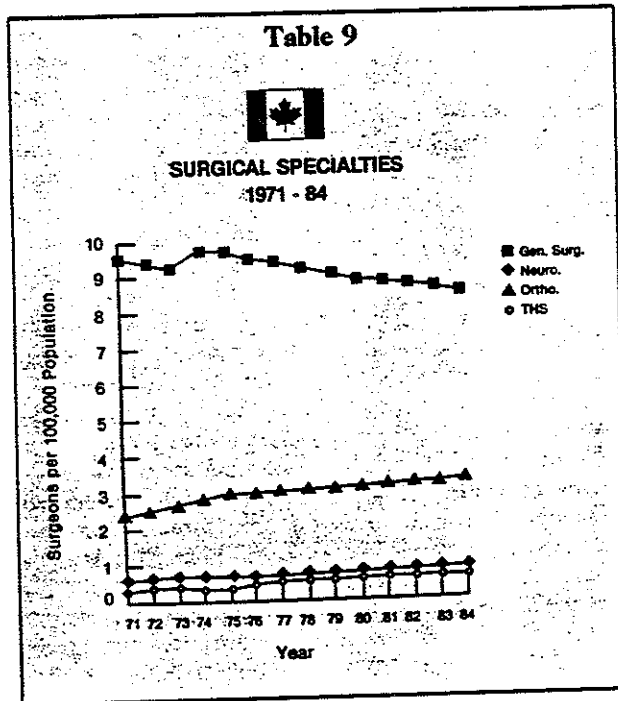
Table 8



### SURGICAL SPECIALTIES 1963 - 79



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trauma center facilities (54 percent), while only two potentially salvageable deaths occurred in 47 patients treated in a trauma center. Coincident with this apparent improvement in clinical care was a reduction in the predicted death rate for motor vehicle trauma in Orange County after a regionalized trauma care system was established.

Regionalization of trauma care has received greater emphasis in the urban areas. However, studies of preventable death done in California, Vermont, and Canada all demonstrate a higher death rate among rural versus urban populations. This difference ranges from 4:1 to 9:1. In the California study, Waller et al<sup>23</sup> noted that of 782 fatalities, 111 (44 percent) of 251 rural deaths were potentially salvageable compared with 193 (36 percent) of 531 urban deaths. Even more disconcerting were the observations that rural death followed a lesser magnitude of injury and occurred sooner after injury than the urban deaths. Delay in recognition and surgical treatment of major hemorrhage and of neurological injury emerges as a common variable in studies of rural death. This delay is largely related to the limited availability of appropriate physicians and the distance to adequate surgical facilities.

Susan Baker has done a population-based study on mortality of motor vehicle occupants for all counties in the United States.<sup>24</sup> This study vividly demonstrates the inverse relationship between population density and mortality from motor vehicle accidents. While the study showed that the overall mortality rate for motor vehicle occupants in the United States was 18.7 per 100,000 population, there were substantial variations from county to county. Ten percent of all counties had death rates of less than 13.5 per 100,000, while another 10 percent had rates of 57.3 per 100,000 or higher. The dramatic variation in death rates in the United States was consistently related to population density, as can be seen in Table 17 (page 25). Baker has suggested numerous variables that might contribute to the observed population-based differences in mortality. These included high travel speeds in rural areas, poorer road conditions, reduced seatbelt compliance, increased use of high-risk vehicles (jeeps and pick-up trucks), and poor access to appropriate trauma care. She further em-

Table 13

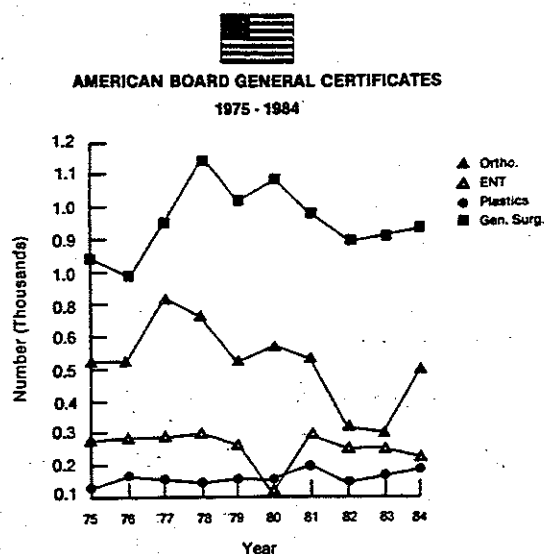
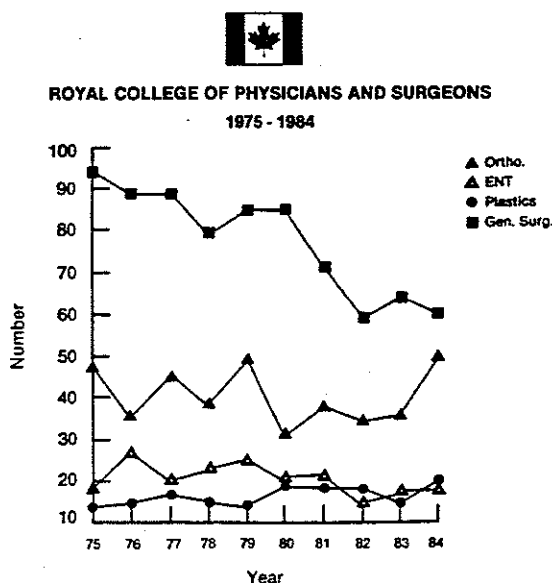


Table 14



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Career	Number	%
General Surgical Practice	440	40.7
<u>Fellowships or Residency</u>		
Cardiothoracic Surgery	152	14.1
Vascular Surgery	117	10.8
Plastic Surgery	85	7.9
Academic Surgery	58	5.4
Colorectal Surgery	39	3.6
Trauma/Critical Care	29	2.7
Oncology	27	2.5
Other*	106	9.8

\*Endoscopy, Gastrointestinal, Hand, Head & Neck, Metabolism, Transplantation (Courtesy of Dr. W. Griffen, American Board of Surgery).

Career	Number	%
General Surgical Practice	44	33
<u>Fellowships or Residency</u>		
Cardiothoracic Surgery	25	19
Vascular Surgery	12	9
Oncology	10	7
Thoracic Surgery	10	7
Colorectal Surgery	9	7
Critical Care	6	5
Pediatric Surgery	5	4
Transplantation	4	3
Plastic Surgery	3	2
Hepatobiliary	3	2
Head & Neck	2	2

(Courtesy of Dr. E. J. Hinchey, Canadian Association of General Surgeons.)

Place	Population/ sq. mile	Mortality/ 100,000
New York (Manhattan)	64,000	2.5
Pennsylvania	12,000	4.3
Esmeralda County (Nevada)	0.2	558

phasized that all of these factors are subject to modification.

The trends in manpower number and composition as a result of specialization are creating a double standard of trauma care in North America. Urban centers have an adequate or excess number of trauma-related surgical specialists and demonstrate a reduction in preventable mortality. The major challenge in urban America is to find an adequate number of committed general surgeons to guide the multiply injured patient through the myriad of highly sophisticated surgical specialists. The rural trauma victim in contrast has an alarming level of preventable mortality that is related to the reduced availability of appropriate surgical care. A recently completed (surgeon-verified) manpower study of general surgeons in Canada confirmed an immediate need for 64 general surgeons predominantly for rural locations.<sup>19</sup>

### Conclusions

What can we conclude from these descriptive epidemiological studies on specialization and regionalization? I suggest the following:

- Specialization has resulted in significant advances in all trauma-related disciplines, and specialization will continue to develop in the next decade, as evidenced by recent certificates of added qualifications in hand surgery and critical care.
- Specialization has resulted in a global increase in manpower in all trauma-related disciplines. This conclusion must be qualified, however. The increase in primary care and other specialties has been significantly greater over the same time frame.
- There has been a significant redistribution of manpower within the trauma-related disciplines that has resulted in a decline in the number of

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broadly trained general surgeons available for the increasingly evident *rural* trauma challenge. The next major frontier for trauma leaders is to ensure equitable access to a high standard of trauma care in rural America. A trauma system based on the longitudinal integration of all levels of trauma care in a region (county or health district) orchestrated by the appropriate Level I trauma center may be a potential solution, considering the tremendous advances that have been made in prehospital transportation.

- At least 60 percent of residents completing training in general surgery are opting for further residency or fellowship training in another surgical specialty. Many authors have examined the reasons for this phenomenon.<sup>7</sup> Do the present federation of autonomous boards and the present definition of general surgery contribute to our present dilemma? I think they do. Is it time to consider the concept of a Super Board in "Surgery in General" or a mechanism that would allow greater cooperation among all surgical disciplines? This concept would diminish local turf battles in the area of patient care as well as in undergraduate and graduate surgical education. I believe it would also facilitate training of a broad, physiologically based general surgeon who could not only orchestrate the urban trauma team, but also play an optimal role in rural America.

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