Norwegian surgeons provide for a wide range of modern surgical services with excellent results. With a thriving economy and a high standard of living and education, the major disease spectrum relates to cancer and cardiovascular diseases. Almost all types of surgery are performed in Norway. Improvements have been achieved through national programs and population-based registries have served as instrumental tools (eg, for cancer surgery). About 1 in every 5 general surgeons holds a PhD degree, with an even greater number for some subspecialties (30%-40% have PhD degrees). Trauma and acute care surgery is not a formal specialty, but a formal trauma system is likely to be established in the near future. Ringfencing of elective surgical tasks from emergency surgery is increasingly being performed in surgical departments. Governmental coverage (85% of health care costs) and equal access to care have created waiting lists and given rise to private surgical outpatient clinics. The increase of women in medical school (>60%) has yet to be paralleled in most surgical specialists (eg, about 10% of general surgeons are women). Subspecialization, the 40-hour workweek, technical improvements (interventional and minimally invasive procedures), and quality demands have changed the surgical work scenario for both junior and senior staff members. Formal requirements in training duration and educational content are likely to change. Recruitment to surgery and ensuring continuity of patient care take surgery in Norway beyond the scalpel into the 21st century.

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Norway occupies the western part of the Scandinavian peninsula (Figure 1) and extends 1770 km from the south to North Cape; if it was virtually rotated 180° around the southern axis, North Cape would reach as far south as Rome, Italy. The coastline is about 2740 km long with thousands of islands and numerous fjords—attractive to tourists, but a challenge for transport. The North Atlantic Drift from the Mexican Gulf provides for a relatively mild and humid climate. The arctic areas experience extreme circadian daylight variation from summer to winter; thus, Norway is often referred to as the “Land of the Midnight Sun.”

With about 4.6 million inhabitants, the highest population density is in the southern regions (about three-quarters of the population), with major cities like Oslo (capital), Bergen, Stavanger, Trondheim, and Kristiansand (Figure 1). Tromsø has the world’s northernmost-located neurological department at the University Hospital of Northern Norway.

The 1969 discovery of oil in the North Sea has positioned Norway as one of the wealthiest countries in the world. However, trading also includes mineral resources, hydroelectric power, and shipbuilding industry. The Norwegian merchant fleet carries a large part of the
world’s trade. Major trading partners are the United Kingdom, Germany, Sweden, the Netherlands, Denmark, and the United States.

**BRIEF HISTORY**

Surgery has been performed since the ages of the Vikings in Norway. Influence from foreign cultures has always been extensive, including travels to the Mediterranean cities and the Salerno Medical School during the Viking ages. An important feature of the late 19th and early 20th centuries was the large-scale emigration to the United States. This also pertained to surgical training and education in some instances; the Norwegian Alfred Gundersen, MD (1865-1938), established the Gundersen Clinic in La Crosse, Wisconsin, in 1929; orthopedic surgeon Marius Smith-Pedersen, MD (1886-1938), received his MD degree from the University of Chicago and became professor of orthopedic surgery at Harvard and chief of Orthopedic Services at Massachusetts General Hospital in 1935. Kaare K. Nygaard, MD (1903-1989), received surgical training both at the Gundersen Clinic and the Mayo Clinic (Rochester, Minnesota) before returning to Norway as a surgeon at the National Hospital in the 1930s.

The number of “firsts” is moderate in Norwegian surgical history, and the evolution in Norwegian surgery followed that of German and Austrian surgeons. Axel Cappelen, MD, attempted the suture of a cardiac stab wound in 1895, but the patient died. Zollinger-Ellison syndrome was correctly described in 1952 by surgeon Roar Strom, MD (1903-1958); however, the pancreatic tumor was wrongly interpreted as an “insuloma [sic]” rather than a gastrinoma.

**HEALTH CARE SYSTEM**

The Norwegian health care system is currently organized in 4 geographical health trusts owned by the government. While the 19th and 20th centuries saw a focus on decentralized specialized care with development of many smaller hospitals all over the country, focus has shifted toward centralized functions, affecting hospital structure, population catch areas, patient autonomy, and medical training, in particular for surgery.

**Public Health**

The Norwegians are rather healthy; perinatal mortality is very low, average life expectancy is high (83 years of age for women; 78 years of age for men), and socioeconomic figures (unemployment rate, average income) are among the best in the world. However, a high-standard, western way of living is reflected in the disease spectrum; cancer is a leading cause of death together with cardiovascular diseases, and morbid obesity is becoming an epidemic among young children and adolescents. A selected overview of some common surgical procedures is given in **Table 1**.

**Costs and Reimbursement**

The Norwegian National Health Service share of the gross national product increased from 8.2% to 9.5% during the period 1995-2004. When health care costs are calculated in US dollars and corrected for purchasing power, only the United States has higher health care costs than Norway. However, while government spending on health care is only 44% in the United States, as much as 84% of health care in Norway is covered through tax revenues. All in-hospital care is provided free of charge, and in principle, all other necessary health care is also free, with a minimal fee for out-of-hospital services.

**Day-Case Surgery**

Day-case surgery is increasing with the implementation of minimally invasive methods. However, equal access
with a “first come, first serve” policy has created waiting lists for some procedures. Because governmental hospitals are on a strict budget, and acute and severe illnesses take priority by law, elective surgery may consequently suffer under scrutinized resources and staff. Thus, an increasing number of surgical departments (from <20% to >40%, 1999-2005) are “ring-fencing” the elective surgical activity by separating elective from emergency operations in parallel hospital production lines.

A consequence of waiting lists in public hospitals, and the increase in the purchasing capacity of the population, is the emergence of several private clinics that offer surgical outpatient treatment, ranging from bariatric and laparoscopic to purely cosmetic surgery. When complications occur (as they do), they are taken care of at the governmental hospitals (as are the costs). Restrictions are placed on employees of governmental institutions regarding work in competing private clinics. Competitiveness in salary and benefits is becoming an increasing challenge in the recruitment and retention of surgical faculty.

Work Restrictions and Social Security

A 40-hour maximum workweek was made statutory more than 3 decades ago in Scandinavia. Recent enforcements have restricted the time a resident is allowed to stay in the hospital to no more than 19 continuous hours. For surgery trainees, night shifts thus preclude elective clinical activity the day before and after a night on call. Attendance at mandatory trainee courses further contributes to absence from work.

The workload nevertheless often implies more than 40 hours a week for residents. Too many working hours during a given period are followed by compensatory days off in order to level out, on average, to 40 hours a week on a monthly/quarterly basis.

Maternity leave is granted by law and starts 3 weeks before the due date, with full economic compensation for 11 months after birth. Fathers are given 2 weeks’ paid leave after birth and (at least) 6 weeks of mandatory paternity leave as the mother ends her leave. While this ensures protected family time, it has influence on junior staff retention and attendance.

MEDICAL EDUCATION

Medical education in Norway consists of 6 years of medical school, with an additional 1.5 years of a rotational internship in internal medicine, surgery, and district general practice before obtaining the medical degree and full license. The rotational internship is provided at some 50 hospitals and thus ensures a rather equal experience and degree of training under supervision in clinical medicine. About 24% of Norwegian medical students study abroad and are said to make up a “fifth” medical faculty in Norway.

SURGICAL TRAINING

Surgical training lasts 6 years for general surgery, and most candidates continue with subspecialization, in either gastroenterologic, endocrine, urologic, or vascular surgery. Pediatric surgery, neurosurgery, orthopedics, and cardiothoracic surgery are independent surgical specialties and formal training in general surgery is limited to 2 years or less. In principal, many surgical departments experience considerable turnover of candidates in training who never intend to complete general surgical training.

A list of operations and procedures, with a required number for each operation/procedure, has to be completed (Table 2). Formal education has to be provided by the departments with a resident or fellow program, at least 2 hours a week. In addition, several mandatory national courses, most organized at the university hospitals, have to be completed before an application for certification can be considered. Research, publishing, and oral presentations are encouraged but still are not mandatory. Formal courses in administration and management have recently been mandated. Superfluous accomplishments have been eliminated from the training period and shifted to midlevel health care providers, most commonly nurses.

Training in surgery is completed at district or regional hospital departments. All surgical departments have educational accreditation for a few or more (sub) specialties. With the increasing centralization, candidates must move from one hospital to another, “shopping” for procedures, because very few hospitals/departments are able to provide the full range of procedures required (Table 1 and Table 2). As such, ex...

<table>
<thead>
<tr>
<th>Table 2. Procedures Required for Training in General Surgery</th>
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<tr>
<td><strong>Type of Procedure</strong></td>
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<tr>
<td>Major surgery</td>
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<tr>
<td>Gastroenterologic and endocrine surgery</td>
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<tr>
<td>Laparoscopy</td>
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<tr>
<td>Hernia, adults</td>
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<tr>
<td>Appendectomy</td>
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<tr>
<td>Proctology</td>
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<tr>
<td>Biliary surgery</td>
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<tr>
<td>Stomach/duodenum</td>
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<tr>
<td>Bowel resection</td>
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<tr>
<td>Colostomy</td>
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<tr>
<td>Laparotomy, other</td>
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<tr>
<td>Endoscopy</td>
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<tr>
<td>Thyroid surgery</td>
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<tr>
<td>Breast surgery</td>
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<tr>
<td>Urology and pediatric surgery</td>
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<tr>
<td>Cystoscopy</td>
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<tr>
<td>Renal surgery</td>
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<tr>
<td>Scrotal surgery</td>
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<tr>
<td>Testicular retention</td>
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<tr>
<td>Hernia, children</td>
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<tr>
<td>Thoracic and vascular surgery</td>
</tr>
<tr>
<td>Thoracotomy</td>
</tr>
<tr>
<td>Arterial surgery</td>
</tr>
<tr>
<td>Veins</td>
</tr>
<tr>
<td>Various, major surgery (including any orthopedic, reconstructive surgery, neurosurgery, and gynecology)</td>
</tr>
<tr>
<td>Minor surgery (including pilonidal disease, plastic surgery, thoracic drains, wound revisions, and amputations)</td>
</tr>
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</table>
posure to various types of surgery may be limited, such as a lack of “minor” surgery in hospitals taking care of larger volumes of cancer or trauma surgery and where, for example, vasectomies, hernia, cholecystectomies, and varicose surgery are referred to district hospitals. While interhospital rotation would easily solve these issues, the logistics and current management structure (requirements for efficiency, less time for education and training) have made it a potential Achilles heel of general surgical training.

Structurally, the surgical training program in Norway has improved during the last decades. Postoperative mortality and morbidity and functional outcome after surgery have improved dramatically over the past 3 decades. Achievements are in fact at the international front line in several areas, in particular with regard to national audits and structure of surgical oncology.

The total number of hospitals in Norway is decreasing, and during recent years, major elective surgery has moved from “all serve” to higher levels of care. While patients are free to choose hospital of care, less than 1% of patients chose hospitals outside their geographic region.

WOMEN IN SURGERY

Currently, women make up more than 60% of all Norwegian medical students but less than 30% of the hospital specialists. The percentage of women working in surgery and related fields is given in Figure 2. Compared with internal medicine (about 20% women) and other specialties (pathology, radiology, and psychiatry, all higher than 30%-40%), surgical specialties are lagging, which is of concern for future recruitment. Women have already provided for substantial input, progress, and improvement in the Norwegian health care system and will continue to do so in the future. The number of women in hospital specialties is expected to exceed 50% by 2016; how this may be attributed to an increased share of women in surgery remains unclear.

TRAUMA

Trauma surgery does not require formal training in Norway. Geography and weather do not allow for easy, reliable transport to a higher-level hospital. Thus, care of the injured is basically performed at the nearest available hospital.

Currently, trauma and acute care surgery is performed in more than 50 Norwegian rural and urban hospitals. A formal trauma system with designated levels of care is lacking. Formal trauma training is not mandated outside courses in “war and hemostatic surgery” performed on a porcine model and required for all candidates in general surgery. National courses in advanced trauma life support, damage control surgery, and definitive trauma surgery care are held with support from US colleagues, and the concept of “better and more systematic trauma care” (called BEST) has been performed nationwide with a focus on team training and communication.

Critically injured or acutely ill patients are reached within a relatively short time by airborne transport, located either at the larger hospitals or from military base resources. A total of 11 rotor-wing, 5 search and rescue, and 5 fixed-wing units are used over the country. A proposal for a formal trauma system and a Norwegian Trauma Databank is under evaluation and will likely change the requirements for training, facilitation, and recertification for both surgeons and the designated hospitals.

CANCER

The subspecialty of surgical oncology is not a formal one, and cancer surgery is basically incorporated into the other surgical subspecialty training. The majority of patients with cancer are treated surgically in hospitals throughout the country, preferably university-affiliated or regional hospitals for major cancer surgery. National audits (eg, for rectal cancer surgery) have led to centralization of procedures and improvements in both short- and long-term results.

National programs initiated by multidiscipline specialist groups, such as the Norwegian Breast Cancer Group or the Norwegian Rectum Cancer Group, ensure that national initiatives and guidelines are implemented. For one, the recent focus on the national audit on surgical treatment of rectal cancer has led to changes in national trends and now receives international acknowledgment and serves as a model for training and implementation in other countries.

TRANSPLANTATION

Transplantation is exclusively performed at the National Hospital in Oslo. Annually, about 230 kidneys, 40 livers, 30 to 35 hearts, 20 lungs, and 10 to 12 pancreas transplants are being performed. Norway has one of the highest living related donor rates in the world. Some 28 hospitals are recognized by the Norwegian Board of Health as donor hospitals and work in close connection with the National Hospital whenever there are potential donor candidates. Norway also takes part in the Nordic
(Scandiatransplant) and European (Eurotransplant) programs, but more than 85% of all transplants are performed with organs received from the national donor hospitals.

POPULATION-BASED REGISTRIES

All Norwegians receive a unique 11-digit identity number at birth or by the time of immigration. This allows for the establishment of unique nationwide registries covering a number of diseases. Of particular interest and value to surgeons are the Cancer Registry, the Norwegian Inpatient Registry, and Statistics Norway (with a cause of death registry) as well as numerous other specialty-related registries and databases, including those of the Norwegian Gastrointestinal Cancer Group, including a rectum cancer registry and colorectal cancer registry, the Norwegian Breast Cancer Group, and the orthopedic Norwegian Arthroplasty Registry.

The Cancer Registry of Norway10 (established in 1951) is a governmental institute for population-based cancer research. The registry has records of all types of cancers diagnosed in Norway since 1953 and reports cancer incidence and changes over time.

All doctors are required by law to report all (pre) cancer conditions to the Cancer Registry. Cross-matching the reports from surgeons, pathologists, and oncologists involved in treatment and diagnosis, together with links to the cause of death registry, ensures a unique and very correct overview of cancer epidemiology in Norway, published online.10

The Cancer Registry is involved in several screening projects (breast, cervix, and colorectal cancer) and clinical monitoring and genetics in relation to cancer, which also involves surgeons.

RESEARCH

The Scandinavian Surgical Society was established in 1892, and the official journal is the currently restructured Scandinavian Journal of Surgery, which serves as the only general surgical journal in Scandinavia.11 The Norwegian Surgical Association (established in 1911) was the first subdivision of the Norwegian Medical Association (established in 1886) and has for more than 80 years fostered education and research through the annual national meeting held in Oslo.

Research in surgery may evolve through any of the mentioned national databases or in connection with (basic) research laboratories or clinics offering surgical training. Developments in new technologies are being performed in connection with engineering sciences, such as development of the “operating room of the future” at St. Olav University Hospital in Trondheim or minimally invasive and robotic techniques at the National Hospital in Oslo. Basic science, animal research, clinical investigation, and epidemiological studies are performed in a wide range of surgical specialties. Some 17% of general surgeons have obtained a PhD degree, a rate far higher than the overall 8% for all Norwegian doctors and just short of a somewhat higher rate for internal medicine. Overall, 1 in every 3 subspecialist (gastrointestinal, vascular, pediatric, and thoracic) surgeons has a PhD degree.

While academic activity is not a mandated requirement for specialization, time involved in research (preferably leading to a PhD degree)—up to 12 months of research—can be acquired for when applying for the surgical license. Some faculties have introduced PhD programs for students to recruit more researchers/scientists with a medical degree and to speed up research productivity.

The majority of research is financed from the respective regional health trusts. National funding can be also be obtained, such as through the Norwegian Cancer Society or the Norwegian Research Council. Further, funds, grants, or support given by societies, patient associations, or private donations contribute to economic support.

FUTURE CHALLENGES

Recruitment

In 2006, the number of board-approved Norwegian specialists in general surgery reached the lowest approval level recorded since 1972 and the lowest number since 1994, if converted licenses from foreign countries are included.3 The slow recruitment of general surgeons over the past decade is far beyond that of other (comparable) professions. For one, orthopedic surgery has seen a 4-fold relative increase in specialists in the same period. Further, the increasing pool of aging specialists in general surgery calls for action; 1 in every 3 will reach the age of retirement by 2015, with the highest rates in vascular surgery (>40%).

Continuity of Care

In a 40-hour work week environment affected by recently added restrictions on on-call time, a significant drop has been seen in the number of residents available at the wards and in the operating room. The clinical work burden for an overloaded faculty has further increased. Time for academic tasks and improvements in surgical services, teaching, and supervision is constrained. Concerns and criticism have been forwarded from both academic and nonacademic departments. Restrictions on surgical positions governed by the National Board of Specialized Health Care and a lack of (available) residents have not been compensated for so far.

Far-reaching subspecialization has taken place during the last 2 decades. As a result, the quality of surgical care has improved but the role of the general surgeon has blurred.12 To ensure recruitment and competitiveness, the training process needs to be smoothed while ensuring quality. A “common trunk” of training before specialization has been entertained but is in a current vacuum.

The technical revolution, including endoscopy, minimally invasive access, interventional radiology, and nonoperative treatment alternatives, changes the surgical curriculum. Geographical differences in case load and organization of services make it difficult to outline a rigid national educational program.
In summary, constrained hospital budgets and low recruitment to surgical specialties are all challenges that need to be faced in the immediate future. Several governmental, societal, educational, and technical evolutions continue to change the working environment. Yet, active surgeon participation continues to ensure a high focus on patient care and safety, staff education and training, and high academic achievements. National restructuring should provide for continued opportunities and clinical excellence for future surgeons.

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REFERENCES


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