Commentary
Preparing physicians to practice genomic medicine

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As genomics takes the IVD industry by storm, integrating new genomic technologies into clinical practice will require physicians to improve their knowledge of genetics and the molecular implications of genomics. Genomics-based IVDs, such as profiling of single nucleotide polymorphisms, mRNA, and protein, can improve healthcare through prevention, predictive diagnoses, improved prognoses, and tailored drug treatments. To use such technologies effectively, physicians must understand their benefits, risks, utilities, and limitations as well as the medical management and counseling needs based on patients’ genomic profiles.

During the last three decades, several national groups have assessed the knowledge and education of genetics among health professionals and made numerous recommendations in their reports. The groups concluded that more information about genetics and genomics must be included in medical education and training programs. In addition, each subsequent report’s recommendations became more specific and focused as genetics research and clinical applications advanced.

While some recommendations have been implemented, change has been slow in medical schools and the medical practice community. Professional organizations and the IVD industry must continue their outreach efforts to ensure that physicians are prepared to utilize genomics-based IVDs appropriately.

Physician Training in Genetics and Genomics

The current status of genetics and genomics education and training can be determined by evaluating the stages of physician education. For admission to medical school, genetics is typically not required, although some schools may be revising their general requirements. A 2004 review of admissions requirements at the top 20 medical schools as ranked by U.S. News & World Report found that while only one school requires genetic coursework, several other schools recommend coursework in biochemistry, molecular biology, and cell biology.

The primary source of genetics and genomics information for physicians is medical school. Surveys have shown that the number of medical students taking genetics courses has increased during the past 30 years. A 1975 survey of pediatricians, family physicians, and obstetricians found that nearly 75% had no courses in genetics during their medical training. However, in 1998 and 2000, two separate surveys found that 69% and 86% of nongeneticist physicians took one or more genetics courses in medical school.

While the provision of genetics coursework has improved, the content and depth of these courses vary, and the integration of genetics across other subjects is minimal. Moreover, genetic concepts learned during the first two years of medical school are rarely reinforced through practical applications in the third and fourth years, thereby indirectly diminishing the importance of genetics in practice.

The genetics education obtained during medical school is further diminished during residency training programs, which typically do not require genetics. The exceptions are pediatrics, obstetrics, and gynecology, in which genetics has traditionally been practiced. For genetics to make an impact on the content of clinical training programs, specialists in each field must advocate for their training programs to include genetics as a requirement.

This challenge has met varying degrees of success. For example, internal medicine residency training programs have no specific requirements for training in genetics, other than exposure at conferences and during grand rounds. However, in 2002, the Accreditation Council for Graduate Medical Education (ACGME; Chicago) set up a genetics curriculum committee for the internal medicine programs. This committee...
developed a concise curriculum to guide the inclusion of genetics in these training programs.

Similarly, while genetics is not explicitly required in family medicine residency programs, ACGME recommended that residents receive some training in genetic counseling.8 In 1999, in an effort to support genetics and genomics requirements in family medicine programs, the American Academy of Family Physicians (Leawood, KS) endorsed the core educational guidelines for medical genetics for family practice residents. In addition, several dual training programs that provide genetics training alongside other medical specialties (e.g., pediatrics, psychiatry, neurology) are either available or being developed.

Despite efforts to expand genetics education and training, the inclusion of genetics material on the U.S. Medical Licensing Examinations (USMLES) has been minimal. This is in part because the USMLEs are designed to test knowledge that is essential to current medical practices rather than future ones, such as the application of genetics to complex diseases. Similarly, the content of medical specialty certification board exams is linked to residency training requirements; therefore, genetics and genomics are rarely included.

One way to bridge the generational gap for providers who were trained before the era of genomics is through continuing medical education (CME) programs in genetics. However, a survey of medical specialty societies found that only 36% offer CME materials in medical genetics, 32% were currently developing materials, and almost two-thirds expressed interest in having educational materials in medical genetics available to specialists.7

The Roadblocks

Despite national groups recommending for three decades changes to enhance genetics instruction, the importance of genetics and genomics has only recently been acknowledged in medical education and training. Nonetheless, revising medical education and training to include a subject that is important for physicians continues to be difficult. This is due to the following four obstacles: perceived lack of relevance of genetics to today’s medical practices; lack of treatments for many genetic disorders; lack of faculty to champion and teach genetics; and overcrowded curricula in medical schools and other competing specialties.

Lack of Relevance. Although many healthcare practitioners expect genomics to affect the practice of medicine, not everyone shares this view.8,9 The perceived irrelevance of genetics by some may stem from the view that genetics and genomics are futuristic and applicable only to rare disorders. This would explain the paucity of genetics-related questions on the USMLE and certification examinations, as well as the low percentages of nongeneticist practitioners who attend CME programs on genetics.

The challenge is to demonstrate the immediate and future relevance of genetics to those healthcare providers unfamiliar with the field. IVD manufacturers can play a critical role in raising physician awareness that would facilitate the transition of genomics-based diagnostics into clinical practice. IVD manufacturers could host seminars at academic or hospital centers, conduct workshops and exhibits at professional society meetings, and disseminate written or on-line educational materials. Such materials would describe new genomic diagnostic tools and their benefits, risks, utilities, and limitations, thereby improving awareness and understanding.

Therapeutic Gap. Development of therapies for genetic disorders has lagged behind the ability to diagnose and predict genetic diseases, and will continue to do so for some time. The initial hopes for gene therapies have yet to bear fruit, although some reports are encouraging. Pharmaceutical companies have developed only a few drugs that target the underlying genetic lesions in cancer, such as Gleevac and Herceptin.

However, the value of a genetic diagnosis or prediction of increased risk should not be based solely on improved medical outcomes. A genetic diagnosis or prediction of increased risk may lead to other outcomes, such as preventive screening measures, changes in life-style habits, appropriate drug selection, informed decisions regarding reproduction, counseling needs, and increased awareness of other family members’ health. Users of genomics-based IVDs need to be made aware of these multiple benefits to enable appropriate uses of these tools.

Lack of Faculty. Coincident with increased research and investment in genetics and genomics, the number of board-certified geneticists who are responsible for a large part of genetics education in medical schools is declining. With the shrinking genetics specialist workforce, additional innovative approaches will need to fill the void, including developing on-line genetics courses and resources for practicing physicians.

For those medical schools that do not have qualified geneticists on staff, other departmental faculty members with limited background in genetics may be asked to teach. Faculty development projects are available that can aid in educating nongeneticists on genetic developments and applications. One such project is the Genetics in Primary Care project by the Health Resources and Services Administration (Rockville, MD). IVD manufacturers could participate in faculty development and CME programs through sponsorships and development of educational materials in collaboration with professional medical organizations.
Overcrowded Curricula. Medical school curricula are already overcrowded. However, because most medical schools already offer a course in basic genetics, no additional teaching time is needed. Rather, the basic genetics course should be revised and updated to reflect current genetics knowledge and practices, as well as new applications being used and developed. In addition to a basic genetics course, genetics content should be integrated into other traditional medical specialties as they are taught. Physicians should learn to think "genetically," a perspective and attitude that involve recognizing when genetic factors are or may be playing a role in a patient's health.

Conclusion

The goal of enhancing genetics and genomics education is to increase physician awareness and appreciation of the field, and not to create quasi geneticists. While substantial progress has been made to enhance genetics education, room for improvement remains. The steps taken thus far are encouraging. Medical schools, professional medical organizations, and the IVD industry can hopefully work together to overcome obstacles, whereby physicians will have the knowledge to apply new genomic tools and applications that can improve the current and future health of their patients.

References


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