

REPORT 4 OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH (I-12)
Clinical Application of Next-Generation Genomic Sequencing
(Reference Committee K)

EXECUTIVE SUMMARY

Objectives. With the advent of new DNA sequencing technologies, referred to as “next-generation sequencing,” large-scale analysis of individual genomes has become possible and is rapidly being deployed to guide clinical care. Next-generation sequencing technologies have the potential to drive significant improvements in patient care and outcomes, yet concerns exist that will require careful consideration to ensure appropriate clinical implementation. The Council initiated this report to briefly review the clinical applications of next-generation sequencing, concerns surrounding its implementation, and the extent to which the increasing accessibility of genomic data has the capability to improve health outcomes.

Data Sources. Literature searches were conducted in the PubMed database for English-language articles using the search terms “next generation sequencing,” “whole genome sequencing,” and “whole exome sequencing,” along with the terms “clinic,” “clinical,” and “physician.” To capture reports that may not have been indexed on PubMed, a Google search was also conducted using the same search terms. Additional articles were identified by manual review of the references cited in these publications.

Results. In anticipation that analysis of entire genomes would be valuable for clinical care, new sequencing technologies have been developed that enable rapid genome sequencing for dramatically reduced costs. These next-generation sequencing (NGS)-based analyses include whole-genome sequencing and whole-exome sequencing, which have shown the most clinical utility in facilitating an accurate diagnosis in individuals with disorders that present with atypical manifestations, are difficult to confirm using clinical or laboratory criteria alone, or require extensive or costly evaluation. Cancer diagnosis and treatment have also benefited from NGS-based technologies. However, the potential of NGS technologies to improve patient care is dependent on addressing challenges such as managing extremely large datasets, return of results, and regulation and reimbursement. The establishment of standards and best practices for both laboratories and physicians is needed to promote the appropriate clinical use of NGS technologies.

Conclusions. NGS-based technologies have the potential to drive significant improvements in patient care. Already WGS and WES have shown remarkable ability to end the diagnostic odyssey for patients with disorders that are resistant to standard diagnostic procedures and targeted genetic testing. Cancer patients also stand to gain from improved molecular analysis that enables accurate tumor classification, and improved diagnosis and management options. Current challenges to implementation must be addressed in order to fully realize the incredible potential of NGS-based technologies to improve health outcomes.

RECOMMENDATIONS

The Council on Science and Public Health recommends that the following recommendations be adopted and the remainder of this report be filed:

1. Our American Medical Association recognizes the utility of next-generation sequencing (NGS)-based technologies as tools to assist in diagnosis, prognosis, and management, and acknowledges their potential to improve health outcomes. (New HOD Policy)
2. Our American Medical Association encourages the development of standards for appropriate clinical use of NGS-based technologies and best practices for laboratories performing such tests. (Directive to Take Action)
3. Our American Medical Association will monitor research on and implementation of NGS-based technologies in clinical care, and will work to inform and educate physicians and physicians-in-training on the clinical uses of such technologies. (Directive to Take Action)
4. Our American Medical Association will support regulatory policy that protects patient rights and confidentiality, and enables physicians to access and use diagnostic tools, such as NGS-based technologies, that they believe are clinically appropriate. (New HOD Policy)
5. Our American Medical Association will continue to enhance its process for development of CPT codes for evolving molecular diagnostic services, such as those that are based on NGS; serve as a convener of stakeholders; and maintain its transparent, independent, and evidence-based process. (Directive to Take Action)