distinguish approved therapies from unproven claims and refer interested patients to well-designed clinical trials.

Medical applications of CRISPR-Cas9 are promising, and their safety and efficacy for particular clinical conditions are being carefully evaluated in clinical trials. Applications of CRISPR genome editing in somatic cells to modify or correct problematic genes could lay the foundation for treating a variety of serious diseases, including blood disorders, HIV, cancer, and hereditary blindness. Germline gene editing in blastocysts or embryos raises many ethical questions and is currently not permitted in the United States in clinical trials or clinical practice.

In artificial intelligence (AI), computers carry out tasks typically done by humans. Machine learning (ML) is a type of AI that automatically learns and improves its performance without explicit programming. Clinical algorithms using AI and ML can make diagnoses from radiology images, retinal scans, or skin photographs and identify patients at increased risk for surgical complications, critical care, or hospital readmission. However, such algorithms can also pose risks. Bias may occur if an algorithm was derived or validated from a data set in which groups who suffer from health disparities or poor health outcomes are underrepresented or if the algorithm predicts outcomes that are not clinically meaningful. To address these ethical concerns, researchers should assess AI algorithms in well-designed randomized clinical trials with clinical endpoints. Institutions should integrate validated and unbiased algorithms into clinical workflow without unduly burdening physicians and nurses and should check effectiveness and safety in their particular settings and patient populations.

Physicians should stay informed of emerging evidence about such technologies and the ethical challenges that accompany their use and always keep their patients' best interests and preferences at the forefront.

GLOBAL CONSIDERATIONS

■ International Research