Chapter 8. Health System Infrastructure

Ensuring well-coordinated, high-quality health care requires the establishment of a supportive health system infrastructure. High-performance health systems require a well-distributed workforce, information systems for data collection, quality improvement analysis, and clinical communication support, as well as the organizational capacity to support culturally competent services and ongoing improvement efforts.[1]

Health care models such as Wagner's Chronic Care Model (CCM) and Patient-Centered Medical Home (PCMH) promote a safety culture for patients. CCM promotes health care delivery systems designed to support community-based resources, self-management of care, and information support systems. Information support systems provide the basis for much of the continuity in patient records and clinician communication. PCMH uses a team-based model led by a primary care physician who provides continuous and coordinated care throughout the patient's life. Features such as open scheduling, expanded hours, and new options for communication between patients and their personal physicians and practice staff enhance patient experiences and improve the quality of care.

A well-integrated, culturally competent health care delivery system that allows patient information to be readily available to providers positively affects the quality and efficiency of care and therefore patient outcomes. The adoption and use of health information technology (IT) can be an effective way to manage health care costs and improve the quality of care. Since the publication of the Institute of Medicine (IOM) report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*,[i] which emphasized the need for standardized collection and reporting of racial and ethnic data, the need for more granular detail on racial and ethnic subgroups has become apparent. This is an area where the adoption and use of health IT can be beneficial.

Another area of patient care that could be improved with the adoption and use of health IT is care coordination. A Commonwealth Fund study found that health IT can facilitate care coordination within a practice, but a lack of interoperability makes exchange of information between health care facilities difficult. Evidence has also shown that the adoption and effective use of health IT can help reduce medical errors and adverse events, enable better documentation and file organization, provide patients with information that assists their adherence to medication regimens and scheduled appointments, and assist doctors in tracking their treatment protocol.[1]

Having an adequate number of providers is an important aspect of the health system infrastructure and can be an indicator of quality of care. It is also important to have a large enough and appropriately distributed workforce to respond to expected increases in patient demand. Previous reports have presented data on diversity in the physician, nursing, and dental professions workforce. This year, the National Healthcare Quality Report (NHQR) and National Healthcare Disparities Report (NHDR) present data on the geographic and racial/ethnic distribution of the pharmacy workforce.

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[i] Available at the National Academies Press Web site at http://www.nap.edu/openbook.php?isbn=030908265X.

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Measures

The IOM acknowledges that health system infrastructure measures such as the adoption and effective use of health IT are likely to be in the developmental stage, and evidence of the impact on quality improvement has not yet been strongly established. The IOM highlighted three infrastructure capabilities that should be further evaluated for reporting. These capabilities include care management processes, adoption and use of health IT, and workforce distribution and its relevance to minority and other underserved populations.

Previous reports have included information on the culture of patient safety in hospitals, and this information is updated here. Previous reports have also included information on the health care workforce and information about pharmacists is presented in this report. A new area where there is growing evidence of impact on health care quality is electronic prescribing (e-prescribing). Taking this into account, the 2010 reports include new e-prescribing measures for both hospital and ambulatory settings.

Findings

Care Management Processes: Focus on Patient Safety Culture

The 2010 NHQR and NHDR highlight the organizational capacity—resources, knowledge, and processes—of hospitals in the area of patient safety. High-reliability organizations that achieve low rates of adverse events establish "cultures of safety." A culture of safety is characterized by shared dedication to making work safe, blame-free reporting and communication about error, collaboration and teamwork across disciplines, and adequate resources to prevent adverse events.

AHRQ developed the Hospital Survey on Patient Safety Culture to help hospitals assess the culture of safety in their facilities. AHRQ began producing comparative database reports in 2007 to help hospitals assess their performance relative to similar institutions.

In this NHDR, we present data from the *Hospital Survey on Patient Safety Culture: 2010 User Comparative Database Report*.[2] This report is based on survey responses collected in 2009 from more than 330,000 hospital staff in 885 hospitals representing 15% of the Nation's hospitals. The average hospital response rate was 56%, with an average of 383 completed surveys per hospital.

Most hospitals administered Web surveys, which resulted in lower response rates (50%) compared with response rates from paper (63%) or mixed-mode surveys (56%). In addition, most hospitals administered the survey to all staff or a sample of all staff from all hospital departments. Nurses accounted for more than one-third of respondents, followed by "other." More than three-quarters of respondents had direct interaction with patients.

Results are presented for the 12 patient safety culture composites addressed in the survey, expressed as average percent positive response. Percent positive refers to the percentage of responses that agree or strongly agree with a positively worded item (e.g., "People support one another in this work area") and the percentage that disagree or disagree strongly with a negatively worded item (e.g., "We have safety problems in this work area"). Hospitals contributing data to the comparative database mirror the population of U.S. hospitals as a whole, but participation is entirely voluntary. Thus, it may not be possible to generalize findings to all types of facilities.

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Hospital ownership is affected by factors such as financial support and profitability, and these factors can affect the quality of patient care, including patient safety. Because many minority groups and low-income populations are served by public hospitals, we present patient safety culture survey results for government and nongovernment hospitals.

Figure 8.1. Patient safety culture composites by hospital control, 2009
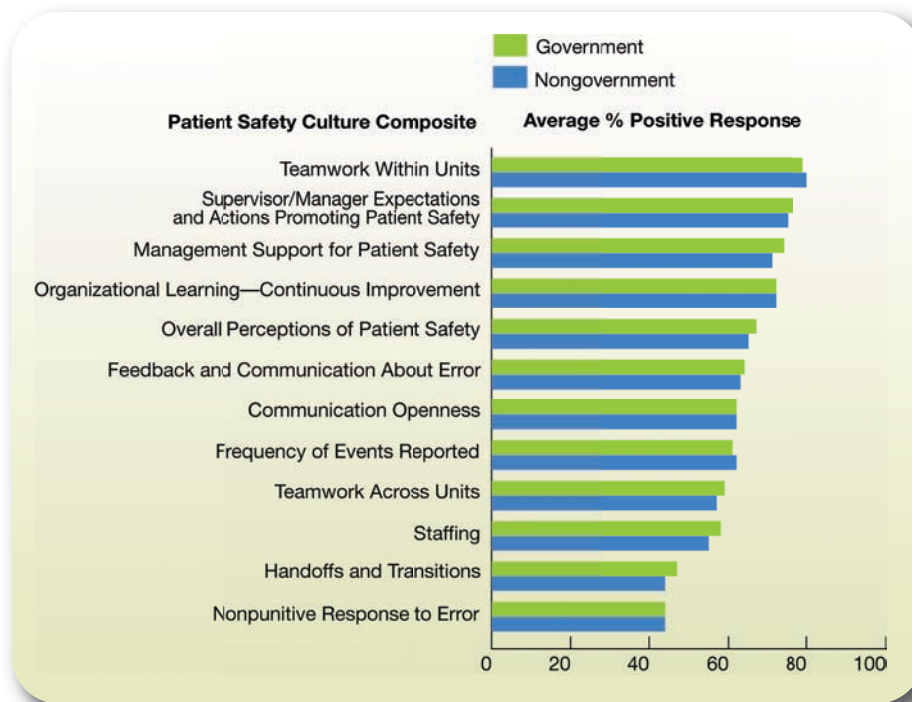
Source: Agency for Healthcare Research and Quality, *Hospital Survey on Patient Safety Culture: 2010 User Comparative Database Report*.

● Nongovernment hospitals had higher percentages of positive response for Teamwork Within Units (80%; Figure 8.1) compared with government hospitals (79%) but government hospitals had a higher percentage of positive response for Supervisor Expectations and Actions Promoting Patient Safety (76%) than nongovernment hospitals (75%). Teamwork Within Units is the extent to which staff support each other, treat each other with respect, and work together. Supervisor/Manager Expectations and Actions Promoting Patient Safety refers to the extent to which supervisors/managers consider staff suggestions for improving patient safety, praise staff for following patient safety procedures, and do not overlook patient safety problems.

● Government hospitals had higher percentages of positive response for Handoffs and Transitions (47%) compared with nongovernment hospitals (44%). For Nonpunitive Response to Error, both government and nongovernment hospitals had 44% positive response.

● Across all composites, government hospitals had a slightly higher percent positive response than nongovernment hospitals (64% compared with 63%; data not shown).

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Also, in the NHQR:

● Hospitals in the East South Central and West South Central regions had higher percentages of positive response for teamwork (81%) and Supervisor Expectations and Actions Promoting Patient Safety (78%) than hospitals in other regions.

Health Information Technology: Focus on Medication Management

E-prescribing uses technology to allow prescribers to electronically transmit prescriptions. The IOM report *Future Directions for the National Healthcare Quality and Disparities Reports* highlights the adoption and use of health IT as a tool to manage cost and improve the quality of care delivered. Medication errors occur during the prescribing, dispensing, administering, and monitoring phases of patient care. Adoption and use of e-prescribing can be a major step in reducing medication errors by improving the prescribing and dispensing aspects of medication management.[3]

Studies show that the elimination of handwriting interpretation decreases medication error rates and reduces communication time between pharmacies and office staff. It also can avoid costs resulting from adverse drug events.[4] It is estimated that between 380,000 and 450,000 adverse drug events occur annually in hospital settings, resulting in a cost of $3.5 billion annually in the United States.[5]

One aspect of e-prescribing, clinical decision support, encompasses a wide range of computerized tools directed at improving patient care, including computerized reminders and advice regarding drug selection, dosage, interactions, allergies, and the need for subsequent orders.[6] In addition, once an e-prescription is in the system, it will follow the patient, avoiding many of the "handoff errors."

Office-Based Physicians With Electronic Prescribing Systems

Populations that often experience health care disparities, including minorities, low-income families, rural residents, and older adults, can benefit from their health care providers adopting health information technologies such as e-prescribing. E-prescribing can improve medication therapy by sending prescriptions directly to pharmacies, alerting physicians to possible adverse drug events, and allowing physicians to select drugs that are of lower cost but equally effective.

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Figure 8.2. Office-based physicians with electronic prescribing system by physician age and percent non-Hispanic White population, 2009 (preliminary)
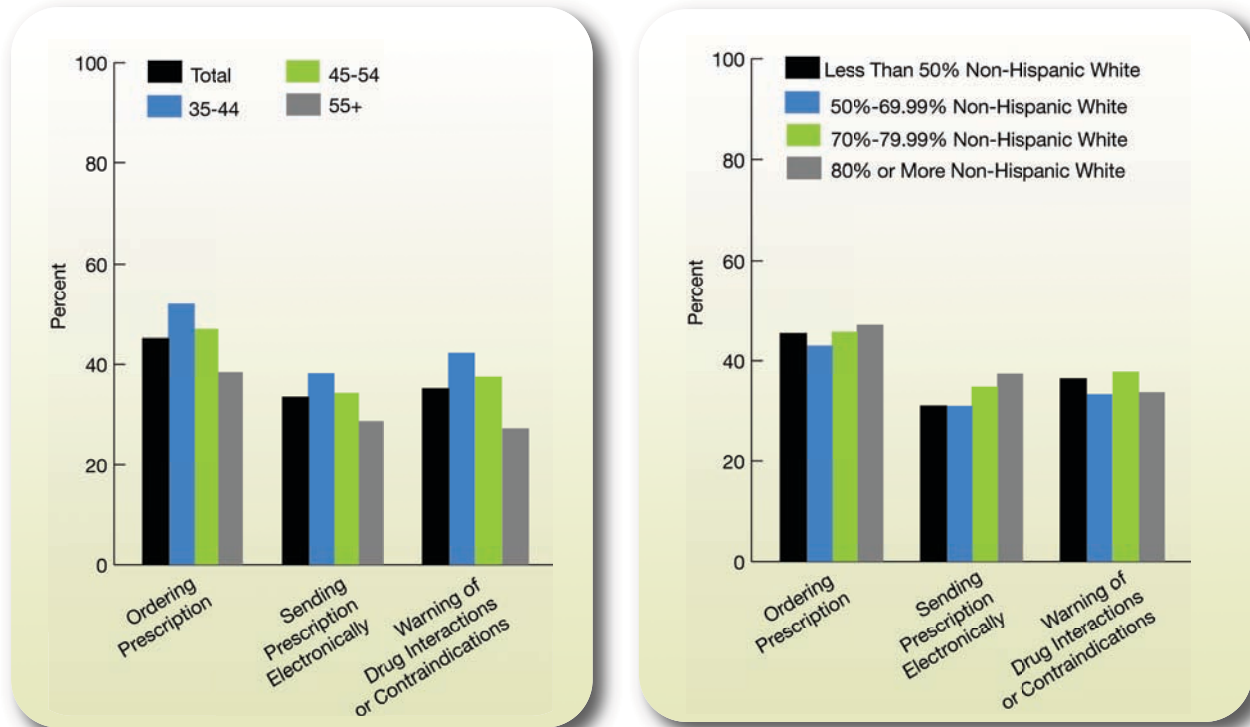
Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Ambulatory Medical Care Survey, Electronic Medical Record Mail Survey Supplement, preliminary 2009.
Note: Percent non-Hispanic White population for physician office's ZIP Code tabulation area is estimated from the 2000 U.S. Census.

Adopting Computerized Systems

- Preliminary estimates from 2009 indicated that office-based physicians ages 35-44 had the highest percentage of adoption of computerized systems for ordering prescriptions, sending prescriptions electronically, and warning of drug interactions or contraindications (Figure 8.2). The percentage of the non-Hispanic White population was not shown to significantly affect adoption.

Ordering Prescriptions

- Preliminary estimates from 2009 indicate that the percentage of office-based physicians ages 35-44 who had a computerized system for ordering prescriptions was significantly higher than that of physicians age 55 and over.

- The percentage of physicians who had a computerized system for ordering prescriptions was comparable in areas with populations of less than 50% non-Hispanic Whites and areas with populations of 50% or more non-Hispanic Whites.

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Sending Prescriptions Electronically

- Preliminary estimates from 2009 indicate that the percentage of office-based physicians ages 35-44 who had a computerized system for sending prescriptions electronically was significantly higher than that of physicians age 55 and over.

- The percentage of physicians who had a computerized system for sending prescriptions electronically was comparable in areas with populations less than 50% non-Hispanic Whites and areas with populations of 50% or more non-Hispanic Whites.

Providing Drug Warnings

- Preliminary estimates from 2009 indicate that the percentage of office-based physicians ages 35-44 who had a computerized system for warning of drug interactions or contraindications was significantly higher than that of physicians age 55 and over.

- The percentage of physicians who had a computerized system for warning of drug interactions or contraindications was comparable in areas with populations of less than 50% non-Hispanic Whites and areas with populations of 50% or more non-Hispanic Whites.

Also, in the NHQR:

- Preliminary estimates from 2009 indicate that the percentage of office-based physicians practicing in metropolitan areas who had a computerized system for ordering prescriptions was significantly higher than that of physicians in nonmetropolitan areas.

- Physicians in the West also had a significantly higher percentage of computerized systems for ordering prescriptions than physicians in the South.

- Physicians in practices with more than 10 physicians had a significantly higher percentage of computerized systems for ordering prescriptions than practices with 10 or fewer physicians.
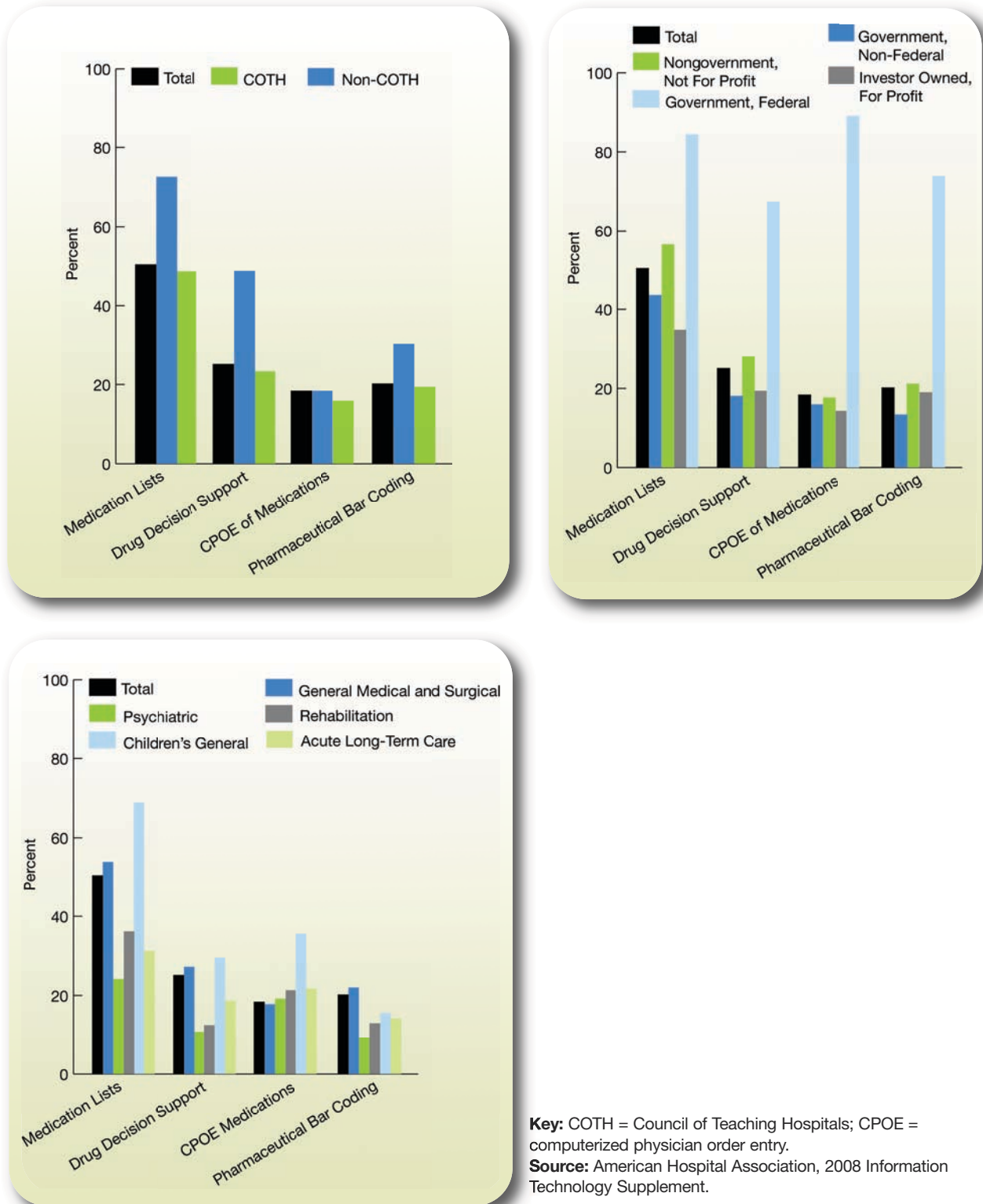
Medication Management in Hospitals

Patient handoffs and transitions of care have been identified as placing patients at increased risk of adverse events. Once a patient is admitted to the hospital, medication plays a vital role in his or her recovery. Doses of patients' medications may be altered, new drugs added, and others discontinued. Electronic medication management can aid in the reduction of adverse events by providing accurate, current medication information as patient care is transferred from one health care team to another.

Hospitals that are members of the Council of Teaching Hospitals (COTH) consist mainly of not-for-profit hospitals, including some government hospitals. Many are located in inner-city areas where they serve large populations that include minorities and Medicaid recipients who experience significant health care disparities. COTH hospitals provide a substantial portion of care to underserved populations. According to the Association of American Medical Colleges, in 2007, teaching hospitals constituted just 6% of all hospitals but incurred 41% of charity care costs.

Figure 8.3. Electronic management of medication in hospitals, by COTH membership, hospital control, and hospital type, 2008

Key: COTH = Council of Teaching Hospitals; CPOE = computerized physician order entry.
Source: American Hospital Association, 2008 Information Technology Supplement.

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Medication Lists

- In 2008, 50.5% of hospitals had an electronic system that supports medication lists (Figure 8.3).

- Hospitals that were members of COTH had a much higher percentage of electronic systems that support medication lists (72.6%) than hospitals that were not members (48.8%).

- Hospitals run by the Federal Government also had a much higher percentage (84.4%) of electronic systems that support medication lists than non-Federal (43.8%), not-for-profit (56.5%), and investor-owned hospitals (34.8%).

- Nearly 70% of children's general hospitals and 53.9% of general medical and surgical hospitals had an electronic system that supports medication lists.

- Between 24% and 36% of psychiatric, rehabilitation, and acute long-term care hospitals had an electronic system that supports medication lists.

Drug Decision Support

- In 2008, 25.1% of hospitals had a fully implemented electronic system for drug decision support.

- The percentage of COTH member hospitals with a fully implemented electronic system for drug decision support (48.9%) was more than twice that of nonmember hospitals (23.3%).

- Hospitals run by the Federal Government also had a much higher percentage (67.4%) of full implementation of electronic drug decision support systems compared with non-Federal (18.1%), not-for-profit (28.1%), and investor-owned hospitals (19.4%).

- Nearly 30% of children's general hospitals and 27.2% of general medical and surgical hospitals had a fully implemented electronic drug decision support system.

- Between 11% and 19% of psychiatric, rehabilitation, and acute long-term care hospitals had a fully implemented electronic drug decision support system.

CPOE for Medication

- In 2008, 18.4% of hospitals had a fully implemented computerized physician order entry (CPOE) system.

- Nearly 20% of COTH member hospitals (18.4%) had a fully implemented CPOE system compared with 15.9% of nonmember hospitals.

- Hospitals run by the Federal Government had a much higher percentage (89.1%) of full implementation of CPOE systems compared with non-Federal (16.0%), not-for-profit (17.7%), and investor-owned hospitals (14.3%).

- More than 35% of children's general hospitals, 21.7% of acute long-term care hospitals, and 21.3% of rehabilitation hospitals had a fully implemented CPOE system. Nearly 20% of psychiatric hospitals (19.2%) and 17.8% of general medical and surgical hospitals had full implementation of CPOE systems.

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Pharmaceutical Bar Coding

- In 2008, 20.2% of hospitals had fully implemented electronic pharmaceutical bar coding systems.

- Nearly one-third of COTH member hospitals (30.3%) had a fully implemented pharmaceutical bar coding system compared with 19.4% of nonmember hospitals.

- Hospitals run by the Federal Government had a much higher percentage (73.9%) of full implementation of pharmaceutical bar coding systems compared with non-Federal (13.4%), not-for-profit (21.2%), and investor-owned hospitals (19.0%).

- More than 20% of general medical and surgical (22%), 15.6% of children's general, 14.2% of acute long-term care, 13% of rehabilitation, and 9.1% of psychiatric hospitals had a fully implemented pharmaceutical bar coding system.

Also, in the NHQR:

- In 2008, 25.1% of hospitals had a fully implemented electronic system for drug decision support.

- The largest difference in implementation was observed between large and small hospitals. Nearly 40% of hospitals with more than 400 beds had a fully implemented electronic system for drug decision support, but only 17.5% of hospitals with fewer than 100 beds had a fully implemented system.

- In the Northeast, nearly 29% of hospitals had fully implemented electronic systems for drug decision support. In the Midwest, 25.6% of hospitals had a fully implemented electronic system for drug decision support. In the South, 24.4%, and in the West, 23% of hospitals had a fully implemented electronic system for drug decision support.

Workforce Diversity

In 2008, the Nation's overall minority population was 104.6 million, or 34 percent of the total population. Nearly half of the Nation's children younger than 5 were members of a racial or ethnic minority group; among all children under 18, 44% were part of a racial or ethnic minority group. It is estimated that by 2050, half of Americans will be members of minority groups.[7] Minority providers are more likely than their White colleagues to practice in underserved minority communities.[8, 9] Health care workforce diversity also is considered to be important for health care research, education, administration, and policy, both to provide role models and to shape a health care system that meets the needs of all individuals.

In 2007, 15.6% of the U.S. labor force was foreign born. Of the 281 million people age 5 and over in the United States in 2007, 55.4 million individuals (20%) reported speaking a language other than English at home. Workforce diversity increases the opportunities for race- and language-concordant health care visits. It also can improve cultural competency at the system, organization, and provider levels in several ways. These include appropriate program design and policies, organizational commitment to culturally competent care, and cross-cultural education of colleagues.[10] As such, diversity is an important element of a patient-centered health care encounter.

Previous reports have presented data on diversity in the physician, nursing, and dental professions workforce. This year, the NHDR presents data on diversity in the pharmacy workforce.

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Pharmacists distribute prescription drugs to individuals. They also advise their patients, physicians, and other health practitioners on the selection, dosages, interactions, and side effects of medications. In addition, pharmacists monitor the health and progress of patients to ensure that they use their medications safely and effectively. Most pharmacists work in a community setting, such as a retail drugstore, or in a health care facility, such as a hospital.

Having an adequate number of providers is an important aspect of the health system infrastructure and can be an indicator of the quality of care. It is also important to have a large enough and appropriately distributed workforce to respond to expected increases in patient demand. Studies have shown that pharmacist involvement in patient care can result in better diabetes and hypertension management as well as a decrease in heart failure events and mortality.[11] Also, pharmacist involvement in patient care can reduce adverse drug reactions or medication errors and increase patient comprehension of treatment protocols and medication adherence.

Figure 8.4. U.S. pharmacy professionals compared with the U.S. population, by race/ethnicity, 2006-2008
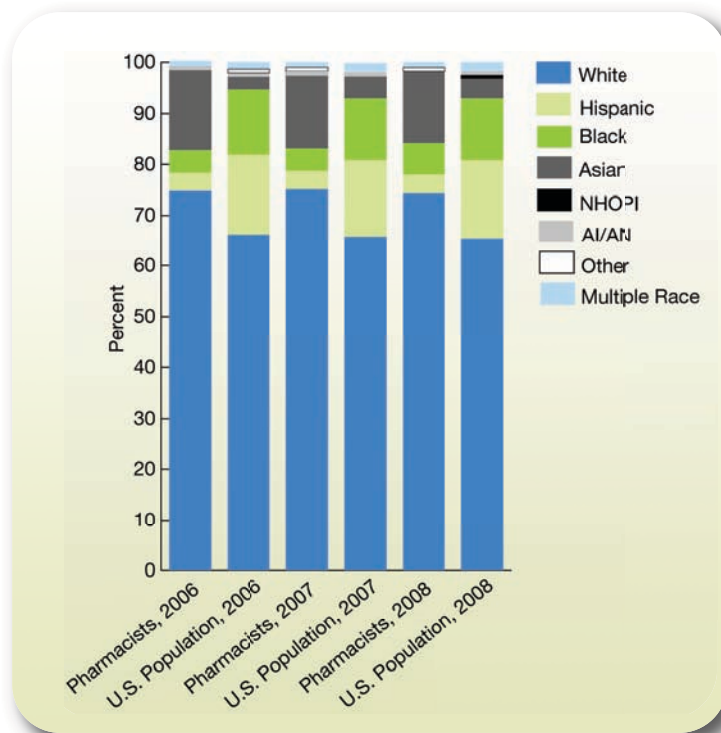
Key: AI/AN = American Indian or Alaska Native; NHOPI = Native Hawaiian or Other Pacific Islander.
Source: U.S. Census, American Community Survey, 2006-2008.
Note: All populations are non-Hispanic except for the population specifically noted as Hispanic.

● Although the number of pharmacists has increased over time, the racial and ethnic makeup of the pharmacist population continues to be disproportionate to the U.S. population. In 2008, 74.3% of the approximately 301,000 pharmacists in the United States were White, 6.2% were Black, 14.4% were Asian, and 3.7% were Hispanic (Figure 8.4). Compared with the general U.S. population, Whites and Asians were overrepresented, and Blacks and Hispanics were underrepresented.

- In 2007, 75.1% of the approximately 290,000 pharmacists were White, 4.4% were Black, 15.4% were Asian, and 3.6% were Hispanic. Relative to the U.S. population, Whites and Asians were overrepresented, and Blacks and Hispanics were underrepresented.

- In 2006, there were about 282,000 pharmacists, of whom 74.4% were White, 5.0% were Black, 16.2% were Asian, and 3.4% were Hispanic. Relative to the U.S. population, Whites, and Asians were overrepresented, and Blacks and Hispanics were underrepresented.

Also, in the NHQR:

- In 2008, 37.8% of the approximately 301,000 pharmacists in the United States practiced in the South, 23.7% in the Midwest, 20.2% in the West, and 18.3% in the Northeast. In all regions, the pharmacist workforce was congruent with the U.S. population. No region had a disproportionate percentage of pharmacists.

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