MARYLAND HEALTH CARE COMMISSION

Health Information Technology

An Assessment of Maryland Hospitals

July 2012

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Executive Summary

Widespread adoption of health information technology (health IT or HIT) has the potential to transform the way health care is delivered, making it safer, more effective, and more efficient.[1, 2, 3, 4] Assessing the landscape of health IT adoption in Maryland can provide decision makers with information to better understand how hospitals are using health IT. This is the fourth year the Maryland Health Care Commission (MHCC) has conducted an annual *Hospital Health Information Technology Survey* (survey) to evaluate Maryland's hospital health IT adoption. The survey is aimed at assessing the current trends and future direction of health IT adoption in Maryland and considered the planning and adoption efforts for eight technologies, including electronic health records (EHRs), electronic prescribing (e-prescribing), computerized physician order entry (CPOE), electronic medication administration records (eMARs), barcode medication administration (BCMA), infection surveillance software (ISS), connectivity to the statewide health information exchange (HIE), and telemedicine.[5]

This is the first year that the MHCC included questions regarding the adoption and planning efforts of telemedicine. In general, telemedicine allows patients to visit with physicians live over video for immediate care or to capture images to be stored and sent to physicians for diagnosis and follow-up treatment at a later time. Effective use of telemedicine can increase access to health care, reduce health disparities, and create efficiencies in health care delivery.[6, 7, 8, 9, 10, 11] In collaboration with the hospital Chief Information Officers, the MHCC has expanded the survey by asking hospitals to report on the number of primary care units implementing each of the technologies. The survey questions were aimed at capturing how the technologies are implemented within each hospital.

Overall, Maryland hospital HIT adoption exceeds national hospital adoption rates. Maryland hospitals reported an increase in the adoption of six out of seven previously assessed technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and HIE connectivity. Overall, health IT adoption trends have increased about 22 percent since the data collection began in 2008.[12] The most notable increase, approximately 18 percent, occurred between 2008 and 2009 as most hospitals adopted technology in anticipation of Federal incentives for EHR adoption.[13] The adoption of BCMA increased the most since the MHCC started surveying hospitals for this information. The statewide

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[1] Institute of Medicine, *Health IT and Patient Safety: Building Safer Systems for Better Care,* 2012. Washington, DC: The National Academies Press.
[2] Health Affairs, *The Benefits of Health Information Technology: A Review of the Recent Literature Shows Predominantly Positive Results*, 30(3), March 2011.
[3] Annals of Internal Medicine, Systematic Review, *Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care*, 2006. Available at: http://www.annals.org/content/144/10/742.full.pdf.
[4] Agency for Healthcare Research and Quality, *Costs and Benefits of Health Information Technology*, April 2006.
[5] For definitions of health information technologies, refer to the *Survey Glossary* in Appendix B.
[6] Medical Science Monitor, *Telemedicine: medical, legal and ethical perspectives,* 2010. Available at: http://www.ncbi.nlm.nih.gov/pubmed/21119593.
[7] Journal of Telemedicine and Telecare, *Systematic Review of Evidence for the Benefits of Telemedicine*, 8(1), 2002.
[8] Journal of Telemedicine and Telecare, *Economic Evaluation in Telemedicine – Still Room for Improvement*, 16(5), 2010.
[9] Neurology, *Long-Term Outcome after Thrombolysis in Telemedical Stroke Care,* 69(9): 898-903, August 2007.
[10] CNS Spectrums: First in Applied Neuroscience, *Can Telepsychiatry Replace In-Person Psychiatric Assessments? A Review and Meta-Analysis of Comparison Studies*, 10(5): 403-413, May 2005.
[11] Archives of Internal Medicine, *Impact of Telemedicine Intensive Care Unit Coverage on Patient Outcomes: A Systematic Review and Meta-analysis,* 171(6): 498-506, March 28, 2011.
[12] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.
[13] The *American Recovery and Reinvestment Act of 2009* includes provisions for funding hospitals and certain health care providers for the adoption and meaningful use of EHRs.

HIE provides the infrastructure for health care providers to securely exchange electronic health information with other providers. During this reporting period, hospitals were required, by regulation, to share select data with the statewide HIE;[14] as a result, their rate of data sharing with the statewide HIE increased by about 89 percent. This data sharing enables the Health Services Cost Review Commission to measure and compare hospital-specific performance on readmissions and to use the data to further enhance and strengthen the financial incentives linked with performance.[15]

The survey also assesses Maryland hospital health IT adoption and implementation by size, geographic location, and hospital affiliation. Consistent with national findings, large and academic hospitals reported the highest rates of adoption. Although national trends indicate higher hospital health IT adoption rates in urban locations, Maryland's rural hospitals had the highest rate of adoption, including a 100 percent adoption rate of EHRs and nearly a 94 percent adoption rate of CPOE. Hospitals were also assessed by their affiliation. Hospitals categorized as part of a larger in-state health system and standalone hospitals had higher heath IT adoption rates as opposed to out-of-state affiliated hospitals. The following table summarizes 2011 hospital health IT implementation overall, and by size, geographic location, and affiliation.

Comparison of Hospital Health IT Implementation by Maryland Hospitals in 2011

Hospital Category		Total Hospitals	EHRs	eRx	CPOE	eMAR	BCMA	ISS	HIE Connectivity	Telemedicine	Health IT Adoption Rate* *(%)*
All Hospitals		46	41	17	38	40	32	16	46	26	**67**
Size	Academic	2	2	1	2	2	1	-	2	1	**67**
	Large	16	16	6	13	16	12	7	16	10	**73**
	Medium	18	15	4	15	15	14	5	18	10	**63**
	Small	10	8	6	8	7	5	3	10	5	**62**
Geographic Location	Urban	12	11	6	10	11	7	4	12	6	**68**
	Suburban	17	13	3	12	13	10	5	17	10	**55**
	Rural	17	17	8	16	16	15	6	17	10	**76**
Affiliation	In State	26	24	10	21	24	18	10	26	12	**69**
	Out of State	3	2	-	1	2	1	1	3	2	**39**
	Standalone	17	15	7	16	14	13	4	17	12	**68**

**The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.*

[14] In 2010, the Health Services Cost Review Commission adopted regulations that require hospitals to electronically connect to the statewide HIE. See COMAR 10.37.07, *Health Information Exchange Data*. Available at: http://www.hscrc.state.md.us/documents/Legal-Legislative/RegulationUpdates/Final/2011/10.37.07.01-07_Final.pdf.

[15] See COMAR 10.37.07, *Health Information Exchange Data*. Available at: http://www.hscrc.state.md.us/documents/Legal-Legislative/RegulationUpdates/Final/2011/10.37.07.01-07_Final.pdf.

Limitations

Information in this report aims at assessing trends in hospital health information technology adoption and planning. The survey data used in developing this report is based on a self-assessment by hospitals and has not been audited. Responses may have been influenced by the respondents' perception of the question.

About the Survey

Background

Widespread adoption of health information technology (health IT or HIT) has the ability to transform health care delivery by providing information about a patient's health, coordinating patient care, helping physicians to diagnose health problems sooner and reduce medical errors.[16, 17] In 2008, the Maryland Health Care Commission (MHCC) began administering the *Hospital Health Information Technology Survey* (survey) to acute care hospitals. Chief Information Officers (CIOs) from acute care hospitals complete the survey each year. CIOs provide critical information regarding current trends and the future direction of health IT adoption in hospitals. The survey assesses current hospital health IT capabilities and adoption progress.

Purpose

The MHCC collects information on hospital health IT adoption and planning efforts among Maryland's acute care hospitals to evaluate hospital adoption and compare rates with those of hospitals nationwide. The findings are used to evaluate opportunities for increasing hospital health IT adoption and implementation. The information is also used by the MHCC to inform policy development regarding the use of health IT in the health care industry.

Survey

Since 2008, the MHCC has administered the survey to all acute care hospital CIOs in Maryland.[18] Similar to previous years, the survey measured the adoption of several key technologies, including electronic health records (EHRs), electronic prescribing (e-prescribing), computerized physician order entry (CPOE), electronic medication administration (eMARs), barcode medication administration (BCMA), infection surveillance software (ISS) and electronic health information exchange (HIE).[19] New to the 2011 survey, the MHCC asked hospitals to report on their use of telemedicine. In collaboration with the hospital CIOs, the MHCC expanded the survey to request information on the implementation of health IT within hospital units to assess the extent of health IT adoption and use.[20] The survey is unique in that it includes planning questions in an effort to better understand the future of health IT adoption. Hospitals that report they have not adopted a technology were asked to indicate their plans to adopt the technology by selecting whether they are assessing, implementing, or undecided at this time about their plans to adopt the technology.

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[16] RAND Corporation, *Health Information Technology: Can HIT Lower Costs and Improve Quality?,* 2005. Available at: http://www.rand.org/pubs/research_briefs/RB9136/index1.html.
[17] Office of the National Coordinator for Health Information Technology, *Health Information Technology.* Available at: http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__home/1204.
[18] For a complete listing of survey questions see *Survey Questions* in Appendix A.
[19] For definitions of health information technologies, refer to the *Survey Glossary* in Appendix B.
[20] Between the 2010 and 2011 reporting periods, the MHCC expanded the definition of primary care units based on feedback from hospital CIOs following the 2010 reporting period.

Hospital Health IT Adoption

Overview

Research suggests that health IT can improve the efficiency, cost-effectiveness, quality, and safety of health care delivery.[21] During the 2011 reporting period, hospitals reported a health IT adoption rate of about 67 percent.[22] Results indicated an increase in adoption of six out of the seven technologies assessed in previous years. This is the first year that the survey assessed telemedicine implementation and planning efforts. The below table summarizes the findings of the survey since its inception. Overall, the use of health IT has increased approximately 25 percent since the survey began in 2008.

Comparison of Hospital Health IT Implementation by Maryland Hospitals 2008 through 2011

Technology	2008 *(n=44)* *# of Hospitals*	2009 *(n=47)* *# of Hospitals*	2010 *(n=46)* *# of Hospitals*	2011 *(n=46)* *# of Hospitals*	2008 – 2011 Change *(# change)*
Electronic Health Records	34	38	41	41	7
Electronic Prescribing	4	13	9	17	13
Computerized Physician Order Entry	24	32	36	38	14
Electronic Medication Administration Record	24	37	37	40	16
Barcode Medication Administration	14	38	29	32	18
Infection Surveillance Software	18	19	17	16	(-2)
Health IT adoption rate* *(%)*	**45**	**63**	**61**	**67**	**22**
HIE Connectivity	*N/A***	*N/A*	5	*46*	*46*
Telemedicine	*N/A*	*N/A*	*N/A*	*26*	*N/A*

**The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.*

***N/A indicates that data for the identified technology was not assessed during the specified reporting period.*

Hospital Health IT Adoption by Technology

Electronic Health Records

An EHR[23] is an electronic version of a patient's medical record and can include key medical data such as progress notes, prescribed medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. When used effectively, EHRs can reduce medical errors and lead to health care savings and better health outcomes.[24] Financial benefits of EHRs are mostly

[21] Agency for Healthcare Research and Quality, *Costs and Benefits of Health Information Technology, 2006.* Available at: http://www.ahrq.gov/clinic/tp/hitsystp.htm#Report

[22] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.

[23] An EHR is a longitudinal collection of electronic health information that serves as a legal medical record, which includes documentation, vital signs, and assessments [see *Survey Glossary* in Appendix B].

[24] Health Affairs, *Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefits, Savings, and Costs*, 24(5), September 2005.

attributed to efficiency gains.[25] While few comprehensive estimates exist of the savings from health IT, one study indicates that effective EHR implementation could save more than $81 billion annually by improving health care efficiency and safety; another study indicates the cumulative potential net efficiency and savings from hospital EHR systems nationally over fifteen years could be nearly $371 billion.[26, 27]

According to a survey administered by the American Hospital Association in 2011 and reported by the U.S. Department of Health and Human Services (HHS), almost 35 percent of hospitals nationwide have adopted an EHR system.[28] Findings from the survey indicate that the hospital EHR adoption rate in Maryland is well above the national average at roughly 89 percent. About 37 percent of Maryland hospitals that have implemented an EHR reported they had fully implemented an EHR system in all hospital units and almost 63 percent reported they had partially implemented an EHR throughout the hospital. Rates of EHR adoption in hospitals nationally and statewide are expected to increase over the next several years. About 95 percent of hospitals throughout the country stated they plan to pursue federal incentives for the adoption and meaningful use of EHRs by 2015, and responses to the Maryland survey indicate all hospitals plan to implement EHRs.[29]

Comparison of Hospital EHR Implementation 2008 through 2011

Adoption Status	**2008** *(n=44)* *# of Hospitals*	**2009** *(n=47)* *# of Hospitals*	**2010** *(n=46)* *# of Hospitals*	**2011** *(n=46)* *# of Hospitals*	**2008 – 2011 Change** *(# change)*
Implemented	34	38	41	41	7
Fully	*23*	*26*	*27*	*15**	*(-8)*
Partially	*11*	*12*	*14*	*26**	*15*
Planning	10	9	5	5	(-5)
Implementing	*1*	*2*	*1*	*3*	*2*
Assessing	*4*	*3*	*4*	*2*	*(-2)*
Undecided	*5*	*4*	-	-	*(-5)*

**In 2011, the primary care unit categories within the survey were updated to more accurately reflect implementation of health IT within hospitals.*

Electronic Prescribing

e-Prescribing[30] is the digital generation, transmission, and filling of a prescription that takes the place of paper and faxed prescription orders to a community or mail-order pharmacy.[31] e-

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[25] Health Affairs, *The Value of Electronic Health Records In Community Health Centers*: *Policy Implications*, 26(1), January, 2007.
[26] Health Affairs, *Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefits, Savings, and Costs*, 24(5), September 2005.
[27] Health Affairs, *The Value of Electronic Health Records In Community Health Centers*: *Policy Implications*, 26(1), January, 2007.
[28] U.S. Department of Health & Human Services, *News Release: HHS Secretary Kathleen Sebelius announces major progress in doctors, hospital use of health information technology.* Available at: http://www.hhs.gov/news/press/2012pres/02/20120217a.html.
[29] American Hospital Association, *AHA Survey on Hospitals' Ability to Meet Meaningful Use Requirements of the Medicare and Medicaid Electronic Health Records Incentive Program*, PowerPoint Presentation February, 2011. Available at: http://www.aha.org/content/11/11EHRsurveyresults.pdf.
[30] e-Prescribing is the electronic transmission of a prescription to a community pharmacy [see *Survey Glossary* in Appendix B].

Prescribing offers many benefits, such as fewer medical errors due to illegible handwriting and a more convenient means for patients to obtain prescription drugs.[32, 33] Research results suggest that e-prescribing can dramatically improve patient safety and is consistently correlated with lowering the frequency of medication errors.[34]

Nationally, about 25 percent of eligible prescriptions were transmitted electronically in 2010.[35] In Maryland, approximately 37 percent of hospitals reported e-prescribing with community pharmacies, a nearly 28 percent increase from 2008. Federal incentives are expected to increase the rate of e-prescribing over the next several years.[36]

Comparison of Hospital e-Prescribing with Community Pharmacies 2008 through 2011

Adoption Status	2008 (n=44) # of Hospitals	2009 (n=47) # of Hospitals	2010 (n=46) # of Hospitals	2011 (n=46) # of Hospitals	2008 – 2011 Change (# change)
Implemented	4	13	9*	17	13
Fully	*N/A***	*N/A*	*N/A*	4	*N/A*
Partially	*N/A*	*N/A*	*N/A*	13	*N/A*
Planning	40	34	37	29	(-11)
Implementing	*4*	*7*	*10*	*17*	*13*
Assessing	*8*	*17*	*16*	*7*	*(-1)*
Undecided	*28*	*10*	*11*	*5*	*(-23)*

**The variation is largely attributed to industry consistency of definitions of hospital e-prescribing.*

***N/A indicates that data for the identified technology was not assessed during the specified reporting period.*

Computerized Physician Order Entry

CPOE[37] is a software application designed for providers to write patient orders electronically rather than on paper. CPOE has the potential to greatly reduce errors and improve patient care by ensuring standardized, legible, and complete orders.[38] Most CPOE systems are components of an EHR and allow providers to electronically specify medication orders as well as laboratory, radiology, referral, and procedure orders, which are integrated with the patient's EHR.[39, 40] According to a RAND study, if all hospitals had an HIT system that included CPOE, about 200,000

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[31] American Medical Association, *A Clinician's Guide to Electronic Prescribing*, October 2008. Available at: http://www.ama-assn.org/ama1/pub/upload/mm/472/electronic-e-prescribing.pdf.

[32] National Conference of State Legislatures, *Views from the Nation: An Overview of E-Prescribing Experiences From the States,* November 2011. Available at: http://www.ncsl.org/documents/telecommunications/EPrescribing.pdf

[33] The Journal of the American Board of Family Medicine, *Early Adopters of Electronic Prescribing Struggle to Make Meaningful Use of Formulary Checks and Medication History Documentation,* 25(1), February 2012. Available at: www.jabfm.org/content/25/1/24.full.

[34] Institute of Medicine, *Health IT and Patient Safety: Building Safer Systems for Better Care,* 2012. Washington, DC: The National Academies Press.

[35] Surescripts, *The National Progress Report on e-Prescribing and Interoperable Healthcare,* 2010. Available at: http://www.surescripts.com/about-e-prescribing/progress-reports/national-progress-reports.aspx.

[36] Surescripts, *The National Progress Report on e-Prescribing and Interoperable Healthcare,* 2010. Available at: http://www.surescripts.com/about-e-prescribing/progress-reports/national-progress-reports.aspx.

[37] CPOE enables providers to enter orders directly into the information system [see *Survey Glossary* in Appendix B].

[38] U.S. Department of Health & Human Services, Agency for Healthcare Research and Quality, *Computerized Provider Order Entry*. Available at: http://psnet.ahrq.gov/primer.aspx?primerID=6.

[39] Brian Dixon and Atif Zafar, *Inpatient Computerized Provider Order Entry: Findings from the AHRQ Health IT Portfolio,* 2009. Available at: http://healthit.ahrq.gov/images/jan09cpoereport/cpoe_issue_paper.htm.

[40] Congressional Budget Office, *Evidence on the Costs and Benefits of Health Information Technology.* Available at: http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/91xx/doc9168/maintext.3.1.shtml.

adverse drug events could be eliminated each year, saving approximately $1 billion per year and improving patient safety.[41] In 2010, a KLAS[42] study found that approximately 22 percent of hospitals nationwide had a CPOE system.[43] In Maryland, approximately 83 percent of hospitals reported using CPOE, which is around a 28 percent increase from 2008 and over 60 percent higher than the national average. The use of CPOE is included as a requirement for federal financial incentive programs, thus CPOE adoption rates are expected to climb.

Comparison of Hospital CPOE Implementation 2008 through 2011

Adoption Status	2008 (n=44) # of Hospitals	2009 (n=47) # of Hospitals	2010 (n=46) # of Hospitals	2011 (n=46) # of Hospitals	2008 – 2011 Change (# change)
Implemented	24	32	36	38	14
Fully	*17*	*15*	*16*	*7**	*(-10)*
Partially	*7*	*17*	*20*	*31*	*24*
Planning	20	15	10	8	(-12)
Implementing	*9*	*8*	*3*	*6*	*(-3)*
Assessing	*9*	*3*	*5*	-	*(-9)*
Undecided	*2*	*4*	*2*	*2*	-

**In 2011, the primary care unit categories within the survey were updated to more accurately reflect implementation of health IT within hospitals.*

Clinical Decision Support

The success of CPOE adoption in hospitals is linked to other systems, such as clinical decision support systems (CDS), EHRs, and eMARs.[44] Complications with interoperability among various technologies are barriers to using the technologies to their full potential.[45] On its own, CPOE has an impact on patient safety by ensuring that orders are legible; the value of this technology is increased with the addition of a CDS.[46, 47] CDS systems can integrate with CPOE to provide clinicians with real-time feedback regarding patient-specific information that is presented at the appropriate times and checks for a variety of potential errors such as drug interactions and allergies.[48] Although CDS generally operates as an application of an EHR system, stand-alone CDS systems are also available.[49]

A CDS system includes functions such as computerized alerts and reminders, condition-specific orders, and diagnostic support. Hospitals that reported using a CPOE were also asked to report on

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[41] The RAND Corporation, *Health Information Technology: Can HIT Lower Costs and Improve Quality?,* 2005. Available at: http://www.rand.org/pubs/research_briefs/RB9136/index1.html.
[42] KLAS is a research firm specializing in monitoring and reporting the performance of health care vendors. Additional information is available at: http://www.klasresearch.com/.
[43] FierceHealthIT, *CPOE adoption up, but most hospitals still lack capability,* August 2011. Available at: http://www.fiercehealthit.com/story/cpoe-adoption-most-hospitals-still-lack-capability/2011-08-09.
[44] Health Affairs, *Implementation of Computerized Physician Order Entry in Seven Countries*, 28(2). March/April 2009.
[45] Health Affairs, *Implementation of Computerized Physician Order Entry in Seven Countries*, 28(2). March/April 2009.
[46] CDS is a computer application to assist in clinical decisions by providing evidence –based knowledge in the context of patient-specific data [see *Survey Glossary* in Appendix B].
[47] U.S. Department of Health & Human Services, Agency for Healthcare Research and Quality, *Inpatient Computerized Provider Order Entry.* Available at: http://healthit.ahrq.gov/images/jan09cpoereport/cpoe_issue_paper.htm.
[48] The Agency for Healthcare Research and Quality, *Inpatient Computerized Provider Order Entry: Findings from the AHRQ Health IT Portfolio,* January 2009. Available at: http://healthit.ahrq.gov/images/jan09cpoereport/cpoe_issue_paper.htm.
[49] Office of the National Coordinator, *Clinical Decision Support,* November 2011. Available at: http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__cds/1218.

CDS for medication alerts (Medication CDS) and for information related to clinical standards of care (SOC-CDS), which help providers adhere to evidence-based guidelines and avoid preventable errors. Providers may also customize reminders and alerts based on specific patient care needs. Approximately 97 percent of hospitals utilizing CPOE software reported implementing medication CDS software and about 69 percent reported implementing SOC-CDS.

Comparison of Hospital CDS Integration Among Hospitals that Reported Implementing CPOE 2008 through 2011

Adoption Status	2008 *(n=24)* *# of Hospitals*	2009 *(n=32)* *# of Hospitals*	2010 *(n=36)* *# of Hospitals*	2011 *(n=39)* *# of Hospitals*	2008 – 2011 Change *(# change)*
Medication CDS	17	28	33	38	21
Diagnosis/SOC-CDS	10	19	21	27	17

Electronic Medication Administration Records

eMAR[50] is an application that maintains electronic records of ordered and administered medications to minimize the opportunities for human error or error due to lack of documentation.[51] The goal of eMAR is to help clinicians reduce medication errors, thereby improving patient safety and overall medical care. The Institute of Medicine estimates that on average, a hospitalized patient is subject to one medication administration error per day and approximately 90 percent of inpatient medication errors occur at either the ordering or transcribing stage.[52, 53] Estimates indicate more than 1.5 million preventable adverse drug events occur annually.[54]

In general, eMARs are widely regarded as the technical solution to common sources of medication errors, including illegible handwritten prescriptions and decimal point errors.[55, 56] According to a study by the Healthcare Information and Management Systems Society, approximately 60 percent of hospitals have adopted eMAR nationally.[57] During this reporting period, eMAR adoption in Maryland was reported at nearly 87 percent, which is almost a 32 percent increase from 2008 and exceeds the national average. Of those hospitals that implemented an eMAR system, nearly 20 percent had fully implemented and about 80 percent had partially implemented this technology.

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[50] An eMAR is an electronic record of medications administered to a patient during his or her hospital stay [see *Survey Glossary* in Appendix B].
[51] Brady, *Laboratory Identification and Specimen Tracking*, Found at: http://www.bradyid.com/bradyid/cms/contentView.do/8142/Laboratory.html#q1.
[52] Institute of Medicine of the National Academies, *Preventing Medication Errors: Quality Chasm Series,* June 2006. Available at: http://www.iom.edu/Reports/2006/Preventing-Medication-Errors-Quality-Chasm-Series.aspx.
[53] U.S. Department of Health & Human Services, Agency for Healthcare Research and Quality, *Computerized Provider Order Entry.* Available at: http://psnet.ahrq.gov/primer.aspx?primerID=6.
[54] Institute of Medicine of the National Academies, *Preventing Medication Errors: Quality Chasm Series,* June 2006. Available at: http://www.iom.edu/Reports/2006/Preventing-Medication-Errors-Quality-Chasm-Series.aspx.
[55] The Leapfrog Group, *Leapfrog Patient Safety Standards: The Potential Benefits of Universal Adoption,* November 2000. Available at: http://www.leapfroggroup.org/media/file/Leapfrog-Launch-Full_Report.pdf.
[56] The Leapfrog Group, *Computerized Physician Order Entry Factsheet,* March 2011. Available at: http://www.leapfroggroup.org/media/file/FactSheet_CPOE.pdf.
[57] HIMSS Analytics, *The State of U.S. Hospitals Relative to Achieving Meaningful Use Measurements,* 2009. Available at: http://www.himssanalytics.org/docs/HA_ARRA_100509.pdf.

Comparison of Hospital eMAR Implementation 2008 through 2011					
Adoption Status	**2008** *(n=44)* *# of Hospitals*	**2009** *(n=47)* *# of Hospitals*	**2010** *(n=46)* *# of Hospitals*	**2011** *(n=46)* *# of Hospitals*	**2008 – 2011 Change** *(# change)*
Implemented	24	37	37	40	16
Fully	*10*	*15*	*14*	*8**	*(-2)*
Partially	*14*	*22*	*23*	*32*	*18*
Planning	20	10	9	6	(-14)
Implementing	*13*	*2*	*3*	*3*	*(-10)*
Assessing	*5*	*5*	*5*	*2*	*(-3)*
Undecided	*2*	*3*	*1*	*1*	*(-1)*

**In 2011, the primary care unit categories within the survey were updated to more accurately reflect implementation of health IT within hospitals.*

Barcode Medication Administration

BCMA[58] is software that uses barcodes to prevent human errors in the distribution of prescription medications at hospitals. BCMA can be used to verify that the correct patient is receiving the proper medication in the right dose and method at the right time when the medication is administered. More than one million serious medication errors occur every year in United States hospitals, including administration of the wrong drug, drug overdoses, and over-looked drug interactions and allergies due to illegible handwriting and decimal point errors, among other things.[59]

Medication errors can cause harm to the patient and although they occur for a variety of reasons, the U.S. Food and Drug Administration cites common causes to be poor communication; ambiguities in product names; poor procedures or techniques; and patient misuse because of poor understanding of the directions for use.[60] According to a study conducted by Brigham and Women's Hospital in Boston, BCMA was associated with a 41 percent reduction in non-timing administration errors and nearly eliminated transcription errors.[61] The national adoption rate of BCMA technology is around 27 percent.[62] The Maryland adoption rate was notably higher at nearly 70 percent. Approximately 71 percent of hospitals that are in the planning stages intent to implement BCMA within the next two years.

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[58] BCMA is technology that uses an infrared scan of the barcodes on the patient's bracelet and medication package at the bedside [see *Survey Glossary* in Appendix B].
[59] The Leapfrog Group, *Factsheet: Computerized Physician Order Entry*. Available at: http://www.leapfroggroup.org/media/file/FactSheet_CPOE.pdf.
[60] U.S. Food and Drug Administration, *Medication Error Reports.* Available at: http://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm080629.htm.
[61] Brigham and Women's Hospital, *BWH Researchers Find that Using Bar-Code Technology with eMAR Drastically Reduces Medication Administration Transcription Errors.* Available at: http://www.brighamandwomens.org/About_BWH/publicaffairs/news/PressReleases/BWHNews.aspx?ID=673.
[62] Health Affairs, *Adoption of Health Information Technology for Medication Safety in U.S. Hospitals*, 27(3), 2008. Available at: http://content.healthaffairs.org/content/27/3/865.abstract.

Comparison of Hospital BCMA Implementation 2008 through 2011					
Adoption Status	**2008** *(n=44)* *# of Hospitals*	**2009** *(n=47)* *# of Hospitals*	**2010** *(n=46)* *# of Hospitals*	**2011** *(n=46)* *# of Hospitals*	**2008 – 2011 Change** *(# change)*
Implemented	14	28	29	32	18
Fully	*1*	*6*	*5*	*5*	*4*
Partially	*13*	*22*	*24*	*27*	*14*
Planning	30	19	17	14	(-16)
Implementing	*18*	*6*	*8*	*10*	*(-8)*
Assessing	*4*	*6*	*5*	*1*	*(-3)*
Undecided	*8*	*7*	*4*	*3*	*(-5)*

Infection Surveillance Software

ISS[63] is a real-time application that alerts health care providers to spikes in infection rates and the location of affected patients within a facility in real time. ISS applications have the ability to integrate data from laboratories, admissions, discharges and transfers, pharmacies, and in some cases, electronic medical records.[64] ISS alerts hospital providers to certain infections and enables early intervention.[65] Health care-associated infections are infections that patients acquire during the course of receiving treatment for other conditions and are a significant cause of mortality in the United States.[66] Risk factors for contracting health care-associated infections occur when patients undergo invasive techniques or require use of medical devices that increase the risk of infections such as intravenous needles.[67] ISS has the potential to improve patient safety by helping hospital staff monitor and prevent infections. ISS may also facilitate reporting to state and federal agencies.[68]

A 2011 KLAS report estimated that 20 to 25 percent of hospitals nationwide use real-time infection surveillance software.[69] During this reporting period, hospital ISS adoption in Maryland was reported at about 35 percent and about 27 percent of hospitals without ISS technology are currently assessing its use. Based on the 2011 survey results, the rate of ISS adoption is expected to increase in the next year. Hospital adoption of ISS is expected to increase nationally, partly due to new Medicare policies, including non-payment for hospital-acquired conditions.[70]

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[63] ISS electronically tracks the rates of infection outbreaks [see *Survey Glossary* in Appendix B].
[64] Materials Management in Healthcare, *Curbing Infections via Electronic Surveillance,* February 2012. Available at: http://www.matmanmag.com/matmanmag_app/jsp/articledisplay.jsp?dcrpath=MATMANMAG/Article/data/02FEB2010/1002MMH_FEA_ICHot&domain=MATMANMAG.
[65] FierceHealthIT, *Hospitals' use of infection surveillance software growing fast*, June 2011. Available at: http://www.fiercehealthit.com/story/hospitals-use-infection-surveillance-software-growing-fast/2011-06-23.
[66] Public Health Report, *Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals,* 2007. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1820440/.
[67] Premier Inc., *Healthcare-associated infections (HAIs),* February 2012. Available at: https://www.premierinc.com/safety/topics/HAI/.
[68] FierceHealthIT, *Hospitals' use of infection surveillance software growing fast*, June 2011. Available at: http://www.fiercehealthit.com/story/hospitals-use-infection-surveillance-software-growing-fast/2011-06-23.
[69] KLAS is a research firm specializing in monitoring and reporting the performance of health care vendors. Additional information available at: http://www.klasresearch.com/.
[70] FierceHealthIT, *Hospitals' use of infection surveillance software growing fast*, June 2011. Available at: http://www.fiercehealthit.com/story/hospitals-use-infection-surveillance-software-growing-fast/2011-06-23.

Comparison of Hospital Infection Surveillance Software Implementation 2008 through 2011					
Adoption Status	**2008** *(n=44)* *# of Hospitals*	**2009** *(n=47)* *# of Hospitals*	**2010** *(n=46)* *# of Hospitals*	**2011** *(n=46)* *# of Hospitals*	**2008 – 2011 Change** *(# change)*
Implemented	18	19	17	16	(-2)
Planning	26	28	29	30	4
Implementing	*8*	*2*	*2*	*11*	*(-3)*
Assessing	*7*	*11*	*11*	*8*	*1*
Undecided	*11*	*15*	*16*	*11*	-

Connectivity to the Statewide HIE

HIE[71] offers enormous potential benefits to health care delivery and research. Efficient and dependable HIE will reduce redundant laboratory tests for patients who seek care in different settings, reduce duplication of radiology studies through digital transmission of reports, enable reliable connections to pharmacies to help generate better medication lists, and reduce adverse effects from drug interactions. HIE could also be used to improve the referral process and communication between providers, and transitional care (such as between clinic and hospital) would be safer for all patients. Exchanging health information electronically could provide more timely and expanded public health reporting as it relates to disease and bioterrorism outbreaks, allowing for more rapid response and potentially saving many lives.[72, 73]

Recent national estimates indicate about 17 percent of acute care hospitals report they are actively exchanging electronic health information with other unaffiliated providers.[74] The goal in Maryland is to create an interconnected, consumer-driven electronic health care system aimed at enhancing health care quality and effectiveness, and reducing health care costs; the statewide HIE is an essential component to the success of Maryland's health IT goal.[75] During this reporting period, all of the 46 acute care hospitals and two specialty hospitals connected to the HIE and are now able to share data about individual health care encounters.[76] This data sharing enables the Health Services Cost Review Commission to measure and compare hospital-specific performance on readmissions and to use the data to further enhance and strengthen the financial incentives linked with performance.[77] Between 2010 and 2011, the hospital connectivity to the statewide HIE increased almost 89 percent. This large scale connectivity effort has established Maryland as a leader in

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[71] HIE is the electronic movement of health-related information among organizations [see *Survey Glossary* in Appendix B].
[72] Institute of Medicine. Patient safety: Achieving a new standard for care. Washington, DC: National Academy Press; 2003.
[73] MHCC, Electronic Health Information Exchange Task Force to Study Electronic Health Records, *Health Information Exchange*, September 2006.
[74] Health Affairs, *Hospitals Ineligible For Federal Meaningful-Use Incentives Have Dismally Low Rates Of Adoption Of Electronic Health Records*, 31(3). March 2012.
[75] Governor O'Malley's StateStat, *Establish Best in the Nation Statewide Health Information Exchange and Electronic Health Records Adoption by End 2012.* Available at: http://www.statestat.maryland.gov/gduhealth.asp.
[76] In 2010, the Health Services Cost Review Commission adopted regulations that require hospitals to electronically connect to the statewide HIE to measure and compare hospital-specific performance on readmissions and to use the data to further enhance and strengthen the financial incentives linked with performance. See COMAR 10.37.07, *Health Information Exchange Data*. Available at: http://www.hscrc.state.md.us/documents/Legal-Legislative/RegulationUpdates/Final/2011/10.37.07.01-07_Final.pdf.
[77] See COMAR 10.37.07, *Health Information Exchange Data*. Available at: http://www.hscrc.state.md.us/documents/Legal-Legislative/RegulationUpdates/Final/2011/10.37.07.01-07_Final.pdf.

exchanging electronic health information; Maryland was the first state to connect all acute care hospitals to its statewide HIE.

Hospital Connectivity to the Statewide HIE 2010 through 2011			
Adoption Status	**2010** *(n=46)* *# of Hospitals*	**2011** *(n=46)* *# of Hospitals*	**2010 – 2011 Change** *(# change)*
Connected	5	46	41
Planning	41	-	(-41)
Implementing	*18*	-	*(-18)*
Assessing	*13*	-	*(-13)*
Undecided	*10*	-	*(-10)*

Telemedicine

Telemedicine[78] can bridge the gaps of distance and health care disparity.[79, 80, 81, 82, 83] Telemedicine is generally a means of delivering health care remotely through the use of communication technologies, such as video conferencing. This technology enables health care providers to conduct the diagnosis, consultation, treatment, education, and care management of patients from a different location. The use of telemedicine is expected to provide an efficient and potentially cost effective method of care delivery, particularly when access to specialty consultation is limited. According to the American Telemedicine Association, it is estimated that about 200 telemedicine networks exist in the United States, which includes nearly 3,500 health care institutions.[84] The global tele-hospital market was roughly $8 billion in 2011 and is expected to increase to nearly $17.6 billion in 2016.[85]

Maryland, like several other states, is exploring opportunities to expand health care access and reduce costs by advancing telemedicine use.[86, 87] On May 22, 2012, Governor Martin O'Malley signed into law Senate Bill 781 (SB 781), *Health Insurance – Coverage for Services Delivered through Telemedicine*, which was passed by the General Assembly during the 2012 legislative session. The law requires, among other things, certain insurers, nonprofit health service plans, and health

[78] Telemedicine means, as it relates to the delivery of health care services, the use of interactive audio, video, or other telecommunications by a health care provider to deliver health care services at a site other than the site at which the patient is located [see *Survey Glossary* in Appendix B].
[79] Journal of Telemedicine and Telecare, *Systematic Review of Evidence for the Benefits of Telemedicine*, 8(1), 2002.
[80] Journal of Telemedicine and Telecare, *Economic Evaluation in Telemedicine – Still Room for Improvement*, 16(5), 2010.
[81] Neurology, *Long-Term Outcome after Thrombolysis in Telemedical Stroke Care,* 69(9): 898-903, August 2007.
[82] CNS Spectrums: First in Applied Neuroscience, *Can Telepsychiatry Replace In-Person Psychiatric Assessments? A Review and Meta-Analysis of Comparison Studies*, 10(5): 403-413, May 2005.
[83] Archives of Internal Medicine, *Impact of Telemedicine Intensive Care Unit Coverage on Patient Outcomes: A Systematic Review and Meta-analysis,* 171(6): 498-506, March 28, 2011.
[84] American Telemedicine Association, *What is Telemedicine & Telehealth* ? Available online at: http://www.kdheks.gov/hcf/hite/download/What_Is_Telemedicine.pdf.
[85] Healthcare IT News, *Global telemedicine market pegged to more than double by 2016*, March 2012. Available at: http://www.healthcareitnews.com/news/global-telemedicine-market-pegged-more-double-2016.
[86] Journal of Telemedicine and Telecare, *Improved Access to Subspecialist Diabetes Care by Telemedicine: Cost Savings and Care Measures in the First Two Years of the FITE Diabetes Project*, 11(1) 2005.
[87] Neurology, *The Cost Effectiveness of Telestroke in the Treatment of Acute Ischemic Stroke*, 77(17), 2011.

maintenance organizations to provide coverage for health care services delivered through telemedicine.[88] SB 781 goes into effect October 1, 2012.

Establishing a technology infrastructure that can connect disparate telemedicine networks is essential for expanding telemedicine. For example, a physician at a hospital in Baltimore could connect with a rural health facility to provide consultative services, allowing the distant provider to treat the patient closer to home and eliminating the costs associated with transferring care. The value of telemedicine increases when coupled with electronic access to patient records and greater availability of remote provider access. The technology infrastructure envisioned for Maryland would be supported by HIE and include a listing of providers on the telemedicine network available to provide health care and facilitate access to patients' electronic medical records.

The 2011 reporting period is the first year that hospitals were asked to provide information regarding telemedicine adoption. Nearly 57 percent of hospitals in Maryland reported they have implemented telemedicine technology. Approximately 25 percent of hospitals in the planning stages plan to implement telemedicine technology within the next two years.

Hospital Implementation of Telemedicine

Adoption Status	**2011** *(n=46)* *# of Hospitals*
Implemented	26
Planning	20
Implementing	*5*
Assessing	*1*
Undecided	*14*

[88] Senate Bill 781. Available at: http://mlis.state.md.us/2012rs/bills/sb/sb0781t.pdf.

Comparison of Hospital Health IT Adoption 2008 through 2011

The table below indicates the total number of units within each hospital, the number of units implementing each technology and the implementation percent. Additionally, the table identifies the number of hospitals that have implemented ISS and telemedicine.

Hospital	Total Units #	EHRs		e-prescribe		CPOE		eMAR		BCMA		ISS	Telemedicine
		Units		Units		Units		Units		Units		Adopted?	Adopted?
		#	%	#	%	#	%	#	%	#	%	*Yes/No*	*Yes/No*
Anne Arundel Medical Center	37	32	86	32	86	32	86	32	86	32	86	No	Yes
Atlantic General Hospital	4	1	25	0	0	1	25	2	50	0	0	No	Yes
Baltimore Washington Medical Center	27	18	67	1	4	4	15	15	56	0	0	Yes	Yes
Bon Secours Hospital	11	0	0	0	0	0	0	0	0	0	0	No	Yes
Calvert Memorial Hospital	25	15	60	1	4	4	16	14	56	11	44	No	Yes
Carroll Hospital Center	13	12	92	0	0	12	92	10	77	10	77	No	Yes
Chester River Hospital	7	7	100	0	0	1	14	6	86	5	71	Yes	No
Civista Medical Center	20	19	95	0	0	19	95	19	95	19	95	No	No
Doctors Community Hospital	13	13	100	0	0	1	8	6	46	6	46	No	Yes
Dorchester General Hospital	8	8	100	4	50	1	13	4	50	4	50	Yes	No
Edward McCready Memorial Hospital	6	6	100	6	100	6	100	0	0	0	0	No	No
Fort Washington Hospital	55	0	0	0	0	0	0	0	0	0	0	Yes	Yes
Franklin Square Hospital Center	59	15	25	0	0	3	5	18	31	15	25	No	Yes
Frederick Memorial Hospital	18	18	100	18	100	14	78	15	83	15	83	Yes	Yes
Garrett County Memorial Hospital	9	1	11	1	11	1	11	1	11	1	11	No	Yes
Good Samaritan Hospital	143	17	12	0	0	0	0	17	12	17	12	No	Yes
Greater Baltimore Medical Center	23	23	100	0	0	23	100	23	100	21	91	No	No
Harford Memorial Hospital	10	8	80	0	0	1	10	8	80	6	60	No	No
Holy Cross Hospital	29	27	93	0	0	27	93	27	93	24	83	Yes	Yes
Howard County General Hospital	40	19	48	0	0	19	48	19	48	19	48	Yes	Yes
James Lawrence Kernan Hospital	38	8	21	8	21	9	24	8	21	0	0	No	No
Johns Hopkins Bayview Medical Center	24	23	96	0	0	23	96	23	96	22	92	No	No
Johns Hopkins Hospital	790	56	7	56	7	56	7	56	7	0	0	Yes	Yes
Laurel Regional Hospital	7	0	0	0	0	0	0	0	0	0	0	No	No
Maryland General Hospital	17	10	59	8	47	10	59	8	47	8	47	Yes	No
MedStar Harbor Hospital	48	39	81	0	0	39	81	39	81	39	81	Yes	Yes
Memorial Hospital at Easton	22	22	100	19	86	2	9	9	41	7	32	Yes	No
Mercy Medical Center	15	12	80	0	0	9	60	12	80	12	80	Yes	Yes
Meritus Medical Center*	17	17	100	0	0	1	6	17	100	17	100	No	Yes
Montgomery General Hospital	14	14	100	0	0	14	100	14	100	14	100	No	Yes
Northwest Hospital Center	18	16	89	1	6	16	89	16	89	0	0	Yes	No
Peninsula Regional Medical Center	38	26	68	0	0	26	68	26	68	25	66	Yes	Yes
Prince George's Hospital Center	9	0	0	0	0	0	0	0	0	0	0	No	No
Shady Grove Adventist Hospital	23	23	100	0	0	2	9	23	100	23	100	No	No
Sinai Hospital	26	26	100	1	4	26	100	26	100	0	0	Yes	No
Southern Maryland Hospital Center	19	0	0	0	0	19	100	0	0	0	0	No	No
St. Agnes Hospital	41	4	10	0	0	4	10	4	10	2	5	No	Yes
St. Joseph Medical Center	32	1	3	0	0	0	0	21	66	0	0	No	No
St. Mary's Hospital	11	11	100	11	100	11	100	11	100	9	82	No	Yes
Suburban Hospital	14	13	93	0	0	1	7	9	64	9	64	No	Yes
Union Hospital of Cecil County	22	22	100	22	100	22	100	22	100	22	100	No	Yes
Union Memorial Hospital	21	8	38	8	38	0	0	8	38	8	38	No	Yes
University of Maryland Medical Center	70	48	69	48	100	48	69	48	69	0	0	No	Yes
Upper Chesapeake Medical Center	58	14	24	0	0	14	24	14	24	14	24	No	No
Washington Adventist Hospital	18	18	100	0	0	1	6	18	100	18	100	No	No
Western MD Regional Medical Center	68	16	24	0	0	0	0	16	24	16	24	Yes	Yes
Total Number of Hospitals Implemented		**41**		**17**		**38**		**40**		**32**		**16**	**26**

Health IT Adoption by Hospital Characteristics

Health IT adoption rates vary among certain characteristics. According to a national study conducted by the Robert Wood Johnson Foundation, critical access, small, public, non-teaching, and rural hospitals were the least likely to utilize health IT technologies or to have adopted even a basic EHR.[89] Hospitals in Maryland generally follow national trends; however, rural hospitals have the highest rate of overall HIT adoption throughout the state.

Size

Health IT adoption was assessed by hospital size according to their total number of inpatient beds. Small hospitals were classified as having 100 or fewer beds, medium hospitals with 100-249 beds, large hospitals with 250-500 beds, and academic hospitals were classified as having 500 or more inpatient beds.[90] Hospital size is generally considered to be the strongest predictor of overall health IT implementation.[91, 92, 93]

Hospitals of all sizes had similar health IT adoption rates.[94] Large hospitals in Maryland reported a 73 percent adoption rate followed by academic hospitals at approximately a 67 percent adoption rate. Medium and small hospitals trailed slightly at about 63 percent and about 62 percent, respectively. Large and academic hospitals also reported the highest rates of EHR adoption throughout the state. All academic and large hospitals have adopted EHRs.

Geographic Location

Hospital geographic location was used to assess overall health IT adoption rates among urban, suburban, and rural hospitals.[95, 96] Key findings from the survey indicate that rural hospitals reported the highest rate of health IT adoption at approximately 76 percent. Urban hospitals had about a 68 percent adoption rate and suburban hospitals reported approximately a 55 percent adoption rate. Although national studies indicate that rural hospitals are the least likely group to adopt health IT generally, or even a basic EHR system, the rural hospitals in Maryland reported the highest EHR adoption rate of 100 percent.[97]

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[89] The Robert Wood Johnson Foundation, *Health Information Technology in the United States: Moving Toward Meaningful Use*, 2010. Available at: http://www.rwjf.org/qualityequality/product.jsp?id=71542.
[90] MHCC, *Hospital Guide*, 2011. Available at: http://mhcc.maryland.gov/hospital_services/acute/acutecarehospital/annrptlicbedsfy11_20100714.pdf.
[91] iHealthBeat, *Study: East Coast Hospitals Have Higher Health IT Adoption Rates*, October 2008. Available online at: http://www.ihealthbeat.org/Articles/2008/10/10/Study-East-Coast-Hospitals-Have-Higher-Health-IT-Adoption-Rates.aspx.
[92] RAND Corporation, *The State and Pattern of Health Information Technology Adoption*, 2005. Available at: http://www.rand.org/pubs/monographs/2005/RAND_MG409.pdf.
[93] Health Affairs, *Adoption Of Health Information Technology For Medication Safety In U.S. Hospitals*, 27 (3), 2008. Available at: http://content.healthaffairs.org/content/27/3/865.abstract.
[94] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.
[95] See *Hospital Characteristics* in Appendix C
[96] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.
[97] Agency for Healthcare Research and Quality, *National Healthcare Quality Report*, 2010. Available at: http://www.ahrq.gov/qual/nhqr10/nhqr10.pdf.

Affiliation

Hospital affiliation was also assessed when determining the level of health IT adoption in Maryland. Hospitals were categorized as in-state hospitals if they were affiliated with another hospital in Maryland; hospitals affiliated with a network outside of Maryland were considered as out-of-state; and hospitals without an affiliation were categorized as a standalone institution.[98] A study conducted by the Rand Corporation found that hospitals affiliated with health systems have a higher EHR adoption rate than standalone hospitals.[99]

In contrast to the Rand Corporation findings, standalone hospitals in Maryland had the highest rate of overall health IT adoption.[100] Standalone and in-state hospitals had health IT adoption rates of nearly 68 percent and 69 percent, respectively. Out-of-state hospitals have historically had the lowest rate of health IT adoption in Maryland. These findings remain consistent in this reporting period; however, the level of health IT adoption increased between the 2010 and 2011 reporting period. In-state hospitals had an EHR adoption rate of approximately 92 percent, standalone hospitals both had an EHR adoption of approximately 88 percent, while out-of-state affiliated hospitals had an EHR adoption rate of about 67 percent. The in-state and standalone hospitals were well above the national average.

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[98] See *Hospital Characteristics* in Appendix C

[99] RAND Corporation, *The State and Pattern of Health Information Technology Adoption*, 2005. Available at: http://www.rand.org/pubs/monographs/2005/RAND_MG409.pdf.

[100] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.

2011 Hospital HIT Survey Results

The table below displays results in aggregate, and by hospital size, geographic location, and affiliation.

IT Components	Aggregate	Size				Geographic Location			Affiliation		
	All Hospitals	Academic	Large	Medium	Small	Urban	Suburban	Rural	In State	Out of State	Standalone
Number of Hospitals	46	2	16	18	10	12	17	17	26	3	17
Percent of Hospitals (%)	100	4	35	39	22	26	37	37	56	7	37
Electronic Health Records											
Yes	41	2	16	15	8	11	13	17	24	2	15
Planning Projections											
Implementing	3	-	-	2	1	1	2	-		1	2
Assessing	2	-	-	1	1	-	2	-	2	-	-
Undecided	-	-	-	-	-	-	-	-	-	-	-
Electronic Prescribing											
Yes	17	1	6	4	6	6	3	8	10	-	7
Planning Projections											
Implementing	7	1	4	9	3	4	7	6	9	1	7
Assessing	17	-	5	2	-	1	4	2	5	1	1
Undecided	5	-	1	3	1	1	3	1	2	1	2
Order Entry											
Yes	38	2	13	15	8	10	12	16	21	1	16
Planning Projections											
Implementing	6	-	3	2	1	2	3	1	3	2	1
Assessing	-	-	-	1	-	-	0	-	-	-	-
Undecided	2	-	-	-	1	-	2	-	2	-	-
Clinical Decision Support											
Medications	38	2	13	15	9	10	13	16	23	1	15
Diagnosis	27	2	11	8	6	8	7	12	14	1	12
Electronic Medication Administration Records											
Yes	40	2	16	15	7	11	13	16	24	2	14
Planning Projections											
Implementing	3	-	-	2	2	1	2	1	-	1	3
Assessing	2	-	-	1	1	-	2	-	2	-	-
Undecided	1	-	-	-	-	-	-	-	-	-	-
Barcode Medication Administration											
Yes	32	1	12	14	5	7	10	15	18	1	13
Planning Projections											
Implementing	10	1	3	3	4	3	5	2	4	2	4
Assessing	1	-	1	-	-	1	-	-	1	-	-
Undecided	3	-	-	1	1	1	2	-	3	-	-
Infection Surveillance Software											
Yes	16	-	7	5	3	4	5	6	10	1	4
Planning Projections											
Implementing	11	-	4	7	2	4	5	4	6	2	5
Assessing	8	-	3	3	1	1	4	2	5	-	2
Undecided	11	2	2	3	4	3	3	5	5	-	6
Health IT Adoption Rate*											
Percent (%)	67	67	73	63	62	68	55	76	69	39	68
Connectivity to State Designated Health Information Exchange											
Yes	46	2	16	18	10	12	17	17	26	3	17
Telemedicine											
Yes	26	1	10	10	5	6	10	10	12	2	12
Planning Projections											
Implementing	5	-	1	2	2	-	2	3	3	1	1
Assessing	1	-	-	1	-	-	-	1	1	-	-
Undecided	14	1	5	5	3	6	5	3	10	-	4

**The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.*

Remarks

Health IT is often considered to be one of the most important means to improve the quality and efficiency in health care. The adoption of health IT is complex and realizing the benefits is usually a long process.[101] Over the last year, hospitals in Maryland continued to make notable progress in adopting health IT, increasing nearly 6 percent over the prior year.[102] The health IT adoption incentives available through the Health Information Technology for Economic and Clinical Health Act, enacted as part of the *American Recovery and Reinvestment Act of 2009*, provides funding to build the infrastructure needed for hospitals to achieve the primary goals of the *Patient Protection and Affordable Care Act* (ACA).[103] The ACA will lead to compensating hospitals for higher quality and likely result in far more reasons for hospitals to invest in health IT than a focus on the traditional business metric of cost avoidance.

The benefits of IT adoption in other industries are well documented; in health care, a handful of studies have been published, but none provide the level of rigor or conclusiveness required to fully support the case for investment.[104] Hospitals that invest in health IT accrue workflow benefits over time, and eventually the investment shifts from appearing to be purely a cost increase to being mildly cost reducing. CMS reports payments under the Medicare and Medicaid EHR incentive program to Maryland hospitals at nearly $24M over the last 14 months. The impact of health IT adoption on health outcomes remains uncertain; broad adoption is thought to reduce medical errors and improve health outcomes. If the focus on care delivery remains patient centered, disputing the investment in health IT becomes almost impossible.

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[101] Health Affairs, *The Effect of Health Information Technology on Quality in U.S. Hospitals*, April 2010 29(4).
[102] The hospital health IT adoption rate was calculated using the hospitals that responded yes to adopting each of the following six technologies: EHRs, e-prescribing, CPOE, eMAR, BCMA, and ISS.
[103] Patient Protection and Affordable Care Act, Public Law 111–148.
[104] PriceWaterhouseCoopers, *Information Technology and Hospital Performance*, 2007. Available at http://assets.wharton.upenn.edu/~housman/files/PwCWhitePaper.pdf.

Acknowledgements

The MHCC appreciates the continued willingness of hospitals to complete the survey. The MHCC thanks Traci LaValle, Vice President, Financial Policy, with the Maryland Hospital Association, for her assistance in providing comments during the drafting of the report. Special thanks go to the following individuals for giving of their time to complete the survey.

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Appendix A: Survey Questions

Outlined below is the *2011 Hospital Health Information Technology Survey* (survey), which inquires about the following technologies: CPOE, EHR, eMAR, BCMA, ISS, e-prescribing, HIE and telemedicine. If a technology was not currently being implemented, the hospital was asked to indicate if they were assessing, implementing within 12 months, implementing within two years or beyond, or undecided at this time about the technology. Questions below with an asterisk required hospitals to answer the planning questions in the event the hospital answered with a *No* response. The survey also asked hospitals to report on the total number of primary care units (PCUs) as well as the number of PCUs implementing the technologies, which enabled an assessment of the extent of utilization.

Section 1: Hospital Units

Enter the total number of units for each category.

- Ambulatory (i.e. physician office)
- Emergency Department
- Regulated Outpatient
- Surgical
- Pediatrics
- Psychiatric
- Rehabilitation
- Inpatient
- Other

Section 2: Order Entry

1) *Has your hospital adopted an order entry system where providers (MD, DO, NP, PA) can electronically enter patient care orders? (If no, go to *Planning* section below)
    a) How many units use this technology? (enter value)
    b) Which orders can the provider enter electronically (If yes, enter number of units that use this technology):
        - Pharmacy
        - Laboratory
        - Radiology
        - Nursing
        - Respiratory
        - Ultrasound
        - PT/OT
        - Dietary
2) Does this system allow providers (MD, DO, NP, PA) to electronically view the status and results of the electronically entered orders above? (If yes, enter number of units that use this technology)
3) Does this system have an order set feature where a group of orders can be selected based upon the problem or diagnosis?
    a) How many units use this technology? (enter value)
4) Does this system offer decision support software for medication prescribing, including drug-drug; drug-food; and contraindication/dose limit for diagnosis, allergies, age/weight, lab/radiology results?
    a) Is this feature implemented and operationalized?
    b) How many units use this technology? (enter value)
    c) Does this software offer links to resources for reference?
    d) Is electronic documentation required for overriding an interception?
5) Does this system offer decision support software for diagnosis, chronic conditions, and standards of care, including heart failure, diabetes, and other appropriate treatments such as pneumonia vaccination, flu shot, etc.?
    a) Is this feature implemented and operationalized?
    b) How many units use this technology? (enter value)
    c) Does the software offer links to resources for reference?
    d) Is electronic documentation required for overriding an interception?
6) Is information from pharmacy, laboratory, and admitting-discharge-transfer integrated into the order entry system?
7) Does the system have an active "read-back order" function for verbal/phone orders?

Section 3: Electronic Health Record (EHR)

1) *Has your hospital adopted an EHR?
    a) How many units use an EHR? (enter value)
2) Does this system allow the documentation of patient care?
    a) How many units have this technology? (enter value)

b) Which documentation can be entered electronically (enter the number of units that use this technology):
   - Medication Administration
   - Physician Progress Notes
   - Physician H&P/Assessments
   - Nursing Assessment
   - Nursing Notes
   - Vital Signs
   - Respiratory Treatment
   - PT/OT Notes

3) Does your system allow the review of previous admission data?
   a) How many units use an EHR with this feature? (enter value)
4) Does your system provide patient assignment lists?

Section 4: Medication Administration

1) *Has your hospital adopted an electronic medication administration record (eMAR)
   a) How many units use this technology? (enter value)
2) *Has your hospital adopted a Bar Code Medication Administration (BCMA) system for medication administration at the bedside? (If no, answer Planning below)
   a) How many units use this technology? (enter value)
3) Does your hospital have a medication reconciliation system in place for admission, discharge, and changes in level of care?

Section 5: Infection Management

1) *Has your hospital adopted infection surveillance software to manage infectious diseases?
2) Does your reporting to the National Healthcare Safety Network exceed minimum reporting requirements?
3) Is your hospital linked to the Centers for Disease Control-Alert System?

Section 6: Health Information Exchange (HIE)

1) *Has your hospital adopted a system to electronically prescribe (e-prescribe) discharge medications directly to community pharmacies?
2) *Has your hospital adopted a system that electronically exchanges data for consultation or transfer of care with outpatient providers? (If yes, indicate which providers below)
   a) Please indicate which providers your hospital exchanges data with: ambulatory providers; long term care
3) *Is your hospital connected to the state designated HIE?
4) Is your hospital querying the state designated HIE?

Section 7: Telemedicine

1) *Has your hospital adopted telemedicine?
2) Is your hospital using the following for telemedicine? (enter the number of units that use this technology)
   - Imaging
   - Diagnostic
   - Monitoring
   - Emergency
3) Is your hospital using the following equipment for telemedicine?
   - Desktop software
   - Handheld wireless monitoring devices
   - Interactive video
   - Robotics
   - Home devices

**Planning Questions*

If no to implementing a technology, is your hospital *(select one)*:

1) Assessing the technology within 12 months?
2) Implementing the technology within 12 months?
3) Implementing the technology within two years or beyond?
4) Undecided at this time?

Appendix B: Survey Glossary

Barcode Medication Administration (BCMA):

Technology that allows for the real-time confirmation of the "five rights" – right patient, right medication, right dose, right route, and right time – for medication administration.

Computerized Physician Order Entry (CPOE):

Computer based application system for providers (MD, DO, NP, PA) to enter patient care orders at the point of care.

Clinical Decision Support (CDS):

Computer application to assist in clinical decisions by providing evidence-based knowledge in the context of patient-specific data.

Clinical Quality Measures:

To demonstrate meaningful use successfully, eligible hospitals are required to report on 15 clinical quality measures.

Electronic Health Record (EHR):

A longitudinal collection of electronic health information that serves as a legal medical record, which includes documentation, vital signs, and assessments.

Electronic Medication Administration Record (eMAR):

An electronic format of the traditional paper medication administration record.

Electronic Prescribing (e-prescribing):

The electronic transmission of prescriptions directly to the dispensing pharmacy by the ordering provider.

Health Information Exchange (HIE):

Electronic movement of health-related information among organizations.

Health Information Technology (HIT):

Technology used to maintain health information into electronic format.

Infection surveillance:

An application that monitors the events of infectious disease.

Order Set:

A group of evidenced-based orders for specific diagnosis or problems.

Primary Care Unit:

A culmination of hospital units that comprise the major patient care areas and are typical of any hospital despite the size of the facility.

Provider:

A licensed professional with prescribing privileges.

Telemedicine:

Telemedicine means, as it relates to the delivery of health care services, the use of interactive audio, video, or other telecommunications of electronic technology by a health care provider to deliver health care services within the scope of practice of the health care provider at a site other than the site at which the patient is located.

Appendix C: Hospital Characteristics

Hospital	Size	Geography	Affiliation
Anne Arundel Medical Center	Large	Suburban	Standalone
Atlantic General Hospital	Small	Rural	Standalone
Baltimore Washington Medical Center	Large	Suburban	In State[3]
Bon Secours Hospital	Medium	Urban	Out of State
Calvert Memorial Hospital	Small	Rural	Standalone
Carroll Hospital Center	Medium	Rural	Standalone
Chester River Hospital	Small	Rural	In State[3]
Civista Medical Center	Medium	Rural	Standalone
Doctors Community Hospital	Medium	Suburban	Standalone
Dorchester General Hospital	Small	Rural	In State[3]
Edward McCready Memorial Hospital	Small	Rural	Standalone
Fort Washington Hospital	Small	Suburban	Standalone
Franklin Square Hospital Center	Large	Suburban	In State[2]
Frederick Memorial Hospital	Large	Rural	Standalone
Garrett County Memorial Hospital	Small	Rural	Standalone
Good Samaritan Hospital	Medium	Suburban	In State[2]
Greater Baltimore Medical Center	Large	Urban	Standalone
Harford Memorial Hospital	Medium	Rural	In State
Holy Cross Hospital	Large	Suburban	Out of State
Howard County General Hospital	Medium	Suburban	In State[1]
James Lawrence Kernan Hospital	Small	Urban	In State[3]
Johns Hopkins Bayview Medical Center	Academic	Urban	In State[1]
Johns Hopkins Hospital	Large	Urban	In State[1]
Laurel Regional Hospital	Small	Suburban	In State
Maryland General Hospital	Medium	Urban	In State[3]
MedStar Harbor Hospital	Medium	Urban	In State[2]
Memorial Hospital at Easton	Medium	Rural	In State[3]
Mercy Medical Center	Medium	Urban	Standalone
Meritus Medical Center *(formally Washington County)*	Large	Rural	In State
Montgomery General Hospital	Medium	Suburban	In State[2]
Northwest Hospital Center	Medium	Suburban	In State
Peninsula Regional Medical Center	Large	Rural	Standalone
Prince George's Hospital Center	Medium	Suburban	In State
Shady Grove Adventist Hospital	Large	Suburban	In State
Sinai Hospital	Large	Urban	In State
Southern Maryland Hospital Center	Medium	Suburban	Standalone
St. Agnes Hospital	Large	Urban	Standalone
St. Joseph Medical Center	Large	Suburban	Out of State
St. Mary's Hospital	Small	Rural	Standalone
Suburban Hospital	Medium	Suburban	In State[1]
Union Hospital of Cecil County	Medium	Rural	Standalone
Union Memorial Hospital	Large	Urban	In State[2]
University of Maryland Medical Center	Academic	Urban	In State[3]
Upper Chesapeake Medical Center	Medium	Rural	In State[3]
Washington Adventist Hospital	Large	Suburban	In State
Western Maryland Regional Medical Center	Large	Rural	In State

Size *Licensed Beds*	**Geography** *Counties*	**Affiliation**
Academic: > 500	**Urban**: Baltimore City	**Standalone**: No affiliation
Large: 251 - 500	**Suburban**: Anne Arundel, Baltimore, Howard, Montgomery, and Prince George's	**In State**: Affiliated with another hospital in Maryland
Medium: 100 – 250	**Rural**: Allegany, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Kent, Queen Anne's, Somerset, St. Mary's, Talbot, Washington, Wicomico, and Worcester	**Out of State**: Affiliated with a hospital outside of Maryland
Small: <100		*1 = Johns Hopkins Health System; 2 = MedStar Health; 3 = University of Maryland Medical System*

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