United States General Accounting Office

GAO

Report to the Ranking Minority Member, Committee on Health, Education, Labor, and Pensions, U.S. Senate

October 2003

INFORMATION TECHNOLOGY

Benefits Realized for Selected Health Care Functions

GAO-04-224

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Highlights

Highlights of GAO-04-224 a report to the Minority Member, Committee on Health, Education, Labor, and Pensions, U.S. Senate

Why GAO Did This Study

The rapidly rising costs of health care, along with an increasing concern for the quality of care and the safety of patients, are driving health care organizations to use information technology (IT) to automate clinical care operations and their associated administrative functions. Among its other functions, IT is now being used for electronic medical records, order management and results reporting, patient care management, and Internet access for patient and provider communications. It also provides automated billing and financial management.

The Ranking Minority Member of the Senate Committee on Health, Education, Labor, and Pensions asked GAO to identify cost savings and other benefits realized by health care organizations that have implemented IT both in providing clinical health care and in the administrative functions associated with health care delivery. GAO analyzed information from 10 private and public health care delivery organizations, 3 health care insurers, and 1 community data network.

www.gao.gov/cgi-bin/getrpt?GAO-04-224

To view the full product, including the scope and methodology, click on the link above. For more information, contact David Powner at (202) 512-9286 or pownerd@gao.gov.

What GAO Found

The 10 health care delivery organizations reported 13 examples of cost savings resulting from the use of IT, including reduction of costs associated with medication errors, communication and documentation of clinical care and test results, staffing and paper storage, and processing of information. Other benefits included improved quality of care, more accurate and complete medical documentation, more accurate capture of codes and charges, and improved communications among providers that enabled them to respond more quickly to patients' needs. A few examples are noted in the chart below.

Examples of Cost-Related and Other Benefits Reported by Health Care Delivery Organizations and Insurers

Cost-Related Benefits	Other Benefits
Clinical Care Functions	
A teaching hospital reported that it realized about $8.6 million in annual savings by replacing outpatient paper medical charts with electronic medical records.	An integrated health care delivery system reported improvements in diabetes control for its members with the disease.
A rural community hospital prevented the administration of over 1,200 wrong drugs or dosages using bar code technology and wireless scanners to verify both the identities of patients and their correct medications.	A teaching hospital reported a decrease in average length of stay from 7.3 to 5 days due to improvements in health care efficiency and practice changes.
An integrated health care delivery system reported a 53 percent decease in claims rejected due to eligibility checks during registration.	An insurer reported that it improved clinical care to its members through its health screening reminders.

Source: GAO.

All three insurers reported examples of reduced costs and other benefits resulting from improvements in electronic claims processing and the use of technology to enhance customer service. Benefits included increased staff productivity, improved timeliness in processing claims, improved customer satisfaction, and improved clinical care to members.

One community data network established a regional exchange of health care data among physicians, hospitals, insurers, and others in the community, demonstrating that information can be exchanged securely and affordably while improving the quality and reducing the cost of health care. It expects to realize over $7 million in benefits for participating organizations. Other expected benefits include fewer admissions to the emergency department, reductions in staff time spent handling test results, and avoidance of test duplication.

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Appendix I: Use of Information Technology for Selected Health Care Functions 4

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United States General Accounting Office
Washington, D.C. 20548

October 31, 2003

Senator Edward M. Kennedy
Ranking Minority Member
Committee on Health, Education, Labor, and Pensions
United States Senate

Dear Senator Kennedy:

According to the Institute of Medicine and others, health care is an information-intensive industry that remains highly fragmented and inefficient. Hence, the use of information technology (IT) in delivering clinical care and performing administrative functions has the potential to yield both cost savings and improvements in the care itself. You asked us to identify cost savings and other benefits realized by health care organizations that have implemented IT both in providing clinical health care and in the administrative functions associated with health care delivery.

To identify monetary and other benefits resulting from the use of IT, we reviewed available literature and consulted with experts in the academic and professional community about electronic medical records and about cost savings and other benefits that have been reported by health care organizations. We identified key clinical health care and administrative functions for which IT is used and then identified health care organizations recognized in the health care community that could provide data to demonstrate cost savings and other benefits realized from implementing IT. We obtained and analyzed data reported by 10 private and public health care delivery organizations, 3 health care insurers, and 1 community data network. We conducted our work from October 2002 through August 2003 in accordance with generally accepted government auditing standards.

On October 8, 2003, we provided your office with a briefing on the results of this review, which is included as appendix I. The purpose of this letter is to provide the published briefing slides to you.

In brief, we identified 20 examples of IT initiatives that resulted in reported cost savings or other benefits—13 at health care delivery organizations, 6 at insurers, and 1 at a community data network. The participating organizations also discussed some important lessons they learned from implementing IT solutions. For example, a 1,951-bed teaching hospital serving urban, rural, and international populations reported that it realized

about $8.6 million in annual savings by replacing paper medical charts with electronic medical records for outpatients. It also reported saving over $2.8 million annually by replacing its manual process for handling medical records with electronic access to laboratory results and reports. Additionally, a 350-bed community hospital serving a rural population prevented the administration of over 1,200 wrong drugs or dosages and almost 2,000 early or extra doses by using bar code technology and wireless scanners to verify both the identities of patients and their correct medications. The reported monetary value of the errors prevented was almost $850,000.

IT also contributed to other benefits, such as shorter hospital stays, faster communication of test results, improved management of chronic disease, and improved accuracy in capturing charges associated with diagnostic and procedure codes. For example, a large integrated health care delivery system serving an urban population reported improvements in diabetes control, decreases in upper gastrointestinal studies ordered, and increases in Pap smears performed. Most organizations also reported lessons learned, such as the importance of reengineering business processes, gaining users' acceptance of IT, providing adequate training, and making systems secure.

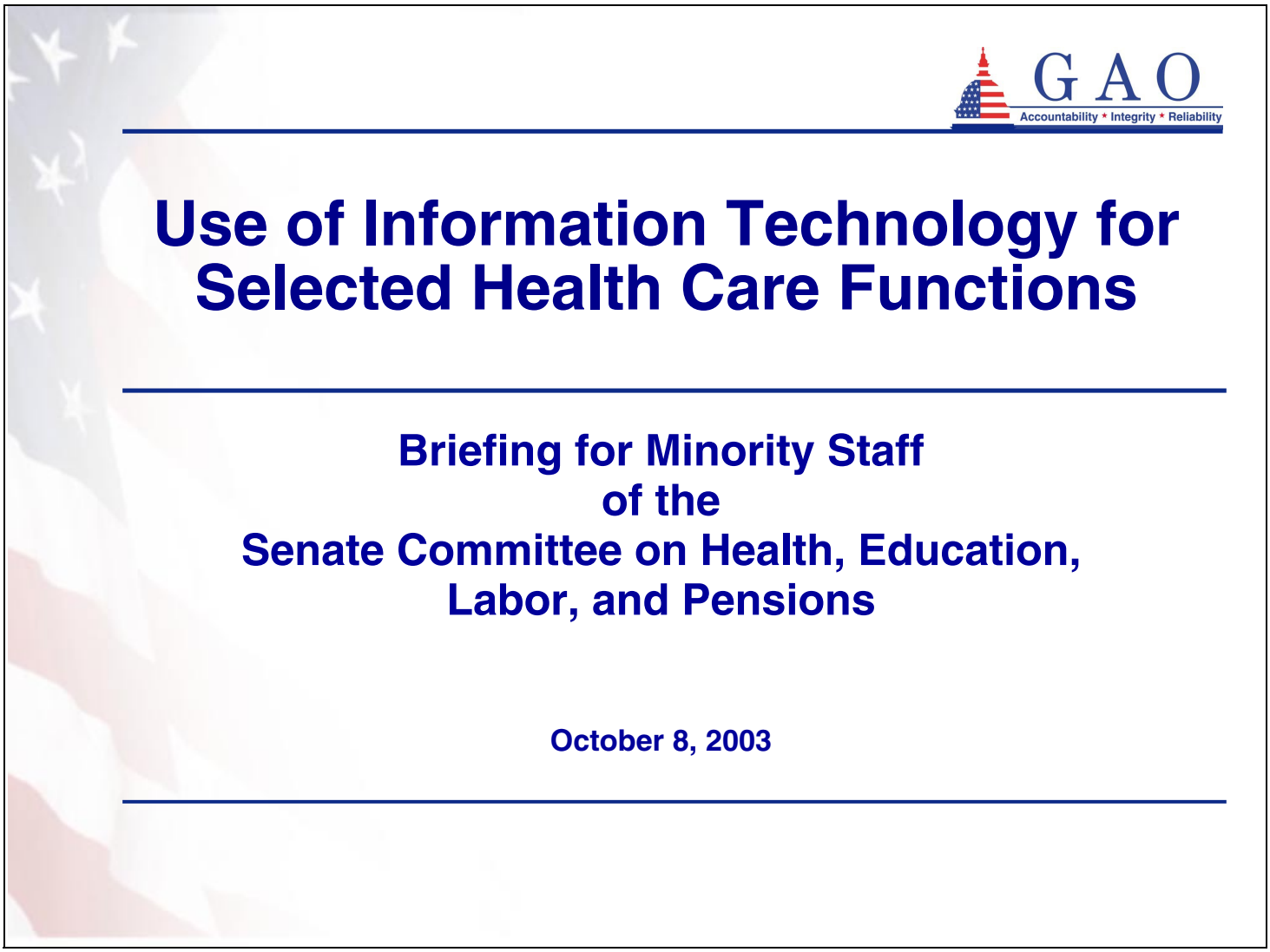
We will send copies of this report to other congressional committees; to the private sector organizations that participated in our review; and to the Secretaries of Defense, Health and Human Services, and Veterans Affairs. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you have any questions about this report, please contact me at (202) 512-9286 or M. Yvonne Sanchez, Assistant Director, at (202) 512-6274. We can also be reached by e-mail at pownerd@gao.gov or sanchezm@gao.gov. Niti Bery, Joanne Fiorino, Pamlutricia Greenleaf, M. Saad Khan, Jessica Steele, and Teresa F. Tucker were major contributors to this report.

Sincerely yours,

David A. Powner
Director, Information Technology Management Issues

Use of Information Technology for Selected Health Care Functions



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Introduction

- The Institute of Medicine, Deloitte Research, and others have reported that while health care is an information intensive industry, it remains highly fragmented and inefficient in comparison to other industries, but nevertheless, major change may be underway due to
  - rapidly rising health care costs
  - increasing concern for patient safety and the quality of care
- The use of information technology (IT) to address improvements in patient safety is currently driving health care organizations to automate clinical care operations and associated administrative functions
- HIPAA[1] requirements to address administrative simplification are to provide for the exchange of health care clinical and administrative information to move the industry to use more efficient and standardized electronic communications
- Over the last decade, the percentage of health insurance claims received electronically has steadily increased to 44% in 2002

[1] Health Insurance Portability and Accountability Act of 1996

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Objective, Scope, and Methodology

Objective

Identify cost savings and other benefits reported by health care organizations that have implemented information technology both in providing clinical health care and in the administrative functions associated with health care delivery

Scope

- We conducted our work at:
  - 11 private and public health care delivery organizations
  - 3 health care insurers
  - 5 community data networks[1]
- We selected these organizations based upon their reported success with implementing IT and sharing data

[1] Community data networks are community-based organizations that are involved in collaborative efforts involving the exchange of electronic health information among two or more organizations

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Objective, Scope, and Methodology

Organizations by Location

Source: GAO

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Objective, Scope, and Methodology

Methodology

- Reviewed available literature and consulted with experts in the academic and professional community about electronic medical records and reported cost savings and other benefits by health care organizations
  - Identified key clinical health care and administrative functions that incorporate the use of IT for health care delivery organizations (e.g., medical record documentation, order management and results reporting, etc.), insurers (e.g., claims processing and customer service), and community data networks
  - Identified health care organizations recognized in the health care community for their use of IT and had data available that demonstrate cost savings and other benefits
- Obtained and analyzed information from 10 of 11 health care delivery organizations, 3 insurers, and 1 of 5 community data network on functions that support clinical care delivery and administrative operations[1]

[1] One of the health care delivery organizations reported success with the implementation of IT but did not provide data; only one of the community data networks provided data on a demonstration project for establishing a regional network for sharing medical information

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Objective, Scope, and Methodology

Methodology (continued)

- Data analyzed included:
  - organizational profile information
  - description of the IT environment
  - cost and cost-related benefits
  - other benefits
  - lessons learned
- Provided participating organizations with the opportunity to comment and verify the accuracy of the material presented
  - All 14 organizations for which we have highlighted specific examples verified the accuracy of their data
- Conducted our work from October 2002 through August 2003 in accordance with generally accepted government auditing standards
  - We did not independently verify the data provided to us

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Objective, Scope, and Methodology
Data Limitations

- The organizations in our review do not represent a statistically valid sample of health care delivery organizations and insurers
- Data from the health care delivery organizations are unique to their specific settings and processes and are not necessarily consistent or comparable from organization to organization

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Objective, Scope, and Methodology

Description of Terms Used

- For health care delivery organizations, based on our review of literature and consultation with experts, we considered clinical care and administrative functions to be:

Clinical Care	Administrative
• Electronic medical records (EMR) management • Order management and results reporting • Patient care management • Internet access for patient and provider communications • Decision support tools	• Automated billing and financial management • Patient admission, discharge, transfers and registration • Coordination of communications infrastructure

- For insurers, we considered administrative functions to consist of claims processing and customer service
- For community data networks, we considered information exchange to consist of electronic data sharing of health information

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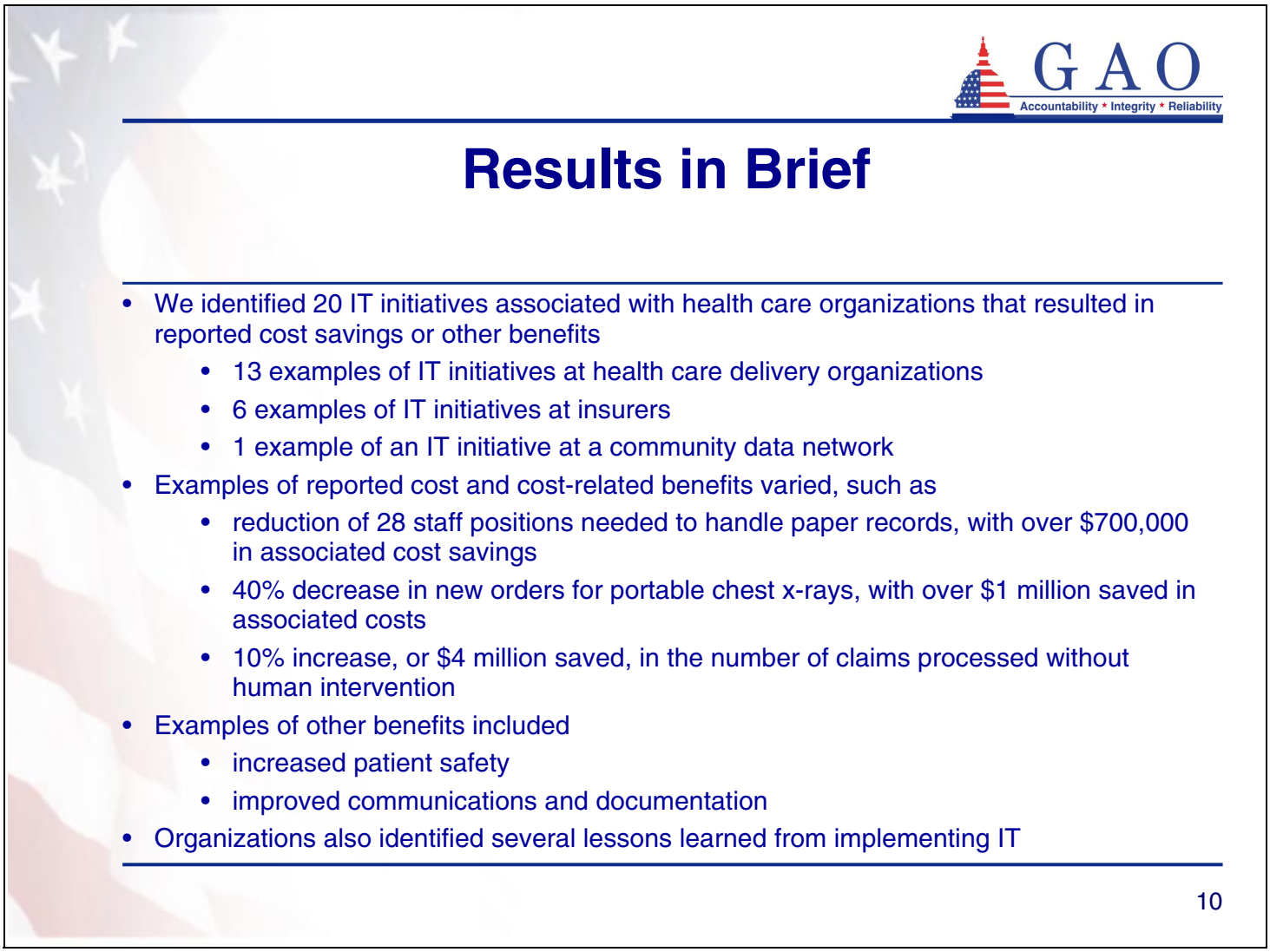
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Results in Brief
• We identified 20 IT initiatives associated with health care organizations that resulted in reported cost savings or other benefits
• 13 examples of IT initiatives at health care delivery organizations
• 6 examples of IT initiatives at insurers
• 1 example of an IT initiative at a community data network
• Examples of reported cost and cost-related benefits varied, such as
• reduction of 28 staff positions needed to handle paper records, with over $700,000 in associated cost savings
• 40% decrease in new orders for portable chest x-rays, with over $1 million saved in associated costs
• 10% increase, or $4 million saved, in the number of claims processed without human intervention
• Examples of other benefits included
• increased patient safety
• improved communications and documentation
• Organizations also identified several lessons learned from implementing IT
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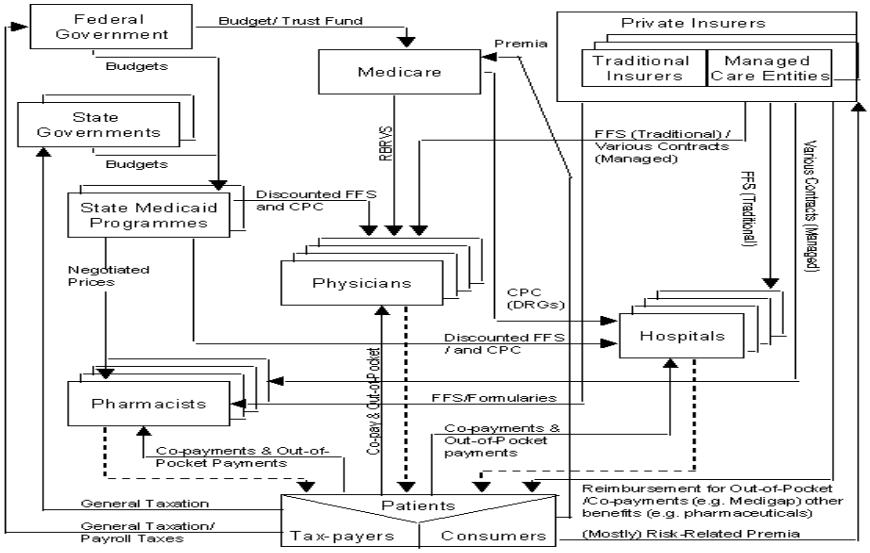
Background

Key Participants in the Health Care System in the United States

- As the graphic illustrates, the health care system in the United States is complex
- Health care is a large sector of the economy that involves multiple provider associations, health care delivery organizations, insurers, consumers, and local, state, and federal agencies; including the emergence of community data networks
- According to Centers for Medicare and Medicaid, national health expenditures are projected to be about $1.78 trillion by 2004



Source: Financing Health Care, Volume II; Hoffmeyer et al., 1994

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Background
Status of IT in Health Care

- The Department of Health and Human Services (HHS) reports that:
  - IT is expensive and it is difficult for organizations to generate the capital needed for IT investment, which is often regarded as an add-on cost
  - Currently, there is fragmented use of electronic connectivity to exchange health data among all providers
  - Standards for content (how the meanings of medical terms are represented) are not yet agreed upon, nor are there standards for how messages are to be sent and received
  - Security, and thus privacy, has not yet been assured—authentication of users and data encryption need to be more effectively implemented
- Despite the $20 billion in health care-related IT expenditures in the United States in 2001, less than 10% of US hospitals had adopted electronic medical records[1]

Appendix 4 contains summaries of selected studies on health care IT benefits

[1] Goldsmith, J; Blumenthal, D; Rishel, W, *Federal Health Information Policy: A Case of Arrested Development*, Health Affairs (July/August 2003)

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Background
Current Federal IT-Related Efforts

- To encourage improvements in patient safety and information sharing, for fiscal year 2004, the President requested $50 million for projects related to the use of IT for patient safety and $12 million to support development of standards
- FDA has proposed a new rule for bar coding medications to improve patient safety by allowing the use of information systems to reduce preventable medication errors
- HHS has licensed SNOMED[1] clinical terms for $32.4 million over 5 years to be available at no charge throughout the United States in order to provide a common vocabulary standard needed for the exchange of health care information
- GAO recently reported on opportunities to improve health care standards initiatives and made several recommendations to further these efforts[2]
  - define activities for ensuring that the various standards-setting organizations coordinate their efforts and reach further consensus on the definition and use of standards
  - establish milestones for defining and implementing all standards
  - create a mechanism to monitor the implementation of standards throughout the health care industry

[1] Systematized Nomenclature of Medicine
[2] U.S. General Accounting Office, *Bioterrorism: Information Technology Strategy Could Strengthen Federal Agencies' Abilities to Respond to Public Health Emergencies*, GAO-03-139 (Washington, DC: May 30, 2003)

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Background

14th Annual HIMSS Leadership Survey[1]

In February 2003, HIMSS reported the results of its annual survey of 287 health care IT executives and other respondents

- 52% of the responses identified the top IT priority as implementing IT to reduce medical errors and promote patient safety
- 23% named the lack of financial support as the biggest barrier to implementing IT at health care organizations
- IT applications identified to be the most important in the next 2 years include computerized provider order entry (64%), clinical information systems (53%), and bar coded medication management (46%)
- 68% reported that their IT operating budgets will increase, although projected increases are small—10% or less
- 55% identified internal breaches of security as the problem of most concern, while 33% named the limits of existing security technology as a concern
- 95% cited high-speed networks as the technology used most frequently by health care organizations, followed by intranets and client/server systems, 87% and 85% respectively
- Web site functionality for patients—including access to clinical information—is expected to increase in the next 2 years; current access is reported at 44%

[1] Health Information Management Systems Society (HIMSS)

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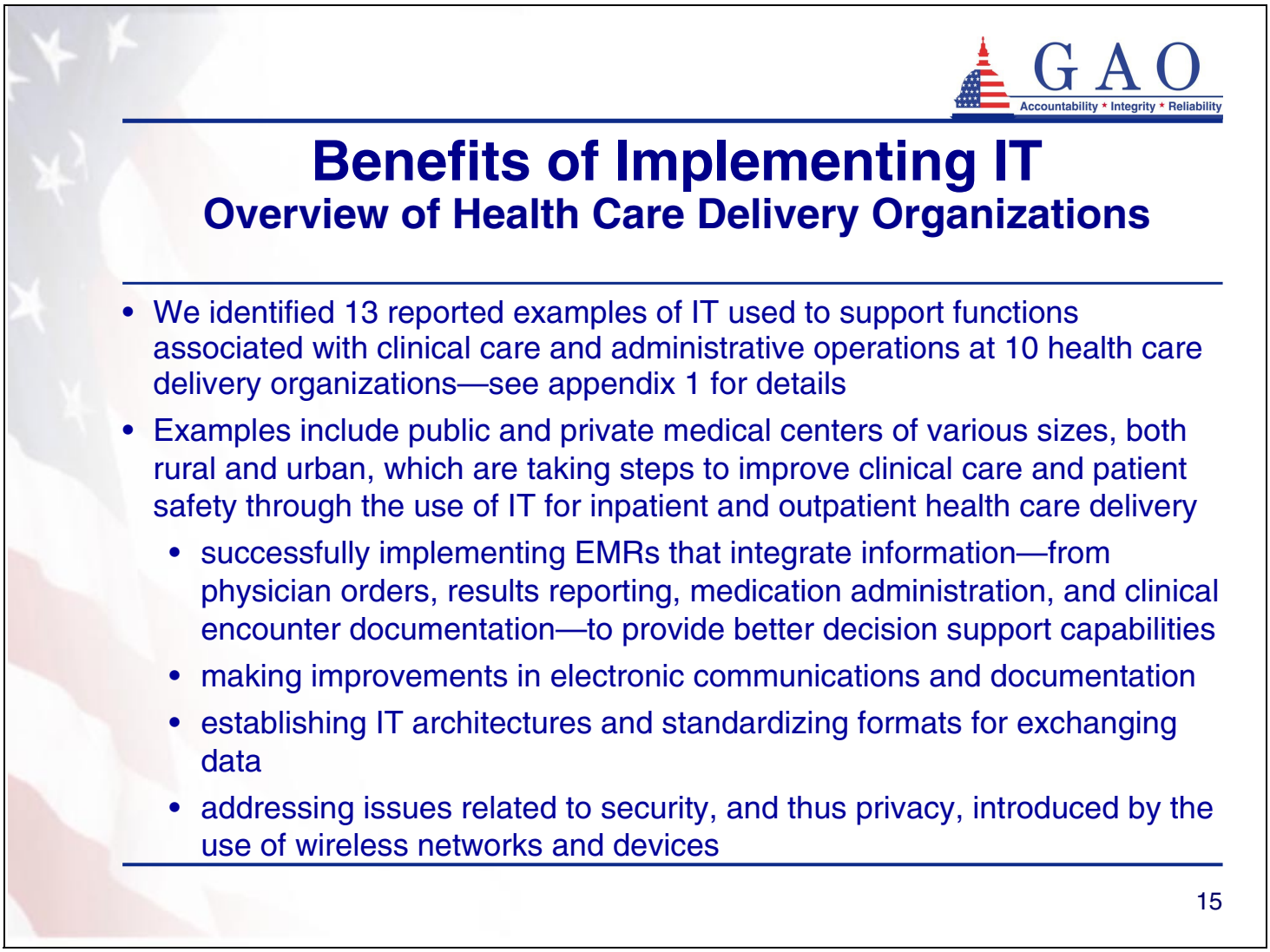
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Benefits of Implementing IT
Overview of Health Care Delivery Organizations
• We identified 13 reported examples of IT used to support functions associated with clinical care and administrative operations at 10 health care delivery organizations—see appendix 1 for details
• Examples include public and private medical centers of various sizes, both rural and urban, which are taking steps to improve clinical care and patient safety through the use of IT for inpatient and outpatient health care delivery
• successfully implementing EMRs that integrate information—from physician orders, results reporting, medication administration, and clinical encounter documentation—to provide better decision support capabilities
• making improvements in electronic communications and documentation
• establishing IT architectures and standardizing formats for exchanging data
• addressing issues related to security, and thus privacy, introduced by the use of wireless networks and devices
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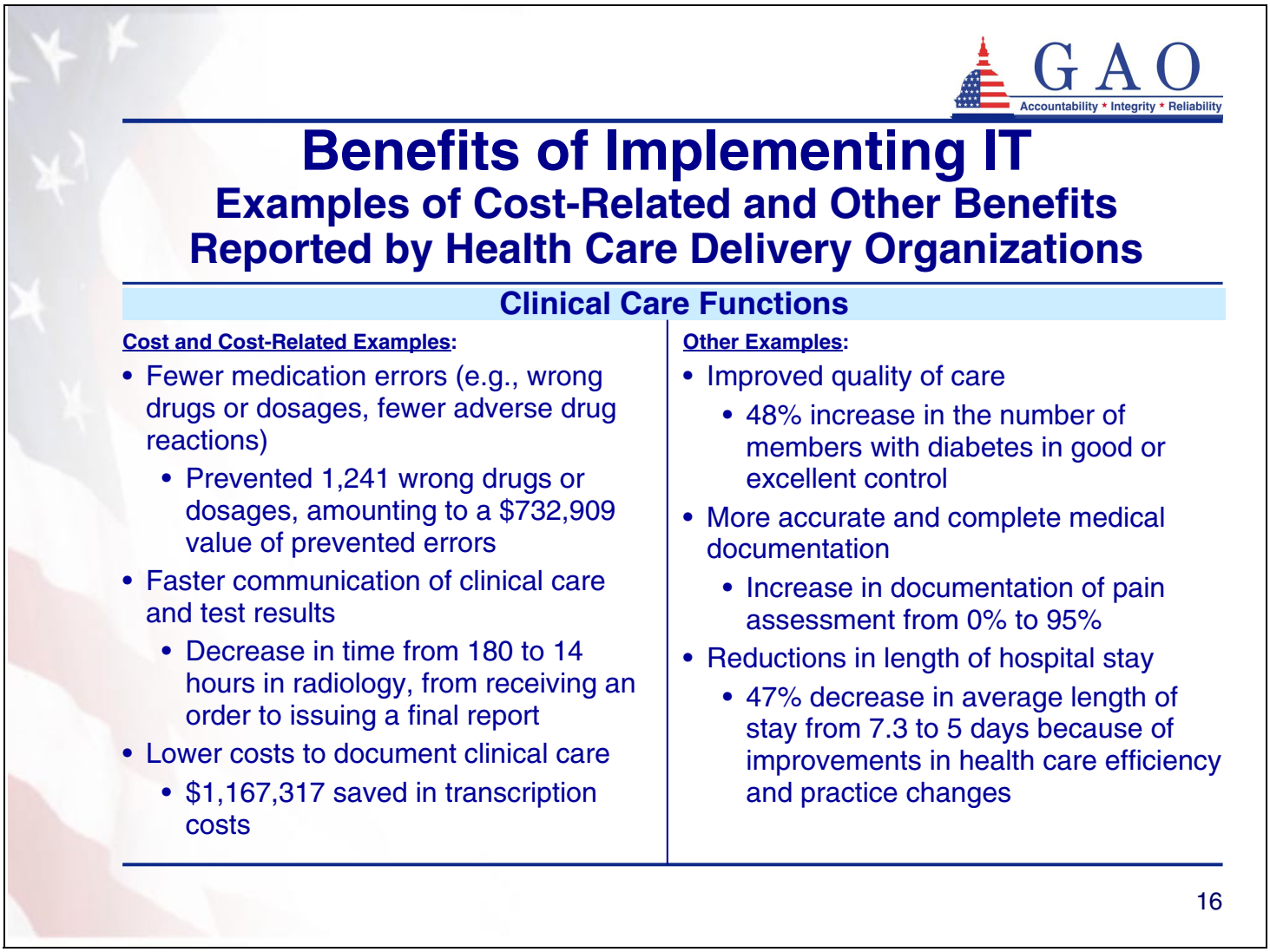
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Benefits of Implementing IT
Examples of Cost-Related and Other Benefits Reported by Health Care Delivery Organizations
Clinical Care Functions
Cost and Cost-Related Examples:
• Fewer medication errors (e.g., wrong drugs or dosages, fewer adverse drug reactions)
• Prevented 1,241 wrong drugs or dosages, amounting to a $732,909 value of prevented errors
• Faster communication of clinical care and test results
• Decrease in time from 180 to 14 hours in radiology, from receiving an order to issuing a final report
• Lower costs to document clinical care
• $1,167,317 saved in transcription costs
Other Examples:
• Improved quality of care
• 48% increase in the number of members with diabetes in good or excellent control
• More accurate and complete medical documentation
• Increase in documentation of pain assessment from 0% to 95%
• Reductions in length of hospital stay
• 47% decrease in average length of stay from 7.3 to 5 days because of improvements in health care efficiency and practice changes
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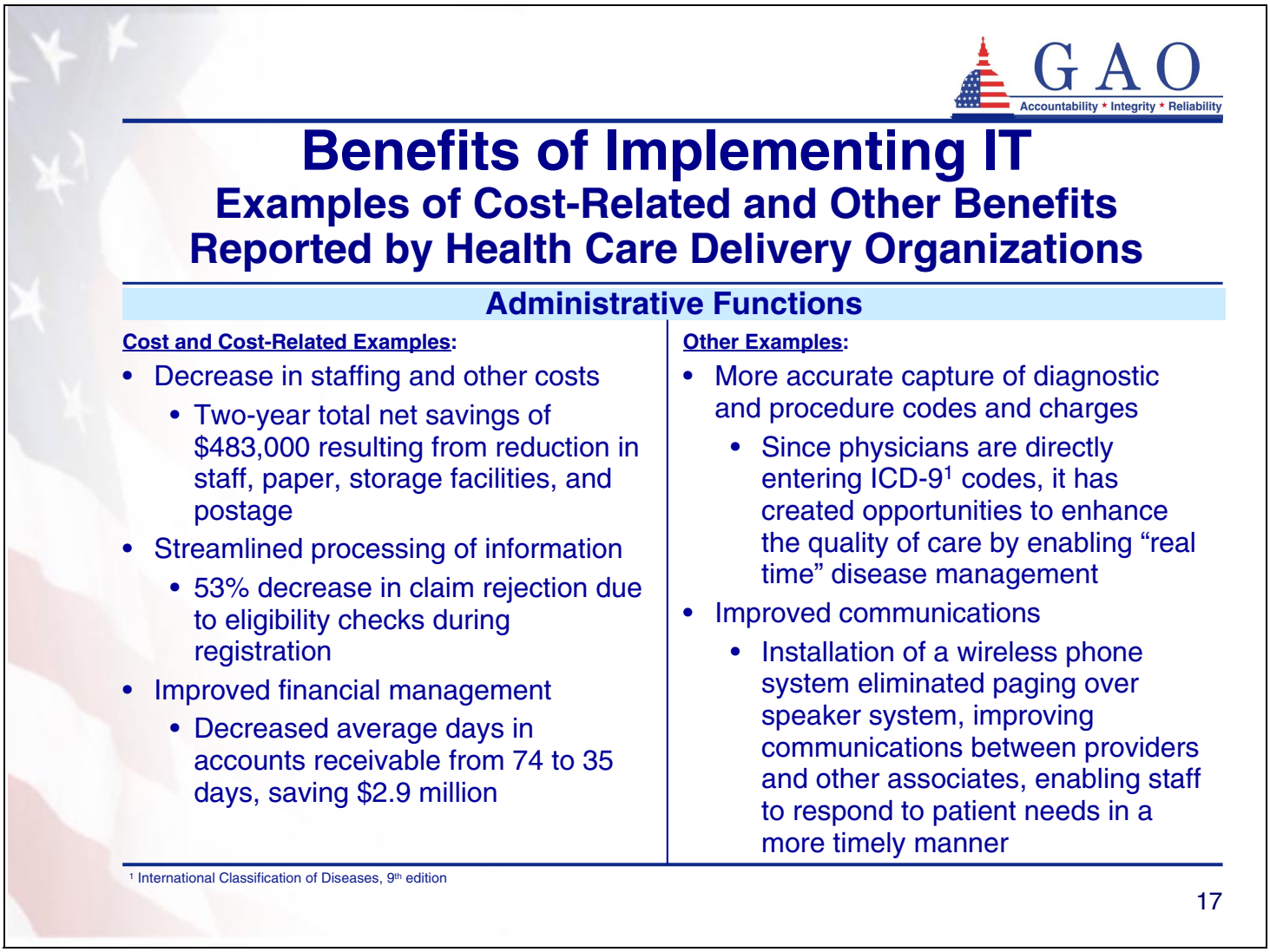
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Benefits of Implementing IT
Examples of Cost-Related and Other Benefits Reported by Health Care Delivery Organizations
Administrative Functions
Cost and Cost-Related Examples:
• Decrease in staffing and other costs
• Two-year total net savings of $483,000 resulting from reduction in staff, paper, storage facilities, and postage
• Streamlined processing of information
• 53% decrease in claim rejection due to eligibility checks during registration
• Improved financial management
• Decreased average days in accounts receivable from 74 to 35 days, saving $2.9 million
Other Examples:
• More accurate capture of diagnostic and procedure codes and charges
• Since physicians are directly entering ICD-9[1] codes, it has created opportunities to enhance the quality of care by enabling "real time" disease management
• Improved communications
• Installation of a wireless phone system eliminated paging over speaker system, improving communications between providers and other associates, enabling staff to respond to patient needs in a more timely manner
[1] International Classification of Diseases, 9th edition
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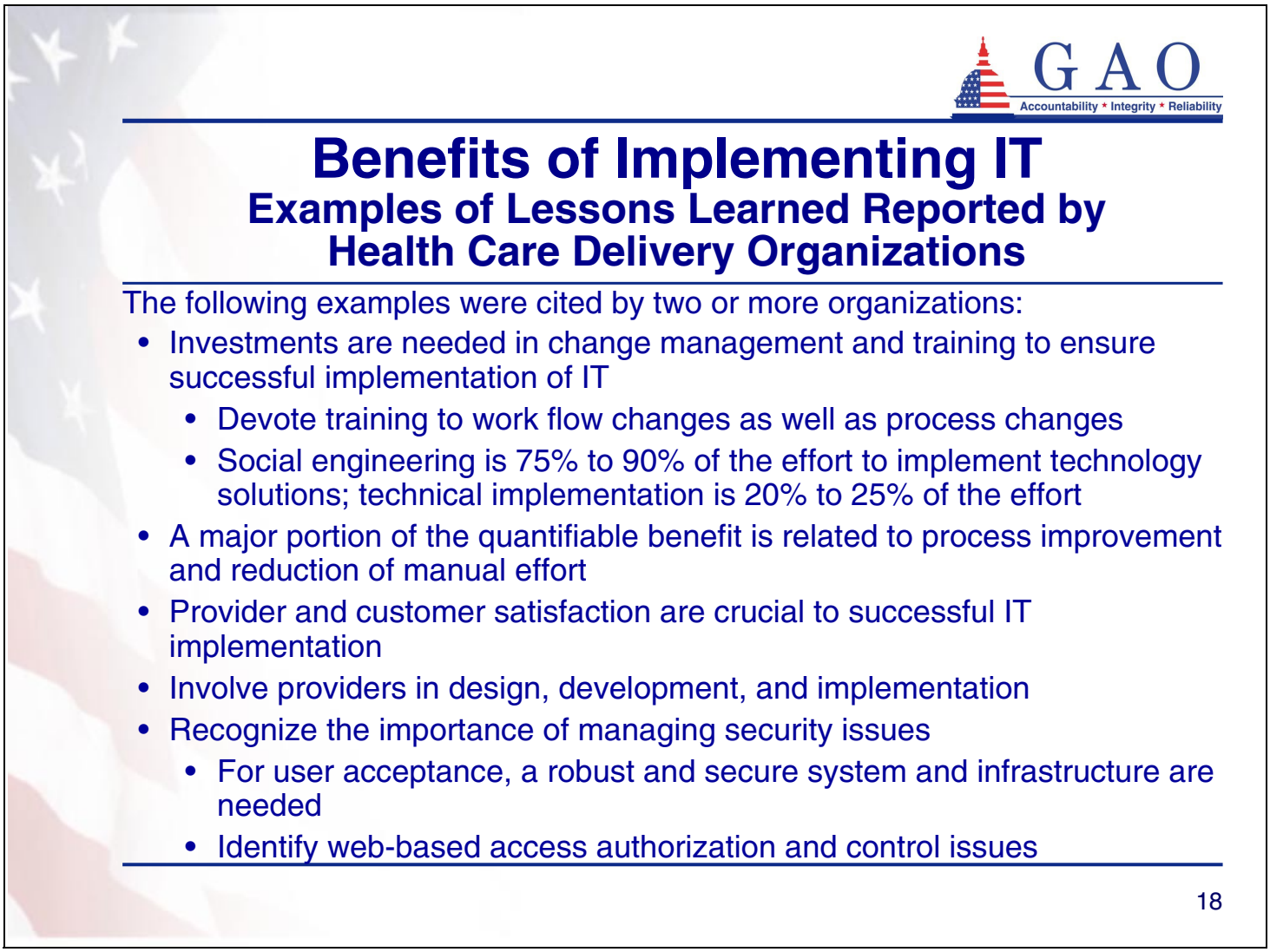
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Benefits of Implementing IT
Examples of Lessons Learned Reported by Health Care Delivery Organizations
The following examples were cited by two or more organizations:
• Investments are needed in change management and training to ensure successful implementation of IT
• Devote training to work flow changes as well as process changes
• Social engineering is 75% to 90% of the effort to implement technology solutions; technical implementation is 20% to 25% of the effort
• A major portion of the quantifiable benefit is related to process improvement and reduction of manual effort
• Provider and customer satisfaction are crucial to successful IT implementation
• Involve providers in design, development, and implementation
• Recognize the importance of managing security issues
• For user acceptance, a robust and secure system and infrastructure are needed
• Identify web-based access authorization and control issues
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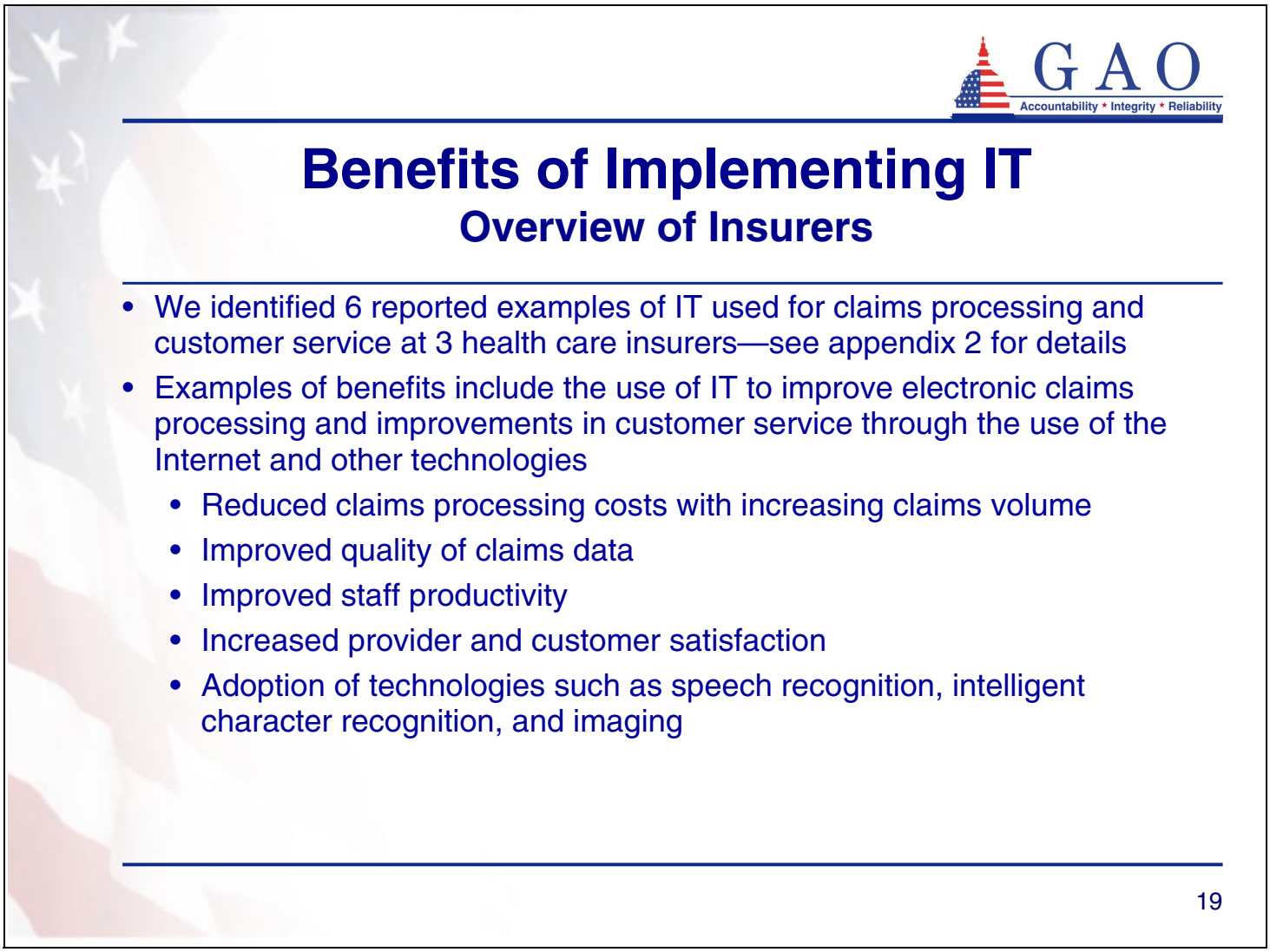
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Benefits of Implementing IT
Overview of Insurers
• We identified 6 reported examples of IT used for claims processing and customer service at 3 health care insurers—see appendix 2 for details
• Examples of benefits include the use of IT to improve electronic claims processing and improvements in customer service through the use of the Internet and other technologies
• Reduced claims processing costs with increasing claims volume
• Improved quality of claims data
• Improved staff productivity
• Increased provider and customer satisfaction
• Adoption of technologies such as speech recognition, intelligent character recognition, and imaging
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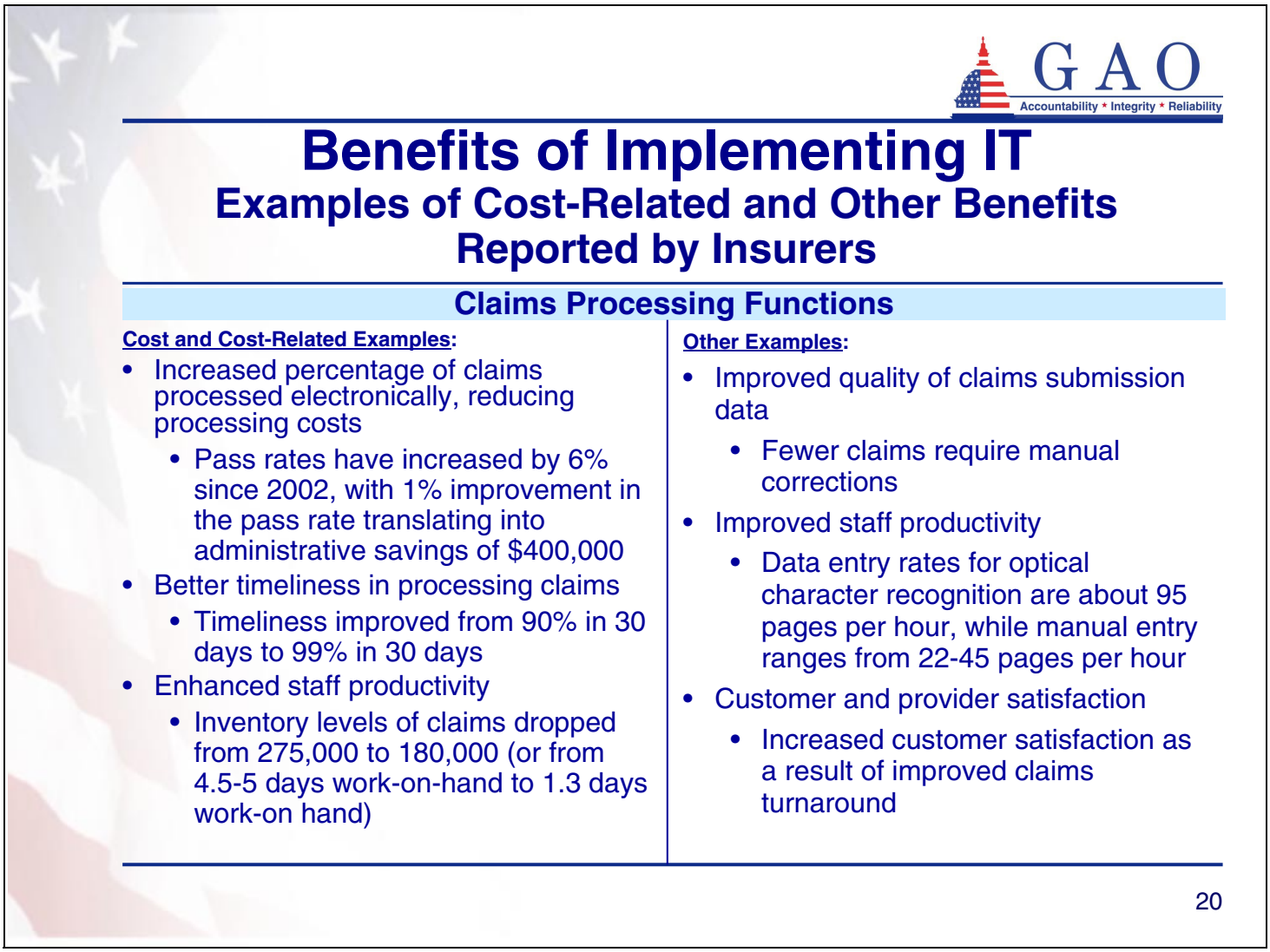
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Benefits of Implementing IT
Examples of Cost-Related and Other Benefits Reported by Insurers
Claims Processing Functions
Cost and Cost-Related Examples:
• Increased percentage of claims processed electronically, reducing processing costs
• Pass rates have increased by 6% since 2002, with 1% improvement in the pass rate translating into administrative savings of $400,000
• Better timeliness in processing claims
• Timeliness improved from 90% in 30 days to 99% in 30 days
• Enhanced staff productivity
• Inventory levels of claims dropped from 275,000 to 180,000 (or from 4.5-5 days work-on-hand to 1.3 days work-on hand)
Other Examples:
• Improved quality of claims submission data
• Fewer claims require manual corrections
• Improved staff productivity
• Data entry rates for optical character recognition are about 95 pages per hour, while manual entry ranges from 22-45 pages per hour
• Customer and provider satisfaction
• Increased customer satisfaction as a result of improved claims turnaround
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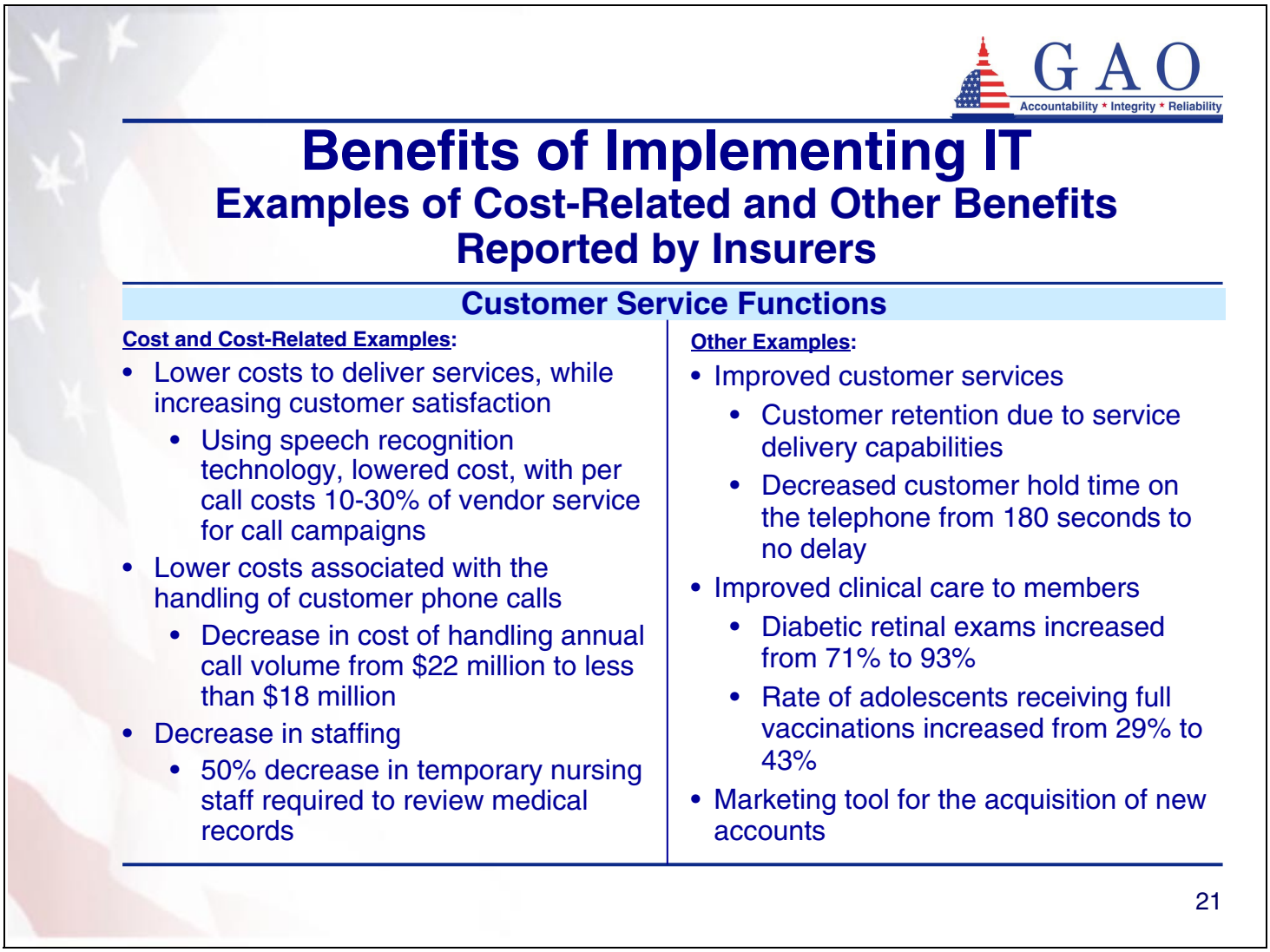
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Benefits of Implementing IT
Examples of Cost-Related and Other Benefits Reported by Insurers
Customer Service Functions
Cost and Cost-Related Examples:
• Lower costs to deliver services, while increasing customer satisfaction
• Using speech recognition technology, lowered cost, with per call costs 10-30% of vendor service for call campaigns
• Lower costs associated with the handling of customer phone calls
• Decrease in cost of handling annual call volume from $22 million to less than $18 million
• Decrease in staffing
• 50% decrease in temporary nursing staff required to review medical records
Other Examples:
• Improved customer services
• Customer retention due to service delivery capabilities
• Decreased customer hold time on the telephone from 180 seconds to no delay
• Improved clinical care to members
• Diabetic retinal exams increased from 71% to 93%
• Rate of adolescents receiving full vaccinations increased from 29% to 43%
• Marketing tool for the acquisition of new accounts
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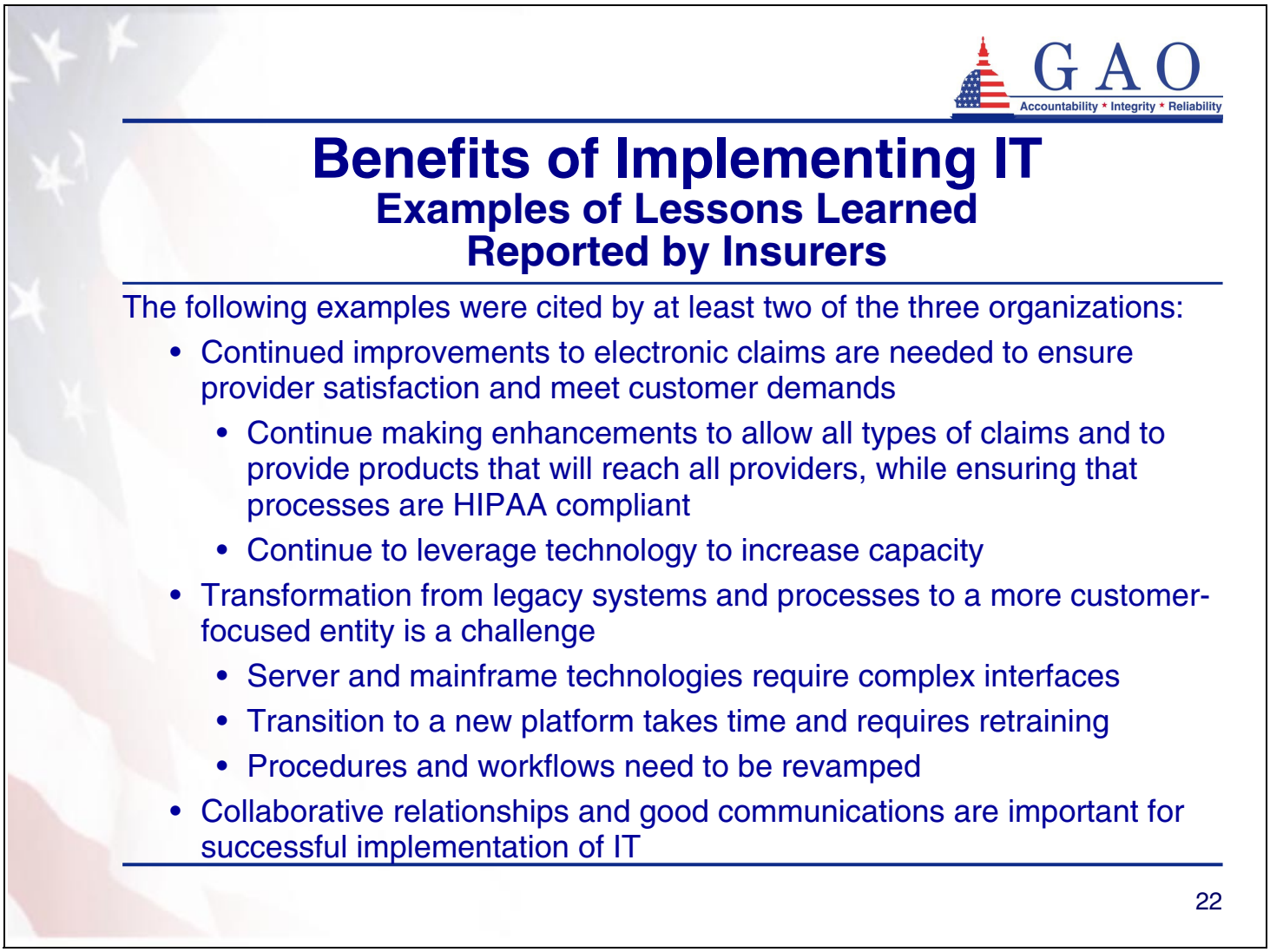
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Benefits of Implementing IT
Examples of Lessons Learned
Reported by Insurers
The following examples were cited by at least two of the three organizations:
• Continued improvements to electronic claims are needed to ensure provider satisfaction and meet customer demands
• Continue making enhancements to allow all types of claims and to provide products that will reach all providers, while ensuring that processes are HIPAA compliant
• Continue to leverage technology to increase capacity
• Transformation from legacy systems and processes to a more customer-focused entity is a challenge
• Server and mainframe technologies require complex interfaces
• Transition to a new platform takes time and requires retraining
• Procedures and workflows need to be revamped
• Collaborative relationships and good communications are important for successful implementation of IT
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Benefits of Implementing IT
Overview of Community Data Networks

- For one of the five community data networks, we identified an example of IT used for the regional exchange of health care data among physicians, hospitals, payers, and ancillary services (e.g., laboratories and radiology)—see appendix 3 for details
  - The organization expects annual benefits to include, among others:
    - annual total benefits of $7.3 million
    - savings in laboratory and radiology labor costs
    - enhanced revenue resulting from proper coding
  - This initiative demonstrates that information can be exchanged securely and affordably in a manner that improves the quality and reduces the costs of health care
- The four other networks are working to ensure secure standard transactions and improve the speed and reliability of secure electronic communications containing health data

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Summary

- Selected health care organizations have reportedly benefited from the implementation of IT initiatives that have resulted in associated cost savings and other benefits
- The range of reported cost and cost-related benefits varied from reductions in staff and supplies, to savings from reductions in transcription services
- Other benefits realized also addressed a wide range of improvements related to increases in patient safety measures and improvements in communications and documentation, among others
- Lessons learned reported by these organizations include the need to redesign business processes and workflows, ensure “ownership” of IT initiatives to facilitate adoption of technology and its benefits, and ensure that staff are adequately trained

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 1 (Clinical Care)

Organizational Overview

- **Danville Regional Medical Center** is a 350-bed, private, not-for-profit community hospital serving a rural population
  - IT budget was $2.7 million (3% of total budget) for 2002, including 28 staff

Description of the IT Environment

- Danville provided data on the use of their medical administration check (MAC) application, which is one component of their EMR system
  - MAC utilizes bar code technology and wireless scanners to provide positive identification of drugs and patients at the point of care
  - Patients' bracelets, medications, and nurse IDs are bar coded; no inpatient receives medication without bar code verification technology
  - Bar code technology is integrated into a wireless network and EMR; patients' charts are updated when medication is administered

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 1 (Clinical Care)

Reported Cost and Cost-Related Benefits

- Prevented 1,241 wrong drugs or dosages, amounting to a $732,909 value in errors prevented[1] (2002)
- Prevented 1,968 early or extra doses, amounting to a $116,226 value in prevented errors (i.e., potential overdoses)(2002)

Other Reported Benefits

- 50% decrease in phone calls to the pharmacy per day
- Increased patient safety
- Decreased medication errors
- Improved communication and documentation
- No paper charting required when medications are administered

[1] Value computations based upon *The Costs of Adverse Drug Events in Hospitalize Patients*, Bates, David, JAMA, 1997, Vol 277 No 4 and, *Adverse Drug Events in Hospitalized Patients*, Classen, David, JAMA, 1997 Vol 277 No 4

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 1 (Clinical Care)

Lessons Learned

- Ensure that the configuration of hardware and equipment (scanners, batteries, bar code placement) is conducive to performing the manual tasks associated with the process (i.e., scanning, charging batteries, etc.)
- Devote training to work flow changes as well as process changes

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 2 (Clinical Care)

Organizational Overview

- **Geisinger Medical Center** is a 437-bed, private, not-for-profit integrated health care system, which provides primary and specialty care in 50 clinics and 3 hospitals serving a rural population; it also operates an HMO covering 290,000 members
  - IT budget in 2002 was $68 million (4.1% of total budget) and included 293 staff

Description of the IT Environment

- Geisinger uses a commercial system as its outpatient EMR system
  - System became operational in 1996 and is still evolving
  - Its EMR database contains 2.4 million patients
  - Used to document 1.2 million patient visits in 2002
- Implemented digital radiological image capture and transmission, with remote reading of studies for hospitals without radiologist

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 2 (Clinical Care)

Description of the IT Environment (continued)

- EMR system functions include:
  - Direct order entry for laboratory and radiology, with real-time alerts and reminders for about 600 physicians
  - Laboratory, radiology, pathology, centrally scanned documents, and transcribed documents that interface with the clinical data repository
  - Patient encounter documentation using electronic templates
  - Web technologies for access to information across the enterprise for providers and patients
  - E-mail that provides rapid, secure messaging to every clinician in the system

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 2 (Clinical Care)

Reported Cost and Cost-Related Benefits

- 372,000 fewer laboratory and radiology reports printed and filed annually
- About $1,000 in savings per year per physician due to improved formulary compliance
- 50% or greater decrease in transcription costs in some medical departments
  - $1,992 savings per month in reduced dermatology transcription costs
- 9-25% increase in productivity in 5 clinical services over a one year period[1] (2001-2002)
- Able to perform 550 extra colonoscopies resulting in $265,000 first year net financial benefit
- 100% ICD-9 coding of all orders by the provider, improving the accuracy of billing
- Chart pulls reduced by 105,000 annually; average non-appointment chart pulls per clinic day decreased from 1,580 to 1,248 (2001)

[1] Productivity measure based on relative value unit per full-time equivalence

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 2 (Clinical Care)

Other Reported Benefits

- Automatic allergy and drug-drug interaction checking on all prescriptions
- Increased ordering of Pneumovax and aspirin for coronary artery disease
- Rapid patient notification of drug and vaccine recalls
- 33% reduction in Medicare disallowance of tests ordered
- 97% of visits have allergies checked and documented
- 1,651 fewer appointments completed without referral authorization (Jan 2001-June 2002)
- 94% of 16,690 patients surveyed in December 2002 rated the “helpfulness of having the computer in the exam room” as good or very good
- More accurate and complete documentation and billing
- Real-time medical necessity checking and warning at order entry

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 2 (Clinical Care)

Lessons Learned

- Develop a phased approach to facilitate implementation
- Recognize the difficulty of writing laboratory result interpretations to allow for easy to understand explanations for patients who are unfamiliar with medical terminology
- Determine how to route patients' drug renewal requests to the correct provider within an integrated delivery system with multiple specialists
- Identify web-based access authorization and control issues for pediatric patients, and for someone other than the patient but authorized by the patient
- Identify ways to achieve efficiencies in system use and to measure benefits

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 3 (Clinical Care)

Organizational Overview

- **Kaiser Permanente Northwest** is a private, not-for-profit integrated health care delivery system serving an urban population of 440,000 members with 1 200-bed medical center, 7 contract plan hospitals, 28 multi-specialty medical offices, and 2 ambulatory surgery centers
  - IT budget in 2002 was about $50 million (about 3% of total)

Description of the IT Environment

- Its clinical information system is a commercially available, comprehensive EMR that automates many of the information transmission processes related to outpatient care, such that they no longer create paper charts
  - Complete life-long paperless medical record
  - Detailed information on over 4 million office visits and 2.5 million telephone interactions per year, with a total of over 30 million visits and 17 million telephone interactions
  - Direct clinician order entry with decision support embedded with alerts and guidelines for prescribing and ordering
  - Extensive intranet web site

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 3 (Clinical Care)

Description of the IT Environment (continued)

- Key components of the EMR include
  - Results reporting system that leverages existing electronic data from departmental systems
  - Commercial outpatient EMR that automates all
    - outpatient documentation (e.g., progress notes, problem list maintenance)
    - order communications for pharmacy, laboratory, radiology and referrals
    - patient instructions
    - coding of all diagnoses, procedures, and length of stay
    - messaging processes
- Databases for
  - Clinical and disease prevention and management
  - Merged financial data for business management, clinician feedback, reduction in variation of care, and research

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 3 (Clinical Care)

Reported Cost and Cost-Related Benefits

- 76% decrease in phone calls to obtain lab results between 1993 and 1997
- Over 90% decrease in chart pulls for quality review
- Reduction of 2,000 in overall daily chart pulls, eliminating 16 FTEs and saving and avoiding about $5.7 million on medical record unit FTE costs[1]
- 7.5% decrease in laboratory test ordering—attributable to reliable and efficient access to test results—decreasing redundant tests
- 10% decrease in outpatient visits per member per year over three years, reversing previous increases
- Decrease in average number of lab tests per member from nearly 17.5 to less than 16 per year

[1] FTE is full-time equivalents

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 3 (Clinical Care)

Other Reported Benefits

- 16% increase in Pap smears performed from 69% to 80% (1995-1998)
- 15% increase in the documentation of smoking status, allowing for targeted patient education from 80% to 92% (1998-2000)
- 44% increase in the documentation of coronary artery disease or peripheral vascular disease in patients with lipids measured in last 24 months (1998-2000)
- 48% increase from 46% to 66% in members with diabetes in good or excellent control (1993-1998)
- 46% increase from 48% to 68% in members with diabetes receiving annual retinal exams (1987-1992)
- 90% of users prefer not to return to paper chart, indicating high user acceptance
- 85% of users feel the EMR has a positive impact on productivity and is worth the time and effort to use
- 65% of users feel that patients are more satisfied with the use of the EMR, while 30% are neutral
- Decrease in the number of upper gastrointestinal studies ordered following automated patient care guidelines

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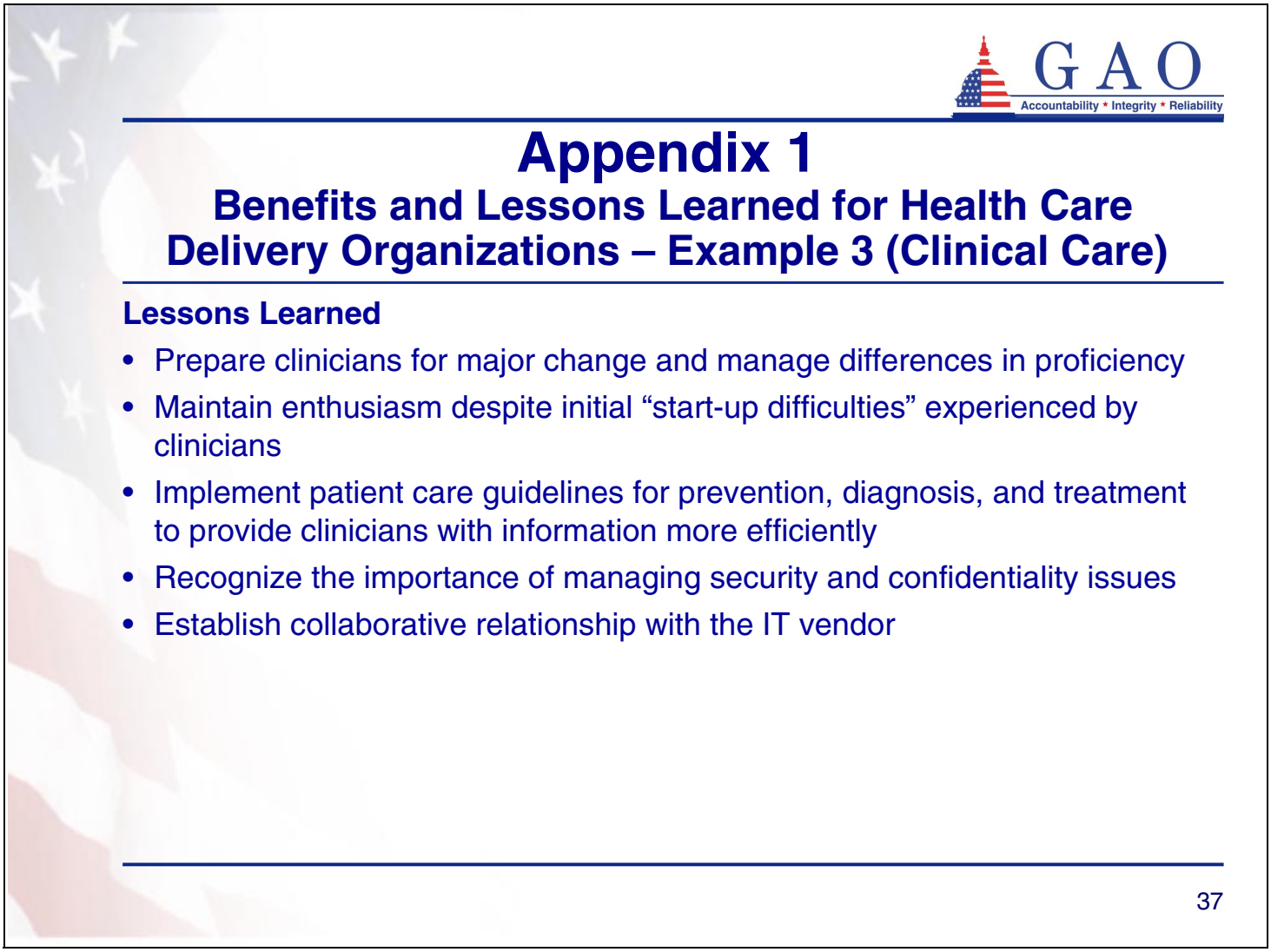
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 3 (Clinical Care)
Lessons Learned
• Prepare clinicians for major change and manage differences in proficiency
• Maintain enthusiasm despite initial "start-up difficulties" experienced by clinicians
• Implement patient care guidelines for prevention, diagnosis, and treatment to provide clinicians with information more efficiently
• Recognize the importance of managing security and confidentiality issues
• Establish collaborative relationship with the IT vendor
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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 4 (Clinical Care)

Organizational Overview

- **Maimonides Medical Center** is a 705-bed, private, not-for-profit independent teaching hospital serving an urban population
  - IT budget in 2002 was $21 million (3.6% of total budget) and included 92 staff

Description of the IT Environment

- Maimonides Access Clinical System (MACS) is a computerized patient record system comprised of four distinct systems from different vendors
  - Inpatient EMR with permanent inpatient record, medication charting and documentation, order entry and results reporting, and communications and management
  - Outpatient EMR with full physician and nurse documentation
  - Emergency department EMR with full physician and nurse documentation
  - Obstetrical EMR with full physician and nurse documentation and decision support with expert knowledge

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 4 (Clinical Care)

Description of the IT Environment (continued)

- Systems that supply data to MAC include, among others
  - decision support system
  - laboratory information system
  - transcription system
  - patient management and accounting system
  - picture archiving and communications system

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 4 (Clinical Care)

Reported Cost and Cost-Related Benefits

- Reduction of adverse drug reactions from 435 to 325, with corresponding increase in pharmacy clinical interventions from 1,046 to 1,873 (1998-2001) as pharmacists respond to electronic flags in the system
- 32% decrease in average length of stay from 7.3 to 5 days (1995 – 2001) because of improvements in health care efficiency and practice changes, such as improved time to deliver medications to the patient's bedside
- Decrease in time from 180 to 14 hours in radiology, from receiving an order to issuing a final report
- 68% decrease in medication processing time from 276 to 88 minutes
- Growth in patient revenues from $369 to $509 million and profit from $751,000 to $6 million during 1995-2001
  - 25% of growth in revenues attributed to improved efficiencies with MACS

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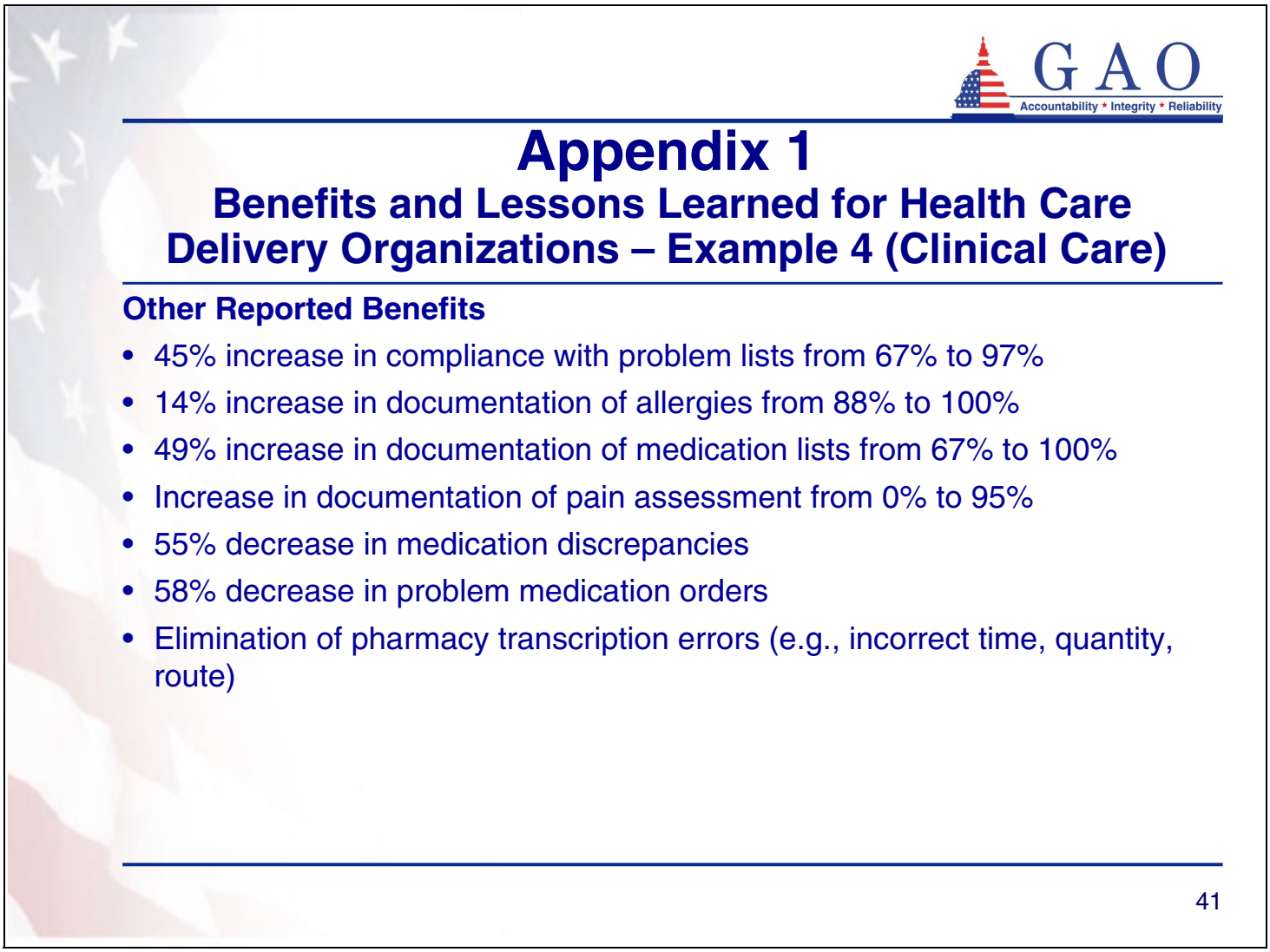
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 4 (Clinical Care)
Other Reported Benefits
• 45% increase in compliance with problem lists from 67% to 97%
• 14% increase in documentation of allergies from 88% to 100%
• 49% increase in documentation of medication lists from 67% to 100%
• Increase in documentation of pain assessment from 0% to 95%
• 55% decrease in medication discrepancies
• 58% decrease in problem medication orders
• Elimination of pharmacy transcription errors (e.g., incorrect time, quantity, route)
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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 4 (Clinical Care)

Lessons Learned

- Create the right information systems environment with proven management and leadership skills, dedicated IT staff, and respected clinical staff
- Establish programs specifically focused on physician participation and ownership of the system
- Provide real-time user support 24 hours, 7 days a week
- Provide “just-in-time” training

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 5 (Clinical Care)

Organizational Overview

- **Mayo Clinic** is a 1,951-bed, private, not-for-profit teaching hospital serving urban, rural, and international populations
  - IT budget in 2002 was $107 million (5% of total budget), including 750 staff[1]

Description of the IT Environment

- Mayo's initial clinical information system consisted of a database management system developed in 1972 and a fiber optic network installed in 1986
- There are 32,000 active users
- The database contains 145 million laboratory/procedure results and 44 million radiology images
- 50,000 clinical notes are created weekly; total of 12 million are in the database
- 125,000 electronic outpatient orders are created weekly

[1] IT budget includes only direct expenses and the total budget is operating expenses

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 5 (Clinical Care)

Description of the IT Environment (continued)

- The Mayo Integrated Clinical Systems (MICS) project was initiated in 1995 to enhance clinical care, education, and research, and to help ensure the financial success of the organization through the use of integrated electronic patient care systems
- MICS is comprised of forty implementation initiatives that support four major categories of activity—electronic medical records, clinical process support, system infrastructure, and other initiatives
- Examples of initiatives to support electronic health records include clinical notes, electronic results and reports, moving to paperless medical records for outpatient services, advanced beneficiary notification, and Mayo's scheduling system

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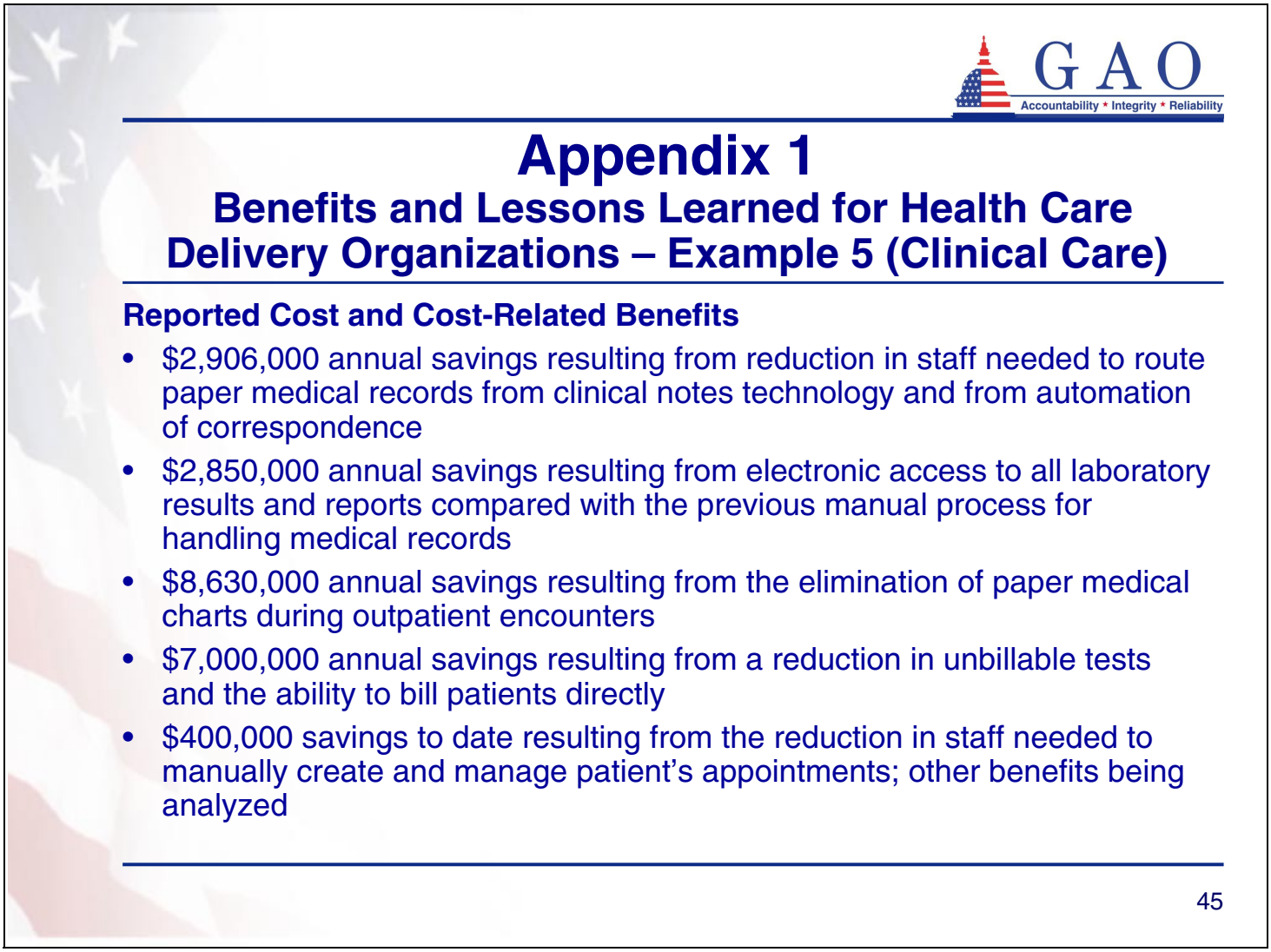
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 5 (Clinical Care)
Reported Cost and Cost-Related Benefits
• $2,906,000 annual savings resulting from reduction in staff needed to route paper medical records from clinical notes technology and from automation of correspondence
• $2,850,000 annual savings resulting from electronic access to all laboratory results and reports compared with the previous manual process for handling medical records
• $8,630,000 annual savings resulting from the elimination of paper medical charts during outpatient encounters
• $7,000,000 annual savings resulting from a reduction in unbillable tests and the ability to bill patients directly
• $400,000 savings to date resulting from the reduction in staff needed to manually create and manage patient's appointments; other benefits being analyzed
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 5 (Clinical Care)

Other Reported Benefits

- Immediate access to legible patient information to support Mayo's three missions of practice, education, and research
- Structured format for ease of access and for support of data mining
- Improved security
- Improved billing process
- Increased patient satisfaction with up-front knowledge and authorization of tests
- Improved patient scheduling, allowing for travel time, fasting, provider, calendar, and other criteria
- Less staff training as scheduling rules are incorporated into scheduling system
- Automatic creation and recreation of schedule material

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 5 (Clinical Care)

Lessons Learned

- Benefits can be obtained from successful IT projects
- Process measurement is time consuming and sometimes difficult to capture, particularly with large integrated systems
- A major portion of the quantifiable benefit is related to process improvement and reduction of manual effort
- Full realization of the benefit requires the combined efforts of IT and operations

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 6 (Clinical Care)

Organizational Overview

- **Partners HealthCare** is a 3,196-bed, private, not-for-profit integrated health care system serving an urban community that consists of 11 hospitals and about 7,200 physicians; includes primary care and specialty physicians, community hospitals, the two founding academic medical centers, specialty facilities, community health centers, and other health-related entities
  - IT budget in 2002 was $112 million (3% of total budget), including about 850 staff
- The two founding academic medical centers—Brigham and Women's Hospital (BWH) and Massachusetts General Hospital (MGH)—have conducted research on their EMR systems
  - BWH data, as reported in several articles about the Brigham Integrated Computing System (BICS), are summarized on the next three pages

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 6 (Clinical Care)

Description of the IT Environment

- In February 2002, Partners implemented a patient portal that is currently in use at 11 practices, with 8,358 patients enrolled as of September 3, 2003
- The portal, called Patient Gateway, provides patients with Web-based access to
  - request routine appointments, prescriptions, and referral authorizations
  - obtain health and disease information
  - obtain practice information
- BWH uses the Brigham Integrated Computing System (BICS) to handle the majority of its clinical, financial, and administrative computing needs
- BICS clinical information system includes:
  - longitudinal medical records
  - critical pathway management
  - operating room scheduling
  - critical event detection and altering
  - results review
  - provider order entry
  - coverage lists
  - automated inpatient summaries

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 6 (Clinical Care)

Reported Cost and Cost-Related Benefits of BICS

- A single drug substitution intervention saved $250,000-$500,000 annually on just one drug
- Using event triggers to identify possible changes in dosing and provide appropriate suggestions to the physicians saved $950,000 for:
  - 8,000 changes in orders of H2 blockers
  - 1,000 changes in orders of Ondansetron[1]
  - 3,000 changes in orders of Ceftriaxone[2]
- 4,500 fewer redundant laboratory tests for a savings of $100,000 per year
- Shift from intravenous to oral drug delivery in 20,000 instances saved $1 million per year
- User acceptance of a drug family suggestion favoring one H2 blocker[3]—because of cost—increased to 94% within the first few days

[1] Ondansetron is used to prevent nausea and vomiting caused by cancer chemotherapy, radiation therapy, anesthesia, and surgery
[2] Ceftriaxone is used in the treatment of infections caused by bacteria
[3] Histamine H 2-receptor antagonists, also known as H 2-blockers, are used to treat duodenal ulcers and prevent their return

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 6 (Clinical Care)

Other Reported Benefits of Patient Gateway

- Less staff labor, time saved, fewer delays, and more accurate information compared with the telephone
- High patient satisfaction associated with the availability of the system and the receipt of replies from the practices
- High satisfaction in medical practices associated with higher use by patients
- Growth in demand among practices as enrollment has risen

Other Reported Benefits of BICS

- Ambulatory record is available at any time and at any location
- 4% of radiology orders into the system were canceled and 55% were changed when an embedded alert warned that an ordered study was inappropriate for specified clinical reasons
- Positive response to order entry; overall score of 5.7 on a scale from 1-7

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)

Organizational Overview

- **Department of Defense** (DOD) operates a worldwide health care program, including overseas facilities, that consists of 75 hospitals and 461 outpatient clinics for about 9 million beneficiaries
  - 20% are active duty personnel and 80% are retirees and dependents

Description of the IT Environment

- We visited Tinker Air Force Base Medical Treatment Facility (MTF) to observe the use of the Composite Health Care System (CHCS) II
  - CHCS II is currently operational in Tinker's outpatient clinics; implementation began on March 31, 2003
  - 6 other MTFs have implemented CHCS II over the past year, with worldwide implementation of release 1 expected to be completed by 2006
- CHCS I, first implemented in 1993 and operational in all DOD MTFs today, is expected to be replaced by CHCS II by fiscal year 2008

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)

Description of the IT Environment (continued)

- CHCS II, a COTS based product, interfaces with the existing military health systems to provide an integrated electronic health record of treatment for the care provided in DOD medical facilities worldwide
- CHCS II, release 1 provides functions for outpatient services
  - Structured documentation of history, physical, diagnostic, and treatment
  - Secure electronic connectivity of the health record
  - Automated coding derived from the patient encounter documentation
  - Enterprise global clinical database for research, management, and military deployment decisions
  - EMR management in support of population health activities
  - Lexicon and health data dictionary
- Future CHCS II capabilities are planned to be fielded incrementally, including inpatient, vision, occupational exposure and surveillance, immunizations, and dental care

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)

Reported Cost and Cost-Related Benefits

- Baseline metrics and data have been established; however, post-implementation review of cost and cost-related benefits are not expected until November 2003

Expected CHCS II Benefits

- Maintain a secure lifelong health record for inpatient and outpatient medical and dental services
- Support force readiness through improved collection, storage, integration, management and communication of patient information
- Enable comparison of structured data with lexicon and health data dictionary
- Improve health care delivery by providing access to previously unavailable clinical information

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)

Expected CHCS II Benefits (continued)

- Enhance enterprise decision-making with timely, accurate, and secure data
- Reduce time for and improve accuracy of billing and coding
- Improve patient and provider satisfaction
- Improve management of resources and availability of Internet resources
- Support record legibility, accuracy, and availability, regardless of record location
- Enhance quality of prescription services
- Enhance patient safety by reducing the likelihood of adverse drug events, therapeutic overlaps, and duplicate procedures and treatments

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)

Other Reported Benefits

- Population data to determine efficacy of patient care plans and treatments
- Standardized care through the use of templates for patient types
- Increased capabilities for "non-provider" technicians, by building pre-set provider care plans and order sets
- Continuity of care enhanced by ability to quickly look up any encounter on the system, refer back to last visits, and see medical records from other sites
- Multiple windows visible on the screen (i.e., patient vitals, drugs, and lab results) for better and quicker decision making
- Provide reminders, alerts, pathways, and guidelines

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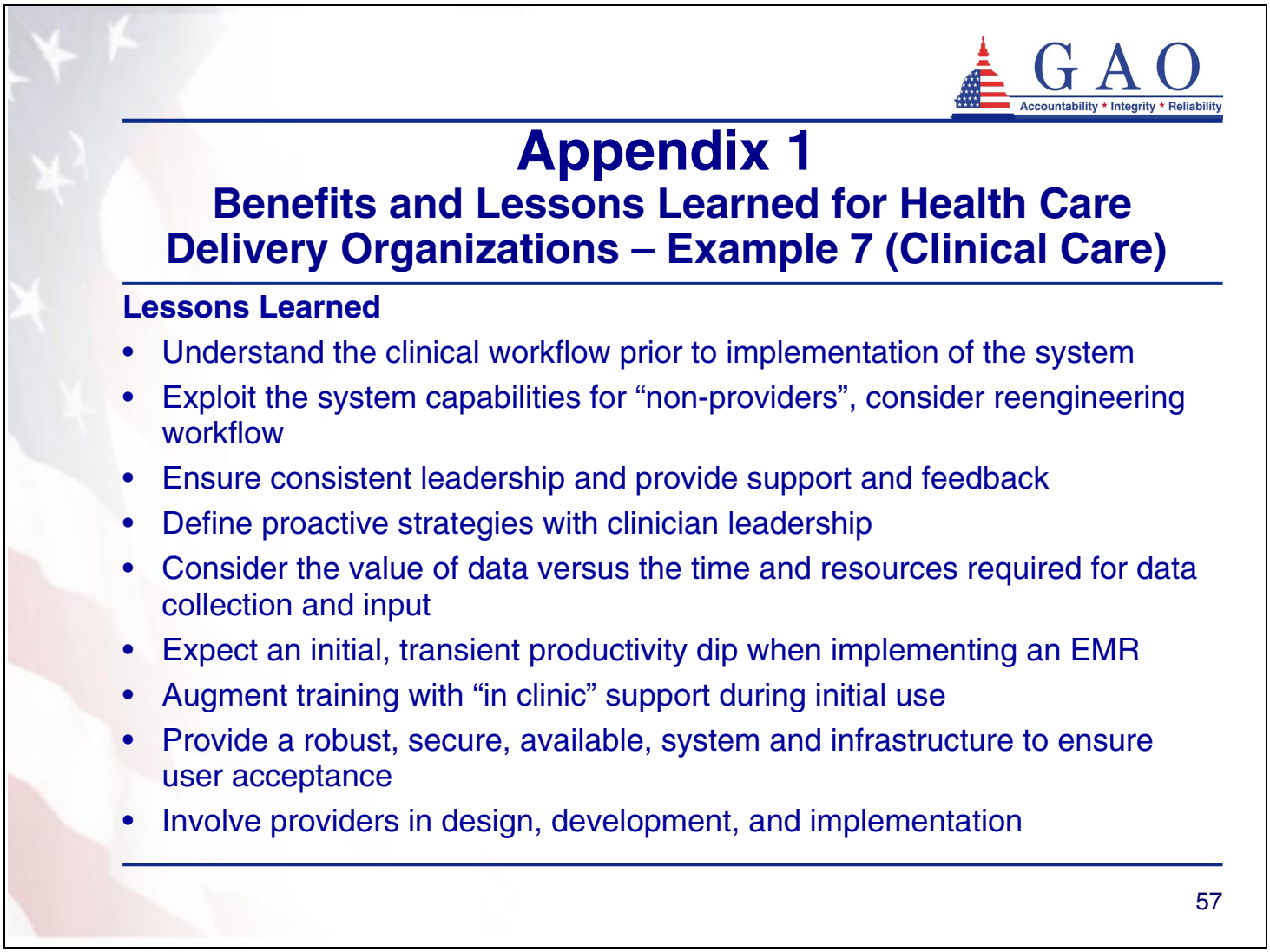
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 7 (Clinical Care)
Lessons Learned
• Understand the clinical workflow prior to implementation of the system
• Exploit the system capabilities for “non-providers”, consider reengineering workflow
• Ensure consistent leadership and provide support and feedback
• Define proactive strategies with clinician leadership
• Consider the value of data versus the time and resources required for data collection and input
• Expect an initial, transient productivity dip when implementing an EMR
• Augment training with “in clinic” support during initial use
• Provide a robust, secure, available, system and infrastructure to ensure user acceptance
• Involve providers in design, development, and implementation
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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)

Organizational Overview

- The Veterans Health Administration consists of 21 regional networks that support 162 hospitals, 137 nursing homes, and 681 community-based outpatient clinics—providing care for over 4.6 million veterans in fiscal year 2002
- We visited the **Department of Veterans Affairs** (VA) Washington DC Medical Center, a 137-bed facility with 3 community-based outpatient clinics and 1 nursing and rehabilitation center to observe how IT is being used in support of patient care

Description of the IT Environment

- VA has had an automated information system, the Decentralized Hospital Computer Program (DHCP), in its medical facilities since 1985
- In 1996, with the introduction of Windows-based applications, DHCP evolved into the Veterans Health Information Systems and Technology Architecture (VistA)

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)

Description of the IT Environment (continued)

- The Computerized Patient Record System (CPRS) is the interface that integrates all clinical VistA data, providing clinicians a complete electronic health record, supporting patient care in both inpatient and outpatient settings
  - CPRS enables clinicians to enter, review, and update all order and encounter related information connected with patients, such as progress notes, lab and radiology tests, medications, diagnoses, procedures performed, allergies, and clinical reminders
- Bar Code Medication Administration (BCMA), a VistA component, validates medications for inpatients and documents medication administration
  - implemented nationwide as part of an effort to eliminate paper prescriptions and reduce medication errors
  - visually alerts staff when the proper parameters are not met
  - uses a handheld device to scan bar codes on patient's wristbands to ensure that the medications are administered accurately and as intended

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)

Description of the IT Environment (continued)

- For this review, VA provided a report addressing the quantitative evaluation of VistA-RAD, the filmless radiology component of the VistA Integrated Medical Imaging System[1]
  - VistA Imaging is a core image capture and archiving system that integrates all types of images, from advanced directives to multi-media gait studies, into the EMR, enabling clinicians to have a complete view of the patient's status
  - VistA-Rad augments VistA Imaging, providing radiologists tools that enable them to "read" x-ray studies directly from computer screens without the need for x-ray film

[1] Data from VA Medical Center in Jackson, Mississippi

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)

Reported Cost and Cost-Related Benefits of VistA-RAD

- Net effect has been a reduction in personnel and materials cost of $13.67 per radiology exam, averting annual operating costs of between $900,000 and $1 million
  - Imaging service workforce was reduced from 45.5 to 36 FTEs, while volume of exams increased by about 23%
  - Cost of film and chemicals was reduced from $2.94 to $.28 per exam, or savings of $230,000 per year in operating expenses
- 99% availability of images (prior to the use of VistaRAD, 9-10% loss rate of hardcopy films or 16,650-18,500 films per year)
- Reduced patient wait time from 28 to 10 minutes, on average
- Reduction of about 100 film retakes per month due to the ability to adjust digital images on the screen, resulting in savings of $3,144 in a 1-year period
- About a 25-27% increase in departmental efficiency (based on comparison of time from exam to report)

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)

Other Reported Benefits of CPRS

- Clinicians have more complete information on which to base clinical care decisions, improving patient safety and quality of care
- Information is from VistA at the site of care
  - information on request from other VA sites and DOD via remote data views
- By standardizing best practices, CPRS can reduce negative variation, create standardized data, acquire (and share) health information beyond care delivered in VA, and automatically link reminders with appropriate documentation
- Nationally, 91% of all prescriptions are entered directly by physicians, up from 79% one year ago

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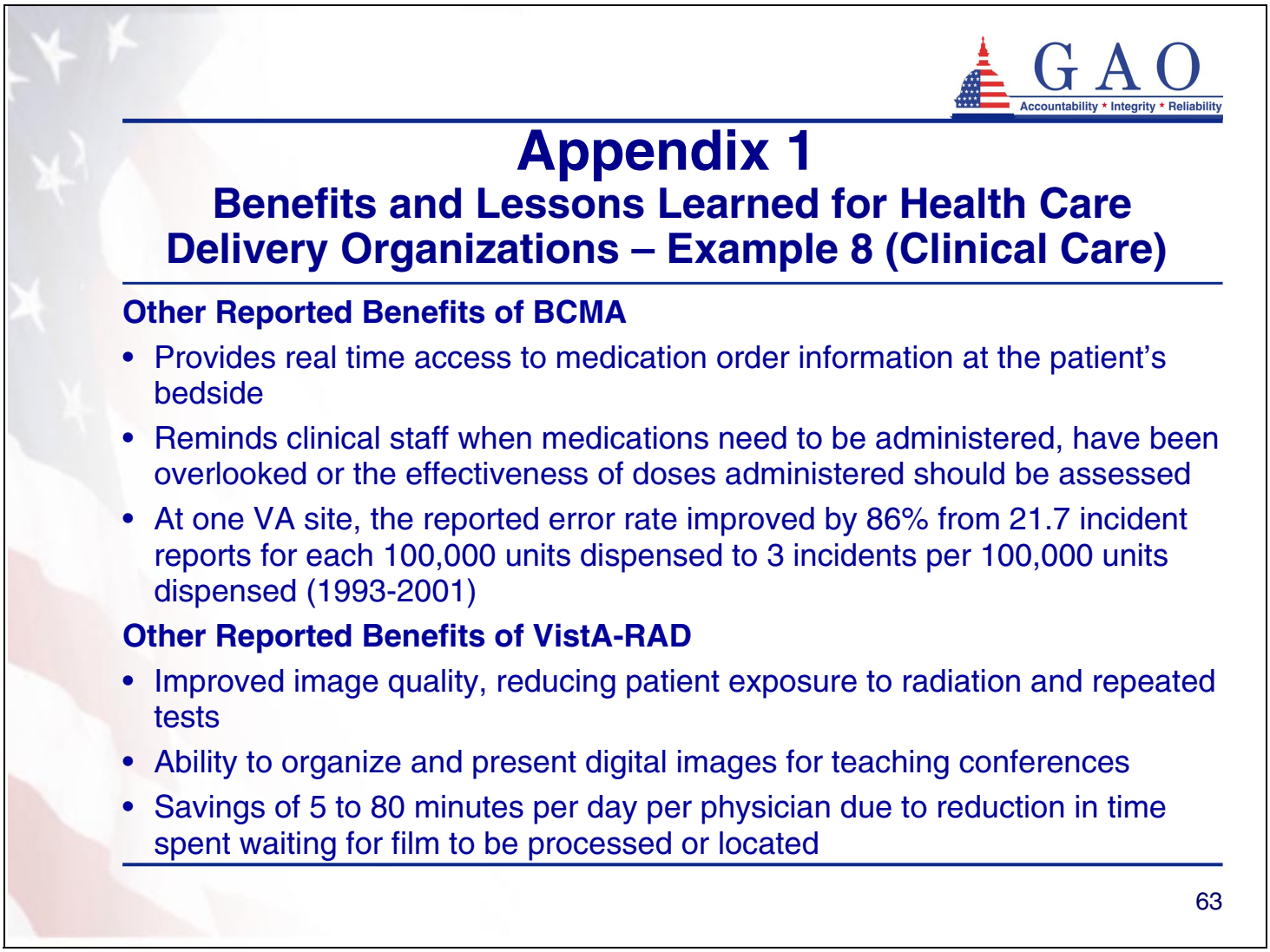
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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 8 (Clinical Care)
Other Reported Benefits of BCMA
• Provides real time access to medication order information at the patient's bedside
• Reminds clinical staff when medications need to be administered, have been overlooked or the effectiveness of doses administered should be assessed
• At one VA site, the reported error rate improved by 86% from 21.7 incident reports for each 100,000 units dispensed to 3 incidents per 100,000 units dispensed (1993-2001)
Other Reported Benefits of VistA-RAD
• Improved image quality, reducing patient exposure to radiation and repeated tests
• Ability to organize and present digital images for teaching conferences
• Savings of 5 to 80 minutes per day per physician due to reduction in time spent waiting for film to be processed or located
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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 9 (Clinical Care)

Organizational Overview

- **Vanderbilt University** is a 927-bed, academic medical center serving an urban population
  - IT budget in 2003 was $30 million (2.3% of total budget), including 207 staff

Description of the IT Environment

- Vanderbilt's information management system was created to automate billing, admissions, discharges, pharmacy, laboratory, radiology, and other functions
- Vendor systems are purchased only if they are "best of class" and able to interface with Vanderbilt's overall IT architecture.
- An information management infrastructure is in use throughout Vanderbilt
  - Shared registration data across all inpatient and outpatient areas
  - Shared electronic patient charts across inpatient and outpatient areas, with about 150 types of documents; used interactively 9,000 times a day by 2,200 distinct users
  - Over 20,000 reports are on a Web-based portal for provider access, with over 2,000 new reports automatically generated on a quarterly basis

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 9 (Clinical Care)

Description of the IT Environment (continued)

- E3 Vision project identified needs of clinicians, patients, and office support for
  - electronic availability of all information, including admissions, results from laboratory, x-rays, pathology, and studies from outside Vanderbilt facilities
  - ability to electronically write all orders for prescriptions, laboratory, and radiology
  - computer-assisted ICD-9 coding
  - electronic clinical notes with prompts
- E3 Star "Cluster" (i.e., StarPanel, StarChart, and StarVisit) supports the electronic health records
- WizOrder provides computerized provider order entry with integrated decision support capabilities, including pharmacy warnings, online access to drug and prescription information, automated ICD-9 justifications for tests ordered, and guidelines to control excessive test ordering
  - generates 7,000-10,000 orders per day directly by physicians

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 9 (Clinical Care)

Cost and Cost Related Benefits of E3/StarCluster

- $1,167,317 saved in transcription costs in 2003
- 40% reduction in paper faxes as they are intercepted and imported into the system
- 28 FTEs saved resulting from automatic scanning, problem lists, and EMR, saving $704,000 (2003)
- Solved problems related to the entry of incorrect ICD-9 codes, saving FTEs and reducing the number of denied claims
- Recovery of storage space for paper charts led to conversion of space into a new patient room

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 9 (Clinical Care)

Reported Cost and Cost-Related Benefits of Provider Order Entry

- About 90% increase in compliance rate for ICD-9 coding for EKGs
- 60% decrease (from previous year) in new blood chemistry test orders; 40% decrease in actual tests performed
- 40% decrease in new orders for portable chest x-rays; 30% decrease in studies performed, amounting to $1.1 million saved annually
- $5 million saved annually on drug substitutions, based upon automated prompts that recommended alternatives that increased quality and decreased cost

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 9 (Clinical Care)

Lessons Learned

- System implementation represents a profound workflow change for users
- Users' concerns must be continuously respected, listened to, and addressed
- Social engineering is 75% to 90% of the effort to implement technology solutions; technical implementation is 20% to 25% of the effort
- Tools have to be usable enough to deliver benefits and support the delivery of medical care, education, and cost control
- Change agent groups are important
- Investments must be made in change management

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 10 (Administrative)

Description of the IT Environment

In 1999, **Danville Regional Medical Center** installed a wireless phone system and network, as well as physician Internet access for clinical data

- **Wireless Phone System:** 180 wireless phones are available for physicians, care givers, and other associates; system selected based upon the scalability of the system and compatibility with the existing phone switch and other in-house wireless devices
- **Wireless Network:** Wireless infrastructure replaced wall-mounted computers with roving wireless devices, which provide for data to be entered into wireless devices and transmitted to the mainframe, updating patients' medical records in real time; system is compliant with HIPAA security requirements
- **Net Access:** Provides physicians secure, direct access to patient data, allowing physicians to customize screens to meet specific needs; system is expandable to include electronic signatures for medical records and is HIPAA compliant

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 10 (Administrative)

Other Reported Benefits

- Wireless phone system eliminated paging over speaker system, improving communications among physicians, care givers, and other associates, enabling staff to respond to patient needs in a more timely manner
- Wireless network enables care givers to remain logged in while traveling from room to room
- Extra wireless device in each clinical area provides downtime coverage
- Larger monitors make status displays visible from inside room
- Secure and timely access to patient data
- Decrease in mailing and faxing of paper medical records
- Decrease in phone calls requesting patient information
- Anytime/anywhere access

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 10 (Administrative)

Lessons Learned

- Service availability and quality of service are critical factors in the design of a wireless phone system
- Physician education was important in managing expectations in the use of the wireless phones in the nursing units

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 11 (Administrative)

Description of the IT Environment

- **Mayo Clinic's** Electronic Clearinghouse Service Project is being implemented to automate claims and remittance processing for all Mayo Clinic and Mayo Health System sites through a central hub[1]
- Implementation began in October 2000 and will continue through October 2003
  - Implementation for remittance processing is currently at 70%
  - Implementation for claims processing is currently at 55% and has been delayed due to HIPAA compliance preparation
- The project is providing service to 20 Mayo sites

[1] Mayo has clinics in Rochester, Minnesota, Jacksonville, Florida, and Scottsdale, Arizona

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 11 (Administrative)

Reported Cost and Cost-Related Benefits

- Two-year total net savings of $483,000 ($229,000 over initial estimate), resulting from reduction in staff, paper, storage facilities, and postage
- The Mayo Clinic in Scottsdale, Arizona reported that billing staff decreased from 5 to 3 FTEs[1]
- Project providing returns on investment throughout the implementation process

Other Reported Benefits

- Facilitates faster payments

[1] Note: We did not visit the Mayo Clinic in Arizona

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 11 (Administrative)

Lessons Learned

- The need to meet October 16th HIPAA requirements slowed progress on the claims implementation
- Spend time ensuring that savings are achieved (e.g., if there is an expected reduction in staff, plan for attrition, retraining, etc. to ensure gains)
- Maintaining customer satisfaction in an environment of significant industry change is a challenge

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 12 (Administrative)

Description of the IT Environment

- **Partners HealthCare** maintains a central data repository, which receives data from all of the hospitals in its system
- In 1998, Partners started using the New England Healthcare EDI Network (NEHEN) for insurance eligibility checking
  - NEHEN is a not-for-profit corporation formed and owned by a collaboration of providers and payers in eastern Massachusetts; its objectives include
    - Creation of a common technology platform to exchange insurance transactions between regional providers and payers
    - Development of a common set of guidelines and policies for implementing transactions and governing the network
- Partners began using PDA[1] handheld devices to capture charges for inpatients at the end of February 2003 for items such as procedure and diagnostic codes, viewing all laboratory and radiology results throughout Partners, and alerts to any abnormal laboratory test results

[1] PDA: personal digital assistants

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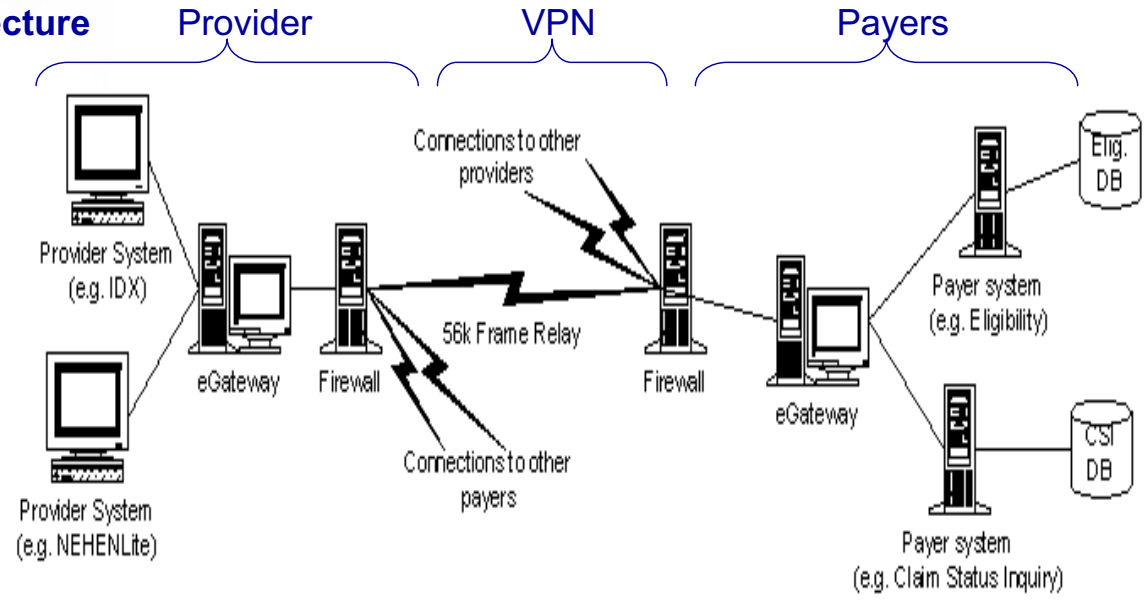
Benefits and Lessons Learned for Health Care Delivery Organizations – Example 12 (Administrative)

NEHEN Architecture



Source: Blackford Middleton, MD, MPH, MSc; Chairman, Center for Information Technology Leadership; Partners HealthCare, Boston, MA

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 12 (Administrative)

Reported Cost and Cost-Related Benefits from the Use of NEHEN

- 37% decrease in the number of days bills are in accounts receivable from 75 to 47 in a one-year period for a large specialty clinic
- 53% decrease in claim rejection due to eligibility checks during registration
- $2.54 decease in cost of an eligibility check from $2.64 to $.10

Reported Cost and Cost-Related Benefits from the Use of PDAs

- Number of lag days reduced from 17 to 10 days[1]
- The number of days bills are in accounts receivable reduced from 54 to 37
- More charges are being captured
- ICD-9 coding accuracy has increased

[1] "lag days" are the number of days from date of service to the date bills are received in the billing office

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 12 (Administrative)

Other Reported Benefits from the Use of NEHEN

- Registration denials dropped from the first to the third most common reason for denials
- Standardized format for extracting and exchanging billing data
- Security provided by a gated community using encrypted data on a virtual private network

Other Reported Benefits from the Use of PDAs

- Since physicians are directly entering ICD-9 codes, it has created opportunities to enhance the quality of care by enabling “real time” disease management

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 13 (Administrative)

Organizational Overview

- **St. Vincent's Hospital** is a 338-bed, private, not-for-profit community hospital serving an urban and rural population
  - IT budget in 2002 was $5.7 million (4% of total budget), including 30 staff

Description of the IT Environment

- For about nine years, largely paperless operations, ranging from bedside pharmaceutical and patient bar code scanning to allowing patients to pre-register from home using a web-based community portal
- All outpatient records online since January 1993
- In the early 1990s, prior to implementing document imaging, the business office processed about 1.3 million pieces of paper annually, while the medical records department processed about 2.8 million pieces of paper
- Significant process redesign related to manual processes and integration of existing information systems

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Benefits and Lessons Learned for Health Care Delivery Organizations – Example 13 (Administrative)

Reported Cost and Cost-Related Benefits

- Decreased average days in accounts receivable from 74 to 35 days, saving $2.9 million (1988-1995)
- Decrease in average registration time from 20 to 12.6 minutes
- 66% decrease in time needed for insurance verification
- 20% decrease in business office staff, although patient registrations increased 40%
- Increased up-front collections by $250,000 due to pre-registration and bad debt modules
- Annual savings of $645,000 through reduction of bad debt and charity, interest on accounts receivable, and savings on folders and supplies
- Annual savings of $277,000 in medical records through reduction on “peer review organization” denials, microfilm, and space requirements

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 13 (Administrative)

Reported Cost and Cost-Related Benefits (continued)

- Annual savings of $258,000 in facility and materials management through reductions in space requirements, microfilm, paper supply, and copy service
- Annual savings of $664,000 from process redesign (includes improvements in productivity, access, and implementation of parallel processing)
- One-time savings of $1.6 million from process redesign
- One-time savings of $1.6 million from reduction in backlog of medical records correspondence and improvements in the process for producing a final bill upon a patient's discharge
- One-time savings of $30,000 from reduction of outpatient accounts receivable

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Appendix 1

Benefits and Lessons Learned for Health Care Delivery Organizations – Example 13 (Administrative)

Other Reported Benefits

- Better customer service for both patients and third-party payers
- Increased staff productivity via the image workstation
- Enterprisewide accessibility of information
- More complete insurance verification
- Expedited chart completion and billing
- Faster issue resolution in follow-up and collections
- Two-day improvement in recurring bills

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Appendix 2
Benefits and Lessons Learned for Insurers Example 1 (Claims Processing)

Organizational Overview

- **Blue Cross and Blue Shield of Alabama** has over 3 million members and processed nearly 63 million claims in 2002
  - Proposed IT budget for 2003 is $71 million (12.5% of total budget)[1]

Description of the IT Environment

- Improved automated claims processing by implementing new technologies over the past decade
- Upgraded claims processing system allows providers to transmit batched claims via dial-up networking, frame relay, or a proprietary network through its Electronic Medical Claims (EMC) system
  - produces reports to help identify which claims have been accepted or need correction, assisting the providers in learning how to send more accurate claims
  - Web applications are available to providers for entering claims
  - 90% of hospitals', 85% of doctors', and 35% of dental claims are submitted electronically

[1] Budget year is 7/1/2003 to 6/30/2004

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Appendix 2
Benefits and Lessons Learned for Insurers Example 1 (Claims Processing)

Description of the IT Environment (continued)

- Other system upgrades include:
  - **Intelligent character recognition** (ICR) system extracts data from claim forms and performs online edits to further increase pass rates
  - **Claims Imaging Processing System** (CIPS) stores images electronically, allowing customer service representatives to instantaneously retrieve an image of a claim when discussing a filed claim with a provider or subscriber
    - replaced the manual processes of batching, counting, and reconciling claims, as well as the need for space to store paper

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Appendix 2
Benefits and Lessons Learned for Insurers Example 1 (Claims Processing)

Reported Cost and Cost-Related Benefits

- Estimated $20 million savings in data entry costs (2002)
- Percentage of "first pass" claims increased from 86 to 90 (projected), saving $1.6 million (2001- 2003)[1]
- Claim documents rejection rate dropped from 5% using optical character recognition (OCR) devices to about 1% using ICR
- Cost to enter claims data reduced from $.74 using OCR to $.26 using ICR; $.48 per claim savings or $100,000 per month
- Total return on investment in ICR since implementation is estimated to have surpassed $3 million
- Images are, on average, 20% faster to enter data from than hardcopy
- Keying from images saves an average of 20% cost per claim or about $.15 per claim in data entry alone—about $3 million savings since inception

[1] First pass rate is measured as the percent of claims that do not require manual intervention to adjudicate after entry

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Appendix 2
Benefits and Lessons Learned for Insurers Example 1 (Claims Processing)

Other Reported Benefits

- Eliminated costly keying, mailings, and other manual interventions
- Improved provider satisfaction and health care delivery
- Increased the quality of claim submission
- Decreased the number of phone calls and inquiries received
- Increased productivity
- Delivery of images to PCs reduced approximately 11 auxiliary type positions that helped maintain paper (logging, batching, etc.) and other functions, which could result in about $4 million in savings
- Imaging led to outsourcing data entry, which increased savings
- Document images are generally of a very high quality compared to microfiche
- Reconciliation became automated based upon an image control number; reports are available for images that are not processed or reconciled

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Appendix 2
Benefits and Lessons Learned for Insurers Example 1 (Claims Processing)

Lessons Learned

- Maintain good communications with providers
- Work directly with vendors and suppliers of EMS software systems
- Furnish free billing software and installation assistance to providers that do not use a commercial software vendor
- Purchase systems instead of trying to build, if there are products that are available that meet the needs of the organization
- Keep up with customer demands by continuing to make improvements to the EMC process
- Continue enhancing EMC to allow all types of claims and to provide products that will reach all providers, while ensuring that processes are HIPAA compliant

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Appendix 2

Benefits and Lessons Learned for Insurers Example 2 (Claims Processing)

Organizational Overview

- **Blue Cross and Blue Shield of Minnesota** has over 2.6 million members and processed over 28 million claims in 2002
  - IT budget in 2002 was $76 million (19% of total budget), consisting of both claims processing and IT, including 1,500 staff

Description of the IT Environment

- Leveraged technology by reengineering claims processing based on the concept of "straight-through processing," resulting in increased system pass rates, automated business rules, and prioritized service requests

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Appendix 2
Benefits and Lessons Learned for Insurers Example 2 (Claims Processing)

Description of the IT Environment (continued)

- Implemented new tools to increase and enhance productivity and reduce human intervention, such as
  - **Super Examiner Workstation**: an online application that moved more than 8000 examiner paper documents to an online format
  - **Super Adjudicator**: a claims rules engine that replaced manual adjudication with automatic adjudication of claims to absorb growth through increasing the pass rate and improving productivity
  - **Desktop image deployment**: allows viewing of paper claims and attachments online, eliminating the need to search for paper documents

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Appendix 2
Benefits and Lessons Learned for Insurers Example 2 (Claims Processing)

Reported Cost and Cost-Related Benefits

- Administrative costs remained flat while receipts grew at an average of 14.5% a year
- Pass rates have increased by 6% since 2002, nearly 10% over the past three years, with 1% improvement in the pass rate translating into administrative savings of $400,000
- Claim processing timeliness improved from 90% to 99% in 30 days (2000-2002)
- Inventory levels dropped from 275,000 to 180,000, or from 4.5-5 days work-on-hand to 1.3 days work-on hand (2000-2003)
- 99% claims accuracy rate

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Appendix 2
Benefits and Lessons Learned for Insurers Example 2 (Claims Processing)

Other Reported Benefits

- System down time and response time were reduced
- Performance results dramatically improved
- Claim inventory levels dropped significantly
- Claim cost stabilized
- Examiner productivity levels increased
- Member and provider satisfaction improved

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Appendix 2
Benefits and Lessons Learned for Insurers Example 2 (Claims Processing)

Lessons Learned

- Creating the required infrastructure that enables the organization to rapidly transform into a more customer-focused entity given the existing legacy systems and processes is a challenge
- Focus on processes
- Continue to leverage technology to increase capacity
- Implement risk mitigation strategies
- Focus on quality

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Appendix 2

Benefits and Lessons Learned for Insurers Example 3 (Claims Processing)

Organizational Overview

- **Premera Blue Cross** has about 1.5 million members and processes about 19.2 million claims a year
  - IT budget in 2002 was $68 million (17% of total budget), including about 400 staff

Description of the IT Environment

- Implemented several applications to increase efficiency and accuracy of claims
  - **Optical Character Recognition (OCR) and Imaging/Scanning Technology**: converts 75% of paper claims into electronic documents prior to processing
  - **Auto-Adjudication (AA)**: claim automatically adjudicated based on a series of established validations or rules
  - **Interactive Voice Response (IVR)**: intelligent call routing with 24-hour self service response to members and providers
  - **Automated Call Distributor (ACD)**: routes calls by selecting the first available agent, while tracking call volume and call handling statistics

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Appendix 2

Benefits and Lessons Learned for Insurers Example 3 (Claims Processing)

Reported Cost and Cost-Related Benefits

- About $1 million in savings resulting from OCR implementation (2002)
- 13% increase in first pass rate with use of Auto-Adjudication, with 70,000 additional claims auto-adjudicated from January through June 2003
- Reduced call volumes to live agents, with about 15% of calls handled with the IVR

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Appendix 2
Benefits and Lessons Learned for Insurers Example 3 (Claims Processing)

Other Reported Benefits

- ACD technology helps facilitate and enable a more consistent call experience, better service, and call tracking
- Improved FTE efficiency resulting from automating processes (e.g., entry rates for OCR are approximately 95 pages/hour, while manual entry ranges from 22-45 pages/hour)
- Increased functionality and system throughput
- Reduction of administrative costs related to handling electronic versus paper claims
- Improved customer satisfaction as a result of improved claims turn-around
- Reduction of archive storage expenses and on-site space requirements
- More efficient production and more accurate data
- IVR provides continuous automated access to member data by phone

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Appendix 2
Benefits and Lessons Learned for Insurers Example 3 (Claims Processing)

Lessons Learned

- Implementation of a new platform required retraining of all associates
- Transition to new platform takes time—took over 3 years
- HIPAA projects increased competition for resources
- Server and mainframe technologies required complex interfaces
- Important to gain corporate confidence in the reliability of new system
- Need to revamp procedures and workflows

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Appendix 2
Benefits and Lessons Learned for Insurers Example 4 (Customer Service)

Description of the IT Environment

- **Blue Cross and Blue Shield of Alabama** reduced the costs of delivering customer service, while increasing customer satisfaction, through the implementation of technology
  - Receives about 7 million calls a year or about 30,000 calls per day.
  - Customer Information System is an Intranet application used by the customer service department to allow representatives to quickly access information at the same time that calls are received
    - a voice response unit allows members to verify eligibility, check claims status, order forms and ID cards, or speak to a representative, substantially reducing the length of time to complete calls, thereby reducing costs

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Appendix 2
Benefits and Lessons Learned for Insurers Example 4 (Customer Service)

Reported Cost and Cost-Related Benefits

- Decreased the average length of call from 271 to 218 seconds, resulting in a 20% cost savings
- Decreased the cost of handling annual call volume from about $22 million to less than $18 million
- Decreased customer hold time from 180 seconds to no delay

Other Reported Benefits

- Increases availability of services to the customer

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Appendix 2

Benefits and Lessons Learned for Insurers Example 5 (Customer Service)

Description of the IT Environment

- **Blue Cross and Blue Shield of Minnesota's** customer relationship management (CRM) is provided by a Web-based customer service system that lets members manage their health benefits online to
  - select health plans
  - calculate contributions to their coverage
  - research information on prescription drugs and other treatments
  - locate participating physicians
  - obtain explanations of benefits
  - check deductibles and out-of-pocket maximums
  - check the status of their claims
- Customers can also order prescriptions by mail and estimate the cost of prescriptions and medical procedures
- CRM integrates all preferred communication channels—including phone, e-mail, and Web-self-service—blending voice and e-mail interactions and directing the member to the appropriate service representative

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Appendix 2
Benefits and Lessons Learned for Insurers Example 5 (Customer Service)

Reported Cost and Cost-Related Benefits

- Call center staff fielded over 4 million calls in 2002, eliminating more costly phone calls
- New flagship national accounts boosted enrollment by 10% (over 264,000 new members) in 2002, with customer service staff remaining steady

Other Reported Benefits

- Increased membership
- Customer retention due to service delivery capabilities
- Controlled or reduced operating costs
- Critical marketing tool for the acquisition of new accounts

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Appendix 2
Benefits and Lessons Learned for Insurers Example 5 (Customer Service)

Lessons Learned

- CRM is most successful when undertaken within an overall corporate strategy and when adopting a small-scale, components-based approach
- Make sure customers really want Web self-service
- Conduct Web site usability and usefulness tests
- Integrate the system with CRM using a centralized architecture
- Keep the Web site content current
- Do not focus on buying a mega-CRM solution; implement smaller, tactical-oriented solutions rather than the “one solution does it all”

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Appendix 2
Benefits and Lessons Learned for Insurers
Example 6 (Customer Service)

Description of the IT Environment

- **Premera Blue Cross** has invested heavily in technologies to better capture, cleanse, and manage information in order to assist in the facilitation of quality care at the most effective cost; these include:
  - **InterQual**: an online decision support tool of clinical review criteria used by Premera to help with care facilitation
  - **ELIZA**: speech recognition technology that lets a person talk with a computer using applications that are developed to anticipate the topic of conversation and possible responses; used for health screening reminders and surveys
  - **HEDIS® real-time data reporting tool**[1] : a comprehensive database that stores claims data, member demographics, and medical records data; developed to calculate performance based on HEDIS
  - **ePocrates Handheld Formulary**: software for handheld devices that provides physicians quick access to drug information
  - **Polypharmacy Program**: a pharmacy education and safety program that searches for members who are using five or more chronic medications, encouraging members to bring all medications to next doctor's appointment to review their drug therapy

[1] The Health Plan Employer Data and Information Set (HEDIS) is a standardized set of performance measures designed to allow comparison of health plan performance nationally

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Appendix 2
Benefits and Lessons Learned for Insurers Example 6 (Customer Service)

Reported Cost and Cost-Related Benefits of ELIZA

- Lower cost, with per call costs 10-30% of vendor service
- Calls completed more quickly with up to 500 calls per hour; completing call campaigns in 1-2 days that previously took 2-6 weeks

Reported Cost and Cost-Related Benefits of HEDIS real-time data collection

- 50% decrease in temporary nursing staff required to review medical records

Other Reported Benefits of ePocrates Handheld Formulary

- 72% of physicians surveyed were satisfied or very satisfied
- 56% said it improved provider efficiency by reducing pharmacy callbacks

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Appendix 2
Benefits and Lessons Learned for Insurers Example 6 (Customer Service)

Other Reported Benefits of InterQual

- Provides reviewers with clear set of rules that determine the medical necessity at any level of care, as well as a method for capturing and reporting the decision, which reduces inconsistent decision making

Other Reported Benefits of ELIZA

- Improved clinical care to members from 2000-2002 (e.g., diabetic retinal exams increased from 71% to 93% and the rate of adolescents receiving full vaccinations increased from 29% to 43%)

Other Reported Benefits of HEDIS real time data collection

- Higher staff satisfaction
- Limited disruption of physician offices and improved data collection

Other Reported Benefits of Polypharmacy Program

- 27% of members reported a change in their prescribed medications (either a dose change, a medication added, or a medication discontinued)

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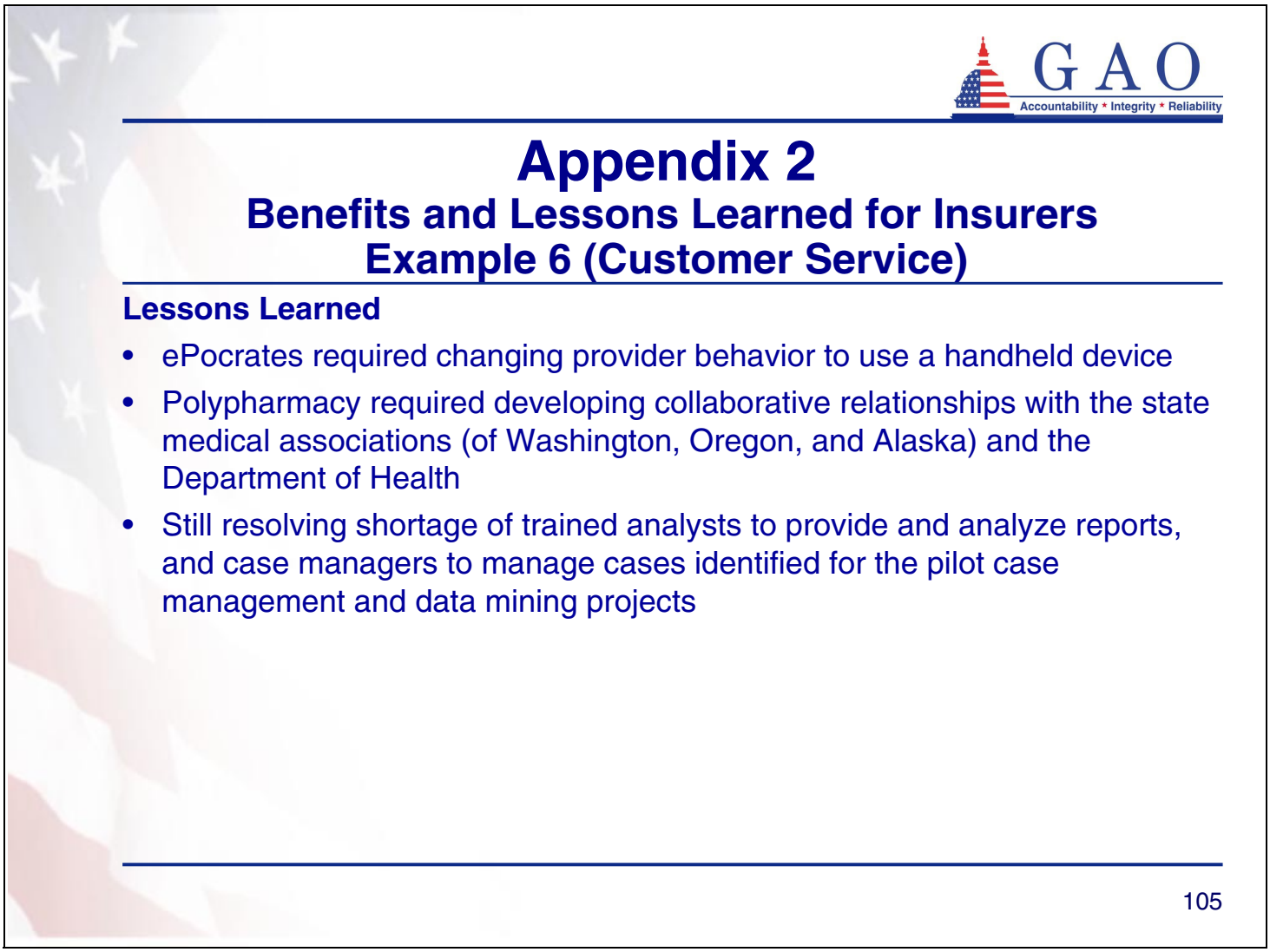
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Appendix 2
Benefits and Lessons Learned for Insurers
Example 6 (Customer Service)
Lessons Learned
• ePocrates required changing provider behavior to use a handheld device
• Polypharmacy required developing collaborative relationships with the state medical associations (of Washington, Oregon, and Alaska) and the Department of Health
• Still resolving shortage of trained analysts to provide and analyze reports, and case managers to manage cases identified for the pilot case management and data mining projects
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Appendix 3
Benefits of Community Data Networks
Example 1

Organizational Overview

- **The Santa Barbara County Care Data Exchange** (SBCCDE) was founded in 1998 by leading public and private health care organizations throughout Santa Barbara County, with a goal of improving the health status of all Santa Barbara residents
- SBCCDE is piloting a data exchange platform for the rapid and secure delivery of patient data to authorized users who have informed consent—physicians, health care organizations and consumers
- Participants include
  - Santa Barbara Regional Health Authority
  - Sansum-Santa Barbara Medical Foundation
  - Catholic Health Center West Marion Med Center
  - NDC Health
  - Pueblo Radiology
  - University of California at Santa Barbara
  - Lompoc Valley Community Healthcare Organizations
  - Santa Barbara Department of Public Health
  - Cottage Health System
  - MidCoast IPA
  - Santa Barbara Medical Society
  - UNILAB Corporation
  - Veterans Health Administration

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Appendix 3
Benefits of Community Data Networks Example 1

Description of the IT Environment

- SBCCDE uses a peer-to-peer network, enabling the participating organizations to retain control over their data while permitting access to authorized users
  - In the final phase of pilot testing; expected to provide $1 million net financial benefit annually to the community
- The technology components illustrated on the next page include:
  - Central CDE infrastructure—manages security and access, patient identification, and keeps a central index of patients and locations of clinical data in secure Web-enabled data stores
  - User access—a browser-based interface created for physicians and other users to search and retrieve data; users may also "subscribe" to a set of patients and then have new information about those patients forwarded to them whenever it is released
    - Users include physicians, patients, hospitals, payers, and laboratories

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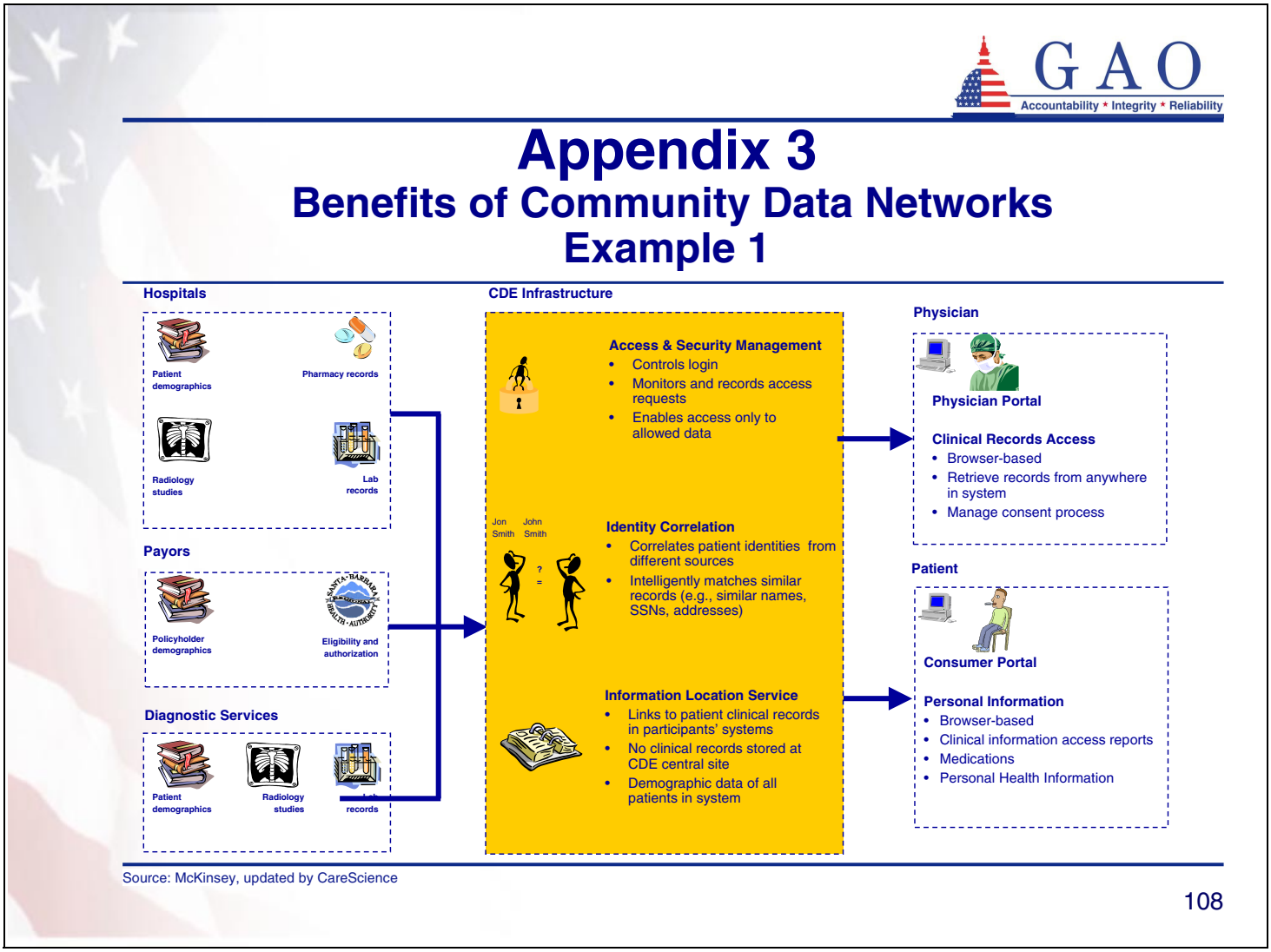
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Appendix 3
Benefits of Community Data Networks
Example 1
Hospitals
Patient demographics
Pharmacy records
Radiology studies
Lab records
Payors
Policyholder demographics
Eligibility and authorization
Diagnostic Services
Patient demographics
Radiology studies
Lab records
CDE Infrastructure
Access & Security Management
• Controls login
• Monitors and records access requests
• Enables access only to allowed data
Jon Smith
John Smith
Identity Correlation
• Correlates patient identities from different sources
• Intelligently matches similar records (e.g., similar names, SSNs, addresses)
Information Location Service
• Links to patient clinical records in participants' systems
• No clinical records stored at CDE central site
• Demographic data of all patients in system
Physician
Physician Portal
Clinical Records Access
• Browser-based
• Retrieve records from anywhere in system
• Manage consent process
Patient
Consumer Portal
Personal Information
• Browser-based
• Clinical information access reports
• Medications
• Personal Health Information
Source: McKinsey, updated by CareScience
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Appendix 3
Benefits of Community Data Networks Example 1

Expected Cost and Cost-Related Benefits (annual results)

	Per Constituent				Total for all Constituents		
Organization	Costs	Stand-alone Web Enablement	Regional Network	Total Individual Benefits	Number of Constituents	Total Costs	Total Benefits
Hospital	$120,000	$180,000	$ 110,000	$290,000	7	$ 840,000	$2,000,000
Imaging Center	$110,000	$44,000	$ (15,000)	$29,000	4	$ 440,000	$120,000
Laboratory	$110,000	$70,000	$ 170,000	$240,000	2	$ 220,000	$480,000
Physician Group	$120,000	$90,000	$ 280,000	$370,000	3	$ 360,000	$1,100,000
Solo Physician	$40	$0	$ 2,400	$2,400	1,750	$ 70,000	$3,500,000
						≈$2,200,000	≈ $7,300,000

Note: Excludes clinical efficiency benefits
Source: McKinsey

Other Expected Benefits

- Savings in laboratory and radiology labor costs
- Less time spent requesting and providing information
- Fewer admissions to the emergency department
- Enhanced revenue resulting from proper coding
- Less staff time spent handling lab and radiology test results
- Fewer readmissions
- Reduction in medical errors
- Shortened length of hospital stay
- Avoidance of test duplication

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Appendix 4

Related Health Care IT Studies: *The Value of Computerized Provider Order Entry in Ambulatory Settings*[1]

- Computerized provider order entry (CPOE) is a software application that supports the ordering of medications, lab tests, radiology studies, nursing interventions, and referrals
- Ambulatory CPOE systems encompass different features and levels of functionality, grouped into five classes
  - basic prescription
  - basic prescription and diagnostic orders
  - intermediate prescription
  - intermediate prescription and diagnostic orders
  - advanced prescription and diagnostic orders
- A key component of ambulatory CPOE is clinical decision support, which provides clinicians with a range of diagnostic and treatment-related tools

[1] Center for Information Technology Leadership, *The Value of Computerized Provider Order Entry in Ambulatory Settings* (March 2003)

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Appendix 4

Related Health Care IT Studies: *The Value of Computerized Provider Order Entry in Ambulatory Settings* (continued)

Benefits

- **Improved patient outcomes**
  - Nationwide adoption of advanced ambulatory CPOE systems will eliminate more than 2 million adverse drug events and more than 190,000 hospitalizations per year
  - Projected annual savings of more than $10 billion in radiology, nearly $5 billion in laboratory costs, over $2 billion from hospitalizations related to avoided adverse drug events
- **Provider revenue enhancement**
  - Using advanced ambulatory CPOE, providers can eliminate more than $10 in rejected claims per outpatient visit

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Appendix 4

Related Health Care IT Studies: *Computerized Physician Order Entry in Community Hospitals: Lessons from the Field*[1]

- About 89% of US hospitals are community hospitals, where most physicians who admit patients have independent practices in the community, often admitting patients to several hospitals and spending limited time at the hospital each day
- Research based on interviews with key staff in ten community hospitals that have made significant progress in implementing CPOE
- Example of CPOE-related safety and quality improvements at **Queen's Medical Center** in Hawaii include:
  - 75% reduction in transcription errors
  - 30% reduction in wrong medication or route
  - 75% reduction in inappropriate vancomycin use
  - 60% decrease in time to first dose of antibiotic for community acquired pneumonia
  - 98% compliance with the Joint Commission on Accreditation of Health Care Organizations standard for orders for restraints
  - 85% reduction in unsigned orders
  - 40% reduction in turnaround time for STAT2[2] medication orders

[1] California Healthcare Foundation and First Consulting Group, *Computerized Physician Order Entry in Community Hospitals: Lessons from the Field* (June 2003)
[2] STAT orders are those required for an emergent clinical situation

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Appendix 4

Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1]

Anecdotal evidence from the Kaiser Permanente Institute for Health Policy identified the value of clinical information systems at various organizations in the following areas:

1. Improved Quality, Outcomes, and Safety

- Increase in compliance with preventive health guidelines
  - Use of a health maintenance tracking system significantly improved provider compliance with 8 of 11 recommended procedures, at a cost of $.78 per patient per year
  - Use of computerized protocols increased the rate of recording blood pressure by 34%
- Improved disease management
  - Kaiser Permanente's use in Ohio of automated medical records and prompts to stratify and treat diabetic patients by risk group was successful at increasing preventive care, reducing unnecessary visits for low-risk patients, and substantially reducing the number of amputations for high-risk patients
  - Use of computer-generated reminders was found to improve patient management of asthma, reducing asthma-related hospitalizations by 60% and emergency department visits by 50%

[1] Kaiser Permanente Institute for Health Policy, *Clinical Information Systems: Achieving the Vision* (February 2002)

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Appendix 4

Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1] (continued)

- Improved disease management (continued)
  - Use of computer-generated reminders in an outpatient mental health clinic improved adherence to clinical guidelines by 25% and improved documentation of problems by over 90%
  - Use of an automated heparin protocol for treating unstable angina reduced the average time to reach therapeutic levels from 14% within 24 hours to 96% within 24 hours
  - Use of a computer-based decision support system was more effective and efficient than standard guidelines tables in applying preventive therapy for tuberculosis by 95% for physicians who used the system, compared to 56% for those who used paper-based resources
- Improved drug prescribing and administration
  - Intermountain Health Care's (IHC) use of an antibiotic information system helped physicians select antibiotic regimens, resulting in fewer susceptibility mismatches and allergic reactions, reducing adverse drug reactions by over 70%, reducing the number of days patients received excessive dosage by 2.9 days, and reducing the overall cost of antibiotic therapy

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Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1] (continued)

- Reduction in medical errors
  - Regenstrief Institute's use of computer-generated reminders in an inpatient setting, followed practice guidelines 25% more often
  - Brigham and Women's Hospital's use of computerized provider order entry eliminated more than 80% of medication errors unrelated to missed dosage
- Improved medical data capture and display
  - Use of an automated patient data management system eliminated charting errors that had previously occurred in 25% of hand-written flow sheets and increased the number of progress notes documented
  - Northwestern University's use of EMRs produced more appropriate clinical decisions by physicians when compared with providers who used paper medical records

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Appendix 4

Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1] (continued)

2. Improved Efficiency, Productivity and Cost Effectiveness

- More appropriate utilization of services
  - IHC's use of a clinical laboratory alerting system increased the likelihood that patients in life-threatening situations received appropriate care, decreasing length of stay by up to 6 days for some conditions
  - Regenstrief Institute's use of a provider order entry system in an inpatient setting lowered patient charges and hospital costs mainly by reducing length of stay by 10.5%, reducing test charges by 12.5%, and reducing drug costs by 15.3%; total charges per admission were 12.7% less for teams that used the order entry system
- Better use of formulary and generic drugs
  - Duke University's use of monthly computerized feedback of prescribing charges and patterns encouraged physicians to substitute less costly generic alternatives for brand name drugs 30% more often
- Improved workflow and time savings
  - Duke University's use of a EMR resulted in an overall time savings of 13% for physicians, and it improved physician response to information regarding diagnosis and treatment

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Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1] (continued)

- Savings related to the storage of medical records
  - Memorial Sloan Kettering Cancer Center's use of an EMR resulted in space savings of 2,000 sq.ft., worth $100,000 annually
  - Kaiser Permanente's use in Colorado of an EMR resulted in estimated annual savings of $400,000 in avoided lease costs
- Savings related to reduction in chart pulls
  - Beth Israel Deaconess Medical Center's use of an EMR to reduce the paper chart pulls for processing telephone messages saved between $300,000 and $500,000 annually
  - Kaiser Permanente's use in Colorado of an EMR has resulted in annual payroll savings of $4 million, while chart availability is almost 100%
- Improved charge capture and revenue
  - Beth Israel Deaconess Medical Center's use of an integrated hospital system reduced the time to collect unpaid bills from 65 days to 39 days, enabling more than 90% of each patient's charges to be captured

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Related Health Care IT Studies: *Clinical Information Systems: Achieving the Vision*[1] (continued)

3. Improved Service and Satisfaction

- Improved communication
  - Brigham and Women's Hospital's use of an outpatient clinical referral system decreased the amount of time needed to complete the referral process, improving the communication between physicians
- Improved satisfaction
  - Palo Alto Medical Foundation's use of an Internet service giving patients access to health care services and their medical records, increased patient satisfaction in communicating with the physician and staff and promoted the feeling of shared decision making

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Appendix 4

Related Health Care IT Studies: *Clinical Transformation: Cross-Industry Lessons for Health Care*[1]

- According to Deloitte Research, while health care faces massive challenges integrating internal and external IT systems, its most overwhelming problems relate to gaining physician and hospital staff cooperation for implementation
  - Based on cross-industry analysis, two major common conditions required for clinical transformation are:
    1. An effective, competitive market environment that rewards organizations' investments in technologies that raise productivity, either by improving product quality, reducing the costs of production, or both
    2. An intense focus on the consumer, combined with IT leadership, enabling organizations to excel with IT-integrated business strategies and ongoing IT innovations developed in response to market opportunities and threats

[1] Deloitte Research, *Clinical Transformation: Cross-Industry Lessons for Health Care* (2003)

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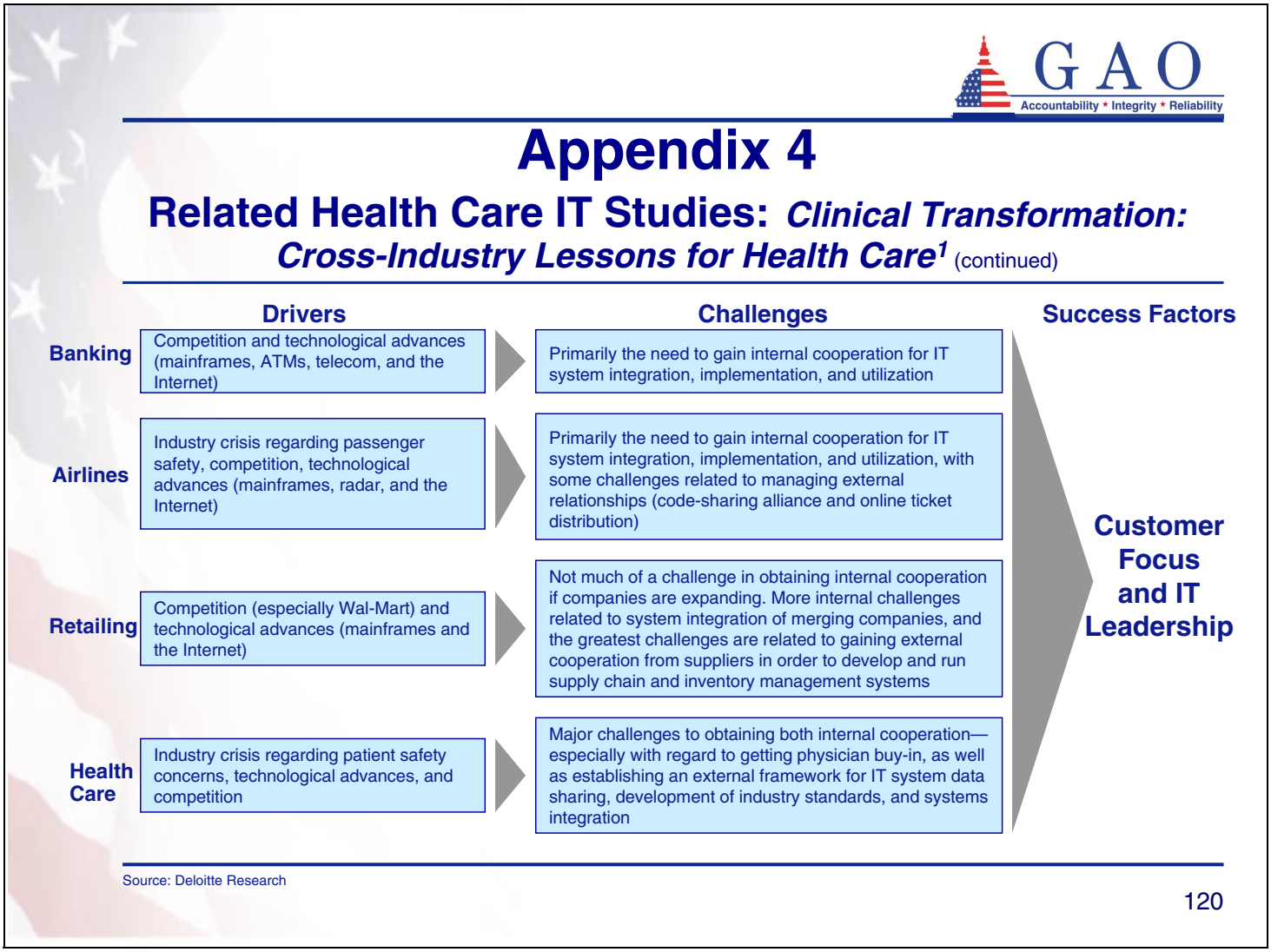
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Appendix 4
Related Health Care IT Studies: Clinical Transformation: Cross-Industry Lessons for Health Care[1] (continued)
Drivers
Challenges
Success Factors
Banking
Competition and technological advances (mainframes, ATMs, telecom, and the Internet)
Primarily the need to gain internal cooperation for IT system integration, implementation, and utilization
Airlines
Industry crisis regarding passenger safety, competition, technological advances (mainframes, radar, and the Internet)
Primarily the need to gain internal cooperation for IT system integration, implementation, and utilization, with some challenges related to managing external relationships (code-sharing alliance and online ticket distribution)
Retailing
Competition (especially Wal-Mart) and technological advances (mainframes and the Internet)
Not much of a challenge in obtaining internal cooperation if companies are expanding. More internal challenges related to system integration of merging companies, and the greatest challenges are related to gaining external cooperation from suppliers in order to develop and run supply chain and inventory management systems
Health Care
Industry crisis regarding patient safety concerns, technological advances, and competition
Major challenges to obtaining both internal cooperation—especially with regard to getting physician buy-in, as well as establishing an external framework for IT system data sharing, development of industry standards, and systems integration
Customer Focus and IT Leadership
Source: Deloitte Research
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