

## CAPITALIZING ON HEALTH INFORMATION TECHNOLOGY TO ENABLE DIGITAL ADVANTAGE IN U.S. HOSPITALS

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## Appendix A

### Review of Organizational IT Adoption Research

**Table A1. Summary of Organizational IT Adoption Studies**

| Study                                    | Sample              | Innovation                | Theories         | Determinants of IT Adoption |   |                  |   |
|--|---------------------|---------------------------|------------------|-----------------------------|---|------------------|---|
|  |                     |                           |                  | Cultural Capital            | Social Capital  | Economic Capital | Other Factors   |
| <b>Hospital HIT Adoption Studies</b>     |                     |                           |                  |                             |   |                  |   |
| Adler-Milstein, Des Roches et al. (2014) | 2674 U.S. hospitals | Electronic Health Records | None             |                             |   | Hospital size    | Rural/urban location, teaching status, profit status, critical access   |
| Adler-Milstein, Kvedar, and Bates (2014) | 2891 U.S. hospitals | Telemedicine              | None             |                             | System affiliation  |                  | Rural/urban location, teaching status, profit status, state policy (reimbursement and licensure), non-competition |
| Angst et al. (2010)                      | 3989 U.S. hospitals | Electronic Health Records | Social contagion |                             | Contagion effects (social proximity to system adopters, Spatial proximity to hospital adopters) | Hospital size    | Hospital age, profit status, teaching status, regional location, "most wired" hospital status                     |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                        | Sample                             | Innovation                                     | Theories  | Determinants of IT Adoption                            |   |                                |  |
|------------------------------|------------------------------------|--|---|--|---|--------------------------------|--|
|                              |                                    |  |   | Cultural Capital                                       | Social Capital  | Economic Capital               | Other Factors  |
| Burke et al. (2002)          | 3220 U.S. hospitals                | Multiple HIT applications                      | None  |  | System affiliation  | Hospital size                  | Competition, profit status, rural/urban location   |
| Cutler et al. (2005)         | 487 U.S. hospitals                 | Computerized Physician Order Entry             | None  |  |   | Hospital size                  | Ownership status, teaching status  |
| Diana et al. (2014)          | 4683 U.S. hospitals                | Electronic Health Records                      | None  |  | System affiliation  | Hospital size                  | Prior EHR implementation, profit status, medicaid incentive eligible, single HIT vendor, accreditation status, public payer mix, regional location   |
| Furukawa et al. (2008)       | 4561 U.S. hospitals                | 8 Clinical HIT Applications                    | None  |  | System affiliation  | Hospital size                  | Profit status, public payer mix, teaching status, accreditation status, geographic location  |
| Gabriel et al. (2014)        | 793 U.S. critical access hospitals | 7 HIT applications, each examined individually | None  |  | System affiliation, Centralization of HIT decisions and support | Group purchasing arrangement   | Profit status, IT compatibility  |
| Goes and Park (1997)         | 388 California hospitals           | Service Innovations                            | Network ties                                    |  | Interorganizational relationships                               | Organization size <sup>†</sup> | Urbanization, <sup>†</sup> affluence, <sup>†</sup> market concentration, <sup>†</sup> public ownership <sup>†</sup>  |
| Jaana et al. (2006)          | 74 Iowa hospitals                  | 19 Clinical HIT Applications                   | Resource-based theory, Diffusion of innovations | IT leadership resources, Technical knowledge resources | Membership in a system; membership in a network                 | Hospital size, Slack resources | Public payer mix   |
| Jha et al. (2009)            | 2952 U.S. hospitals                | Electronic Health Records                      | None  |  |   | Hospital size                  | Rural/urban location, teaching status  |
| Jha et al. (2010)            | 3101 U.S. hospitals                | Electronic Health Records                      | None  |  |   | Hospital size                  | Rural/urban location, profit status, critical access, teaching status  |
| Kahn et al. (2014)           | 4760 U.S. hospitals                | ICU Telemedicine                               | None  |  |   | Hospital size                  | Rural/urban location, profit status, teaching status   |
| Kazley and Ozcan (2007)      | 4606 U.S. hospitals                | Electronic Health Records                      | Resource dependency theory                      |  | System affiliation  | Hospital size                  | Rural/urban location, environmental uncertainty (unemployment change)  |
| Kimberly and Evanisko (1981) | 489 hospitals                      | Respiratory Disease Technology                 | Innovation adoption                             | Job tenure, Educational level                          |   | Hospital size                  | Hospital age, functional differentiation, competition, city size   |
| Khoubati et al. (2006)       | 1 hospital (case study)            | Enterprise Application Integration Technology  | Innovation adoption                             | IT sophistication, IT support                          |   | Organization size              | Benefits, costs, compatibility, EAI evaluation frameworks, patient satisfaction, internal pressure, external pressure, physician/ administrator relationships, telehealth, IT infrastructure |
| McCullough (2008)            | 1965 U.S. hospitals                | 3 HIT applications, each examined individually | Utility maximization                            |  | System affiliation, Market IS penetration                       |                                | Case mix index, public payer mix, patient care activity, ownership status, rural/urban location, propensity for IS adoption  |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study   | Sample                          | Innovation                                      | Theories  | Determinants of IT Adoption  |  |   |  |
|---|---------------------------------|---|---|--|--|---|--|
|   |                                 |   |   | Cultural Capital   | Social Capital   | Economic Capital                            | Other Factors  |
| Menachemi et al. (2005)                         | 28 rural Florida hospitals      | 22 HIT applications, each examined individually | None  |  | System affiliation   | Financial resources                         |  |
| Meyer and Goes (1988)                           | 25 hospitals                    | Medical Innovations                             | Technology assimilation   | CEO education, Recency of medical education  |  | Organizational scale                        | CEO tenure, CEO advocacy, leadership characteristics, <sup>†</sup> environmental scale, environmental characteristics <sup>†</sup> |
| Peng et al. (2014)                              | 5171 U.S. hospitals             | Clinical Data Repository System                 | Social networks, knowledge transfer                                       | Absorptive capacity  | Collective disseminative capacity, Business scope similarity, Contagion effect | Hospital size <sup>†</sup>                  | Hospital type, <sup>†</sup> hospital age, <sup>†</sup> time to adoption decision <sup>†</sup>                                      |
| Wang et al. (2005)                              | 1441 U.S. acute care hospitals  | Multiple HIT applications                       | Diffusion of innovations, Strategic contingency, Financial theory         |  | System affiliation, Geographic concentration                                   | Hospital size, Operating revenue, Cash flow | Profit status, case mix, number of preferred provider organization contracts   |
| Zhang et al. (2013)                             | 586 U.S. hospitals              | 52 HIT applications                             | None  |  |  | Hospital size                               | Profit status, rural/urban location, HMO penetration, public payer mix, regional location  |
| <b>Other Organizational IT Adoption Studies</b> |                                 |   |   |  |  |   |  |
| Armstrong and Sambamurthy (1999)                | 169 firms                       | IT for Business Strategy and Value Chain        | Resource-based and Knowledge-based theories of the firm                   | Senior leadership knowledge, Systems of knowing  |  |   | IT infrastructure sophistication   |
| Atzeni and Carboni (2008)                       | 3628 firms in Italy             | Investment in ICT                               | None  | IT learning/experience, R&D engagement   | Geographic location  | Financial resources                         |  |
| Baird et al. (2012)                             | 21375 ambulatory care clinics*  | Clinical Patient Portal                         | Diffusion of innovations, Contingency theory                              |  | Learning externalities   | Organization size <sup>†</sup>              |  |
| Bajaj (2000)                                    | 23 firms                        | Computing Architecture                          | Grounded theory, Diffusion of innovations                                 |  |  | Costs                                       | Software quality, architecture centralization, acceptance  |
| Bajwa et al. (2008)                             | 538 firms across five countries | Collaborative Information Technologies          | Diffusion of innovations  | Functional integration (includes idea exchange, information sharing), Promotion of collaboration |  | Organization size, IT function size         | Decision-making pattern  |
| Bala and Venkatesh (2007)                       | 11 firms                        | Interorganizational Business Process Standards  | Relational view of the firm, Institutional theory, Organizational inertia |  | Relationship depth   |   | Coercive, mimetic and normative pressures; relationship specificity and extendability; resource and routine rigidity               |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                            | Sample                        | Innovation                            | Theories  | Determinants of IT Adoption   |  |   |  |
|----------------------------------|-------------------------------|---------------------------------------|---|---|--|---|--|
|                                  |                               |                                       |   | Cultural Capital  | Social Capital                           | Economic Capital  | Other Factors  |
| Bharati and Chaudhury (2010)     | 135 SMEs                      | Logistics Software Systems            | Resource-based view of the firm, Knowledge-based view of the firm | Knowledge acquisition   | Social Influence                         | Organization size <sup>†</sup>                            | Institutional influences (customers, competitors, government agencies), top management support <sup>†</sup>  |
| Bretschneider and Wittmer (1993) | 1005 public and private firms | Microcomputer                         | Diffusion of innovations  | IT experience <sup>†</sup>  |  | Slack resources <sup>†</sup>                              | Sector, bureaucracy and red tape, incumbent system substitutability and complementarity  |
| Chan and Ngai (2007)             | 10 firms in Hong Kong         | Web-based Training                    | Internet adoption model   | IT knowledge among top management and individual learners   |  | Organization size, Financial resources                    | Perceived benefits, competitive pressures, level of IT use   |
| Chatterjee et al. (2002)         | 62 U.S. firms                 | Web Technologies                      | Institutional theory, Structuration theory of technology use      | Web experience, <sup>†</sup> Coordination mechanisms  |  | Organization size, Financial resources                    | Top management support, strategic investment rationale, organization age, <sup>†</sup> industry type <sup>†</sup>  |
| Chau and Tam (1997)              | 89 firms in Hong Kong         | Open Systems                          | Technology-Organization-Environment framework                     |   |  |   | Perceived benefits, barriers, and importance of compliance; market uncertainty; IT infrastructure complexity; satisfaction with existing system; formalization |
| Chengalur-Smith et al. (2010)    | 149 firms                     | Open Source Software                  | Business value of IT, Absorptive capacity                         | Absorptive capacity   | Community ties                           | Organization size <sup>†</sup>                            | Infrastructure source openness, number of employees (MySQL) <sup>†</sup>   |
| Chwelos et al. (2001)            | 268 firms                     | Electronic Data Interchange           | Technology-Organization-Interorganization framework               | IT sophistication   |  | Financial resources                                       | Perceived benefits, competitive pressure, enacted trading partner power, partner readiness   |
| Cooper and Zmud (1990)           | 62 manufacturing firms        | Material Resource Planning            | IT implementation model   |   |  |   | Technology and task characteristics, technology and task complexity, task-technology; compatibility  |
| Fichman (2001)                   | 608 U.S. firms                | Software Process Technologies         | Organizational learning   | Learning-related scale, Knowledge diversity, Technology-related knowledge, Education and Specialization of IT staff |  | IS unit size  |  |
| Fichman and Kemerer (1997)       | 608 U.S. firms                | Object-oriented Programming Languages | Organizational learning   | Learning-related scale, Knowledge diversity, Technology-related knowledge, Education and Specialization of IT staff |  | IS unit size, <sup>†</sup> Organization size <sup>†</sup> | Environmental complexity, sector   |
| Green et al. (2015)              | 3 Michigan FQHCs*             | Electronic Health Records             | Sensemaking and learning, Problem detection and monitoring        | Managerial expertise, EHR training  | System affiliation, Vendor relationships | Financial resources                                       | Rural/urban location, technology support   |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                    | Sample              | Innovation  | Theories   | Determinants of IT Adoption   |                              |   |   |
|--------------------------|---------------------|---|--|---|------------------------------|---|---|
|                          |                     |   |  | Cultural Capital  | Social Capital               | Economic Capital  | Other Factors   |
| Grover et al. (1997)     | 313 U.S. firms      | IS Innovations (Outsourcing, CASE, OOPS, DBMS, EIS, Teleconferencing, Expert System, Email, CAD/ CAM, EDI)                                | Tri-core model of innovation                         |   |                              | IS size, Slack resources, Organization size                   | Diversity of IT portfolio, IS unit professional orientation and strategic importance  |
| Grover and Goslar (1993) | 154 firms           | Telecommunication Technologies  | Diffusion of innovations                             |   |                              | Organization size   | Organization centralization and formalization, IS maturity, IT business role and contribution, IS dispersion, environmental uncertainty   |
| Harrison et al. (1997)   | 162 firms           | Multiple IT's (e.g., contracting software, relational DBs, inventory control, graphics applications, network technology, CD-ROM, laptops) | Diffusion of innovations, Theory of planned behavior | Employee Training <sup>†</sup>  |                              | Organization size, <sup>†</sup> Financial assets <sup>†</sup> | Attitude, subjective norm, perceived behavioral control, software and hardware compatibility, <sup>†</sup> tenure with firm, <sup>†</sup> control over adoption, <sup>†</sup> organization age <sup>†</sup>                   |
| Hart and Saunders (1998) | 224 supplier firms  | Electronic Data Interchange   | Power, Trust   |   |                              | Supplier dependence (includes annual revenue)                 | Customer power, supplier commitment, supplier trust   |
| Hsu et al. (2012)        | 140 Korean firms    | Information Security Management Innovations   | Institutional theory                                 | IT capability   |                              | Availability of resources                                     | Top management support, peer influence, supervisory authority influence, perceived environmental uncertainty, perceived gain in competitive advantage, cultural acceptability   |
| Hung et al. (2010)       | 95 Taiwan hospitals | Customer Relationship Management System   | Diffusion of innovations                             | IS knowledge, Innovation of executives, Knowledge management capabilities |                              | Hospital size   | Relative advantage  |
| Iacovou et al. (1995)    | 7 supplier firms    | Electronic Data Interchange   | Diffusion of innovations                             |   |                              | Slack resources   | Perceived benefits, organizational readiness, external pressure   |
| Iskandar et al. (2001)   | 103 supplier firms  | Electronic Data Interchange   | Transaction cost theory, Resource dependency theory  | EDI experience, Technical capability <sup>†</sup>                         |                              | Organization size <sup>†</sup>                                | Years of EDI relationship with the customer, number of competitors, number of customers, EDI customer dependency, frequency of buyer-supplier transactions, proactiveness, specialist/ generalist, supplier tier <sup>†</sup> |
| Kettinger et al. (2013)  | 103 U.S. firms      | Information Use   | Resource-based theory, Institutional theory          | Integrated information delivery, Information systems resources            | Process information delivery |   | Coercive, mimetic and normative pressures   |
| Kuan and Chau (2001)     | 575 firms           | Electronic Data Interchange   | Technology-organization-environment (TOE) framework  | Perceived technical competence  |                              | Perceived financial readiness                                 | Perceived direct and indirect benefits, perceived industry and government pressure  |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                           | Sample                                       | Innovation  | Theories   | Determinants of IT Adoption   |                             |   |   |
|---------------------------------|--|---|--|---|-----------------------------|---|---|
|                                 |  |   |  | Cultural Capital  | Social Capital              | Economic Capital  | Other Factors   |
| Lee and Choi (2010)             | 187 firms                                    | Knowledge Management Innovations                  | Resource-based view (RBV) of the firm, Knowledge-based view (KBV) of the firm, Technology assimilation | Knowledge worker management, KM process, Technology knowledge infrastructure, Knowledge strategy and climate    | External knowledge linkages |   |   |
| Li et al. (2011)                | 178 firms                                    | Internet as an Online Direct Sales Channel (ODSC) | Diffusion of innovations   | Internet expertise  |                             | Slack resources   | Relative advantage, ease of use, competitive pressure, risk opportunity   |
| Liang et al. (2007)             | 77 firms                                     | Enterprise Resource Planning                      | Technology assimilation, Innovation diffusion, Institutional theory                                    | Absorptive capacity <sup>†</sup>  |                             | Organization size <sup>†</sup>                                | Top management support; organization compatibility <sup>†</sup> ; coercive, mimetic, and normative pressures; time <sup>†</sup>                           |
| Lind and Zmud (1991)            | 48 departments in a large multinational firm | IT Innovations                                    | Convergence model, Media richness  | Convergence   |                             |   | Communication frequency, communication channel richness   |
| Mishra and Agarwal (2010)       | 292 firms                                    | B2B Markets for Electronic Procurement            | Managerial and organizational sensemaking, Technological frames, Organizational capabilities           | Technological opportunism, Technological sophistication   |                             | Organization size <sup>†</sup>                                | Benefit frame, threat frame, adjustment frame, industry <sup>†</sup>  |
| Montazemi et al. (2008)         | 90 respondents from 25 firms                 | Electronic Trading Systems                        | Network relation model   |   |                             |   | Shared language, codes, and narratives; network ties, network configuration, trust, norms, obligations, identification                                    |
| Pan and Jang (2008)             | 99 firms                                     | Enterprise Resource Planning                      | Technology-organization-environment (TOE) framework  |   |                             | Organization size   | Perceived barriers, production and operations improvement, IT investments   |
| Pennings and Harianto (1992)    | 152 banks                                    | Home Banking                                      | Networking, Technological convergence and innovation   | Technological experiences, Systems investment ("learning by using"), Inter-organizational experiences and links |                             | Organization size, <sup>†</sup> Return on equity <sup>†</sup> | Size of demand, <sup>†</sup> Number of competitors, <sup>†</sup> organization innovativeness, <sup>†</sup> nontechnical attributes                        |
| Premkumar and Ramamurthy (1995) | 201 firms                                    | Electronic Data Interchange                       | IT adoption and implementation   |   |                             |   | IS infrastructure, top management support, EDI champion, internal need, organizational compatibility, competitive pressure, transactional climate         |
| Purvis et al. (2001)            | 124 firms                                    | CASE Technology                                   | Knowledge-based views of the firm, Technology assimilation; Institutional theory                       | Knowledge embeddedness  |                             | Organization size <sup>†</sup>                                | Management championship, current and prior methodology, methodology compatibility, time since adoption, <sup>†</sup> project characteristics <sup>†</sup> |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                       | Sample                                    | Innovation  | Theories   | Determinants of IT Adoption  |  |   |  |
|-----------------------------|---|---|--|--|--|---|--|
|                             |   |   |  | Cultural Capital   | Social Capital                             | Economic Capital                                      | Other Factors  |
| Rai et al. (2009)           | 166 firms                                 | Electronic Procurement Innovations (EPI)                        | Innovation assimilation, Structuration theory                          | IT sophistication  |  | Financial resources                                   | EPI standards efficacy, security safeguards of EPI, top management support, trusting beliefs about suppliers, industry type <sup>†</sup>   |
| Rai and Patnayakuni (1996)  | 405 firms                                 | CASE Technology   | Information technology diffusion                                       | CASE training availability, Internal experimentation, Job/role rotation in the ISD | Learning from external information sources | IS size <sup>†</sup>                                  | CASE champions, environment instability, performance gaps of the ISD; top management support for the IS function   |
| Ravichandran (2005)         | 105 firms                                 | Component-based Software Development                            | Demand-pull model, Absorptive capacity, Economic theories of diffusion | Knowledge stocks   | Knowledge sharing                          | Organization size, <sup>†</sup> IS slack <sup>†</sup> | Perceived technology uncertainty, signaling  |
| Raymond (1990)              | 34 firms                                  | Reporting systems   | Organizational context of MIS  | IS sophistication  |  | Organization size, Organizational resources           | Organization maturity, strategic decision making time frame  |
| Reardon and Davidson (2007) | 567 physician practices*                  | Electronic Health Records                                       | Organizational learning and innovation                                 | Learning-related scale, Related knowledge, Knowledge diversity                     |  | Organization size <sup>†</sup>                        |  |
| Son and Benbasat (2007)     | 98 potential and 85 current adopter firms | Business-to-Business (B2B) Electronic Marketplaces              | Institutional theory, Transaction cost theory                          | IT capabilities <sup>†</sup>   |  | Organization size <sup>†</sup>                        | Product characteristics, demand uncertainty; market volatility, coercive, mimetic, and normative pressures   |
| Son et al. (2005)           | 233 firms                                 | Electronic Data Interchange                                     | Social exchange theory, Transaction cost theory                        |  |  | Transaction volume <sup>†</sup>                       | Relative advantage, <sup>†</sup> IT infrastructure, <sup>†</sup> power exercised by customer, trust, uncertainty, years of EDI relationship with the customer, <sup>†</sup> reciprocal investments, cooperation, asset specificity |
| Stevens et al. (1991)       | 38 firms                                  | Computer Hardware and Software, Integrated MIS and Financial IS | Diffusion of Innovations   |  |  |   | Perceived complexity, storage capacity, state fiscal scarcity, political influences, state per capita income, organizational support, top management support, clear user needs   |
| Teo et al. (2003)           | 1021 firms in Singapore                   | Financial EDI   | Institutional theory   |  |  | Organization size, <sup>†</sup> IT size <sup>†</sup>  | Perceived complexity, extent of EDI implementation, <sup>†</sup> coercive, mimetic, and normative pressures, float management practice <sup>†</sup>  |
| Venkatesh and Bala (2012)   | 248 firms                                 | RosettaNet-based IBPS   | Technology-organization-environment (TOE) framework                    | Organizational innovativeness; Technology readiness (expertise)                    |  | Organization size <sup>†</sup>                        | Expected benefits, process compatibility, standards uncertainty, technology readiness, relational trust, coercive, mimetic, and normative pressures <sup>†</sup> ; relationship length <sup>†</sup> ; dependency                   |

**Table A1. Summary of Organizational IT Adoption Studies (Continued)**

| Study                       | Sample   | Innovation        | Theories   | Determinants of IT Adoption                |                 |  |  |
|-----------------------------|--|-------------------|--|--|-----------------|--|--|
|                             |  |                   |  | Cultural Capital                           | Social Capital  | Economic Capital   | Other Factors  |
| Zheng et al. (2013)         | 148 public admin firms in China                | E-Government      | Institutional theory, Resource-based theory of the firm                                | IT human resources                         |                 | Financial resources  | Top management support, coercive, mimetic, and normative pressures   |
| Zhu, Dong et al. (2006)     | 1415 firms from 6 countries                    | E-Business        | Diffusion of innovation, Technology-organization-environment (TOE) framework           | Technology competence                      |                 | Organization size  | Relative advantage, compatibility, costs, security concern, competitive pressure, partner readiness, industry, <sup>†</sup> country <sup>†</sup> |
| Zhu and Kraemer (2005)      | 624 firms from 10 countries                    | E-Business        | Technology-organization-environment (TOE) framework, Resource-based theory of the firm | Technology competence                      |                 | Organization size, International scope, Financial commitment | Competitive pressure, regulatory support   |
| Zhu, Kraemer et al. (2006)  | 1394 firms from 10 countries                   | Open-standard IOS | Economic perspective of adoption, Network effects, Path dependency                     | EDI experience                             | Network effects | Organization size <sup>†</sup>                               | Expected benefits, adoption costs, industry type, <sup>†</sup> ICT penetration (country) <sup>†</sup>  |
| Zhu et al. (2003)           | 3100 firms and 7500 consumers from 8 countries | E-Business        | Technology-organization-environment (TOE) framework                                    | Technology competence                      |                 | Organization size  | Competitive pressure, consumer readiness, partner readiness, organization scope  |
| Zhu, Kraemer, and Xu (2006) | 1857 firms from 10 countries                   | E-Business        | Innovation assimilation  | Technology readiness, Managerial resources |                 | Organization size  | Competition intensity, regulatory environment, technology integration  |

<sup>†</sup>Indicates a control variable.

\*Healthcare institutions that are not hospitals.

FQHC: Federally Qualified Health Center; HIT: Healthcare Information Technology; HMO: Health Maintenance Organization; ICU: Intensive Care Unit

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## Appendix B

### HIT Applications, Adoption Rates, and Saidin Weight

| <b>Business IT</b>                          | <b>Adoption Rate</b> | <b>Saidin Weight</b> | <b>Clinical IT</b>                                 | <b>Adoption Rate</b> | <b>Saidin Weight</b> |
|---|----------------------|----------------------|--|----------------------|----------------------|
| Abstracting                                 | 92.82%               | 0.07                 | Anatomical Pathology                               | 58.06%               | 0.42                 |
| Accounts Payable                            | 99.27%               | 0.01                 | Cardiology—Cath Lab                                | 21.02%               | 0.79                 |
| Admit Discharge Transfer (ADT)/Registration | 97.61%               | 0.02                 | Cardiology—CT (Computerized Tomography)            | 11.55%               | 0.88                 |
| Benefits Administration                     | 85.43%               | 0.15                 | Cardiology—Echocardiology                          | 18.94%               | 0.81                 |
| Blood Bank                                  | 66.08%               | 0.34                 | Cardiology—Intravascular Ultrasound                | 12.80%               | 0.87                 |
| Browser                                     | 77.42%               | 0.23                 | Cardiology—Nuclear Cardiology                      | 11.03%               | 0.89                 |
| Budgeting                                   | 80.44%               | 0.20                 | Cardiology Information System                      | 39.96%               | 0.60                 |
| Business Intelligence                       | 30.80%               | 0.69                 | Chart Deficiency                                   | 87.62%               | 0.12                 |
| Case Mix Management                         | 80.54%               | 0.19                 | Chart Tracking/Locator                             | 86.89%               | 0.13                 |
| Contract Management                         | 67.43%               | 0.33                 | Clinical Data Repository                           | 78.56%               | 0.21                 |
| Cost Accounting                             | 74.40%               | 0.26                 | Clinical Decision Support                          | 68.05%               | 0.32                 |
| Credit/Collections                          | 86.37%               | 0.14                 | Computerized Practitioner Order Entry (CPOE)       | 38.92%               | 0.61                 |
| Data Warehousing/Mining - Financial         | 26.12%               | 0.74                 | Data Warehousing/Mining—Clinical                   | 19.04%               | 0.81                 |
| Database Management System (DBMS)           | 68.26%               | 0.32                 | Dictation  | 83.14%               | 0.17                 |
| Document Management—Business Office         | 36.21%               | 0.64                 | Dictation with Speech Recognition                  | 11.76%               | 0.88                 |
| Document Management—HIM                     | 47.35%               | 0.53                 | Electronic Medication Administration Record (EMAR) | 51.40%               | 0.49                 |
| Document Management—Human Resources         | 17.79%               | 0.82                 | Emergency Department Information System (EDIS)     | 68.57%               | 0.31                 |
| EDI—Clearing House Vendor                   | 57.13%               | 0.43                 | Enterprise EMR                                     | 93.96%               | 0.06                 |
| Electronic Forms – Business Office          | 19.46%               | 0.81                 | Enterprise Master Person Index (EMPI)              | 38.29%               | 0.62                 |
| Electronic Forms – HIM                      | 24.77%               | 0.75                 | In-House Transcription                             | 76.38%               | 0.24                 |
| Electronic Forms – Human Resources          | 10.51%               | 0.89                 | Intensive Care/ Medical Surgical                   | 49.74%               | 0.50                 |
| Eligibility                                 | 62.75%               | 0.37                 | Laboratory Information System                      | 94.17%               | 0.06                 |
| Email                                       | 81.27%               | 0.19                 | Microbiology                                       | 70.03%               | 0.30                 |
| Encoder                                     | 51.40%               | 0.49                 | Nurse Acuity                                       | 18.63%               | 0.81                 |
| Enterprise Resource Planning                | 20.29%               | 0.80                 | Nursing Documentation                              | 57.65%               | 0.42                 |
| Executive Information System                | 63.48%               | 0.37                 | Obstetrical Systems (Labor and Delivery)           | 41.00%               | 0.59                 |
| Financial Modeling                          | 31.32%               | 0.69                 | Operating Room (Surgery)—Peri-Operative            | 54.32%               | 0.46                 |
| General Ledger                              | 99.17%               | 0.01                 | Operating Room (Surgery)—Post-Operative            | 54.42%               | 0.46                 |

**Table B1. List of HIT Applications, their Adoption Rates, and Saidin Weight (Continued)**

| <b>Business IT</b>        | <b>Adoption Rate</b> | <b>Saidin Weight</b> | <b>Clinical IT</b>                          | <b>Adoption Rate</b> | <b>Saidin Weight</b> |
|---------------------------|----------------------|----------------------|---|----------------------|----------------------|
| Interface Engines         | 44.54%               | 0.55                 | Operating Room (Surgery)—Pre-Operative      | 67.01%               | 0.33                 |
| Materials Management      | 95.63%               | 0.04                 | Order Entry (Includes Order Communications) | 89.07%               | 0.11                 |
| Nurse Staffing/Scheduling | 63.58%               | 0.36                 | Outcomes and Quality Management             | 70.03%               | 0.30                 |
| Operating Room Scheduling | 62.64%               | 0.37                 | Outsourced Transcription                    | 5.52%                | 0.94                 |
| Patient Billing           | 98.34%               | 0.02                 | Pharmacy Management System                  | 93.55%               | 0.06                 |
| Patient Scheduling        | 82.10%               | 0.18                 | Physician Documentation                     | 32.15%               | 0.68                 |
| Payroll                   | 95.53%               | 0.04                 | Radiology—Angiography                       | 59.83%               | 0.40                 |
| Personnel Management      | 85.33%               | 0.15                 | Radiology—CR (Computed Radiography)         | 67.33%               | 0.33                 |
| RFID—Supply Tracking      | 3.75%                | 0.96                 | Radiology—CT (Computerized Tomography)      | 69.51%               | 0.30                 |
| Single Sign-On            | 14.46%               | 0.86                 | Radiology—DF (Digital Fluoroscopy)          | 60.67%               | 0.39                 |
| Staff Scheduling          | 37.77%               | 0.62                 | Radiology—Digital Mammography               | 25.81%               | 0.74                 |
| Time and Attendance       | 88.35%               | 0.12                 | Radiology—DR (Digital Radiography)          | 59.00%               | 0.41                 |
| Turnkey Portal            | 14.46%               | 0.86                 | Radiology—MRI (Magnetic Resonance Imaging)  | 67.01%               | 0.33                 |
| Web Development Tool      | 38.81%               | 0.61                 | Radiology—Nuclear Medicine                  | 63.06%               | 0.37                 |
|                           |                      |                      | Radiology—Orthopedic                        | 21.44%               | 0.79                 |
|                           |                      |                      | Radiology—US (Ultrasound)                   | 67.95%               | 0.32                 |
|                           |                      |                      | Radiology Information System                | 90.74%               | 0.09                 |
|                           |                      |                      | Respiratory Care Information System         | 33.19%               | 0.67                 |
|                           |                      |                      | RFID—Patient Tracking                       | 5.52%                | 0.94                 |
|                           |                      |                      | Telemedicine—Radiology                      | 21.02%               | 0.79                 |
| <b>Mean</b>               | 59.08%               | 0.41                 |   | 51.78%               | 0.48                 |
| <b>Standard deviation</b> | 29.13%               | 0.29                 |   | 26.89%               | 0.27                 |

**Note:** Saidin weight of a technology is calculated as 1-adoption rate

# Appendix C

## Data Sources

### ***American Hospital Association (AHA)***

Founded in 1898, the American Hospital Association (AHA) is the national organization that represents healthcare organizations including all types of hospitals, health care networks, and their patients and communities. AHA includes nearly 5,000 hospitals, health care systems, networks, other providers of care and 43,000 individual members. It focuses on getting members' perspectives and needs heard and addressed in national health policy development, legislative and regulatory debates, and judicial matters. AHA also provides education and information on health care issues and trends. AHA maintains a comprehensive census of United States hospitals based on the AHA Annual Survey of Hospitals conducted since 1946. The database is released annually and covers organizational structure, personnel, hospital facilities and services, and financial performance. It has been used by government agencies, research universities, health policy organizations, health care vendors, and professional services firms.

Source: <http://www.aha.org/>

### ***American Hospital Directory (AHD)***

The American Hospital Directory (AHD) provides information on more than 6,000 hospitals nationwide from authoritative sources. The data and statistics are derived from both public and private sources such as Medicare claims data, hospital cost reports, and commercial licensors. AHD is not affiliated with the American Hospital Association (AHA).

Source: <https://www.ahd.com/>

### ***Center for Medicare & Medicaid Services (CMS)***

The Centers for Medicare & Medicaid Services (CMS) is a federal agency within the Department of Health and Human Services (HHS). It works in partnership with state governments to administer programs such as Medicare, Medicaid, the State Children's Health Insurance Program (SCHIP), and health insurance portability standards.

Source: <https://www.cms.gov/>

### ***Healthcare Information and Management Systems Society (HIMSS)***

As a global, cause-based, non-profit organization founded in 1961, HIMSS (Healthcare Information and Management Systems Society) focuses on improving health engagements and the access, quality, cost-effectiveness, and value of healthcare through information technology (IT). Headquartered in Chicago and with offices in the United States, Europe, and Asia, HIMSS engages the global health IT community by providing thought leadership, community building, professional development, public policy, and events. HIMSS Analytics, a wholly owned subsidiary of HIMSS, leads efforts in healthcare research and advisory for healthcare delivery organizations, IT companies, governmental entities, and financial, pharmaceutical, consulting and emerging technology solution partners worldwide. It conducts an annual study on United States healthcare organizations to collect data on the inventory and use of healthcare information technology.

Source: <http://www.himss.org/>, <http://www.himssanalytics.org/>