A National Job Analysis Study of the Certified Healthcare Technology Specialist Technical Role 2016

Conducted for:

American Health Information Management Association

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Executive Summary

The Job Analysis described in this report was conducted in 2016 at the request of the American Health Information Management Association (AHIMA). The purpose of the study was to describe the job activities of the healthcare technology specialist in a Technical Role in sufficient detail to provide a basis for the development of a professional, job-related certification examination.

A Job Analysis Advisory Committee (AC) was appointed by AHIMA to conduct the activities necessary to identify job responsibilities and develop the test specifications for the Certified in Healthcare Technology Specialist - Technical (CHTS-TS) examination. The AC represented varied national regions and practice settings. All AC members were experts in the duties and activities associated with the profession.

The study involved developing a job task list and survey, distributing the survey, and analyzing the survey responses. Test specifications for the CHTS-TS examination were developed based on survey responses. The AC was responsible for the following functions regarding Job Analysis survey development:

- ➢ developing a sampling plan for the survey,
- ➢ identifying task statements for the survey instrument,
- ➢ determining the survey rating scales,
- ➢ determining the relevant demographic variables of interest, and
- ➢ integrating tasks, rating scales, and demographics into a survey instrument.

AMP, a PSI business (PSI/AMP) project staff modified and created an online survey for distribution to a sample of healthcare technology specialists. The target professional was defined as follows:

CHTS Technical Role:

Individuals in this role provide on-site user support for implementation and maintenance of health IT systems in healthcare settings. The background of workers in this role may include information technology, information management, or informatics. The CHTS Technical Role includes:

- *Executing implementation project plans by installing hardware (as needed) and configuring software to meet practice needs*
- *Incorporating usability principles into design and implementation*
- *Testing the software against performance specifications*
- *Interacting with vendors as needed to rectify problems that occur during the deployment process*
- *Interacting with end users to diagnose IT problems and implement solutions*
- *Documenting IT problems and evaluating the effectiveness of problem resolution*
- *Supporting systems security and standards.*

Hyperlinks to a web-based survey were distributed by electronic mail to 1,333 healthcare technology specialists, with 32 survey invitations returned as undeliverable. Three hundred forty nine (349) participants responded and provided usable responses to be included in the analysis, which resulted in an overall return rate of 27%. After a demographic section, respondents were

routed to either one or up to all four specialist role surveys, depending on their choice. There were a total of 213 respondents who completed the CHTS Manager Role survey, 109 respondents completed the CHTS Technical Role survey, 105 respondents completed the CHTS Trainer Role survey, and 75 respondents completed the Clinician/Practitioner Consultant Role survey. The results from the 109 CHTS Technical Role respondents are presented in this report. The results from the three other specialist role surveys are also reported but documented elsewhere. Responses to the demographic questions indicated that there were sufficient numbers from relevant groups for subsequent analyses.

Survey data were presented to the AC at the second job analysis meeting for review and comment. The survey was divided into three parts – Task Inventory, Knowledge/Skill Inventory, and Background Information sections. The Task Inventory consisted of five major areas:

1. Analyze
2. Design/Build/Test
3. Implement into Production
4. Support and Troubleshoot
5. Disaster Continuity Planning

The AC developed and used exclusion decision rules to identify tasks appropriate for the examination content outline. Of the 65 tasks on the original survey, 11 tasks were excluded based on the following exclusion criteria.

Rule 1   *Keep only tasks performed by 71.5% or more of respondents.*
Applying this rule eliminated 10 tasks.(T63: Perform disaster drills on a regular basis; T62: Maintain disaster plan hardware; T65: Create device management documentation; T64: Validate redundancy systems; T33: Install hardware and software; T60: Identify how disaster plans relate to one another; T17: Build the product; T26: Develop back-out plan; T59: Participate in defining a disaster plan for specific work enviornments; T58: Provide input on policies and procedures related to risk management).

Rule 2   *Keep only tasks rated at least Significant (2.00) by respondents.*
Applying this rule did not eliminate any additional tasks.

Rule 3   *Keep only tasks rated at least Significant (1.90) by 3 out of 4 region subgroups (Northeast, Midwest, South, and West).*
Applying this rule eliminate one additional task (T38: Implement changes to hardware).

Rule 4   *Keep only tasks rated at least Significant (1.90) by 3 out of 3 years of experience in health IT workforce roles subgroups (0-5 years; 6-16 years; and more than 17 years).*
Applying this rule did not eliminate any additional tasks.

Rule 5   *Keep only tasks rated at least Significant (1.90) by 3 out of 3 levels of education (High school graduate, GED, or associates degree; Bachelor's degree; Master's and above).*
Applying this rule did not eliminate any additional tasks.

Rule 6 *Keep only tasks rated at least Significant (1.85) by 6 out of 6 certifications held subgroups (CP, IM, IS, PW, TR, and TS).*
Applying this rule did not eliminate any additional tasks.

Rule 7 *Keep only tasks rated at least Significant (1.85) by 3 out of 4 job title subgroups (Director/Executive; Manager; Technical; and Other).*
Applying this rule did not eliminate any additional tasks.

Rule 8 *Keep only tasks rated at least Significant (1.90) by 3 out of 3 number of employees subgroups. (Less than 100; Between 101 and 1,000; and More than 1,000).*
*Appl*ying this rule did not eliminate any additional tasks.

In summary, the decision rules resulted in identifying tasks comprising the content domain that were performed by 71.5% of the respondents. Also, the tasks identified were considered at least significant by the respondents. Finally, the tasks were viewed similarly regardless of the location, years of work experience, highest level of education, certifications held, primary job level, and number of employees.

The AC also developed and used exclusion decision rules to identify knowledge/skill statements appropriate as supplemental information on the examination content outline. The Knowledge/Skill Inventory consisted of four major areas:

1. Technical Knowledge: Health Data Management
2. Technical Knowledge: Health Information Technology & Systems
3. Non-Technical Knowledge: Hard Skills
4. Non-Technical Knowledge: Soft Skills

Of the 80 knowledge/skill statements on the original survey, 3 statements were excluded based on the following exclusion criterion.

Rule 1 *Keep only tasks rated at least Significant (1.70) by respondents.*
Applying this rule eliminated three statements. (K45: Ergonomics; K48: Human resource management; K50: Inferential statistics).

One purpose of the knowledge/skill statements is to provide guidance to the item writers/exam committee. As such, the AC assigned priority designations (low, medium, or high) to each knowledge/skill statement to provide some additional detail on the level of emphasis for each statement.

The AC reviewed and considered all respondent comments. No additional tasks or knowledge statements were added or removed. One task was created by the AC to replace seven eliminated tasks related to disaster planning. The final 55 tasks comprising the content domain were used to construct the detailed content outline, consisting of five major content areas. The AC members assigned cognitive complexity designations to each critical task according to their perceptions of job conduct. Items linked to these tasks should closely align with the complexities of the job. The AC members were confident candidates' scores should reflect critical job content and complexity when tests are developed to the new set of specifications. It was decided that a 125-item examination sufficiently samples the content domain to render a pass or fail decision based on examination scores. The resulting examination matrix and detailed content outline will be used by AHIMA to assemble future examination forms.

Introduction

The Job Analysis described in this report was conducted in 2016 at the request of the American Health Information Management Association (AHIMA). The purpose of the study was to describe the job activities of the healthcare technology specialist in a Technical Role in sufficient detail to provide a basis for the development of a professional, job-related certification examination.

A Job Analysis Advisory Committee (AC) was appointed by AHIMA to conduct the activities necessary to identify job responsibilities and develop the test specifications for the Certified in Healthcare Technology Specialist - Technical (CHTS-TS) examination.

The AC developed a comprehensive inventory of activities that the healthcare technology specialist in a Technical Role may perform by brainstorming job activities and reviewing both the current detailed content outline and the previous Job Analysis study. In addition, demographic variables were developed, and a rating scale was selected for use on the survey. After pilot testing, the Job Analysis survey was distributed to 1,333 healthcare technology specialists. The returned surveys were analyzed to determine the significance of each task to the healthcare technology specialist in a Technical Role.

Job Analysis survey data were evaluated to determine the degree of consensus among professionals on critical aspects of the job. Data were specifically analyzed to answer the following questions:

1. What percentage of professionals performs each job task?

2. Which tasks are more significant to the job?

3. Which knowledge/skill statements are more significant to the job?

These questions helped identify the more significant job activities and knowledge from which the content of the CHTS-TS examination was specified.

Methodology

Forming the Job Analysis Advisory Committee

The AC was consulted throughout the survey development stages to ensure that expert judgment was available to AMP staff. The responsibilities of the AC are listed in the following section. The members of the AC were experienced professionals, all thoroughly familiar with the skills and activities of the profession. Listed below are the AC members.

Name	Credentials	Organization
Valerie Ball	IS	NC State University College of Veterinary Medicine
Tammie Bolling	TR	Pellissippie State Community College
Cynthia Buege	IM	Michigan Public Health Institute
Tamara Flynn	IM	Pitt Community College
Paula Arceneaux Ivey	IM	Hospital Corporation of America - Gulf Coast Division
Diane Lerch	PW, TR	Tampa General Hospital
Daphnie Mustafa	IM	Inova Health System
Geri Newman	IM	UF Health Shands Hospital
Issac Perkins	IM	Johns Hopkins EPIC Training
Tamara Rodriguez	PW	Tallahassee Memorial Healthcare
Nancy Rosivack	IM, IS, PW, TR	NJ-HITEC
LaShunda Smith	IM, PW, TR	Baptist Health
Tatyana Pashnyak	TR	Bainbridge State College
Shelley Safian		Safian Communications Svs. Inc.
Tanya Scott	CP, PW	Lemont Scott Group
Melinda Teel		Midland College

Job Analysis Advisory Committee Responsibilities

1. Provide PSI/AMP current information about the job.
2. Develop the Job Analysis survey:
   a. develop a sampling plan,
   b. identify tasks for the survey instrument,
   c. determine the survey rating scales,
   d. determine the relevant demographic variables of interest, and
   e. integrate the definition, tasks, rating scales, and demographics into a survey instrument.
3. Review the final form of the survey for completeness, relevance to the profession, appropriate language, and clarity of instructions.

A significant investment of time by the AC members ensured a successful Job Analysis study. We are grateful to each of these professionals for their guidance, expertise, and devotion to this complex project.

Developing the Job Analysis Survey

Developing the Task List

With the assistance of PSI/AMP project staff, the AC drafted an inventory containing a comprehensive list of job activities. The task list was drafted from various sources, including the previous test specifications and other descriptions of the healthcare technology specialists in a Technical Role. The final document consisted of 65 tasks presented in content order.

Selecting Rating Scales

The AC also assisted in the selection of the rating scale used in the survey. The scale was based on similar scales used by PSI/AMP in previous national job analysis surveys by other professions. A significance scale, including a "not applicable for my role" data point, was selected by the AC to include on the survey for the tasks.

The scale was designed to identify the job activities that are most significant to achieving the healthcare technology specialist in a Technical Roles' job objectives. Such information was necessary to demonstrate that the examination measures significant aspects of the job and covers appropriate content. The following scale was used:

> **Please use the scale shown below to express your judgment of the significance of each task as it applies to your current role in the health IT workforce.**
>
> 0 = Not applicable for my role
> 1 = Minimally significant
> 2 = Significant
> 3 = Very significant

Selecting Background Information Questions

The Background Information section was designed to gather information about the respondents' demographic characteristics. Demographic questions were used to help the AC evaluate potential bias in the respondent group. Therefore, the following information about the survey respondents was available:

- work location
- facility setting
- primary job level category
- years of relevant work experience
- highest level of education
- whether education included healthcare/medicine or IT
- hold the CHTS credential
- years holding the CHTS credential
- which of the CHTS credentials held
- other certifications held

- licenses held
- primary work setting
- number of employees in your organization
- age
- gender

Region, years of work experience, level of education, additional certifications held, primary job level, and number of employees were used to identify subgroups for analyses and to describe the sample.

Integrating the Definition, Tasks, Rating Scales, and Demographics into a Survey

Following the first AC meeting, survey components were compiled into draft form. The draft survey was reviewed by the AC. The pilot survey was distributed to all AC members and a sample of potential participants for review and comment. The purpose of the pilot study was to determine (1) if the directions were clear, (2) if any important tasks were missing from the survey, (3) if the tasks were clearly worded, and (4) if the rating scale was easy to use and understand. The AC also reviewed comments from the pilot study participants. Any needed modifications to the survey were made prior to distribution. The final survey is shown in Appendix A.

Sample Selection

In an effort to obtain information from respondents who represented professionals throughout the United States and other countries, 1,333 surveys were e-mailed to the certified healthcare technology specialists by PSI/AMP. This group of names was selected by AHIMA, and represented a target sample of the population of the healthcare technology specialists.

Results

Return Rate and Sample Size

Hyperlinks to a web-based survey were distributed by electronic mail to 1,333 healthcare technology specialists, with 32 survey invitations returned as undeliverable and 0 opted out. Three hundred forty-nine (349) participants responded and provided usable responses to be included in the analysis, which resulted in an overall return rate of 26.8%. After a demographic section, respondents were routed to either one or up to all four specialist role surveys, depending on their choice. There were a total of 213 respondents who completed the CHTS Manager Role survey, 109 respondents completed the CHTS Technical Role survey, 105 respondents completed the CHTS Trainer Role survey, and 75 respondents completed the Clinician/Practitioner Consultant Role survey. Table 1 below shows the summary of survey invitations sent and response rate. The results from the 109 CHTS Technical Role respondents are presented in this report. The results from the three other specialist role surveys were reported and documented elsewhere. Responses to the demographic questions indicated that there were sufficient numbers from relevant groups for subsequent analyses.

A general approach was incorporated to evaluate the standard error of the ratings. An approximate standard error was used for the rating scale by applying the equation:

$$\textit{Standard error} = 1/\sqrt{109}, \textit{ where 109 = sample size}$$

The resulting standard error of the ratings was 0.096. This indicates that ratings were highly stable, and reflective of the population of professionals.

Table 1. Response Rate Summary

Credential	No. Sent
Clinician/Practitioner (CHTS-CP)	169
Implementation Manager (CHTS-IM)	292
Implementation Support Specialist (CHTS-IS)	167
Practice Workflow and Information Management Redesign Specialist (CHTS-PW)	360
Trainer (CHTS-TR)	228
Technical/Software Support Staff (CHTS-TS)	117
Total Invitations Sent	**1,333**
Undeliverable	32
Opt-out	0
Valid Overall Response	**349**
Overall Response Rate	**26.8%**
# who responded to Management Role survey	213
# who responded to Technical Role survey	109
# who responded to Trainer Role survey	105
# who responded to the Clinician/Practitioner Consultant survey	75

Task and Respondent Rating Reliability Estimates

To find the extent to which *tasks* were consistently rated within each survey section, a statistic known as coefficient alpha (Norusis, 1994, p. 204; Hopkins, Stanley & Hopkins, 1990, p. 133-134) was used. Coefficient alpha is an estimate of the amount of error reflected by the scores associated with the instrument. Higher estimate values (e.g., .90 or higher) reflect smaller amounts of error. To determine the extent to which the *respondents* were consistent in rating inventory activities, a statistic known as the intraclass correlation (Guilford, 1956) was used. Separate reliability estimates were calculated for content areas and are displayed in Table 2. Since the maximum reliability coefficient is represented by a value of 1.00 and the total reliability estimate for the whole task list was 0.98 (alpha) and 0.96 (intraclass), the respondents' task ratings were considered highly reliable. Based on these data, it is very likely that a different sample from the same population would have produced similar task ratings.

Table 2. Task and Respondent Rating Reliability Estimates

| Survey Section | # of Tasks | Reliability (consistency) | | Number of Respondents* |
		Between Tasks (Coefficient Alpha)	Between Respondents (Intraclass Correlation)	
1. Analyze	10	0.926	0.976	98
2. Design/Build/Test	19	0.950	0.948	92
3. Implement into Production	11	0.902	0.963	93
4. Support and Troubleshoot	17	0.955	0.901	91
5. Disaster Continuity Planning	8	0.911	0.977	90
Total	**65**	**0.981**	**0.959**	**83**

*Only those who responded to every task in each section with a rating of 0 to 3 were included for these analyses.

Demographic Analyses

The following figures and tables present background information collected from the respondents (also see Appendix B). These demographic data helped describe the sample.

A typical respondent is described below:

- ➢ Works in the South of the U.S.
- ➢ Facility is in an urban setting
- ➢ Works in a hospital setting
- ➢ Holds the IM and/or PW certification
- ➢ Has 12 years of relevant work experience
- ➢ Holds a Baccalaureate or Master's degree
- ➢ Education included both healthcare/medicine and information technology
- ➢ Has held the CHTS credential for 3 years
- ➢ Also holds the RHIA and/or the RHIT credential
- ➢ Has more than 1,000 employees in their organization
- ➢ Female over the age of 40
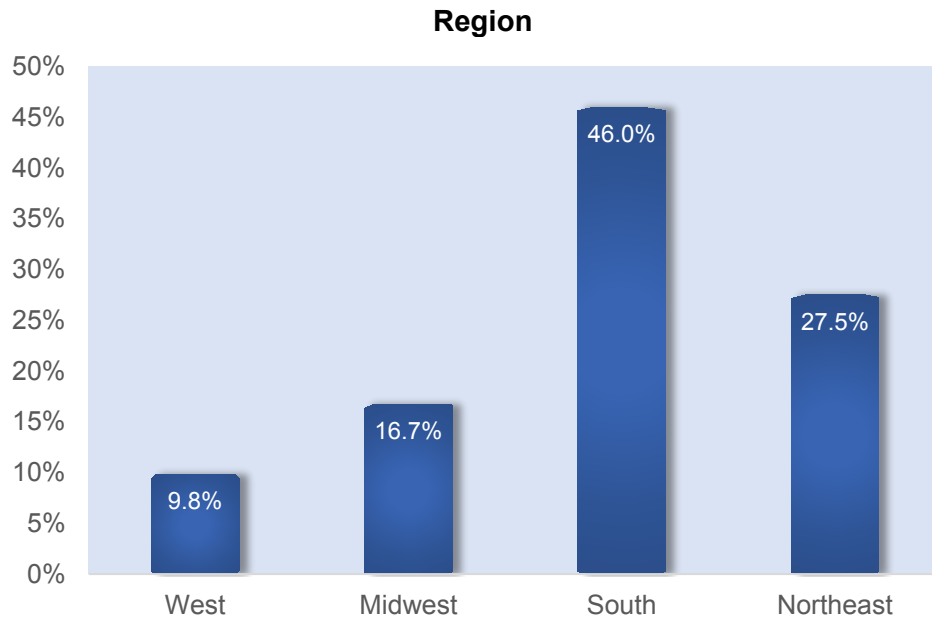
Region

Figure 1. Location (recoded into Region) (n=106)

Survey respondents were first asked to indicate the location in which they work. As shown in *Figure 1,* the respondents were distributed across the U.S. The largest group (46.0%) of respondents was from the South. This demographic variable was used to create subgroups for task analysis (see Appendix F).
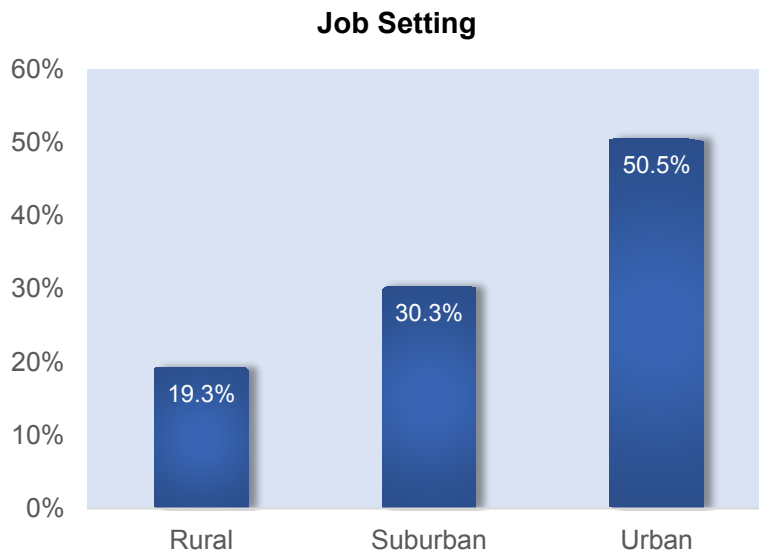
Job Setting

Figure 2. Job Setting (n=109)

Figure 2 shows the job setting respondents held. Approximately 50.5% of the respondents reported they worked in an urban setting, while 30.3% reported a suburban setting.

Primary Job Level Category

Other	13.8%
Director (HIM, HIT, etc.)/Officer	11.9%
Technical Support Analyst/Specialist	11.0%
Manager/Supervisor	11.0%
Tech Implementation Analyst/Specialist	10.1%
Consultant	9.2%
System Administrator	7.3%
IT Project Manager	6.4%
Business Analyst	5.5%
Not currently working	4.6%
Professor/Educator	2.8%
Clerical/Administrative support	1.8%
HIM Technician Role (e.g., coder)	1.8%
Clinician (MD, RN)	1.8%
Executive/President/Vice President	0.9%

Figure 3. Primary Job Level Category (n=109)

Figure 3 shows the primary job level categories that respondents described themselves. The largest groups described themselves as either Director/Officer (11.9%) or Technical Support Analyst/Specialist (11.0%). This demographic variable was used to create subgroups for task analysis (see Appendix J).

Years of Work Experience

Mean = 11.95
Std. Dev. = 8.636
N = 90

Figure 4. Years of Work Experience (n=90)

Figure 4 shows the years of work experience held by the respondents. This demographic variable was used to create subgroups for task analysis (see Appendix G). The average years of experience among the respondents was 12 years.

Highest Level of Education
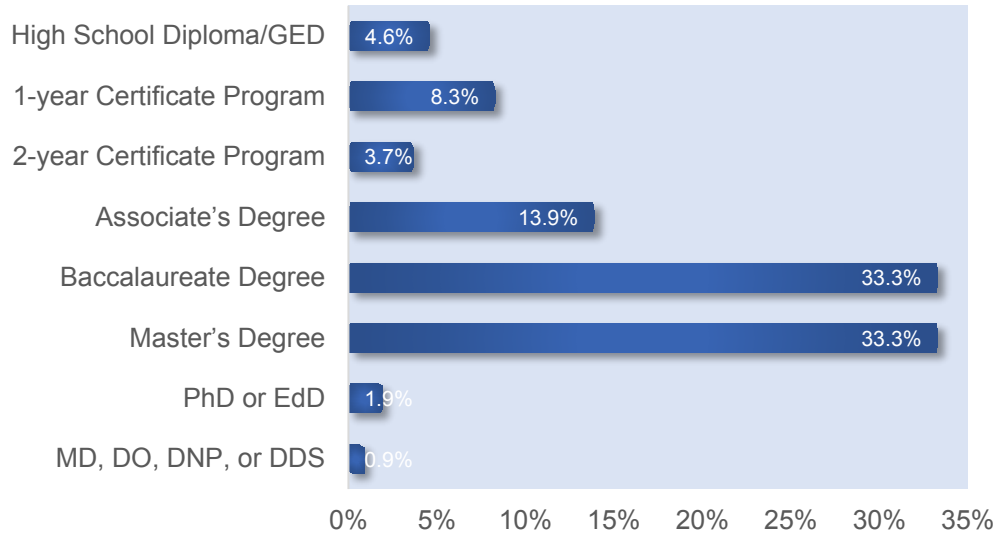
Figure 5. Highest Level of Education (n=108)

Figure 5 shows the highest level of education that was achieved by the respondents. A majority (66.6%) hold either a Baccalaureate or Master's degree. This demographic variable was used to create subgroups for task analysis (see Appendix H).

Educational Experience
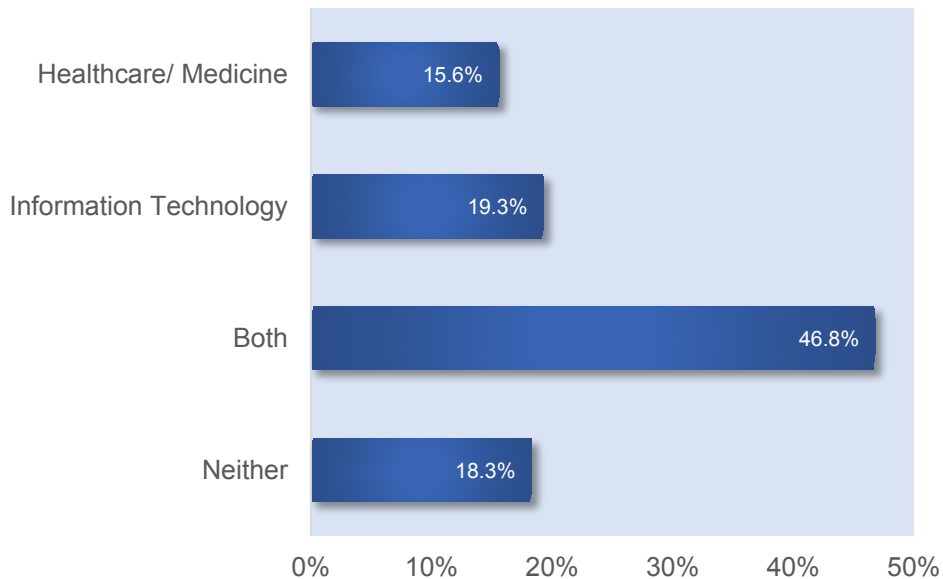
Figure 6. Educational Experience (n=109)

In *Figure 6*, survey respondents were asked to indicate whether their educational experience included healthcare/medicine or information technology. Almost half (46.8%) of the respondents indicated that they have experience in both Healthcare/Medicine and Information Technology.

Hold the CHTS Credential

No, 0.9%

Yes, 99.1%
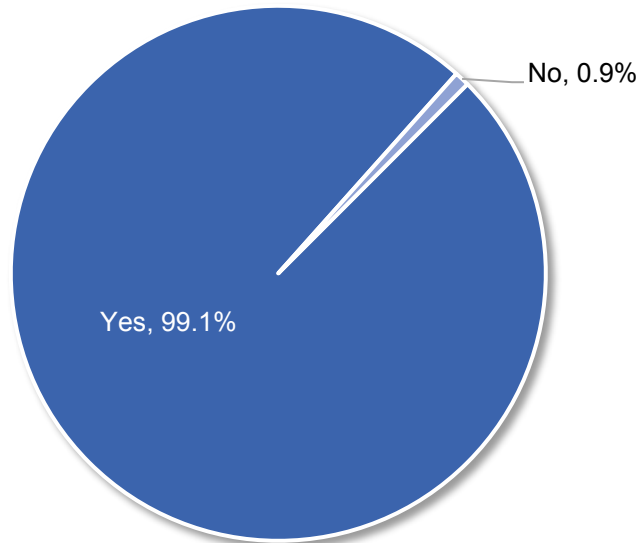
Figure 7. Hold the CHTS Credential (n=108)

In *Figure 7*, survey respondents were asked to indicate whether they hold the CHTS credential. Nearly all (99.1%) of the respondents hold a CHTS credential.

Years Held the CHTS Credential
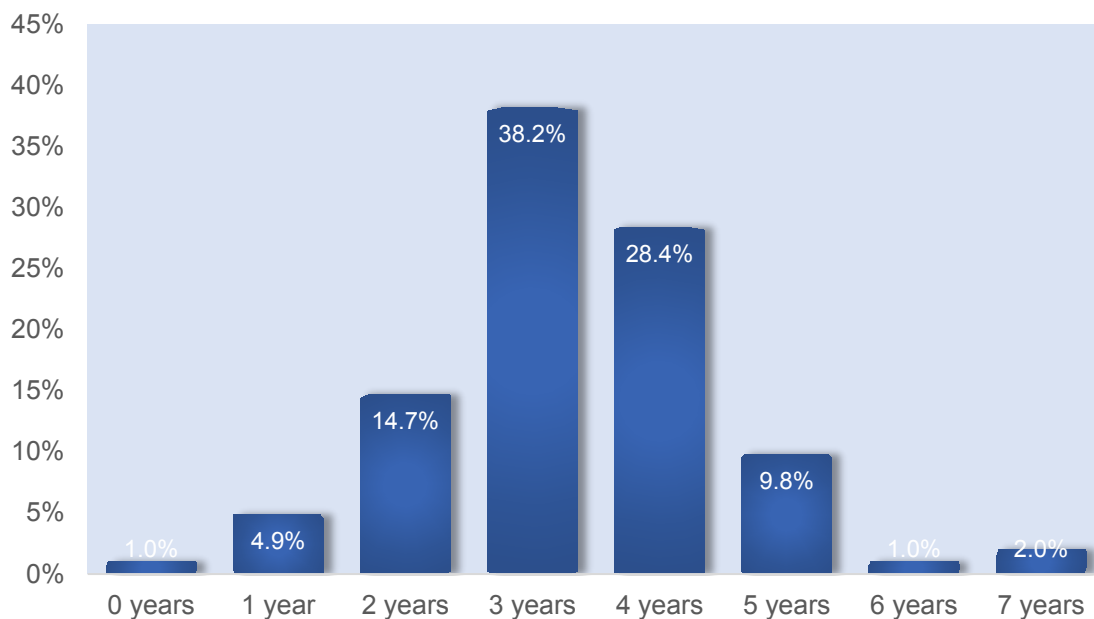
Figure 8. Years held the CHTS Credential (n=102)

Figure 8 shows that most respondents have held the CHTS credential between 2 and 5 years. The average length of time holding the CHTS credential is 3.3 years.

CHTS Credentials Held
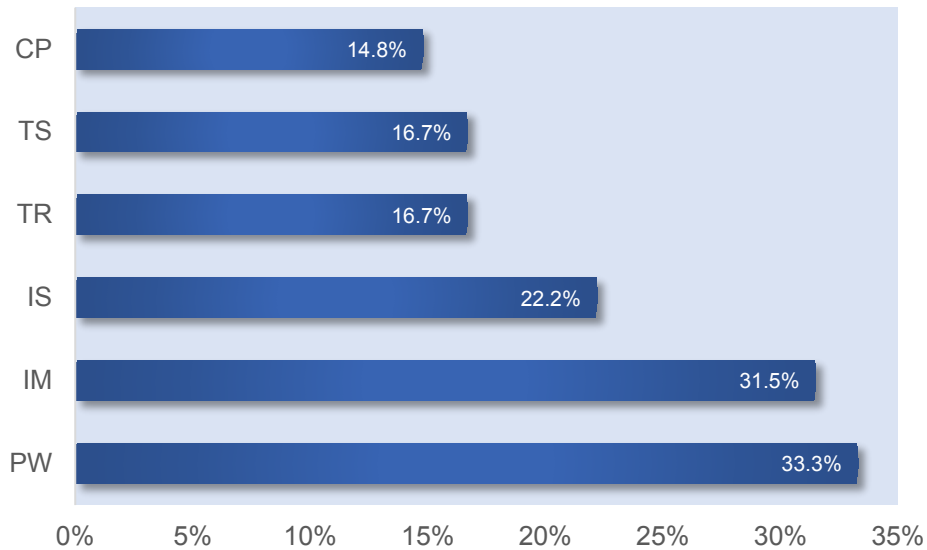
Figure 9. CHTS Credentials Held (n=109)

Figure 9 shows that most respondents (64.8%) held the Implementation Manager (IM) and/or the Practice Workflow and Information Management Redesign Specialist (PW) credential. This was a select all that apply variable. This demographic variable was used to create subgroups for task analysis (see Appendix I).

Other Credentials Held
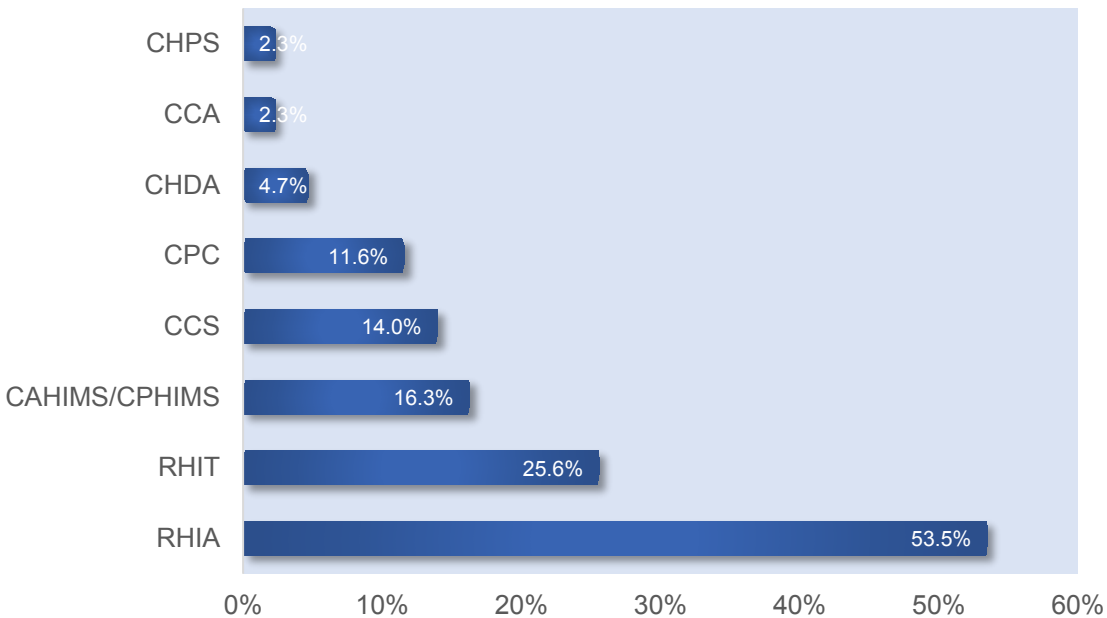
Figure 10. Other Credentials Held (n=43)

Survey respondents were asked about other credentials they may hold. *Figure 10* shows that nearly half (53.5%) of the sample also held the RHIA credential while a quarter (25.6%) held the RHIT credential. This was a select all that apply variable.

Licenses Held
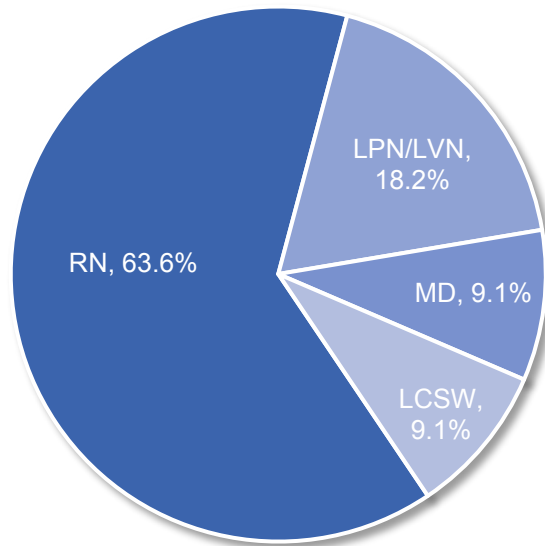
Figure 11. Licenses Held (n=11)

Figure 11 shows that 11 respondents held a license; most (63.6%) held the RN license.

Primary Work Setting

Setting	Percentage
Hospital	26.9%
Physician's office/medical group practice	13.0%
Multi-hospital/diversified system	11.1%
Consultant/vendor EHR/HIM/IT services	11.1%
Ambulatory care facility	10.2%
Vendor EHR/HIM software products	3.7%
Behavioral health facility	3.7%
Government/public health agency	2.8%
Educational institution	2.8%
Managed care HMO/PPO office	1.9%
Long-term care facility	1.9%
Insurance company/payer	1.9%
Veterinary practice	0.9%
Urgent care center (freestanding…	0.9%
Transcription company	0.9%
Rehabilitation facility	0.9%
Professional or trade association	0.9%
Mental health facility	0.9%
Hospice	0.9%
Home healthcare agency	0.9%
Health information exchange organization	0.9%
Billing agency	0.9%

Figure 12. Primary Work Setting (n=108)

The respondents were asked the following question: "Which of the following best describes your primary work setting?" *Figure 12* shows that the majority (26.9%) of respondents describes their work environment as a hospital.

Number of Employees in Organization
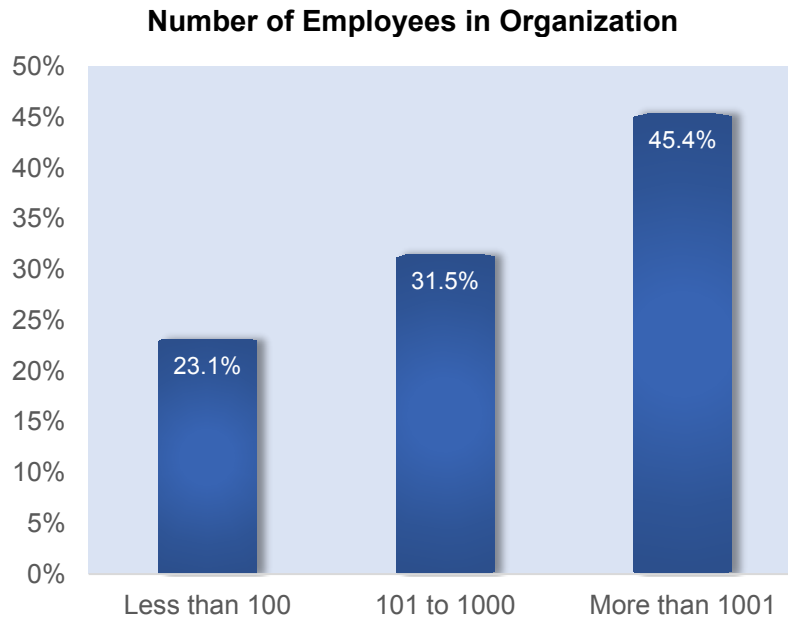
Figure 13. Number of Employees in Organization (n=108)

Figure 13 shows that the majority (45.4%) of respondents work in organizations with more than 1,000 employees. This demographic variable was used to create subgroups for task analysis (see Appendix K).
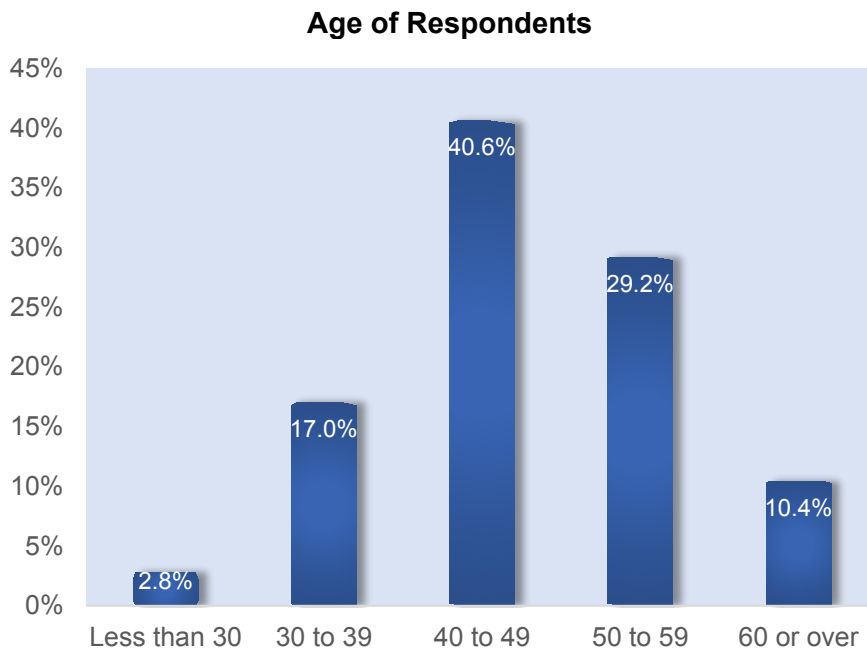
Age of Respondents

Figure 14. Age of Respondents (n=106)

Figure 14 shows that the majority (69.8%) of respondents are between the ages of 40 and 59.

Gender of Respondents
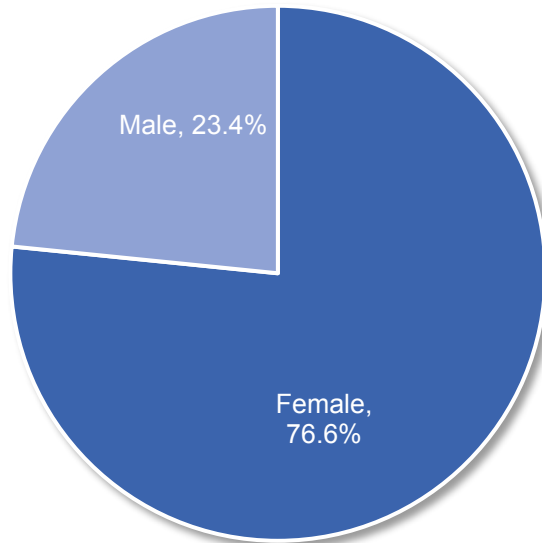
Figure 15. Gender of Respondents (n=107)

Figure 15 shows that most (76.6%) respondents were female.

Percent of Time Spent
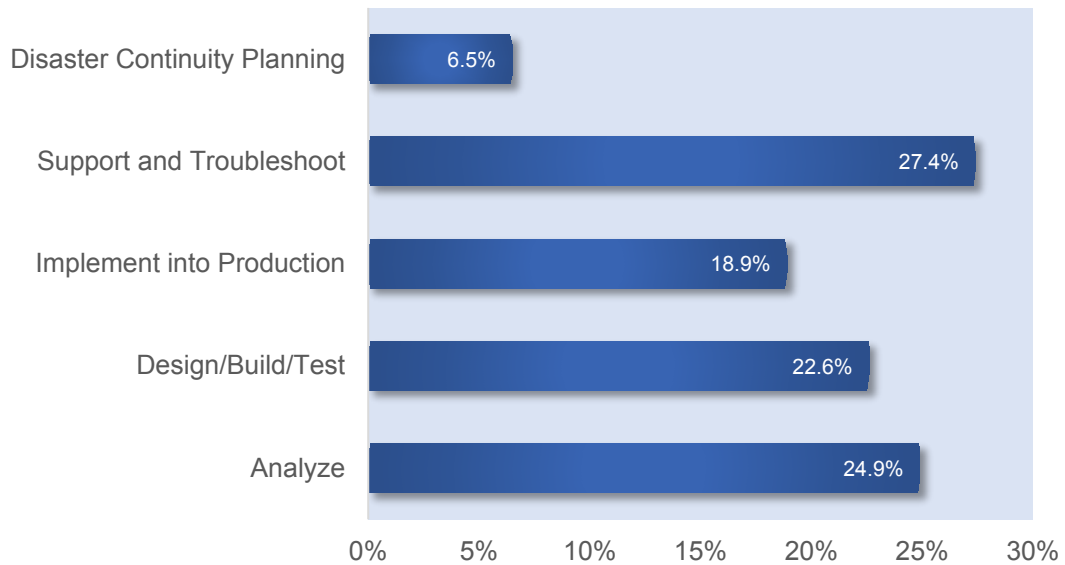
Figure 16. Percent of Time Spent

At the end of the survey, survey respondents were asked to indicate the percent of their time spent in different roles. As shown in *Figure 16*, respondents reported over one-half of their time was spent in support or troubleshoot and analyze.

Respondents were asked to what extent they thought the task and knowledge/skill inventory adequately covered the important job tasks and required knowledge in their role. *Figure 17* below shows that nearly all (98.9%) respondents stated that the task inventory adequately or completely covered the essential job tasks. *Figure 18* shows that all (100%) respondents felt that the Knowledge/Skill inventory adequately covered all knowledge requirements that underlie essential job tasks.

Task Inventory Adequacy
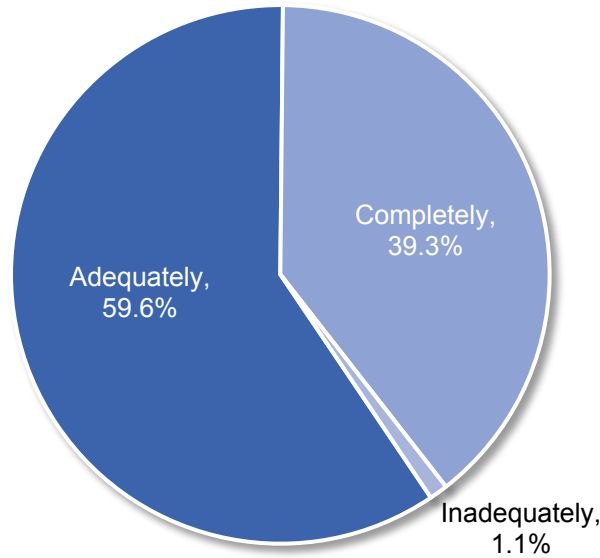
Figure 17. Task Inventory Adequacy (n=89)

Knowledge/Skill Inventory Adequacy
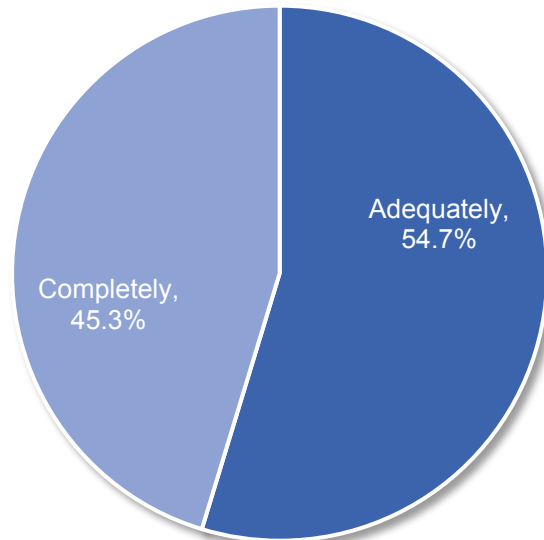
Figure 18. Knowledge/Skill Inventory Adequacy (n=86)

Mean Task Ratings and Percent Performing

To determine which tasks were more significant and performed by respondents, descriptive data were calculated for each task (see Appendices C – E). Additionally, for each task, the frequency of those who selected each significance rating was calculated. The purpose of these data was to determine which tasks would remain on the final content outline.

For example, task 1 (Perform current workflow and process analysis) had a mean significance rating of 2.37. Five (5) respondents provided a "not applicable for my role" or "0" rating for the task. The tasks presented in Appendix C are sorted in the order they appear on the survey. Tasks presented in Appendix D are sorted in ascending order by the frequency of respondents who do perform the task. Appendix E provides the same descriptive information as Appendices C and D, but the tasks were sorted in ascending mean significance order.

Table 3. Summary of Mean Significance Task Ratings

Significance Value Label	Mean Values Range	Frequency	Percent
Very Significant	2.50 – 3.00	1	1.5
Significant	1.50 – 2.49	64	98.5
Minimally Significant	1.00 – 1.49	0	0.0
	Total	65	100.0

The significance scale had values ranging from 1 (Minimally Significant) to 3 (Very Significant). A summary of the ratings for the significance scale for task ratings is shown above in Table 3. None of the average task ratings were rated as "Minimally Significant." All the task ratings were rated at least "Significant" by respondents (mean significance rating of at least 1.50).

The AC reviewed the data for each task. They concluded that the ratings obtained from the Job Analysis survey were in agreement with their judgments about the job. Consequently, the AC also concluded that the survey data adequately defined the profession on a national basis. Moreover, the AC judged the results sufficient for the purpose of delineating the structure and content of a national certification examination.

It is critical that the test specifications reflect the responsibilities of the broadly defined population who might be eligible to take the examination. Therefore, it was vital to ensure that the test specifications and resulting examination content included tasks considered important to job success by those for whom the examination was intended. While developing the test specifications, the AC used their collective judgment to interpret the survey results and ensure that the content of the examination was appropriate for a national sample from a variety of backgrounds.

As indicated previously, Appendices D and E show mean significance ratings and percent performed for each task across the whole sample. Appendices F-K show mean task significance ratings for sample subgroups. The AC was encouraged to consider how best to limit the content eligible for the test specifications to only the broadly performed and significant tasks. Therefore, the AC adopted 8 decision rules to identify tasks *ineligible* for assessment, as summarized in Table 4.

Table 4. Decision Rules

Appendix	Variable		Number and Description of Decision Rule*	Threshold
D	Percent Not Performing	1	Keep only those tasks performed by at least 71.5% of the respondents.	"Not Performed" rating >28.5
E	Mean Rating	2	Keep only those tasks rated by respondents as at threshold.	2.00
F	Region	3	Keep only those tasks rated at least at threshold by 3 out of 4 subgroups.	1.90
G	Years of Experience	4	Keep only those tasks rated at least at threshold by 3 out of 3 subgroups.	1.90
H	Degree	5	Keep only those tasks rated at least at threshold by 3 out of 3 subgroups.	1.90
I	Certifications Held	6	Keep only those tasks rated at least at threshold by 6 out of 6 subgroups.	1.85
J	Level in Organization	7	Keep only those tasks rated at least at threshold by all 4 out of 4 subgroups.	1.85
K	Number of Employees	8	Keep only those tasks rated at least at threshold by 3 out of 3 subgroups.	1.90

Note: To account for error in the mean ratings based on this sample of respondents, means for all tasks were evaluated for inclusion/exclusion within the 95% confidence interval (1.86-2.14) for each variable.

Making Decision Rules Operational

Having judged that the sample sufficiently represented the population, the AC applied the following criteria to implement its decision rules.

Rule 1. *Keep only tasks performed by 71.5% or more of respondents.*
Tasks with "not performed" rating frequencies of more than 28.5% were considered ineligible. Applying this rule eliminated 10 tasks (T63: Perform disaster drills on a regular basis; T62: Maintain disaster plan hardware; T65: Create device management documentation; T64: Validate redundancy systems; T33: Install hardware and software; T60: Identify how disaster plans relate to one another; T17: Build the product; T26: Develop back-out plan; T59: Participate in defining a disaster plan for specific work enviornments; T58: Provide input on policies and procedures related to risk management).

Rule 2. *Keep only tasks rated at least Significant (2.00) by respondents.*
Realizing that error occurs in every measurement, the AC defined the lower boundary of Quite Significant as a mean rating of 2.00 for tasks. They examined all tasks within a 95% confidence interval (2.00 ± 2* standard errors of .096) for inclusion. Applying this rule did not eliminate any additional tasks.

Rule 3.   *Keep only tasks rated at least Significant (1.90) by 3 out of 4 region subgroups (Northeast, Midwest, South, West).*

Because healthcare compliance professionals across the country should endorse the content of a nationally applied examination, the task ratings were examined by geographic region. Therefore, the AC defined a mean importance rating of 1.90 (+/- 2 SEs) for tasks by 3 out of 4 location subgroups as criteria. Applying this rule eliminate one additional task (T38: Implement changes to hardware).

Rule 4.   *Keep only tasks rated at least Significant (1.90) by 3 out of 3 years of experience subgroups (0-5 years, 6-16 years, and 17 or more years).*

Because professionals with different years of experience may view the job differently, the AC examined task ratings by years of experience. The AC defined a mean significance rating of 1.90 (+/- 2 SEs) for tasks for 3 out of 3 subgroups as the criteria. Applying this rule did not eliminate any additional tasks.

Rule 5.   *Keep only tasks rated at least Significant (1.90) 3 out 3 by all levels in the organization subgroups (High School thru associates, baccalaureate, or master's +).*

Because professionals at different educational levels in the organization may view the job differently, the AC examined task ratings by level of education in the organization for all 3 subgroups as the criteria. Applying this rule did not eliminate any additional tasks.

Rule 6.   *Keep only tasks rated at least Significant (1.85) by 6 out of 6 certifications held subgroups (CP, IM, IS, PW, TR, and TS).*

Because professionals at with various types of certifications may view the job differently, the AC examined task ratings by level in the organization. The AC defined a mean significance rating of 1.85 (+/- 2 SEs) for tasks for 6 out of 6 subgroups as the criteria. Applying this rule did not eliminate any additional tasks.

Rule 7.   *Keep only tasks rated at least Significant (1.85) by 3 out of 4 primary job levels. (Director/Executive, Manager, Technical, and Other).*

Because professionals with different levels of experience may view the job differently, the AC examined task ratings by level of experience. The AC defined a mean significance rating of 1.90 (+/- 2 SEs) for tasks for 3 out of 4 subgroups as the criteria. Applying this rule did not eliminate any additional tasks.

Rule 8.   *Keep only tasks rated at least Significant (1.90) by 3 out of 3 number of employees subgroups (Less than 100, 101 to 1,000, and more than 1,000).*

Because professionals at different sized institutions may view the job differently, the AC examined task ratings by level of education. The AC defined a mean significance rating of 1.90 (+/- 2 SEs) for tasks for 2 out of 3 subgroups as the criteria. Applying this rule did not eliminate any additional tasks.

The elimination of all but one task (T61: Comply with security protocols) in content category 5: Disaster Continuity Planning caused some discussion among the AC. The AC decided to create a new task statement that essentially covers all aspects of the seven eliminated tasks. This newly created task intended to replace the seven eliminated tasks was "Participate in disaster management". Further, the AC decided to incorporate the two surviving tasks into content category 4 (4. Support and Troubleshoot) thus eliminating the need for content category 5.

After all decision rules were applied, the AC reviewed and considered all respondent comments, no tasks were removed.

Table 5 presents information used by the AC to determine the number of items for each of the major areas of practice. The goal was to distribute items in accordance with observed working patterns across the major content areas. Respondent data were used to suggest a starting point for the content experts. The AC discussed the respondents' time spent in the five content domains and considered their time spent as how the items should be distributed. The AC decided to start with the respondent's response to percentage of time spent in each of the major domains, and make adjustments based on their expert opinion.

Table 5. Respondent Time Spent

What percentage of your time in the Technical Role is spent in each of these areas?

	N	Min.	Max.	Mean	SD
1. Analyze	80	1	100	24.9	17.9
2. Design/Build/Test	79	0	60	22.6	13.9
3. Implement into Production	80	0	80	18.9	14.0
4. Support and Troubleshoot	82	0	75	27.4	16.8
~~5. Disaster Continuity Planning[1]~~	~~78~~	~~0~~	~~30~~	~~6.5~~	~~6.6~~

Cognitive Complexity

After the number of items was determined for each major domain, the next step involved defining the cognitive complexity of the content domain. A complexity scale was used to determine at what cognitive level individual tasks were performed. The information provided a basis for matching test item complexity to job complexity. The AC discussed each task in each section and considered the typical complexity of task performance using the descriptions described in Table 6. They then determined a distribution for each major category by the cognitive categories of recall, application, and analysis, using Table 7 as a guideline. The AC then finalized the exact distribution based on its experience and perceptions about each major content domain.

Section and task complexity is based on Bloom's *Taxonomy of Educational Objectives* (1956, pp. 201-207) and follows:

[1] Not considered since this category was removed.

Table 6. Cognitive Complexity Scale

Recall	Requires only the identification, recall, or recognition of isolated information, such as specific facts, generalizations, concepts, principles, or procedures. The information generally does not vary relative to the situation.
Application	Requires comprehension, interpretation, or manipulation of limited concepts or data, in which the response or outcome is situationally dependent, but not overly complex (e.g., application of knowledge which varies based on patient characteristics and environment). Activities that require candidates to recognize elements and relationships among data and to classify, explain, or differentiate are usually application level.
Analysis	Requires the integration or synthesis of a variety of concepts or elements to solve a specific problem situation (e.g., evaluating and rendering judgments on complex problems with many situational variables).

Table 7. General Guidelines for Item Distribution by Cognitive Level based on Mean Cognitive Level by Major Content Domain

	<1.45	<2.05	<2.45	>2.449
Recall	100%	40%	20%	20%
Application	0%	60%	60%	20%
Analysis	0%	0%	20%	60%

Test Specifications

The AC reviewed 55 tasks that remained eligible for the examination, assigned cognitive levels to each, and determined the number of items in each category to develop the final detailed content outline. To determine the allocation of content, the AC members expressed independent judgments about the percentage of the examination that should be allocated to the five major domains (content areas) on the examination. They were asked to consider the mean percentage of time in the domains indicated by the survey respondents (Table 5), the number of tasks in each content area, the breadth of those tasks, as well as the mean importance of the tasks expressed by the survey respondents. After discussion, the AC agreed upon the percentage of the examination to be allocated to each area. The AC then considered whether 100 items would be sufficient to adequately sample the content, and they concluded it was not. After discussion, the AC decided that a 125-item examination sufficiently samples the content domain to render a pass or fail decision based on examination scores. The resulting examination matrix and detailed content outline will be used by AHIMA to assemble future examination forms. An overview of the final test specifications is shown in Table 8. The full specifications, including the final detailed content outline, is presented in Appendix M. Test developers, item writers, and the Examination Committee will use the test specifications and detailed content outline to build future forms of the examination.

Table 8. CHTS-TS Test Specifications

Content Area	Cognitive Level			Total
	Recall	Application	Analysis	
1. Analyze	4	15	6	**25**
2. Design/Build/Test	7	13	15	**35**
3. Implement into Production	4	14	7	**25**
4. Support and Troubleshoot	9	22	9	**40**
Total	**24**	**64**	**37**	**125**

Knowledge/Skill Areas

In addition to the task inventory, survey respondents were asked to rate the significance of eighty knowledge/skill statements identified by the AC. The eighty knowledge/skill statements were organized into the following four major domains:

1. Technical Knowledge: Health Data Management
2. Technical Knowledge: Health Information Technology & Systems
3. Non-Technical Knowledge: Hard Skills
4. Non-Technical Knowledge: Soft Skills

To determine which knowledge/skill statements were rated more significant by respondents, descriptive data grouped by CHTS role was calculated for each statement (see Appendix L). The purpose of these data was to determine which tasks would remain on the final content outlines. The AC developed and used an exclusion decision rule to identify knowledge/skill statements appropriate as supplemental information to the examination content outline. Of the 80 knowledge/skill statements on the original survey, 3 statements were excluded based on the following exclusion criterion.

Rule 1   *Keep only tasks rated at least Significant (1.70) by respondents.*
Applying this rule eliminated three statements. (K45: Ergonomics, K48: Human resource management, K50: Inferential statistics).

One purpose of the knowledge/skill statements is to provide guidance to the item writers/exam committee. As such, the AC decided to use priority designations (low, medium, or high) to provide some additional detail on the level of emphasis for each knowledge/skill statement. Table 9 below shows the criteria used by the AC when assigning level of priority to each statement. Full details of the final list of knowledge/skill statements sorted by priority can be viewed in Appendix M, after the task inventory.

Table 9. Knowledge/Skill Statement Thresholds

Mean Threshold	Priority
if mean > 1.995	High
if mean is 1.90 to 1.99	Medium
if mean is < 1.90	Low
if mean is < 1.70	Not included[2]

[2] Unless included by unanimous AC vote due to its importance.

Conclusions

The Job Analysis described in this report was undertaken to provide evidence supporting content valid inferences from examination scores. The study was conducted to determine and comprehensively describe the job of the healthcare technology specialists in a Technical Role, to evaluate this description through the ratings of job experts, and to define areas that should be assessed in CHTS-TS examination.

The AHIMA formed the AC, who prepared a comprehensive list of tasks describing the job. A representative sample of job experts completed the survey. The AC reviewed the survey results and used the survey ratings to develop test specifications directly related to the significant tasks that the healthcare technology specialists perform. These test specifications will be used to ensure the examination is current and job-related. Each future form of the examination will contain the specified number of items distributed across the content areas. Because each test form will be developed to match these job-related test specifications, valid content-related inferences can be drawn about candidates' abilities to perform the job of the healthcare technology specialist in a Technical Role.

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Appendix A. Job Analysis Survey

**Welcome to the Job Analysis Survey for
Healthcare Technology Specialists**

This survey will be used to help define the content for the Certified Healthcare Technology Specialist (CHTS) Exams. You will be asked demographic questions about your background and profession, and then asked to rate tasks, knowledge and skills that may be applicable to your work. Your ratings will provide information about the requirements related to the effective job performance as a healthcare technology specialist.

The survey should take approximately 15 minutes to complete. You will be able to close the survey and begin again where you left off if you do not complete the survey in one session.

If you experience any technical difficulties, please email: AHIMAJASurvey@goamp.com.

This survey is being conducted by American Health Information Management Association (AHIMA).

Please click 'Next' below to begin the survey.

Role Description

The CHTS certification program intends to assess basic competency of individuals who are seeking to demonstrate their proficiency in certain health IT workforce roles integral to the implementation and management of electronic health information in *one or more* of these roles:

- Assess workflows
- Manage projects
- Select hardware and software
- Work with vendors or users
- Install or test systems
- Diagnose IT problems
- Train practice staff on systems

Demographics

Please answer the following questions about your background. This information is confidential and will be used only to analyze the data across different groups of respondents (e.g., respondents from different geographical region; respondents with different level of education).

Please indicate the location of the facility in which you primarily work.

Is the facility in which you work located in a rural, suburban, or urban area?

○ Rural

○ Suburban

○ Urban

Which of the following best describes your primary job level category?

○ Executive/President/Vice President   ○ Business Analyst

○ Director (HIM, HIT, etc.)/Officer   ○ System Administrator

○ Professor/Educator   ○ Tech Implementation Analyst/Specialist

○ Manager/Supervisor   ○ Technical Support Analyst/Specialist

○ Consultant   ○ HIM Technician Role (e.g., coder)

○ Clinician (MD, RN)   ○ Clerical/Administrative support

○ IT Project Manager   ○ Not currently working

○ Other (please specify)

Demographics

How many years of relevant work experience related to this role do you have?

[   ]

What is the HIGHEST level of education you have completed?

- ( ) High School Diploma/GED
- ( ) 1-year Certificate Program
- ( ) 2-year Certificate Program
- ( ) Associate's Degree
- ( ) Baccalaureate Degree

- ( ) Master's Degree
- ( ) Professional Doctorate Degree (e.g., PT, PharmD, JD, DVM)
- ( ) PhD or EdD
- ( ) MD, DO, DNP, or DDS

Did your education include healthcare/medicine or information technology?

- ( ) Healthcare/Medicine
- ( ) Information Technology
- ( ) Both
- ( ) Neither

Do you hold the CHTS credential?

( ) Yes ( ) No

Demographics

How many years have you held the CHTS credential?

☐

Which of these CHTS certifications do you hold?

Select all that apply.

☐ CP

☐ IM

☐ IS

☐ PW

☐ TR

☐ TS

Demographics

What other certifications do you hold?

Select all that apply.

☐ CAHIMS/CPHIMS   ☐ CHPS

☐ CCA   ☐ CMUP/CMUA

☐ CCS   ☐ CPC

☐ CCS-P   ☐ RHIA

☐ CHDA   ☐ RHIT

☐ Other (please specify)

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[                                        ]
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What licenses do you hold?

Select all that apply.

☐ APRN (NP or CNS)   ☐ MD

☐ DO   ☐ PA

☐ LPN/LVN   ☐ RN

☐ LVT/RVT   ☐ LCSW

☐ Other (please specify)

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[                                        ]
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Demographics

Which of the following best describes your primary work setting?

◯ Ambulatory care facility	◯ Managed care HMO/PPO office
◯ Behavioral health facility	◯ Mental health facility
◯ Billing agency	◯ Military health facility
◯ Consultant/vendor EHR/HIM/IT services	◯ Multi-hospital/diversified system
◯ Correspondence company	◯ Outpatient/ambulatory surgery center
◯ Educational institution	◯ Pharma/medical device/biotech manufacturer
◯ Government/public health agency	◯ Physician's office/medical group practice
◯ Health information exchange organization	◯ Professional or trade association
◯ Home healthcare agency	◯ Regional Extension Center (REC)
◯ Hospice	◯ Rehabilitation facility
◯ Hospital	◯ Transcription company
◯ Insurance company/payer	◯ Urgent care center (freestanding emergency care center)
◯ Jail/corrections facility	◯ Vendor EHR/HIM software products
◯ Law firm	◯ Veterinary practice
◯ Long-term care facility	

Approximately how many employees are in your organization?

◯ Less than 10	◯ 101 to 500
◯ 11 to 50	◯ 501 to 1000
◯ 51 to 100	◯ More than 1000

Demographics

Optional Questions

What is your age?

◯ Less than 30

◯ 30 to 39

◯ 40 to 49

◯ 50 to 59

◯ 60 or over

With which sex do you identify?

◯ Female

◯ Male

CHTS Technical Role

CHTS Technical Role:

Individuals in this role provide on-site user support for implementation and maintenance of health IT systems in healthcare settings. The background of workers in this role may include information technology, information management, or informatics. The CHTS Technical Role includes:

- Executing implementation project plans by installing hardware (as needed) and configuring software to meet practice needs
- Incorporating usability principles into design and implementation
- Testing the software against performance specifications
- Interacting with vendors as needed to rectify problems that occur during the deployment process
- Interacting with end users to diagnose IT problems and implement solutions
- Documenting IT problems and evaluating the effectiveness of problem resolution
- Supporting systems security and standards

Does this role describe you?

◯ Yes

◯ No

Task Rating Scale Instructions

Please use the scale shown below to express your judgment of the **significance of each task as it applies to your current role in the health IT workforce**.

Not applicable for my role
Minimally significant
Significant
Very significant

Please consider whether this task is performed in your current role in the health IT workforce; if you do not need to deal with the task, select "not applicable for my role." If you do need to have the knowledge related to the task, select the rating corresponding to how significant it is to your role in healthcare IT workforce.

Technical Role Tasks

Please indicate the significance of each task as it applies to your current role in the health IT workforce.

Analyze

	Not applicable for my role	Minimally significant	Significant	Very significant
1. Perform current workflow and process analysis	◯	◯	◯	◯
2. Perform a current-state assessment	◯	◯	◯	◯
3. Identify end-user needs and expectations	◯	◯	◯	◯
4. Inventory current hardware and software	◯	◯	◯	◯
5. Inventory network infrastructure	◯	◯	◯	◯
6. Evaluate future processes, hardware, and software needs	◯	◯	◯	◯
7. Perform gap analysis	◯	◯	◯	◯
8. Identify the problem areas	◯	◯	◯	◯
9. Identify interface and interoperability requirements (e.g., ancillary systems)	◯	◯	◯	◯
10. Translate user's request into system capabilities	◯	◯	◯	◯

Technical Role Tasks

Please indicate the significance of each task as it applies to your current role in the health IT workforce.

Design/Build/Test

	Not applicable for my role	Minimally significant	Significant	Very significant
11. Define user requirements	○	○	○	○
12. Apply role-based user access as defined	○	○	○	○
13. Develop technical specifications	○	○	○	○
14. Develop interface specifications	○	○	○	○
15. Create technical knowledge database	○	○	○	○
16. Document workflow changes	○	○	○	○
17. Build the product	○	○	○	○
18. Define testing requirements	○	○	○	○
19. Develop test script	○	○	○	○
20. Assemble users to participate in functionality testing	○	○	○	○
21. Perform functionality testing of hardware and software	○	○	○	○
22. Identify and remediate testing and build issues	○	○	○	○
23. Develop new tools or features within the product	○	○	○	○
24. Redesign workflow as warranted by need/issue	○	○	○	○
25. Validate standardized operating procedures	○	○	○	○
26. Develop back-out plan (i.e., "go-no go" plan)	○	○	○	○
27. Participate in go-live planning	○	○	○	○
28. Participate in contingency planning	○	○	○	○
29. Participate in down-time planning	○	○	○	○

Technical Role Tasks

Please indicate the significance of each task as it applies to your current role in the health IT workforce.

Implement into Production

	Not applicable for my role	Minimally significant	Significant	Very significant
30. Develop a training plan and documentation (e.g., functional user guides)	◯	◯	◯	◯
31. Participate in delivery of training	◯	◯	◯	◯
32. Develop a scope of work and timeline for installation	◯	◯	◯	◯
33. Install hardware and software	◯	◯	◯	◯
34. Serve as liaison with vendors and users	◯	◯	◯	◯
35. Perform functionality testing of the installed hardware and software	◯	◯	◯	◯
36. Identify resources for support activities	◯	◯	◯	◯
37. Participate in a transition meeting	◯	◯	◯	◯
38. Implement changes to hardware	◯	◯	◯	◯
39. Implement release changes to software	◯	◯	◯	◯
40. Document changes to hardware and software	◯	◯	◯	◯

Technical Role Tasks

Please indicate the significance of each task as it applies to your current role in the health IT workforce.

Support and Troubleshoot

	Not applicable for my role	Minimally significant	Significant	Very significant
41. Monitor system performance (e.g., error reports) on a defined schedule	◯	◯	◯	◯
42. Perform troubleshooting	◯	◯	◯	◯
43. Research, respond, and document issues from end-users	◯	◯	◯	◯
44. Conduct a "lessons-learned" meeting	◯	◯	◯	◯
45. Implement change control process	◯	◯	◯	◯
46. Identify upgrade requirements	◯	◯	◯	◯
47. Participate in on-going status meetings	◯	◯	◯	◯
48. Track user issues to establish trends	◯	◯	◯	◯
49. Identify and track enhancement requests	◯	◯	◯	◯
50. Evaluate effectiveness of enhancements	◯	◯	◯	◯
51. Participate in change-control process	◯	◯	◯	◯
52. Institute audit/version control for changes	◯	◯	◯	◯
53. Review release notes (e.g., updates)	◯	◯	◯	◯
54. Perform mock upgrades in the test environment	◯	◯	◯	◯
55. Perform technical analysis for test patches, enhancement and/or upgrades	◯	◯	◯	◯
56. Communicate with end-users regarding changes or modifications	◯	◯	◯	◯
57. Update patching, enhancement, and upgrade specification documentation	◯	◯	◯	◯

Technical Role Tasks

Please indicate the significance of each task as it applies to your current role in the health IT workforce.

Disaster Continuity Planning

	Not applicable for my role	Minimally significant	Significant	Very significant
58. Provide input on policies and procedures related to risk management	◯	◯	◯	◯
59. Participate in defining a disaster plan for specific work environments	◯	◯	◯	◯
60. Identify how disaster plans relate to one another	◯	◯	◯	◯
61. Comply with security protocols (e.g., cyber security, biometrics, HIPAA compliance)	◯	◯	◯	◯
62. Maintain disaster plan hardware	◯	◯	◯	◯
63. Perform disaster drills on a regular basis	◯	◯	◯	◯
64. Validate redundancy systems	◯	◯	◯	◯
65. Create device management documentation (e.g., mobile, IT restrictions, equipment inventory)	◯	◯	◯	◯

Technical Role Tasks

How well do you feel the task list covered the important job tasks in the Technical Role?

( ) Completely

( ) Adequately

( ) Inadequately (please specify why)

[   ]

Were any important job tasks in the Technical Role omitted from the survey?

[   ]

What percent of your time in the Technical Role is spent in each of these area?
Please type your numeric response below (i.e., 25, not 25%). Your choices must sum to 100.

Analyze	[ ]
Design/Build/Test	[ ]
Implement into Production	[ ]
Support and Troubleshoot	[ ]
Disaster Continuity Planning	[ ]

Knowledge and Skills Rating Scale Instructions

Please use the scale shown below to express your judgment of the **significance of each knowledge/skill as it applies to your current role in the health IT workforce**.

Not applicable for my role
Minimally significant
Significant
Very significant

Please consider whether this knowledge is used in your current role in the health IT workforce; if you do not need the knowledge, select "not applicable for my role." If you do need to have the knowledge, select the rating corresponding to how significant it is to your role in healthcare IT workforce.

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Technical Knowledge: Health Data Management

	Not applicable for my role	Minimally significant	Significant	Very significant
1. Data analysis	○	○	○	○
2. Health care delivery systems	○	○	○	○
3. Health care regulation	○	○	○	○
4. Health care revenue cycle	○	○	○	○
5. Health informatics	○	○	○	○
6. Health information management concepts & principles	○	○	○	○
7. Diagnostic and procedural coding (e.g., ICD-CM/PCS, CPT, HCPCS)	○	○	○	○
8. Information governance	○	○	○	○
9. Meaningful use	○	○	○	○
10. Medical sciences	○	○	○	○
11. Medical terminology	○	○	○	○

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Technical Knowledge: Health Information Technology & Systems

	Not applicable for my role	Minimally significant	Significant	Very significant
12. Audio/visual skills (e.g., LCD projector)	○	○	○	○
13. Computer systems	○	○	○	○
14. Database structures (e.g., SQL)	○	○	○	○
15. EHR/EMR/PHR principles	○	○	○	○
16. Flowchart applications	○	○	○	○
17. General hardware maintenance	○	○	○	○
18. Health information exchange	○	○	○	○
19. Health information systems	○	○	○	○
20. Health IT applications	○	○	○	○
21. HL7	○	○	○	○
22. Implementation life cycle	○	○	○	○
23. Interface integration	○	○	○	○
24. Interoperability	○	○	○	○

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Technical Knowledge: Health Information Technology & Systems (Continued)

	Not applicable for my role	Minimally significant	Significant	Very significant
25. IT fundamentals	◯	◯	◯	◯
26. IT security principles	◯	◯	◯	◯
27. Network technology (e.g., VPN, cloud-based)	◯	◯	◯	◯
28. Platforms and operating systems (e.g., Windows, Mac, Linux, Mobile devices)	◯	◯	◯	◯
29. PC skills (e.g., Microsoft Office, internet)	◯	◯	◯	◯
30. Performance improvement	◯	◯	◯	◯
31. Peripheral devices (e.g., printers)	◯	◯	◯	◯
32. Servers	◯	◯	◯	◯
33. Software development life cycle	◯	◯	◯	◯
34. Standard technical language	◯	◯	◯	◯
35. Technical specs (hardware, software)	◯	◯	◯	◯
36. Writing test scripts	◯	◯	◯	◯

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Non-Technical Knowledge: Hard Skills

	Not applicable for my role	Minimally significant	Significant	Very significant
37. Accreditation standards	○	○	○	○
38. Adult learning principles	○	○	○	○
39. Basic statistics	○	○	○	○
40. Best practices	○	○	○	○
41. Budget management	○	○	○	○
42. Change management	○	○	○	○
43. Clinical and operations workflow	○	○	○	○
44. Consumerism and marketing	○	○	○	○
45. Ergonomics	○	○	○	○
46. Facilitation skills	○	○	○	○
47. Gov't agencies associated with healthcare	○	○	○	○
48. Human resource management	○	○	○	○
49. Industry trends	○	○	○	○
50. Inferential statistics	○	○	○	○
51. Legal and ethical issues	○	○	○	○
52. Nomenclatures	○	○	○	○

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Non-Technical Knowledge: Hard Skills (Continued)

	Not applicable for my role	Minimally significant	Significant	Very significant
53. Operations management	○	○	○	○
54. Organizational structure	○	○	○	○
55. Process improvement	○	○	○	○
56. Project management	○	○	○	○
57. Public health	○	○	○	○
58. Quality control	○	○	○	○
59. Quality improvement	○	○	○	○
60. Quality of patient care	○	○	○	○
61. Report writing principles	○	○	○	○
62. Resource management	○	○	○	○
63. Risk management	○	○	○	○
64. Simulation technology	○	○	○	○
65. Telehealth and telemedicine	○	○	○	○
66. Training methodologies	○	○	○	○
67. Virtual training or meeting tools	○	○	○	○
68. Work flow improvement & management	○	○	○	○

Knowledge and Skills

Please indicate the significance of each knowledge/skill as it applies to your current role in the health IT workforce.

Non-Technical Knowledge: Soft Skills

	Not applicable for my role	Minimally significant	Significant	Very significant
69. Analytical skills	○	○	○	○
70. Communication skills (written & oral)	○	○	○	○
71. Conflict resolution	○	○	○	○
72. Cultural competency	○	○	○	○
73. Culture of health care	○	○	○	○
74. Issue management	○	○	○	○
75. Leadership	○	○	○	○
76. Linguistic competency	○	○	○	○
77. Organizational culture	○	○	○	○
78. Presentation skills	○	○	○	○
79. Time management	○	○	○	○
80. Working with teams	○	○	○	○

Knowledge and Skills

How well do you feel the knowledge and skills list covered the important knowledge and skills in your role?

○ Completely

○ Adequately

○ Inadequately (please specify why)

Were any important knowledge and skills omitted from the survey?

Thank you

Thank You for Completing the Job Analysis Survey for
Healthcare Technology Specialists

If you have any additional questions or comments about this survey, please e-mail:
AHIMAJASurvey@goamp.com

Appendix B. Job Analysis Survey Demographics

CHTS Technical (N=109)

Table 1. Please indicate the location of the facility in which you primarily work.

	Frequency	Percent
FL	13	12.3
TX	10	9.4
MD	8	7.5
CA	7	6.6
NY	6	5.7
OH	5	4.7
GA	4	3.8
NC	4	3.8
NJ	4	3.8
DC	3	2.8
KS	3	2.8
KY	3	2.8
LA	3	2.8
MA	3	2.8
SC	3	2.8
VA	3	2.8
IL	2	1.9
MN	2	1.9

	Frequency	Percent
MO	2	1.9
PA	2	1.9
TN	2	1.9
WI	2	1.9
AL	1	.9
AR	1	.9
AZ	1	.9
CT	1	.9
HI	1	.9
ME	1	.9
MI	1	.9
MS	1	.9
ND	1	.9
NM	1	.9
OK	1	.9
PR	1	.9
Total	106	100.0

Table 2. Region

	Frequency	Percent
A	10	9.8
B	17	16.7
C	47	46
D	28	27.5
Total	102	100.0

Region A: AK, CO, ID, MT, ND, OR, SD, UT, WA, WY,AZ, CA, HI, NV
Region B: IL, IN, IA, KS, MI, MN, MO, NE, OH, WI
Region C: AL, AR, FL, GA, KY, LA, MS, NM, NC, OK, SC, TN, TX
Region D: CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA, WV

Table 2B. Regions grouped for subgroups

	Geographic Region
A	West
B	Midwest
C	South
D	East

Table 3. Is the facility in which you work located in a rural, suburban, or urban area?

	Frequency	Percent
Rural	21	19.3
Suburban	33	30.3
Urban	55	50.5
Total	109	100.0

Table 4. Which of the following best describes your primary job level category?

	Frequency	Percent
1.Director (HIM, HIT, etc.)/Officer	13	11.9
2.Manager/Supervisor	12	11.0
3.Technical Support Analyst/Specialist	12	11.0
3.Tech Implementation Analyst/Specialist	11	10.1
4.Consultant	10	9.2
4.System Administrator	8	7.3
3.IT Project Manager	7	6.4
4.Business Analyst	6	5.5
4.Professor/Educator	3	2.8
4.Clinician (MD, RN)	2	1.8
4.HIM Technician Role (e.g., coder)	2	1.8
4.Clerical/Administrative support	2	1.8
1.Executive/President/Vice President	1	.9
4.Not currently working	5	4.6
4.Other (please specify)	15	13.8
Total	109	100.0

Table 4B. Primary job level for subgroups

	Frequency	Percent
Director/Executive	14	12.9
Manager	12	11
Technical	30	27.5
Other	53	48.6
Total	109	100

Table 5. How many years of relevant work experience related to this role do you have?

Mean: 12.0 years

SD: 8.6 years	Frequency	Percent	Cumulative Percent	SD: 8.6 years	Frequency	Percent	Cumulative Percent
.0	1	1.1	1.1	16.0	2	2.2	72.2
1.0	1	1.1	2.2	17.0	1	1.1	73.3
2.0	3	3.3	5.6	18.0	2	2.2	75.6
3.0	6	6.7	12.2	19.0	3	3.3	78.9
4.0	5	5.6	17.8	20.0	6	6.7	85.6
4.5	1	1.1	18.9	21.0	2	2.2	87.8
5.0	12	13.3	32.2	23.0	3	3.3	91.1
6.0	4	4.4	36.7	25.0	2	2.2	93.3
7.0	6	6.7	43.3	26.0	1	1.1	94.4
8.0	3	3.3	46.7	27.0	1	1.1	95.6
10.0	6	6.7	53.3	28.0	1	1.1	96.7
11.0	3	3.3	56.7	30.0	1	1.1	97.8
12.0	2	2.2	58.9	36.0	1	1.1	98.9
13.0	2	2.2	61.1	45.0	1	1.1	100.0
14.0	2	2.2	63.3	Total	90	100.0	
15.0	6	6.7	70.0				

Table 5B. Years of experience for subgroups

	Frequency	Percent
0 – 5	29	32.2
6 – 15	34	37.8
16 +	27	30.0
Total	90	100.0

Table 6. What is the HIGHEST level of education you have completed?

	Frequency	Percent	Cumulative Percent
High School Diploma/GED	5	4.6	4.6
1-year Certificate Program	9	8.3	13.0
2-year Certificate Program	4	3.7	16.7
Associate's Degree	15	13.9	30.6
Baccalaureate Degree	36	33.3	63.9
Master's Degree	36	33.3	97.2
PhD or EdD	2	1.9	99.1
MD, DO, DNP, or DDS	1	.9	100.0
Total	108	100.0	

Level 1: High School Diploma/GED, 1-year Certification program, 2-year certification program, Associates degree
Level 2: Baccalaureate degree
Level 3: Master's degree, PhD, EdD, MD, DO, DNP, or DDS

Table 6B. Highest level of education for subgroups

	Frequency	Percent
Level 1	33	30.6
Level 2	36	33.3
Level 3	39	36.1
Total	108	100

Table 7. Did your education include healthcare/medicine or information technology?

	Frequency	Percent
Healthcare/Medicine	17	15.6
Information Technology	21	19.3
Both	51	46.8
Neither	20	18.3
Total	109	100.0

Table 8. Do you hold the CHTS credential?

	Frequency	Percent
Yes	107	99.1
No	1	.9
Total	108	100.0

Table 9. If yes - How many years have you held the CHTS credential?
Mean: 3.3 years

SD: 1.2 years	Frequency	Percent	Cumulative Percent
0	1	1.0	1.0
1	5	4.9	5.9
2	15	14.7	20.6
3	39	38.2	58.8
4	29	28.4	87.3
5	10	9.8	97.1
6	1	1.0	98.0
7	2	2.0	100.0
Total	102	100.0	

Table 10. If yes - Which of these CHTS certifications do you hold? (Select all that apply.) (N=109)

	Frequency	Percent
PW	36	33.3
IM	34	31.5
IS	24	22.2
TR	18	16.7
TS	18	16.7
CP	16	14.8
Total	146	135.2

Table 10B.

	Yes	No
PW	36	73
IM	34	75
IS	24	85
TR	18	91
TS	18	91
CP	16	93
Total	146	

Table 11. What other certifications do you hold? (Select all that apply.) (N=43)

	Frequency	Percent
RHIA	23	53.5
RHIT	11	25.6
CAHIMS/CPHIMS	7	16.3
CCS	6	14.0
CPC	5	11.6
CHDA	2	4.7
CCA	1	2.3
CHPS	1	2.3
Total	56	130.2

Table 12. What licenses do you hold? (Select all that apply.) (N=11)

	Frequency	Percent
RN	7	63.6
LPN/LVN	2	18.2
MD	1	9.1
LCSW	1	9.1
Total	11	100.0

Table 13. Which of the following best describes your primary work setting?

	Frequency	Percent
Hospital	29	26.9
Physician's office/medical group practice	14	13.0
Consultant/vendor EHR/HIM/IT services	12	11.1
Multi-hospital/diversified system	12	11.1
Ambulatory care facility	11	10.2
Behavioral health facility	4	3.7
Vendor EHR/HIM software products	4	3.7
Educational institution	3	2.8
Government/public health agency	3	2.8
Insurance company/payer	2	1.9
Long-term care facility	2	1.9
Managed care HMO/PPO office	2	1.9
Billing agency	1	.9
Health information exchange organization	1	.9
Home healthcare agency	1	.9
Hospice	1	.9
Mental health facility	1	.9
Professional or trade association	1	.9
Rehabilitation facility	1	.9
Transcription company	1	.9
Urgent care center (freestanding emergency care center)	1	.9
Veterinary practice	1	.9
Total	108	100.0

Table 14. Approximately how many employees are in your organization?

	Frequency	Percent	Cumulative Percent
Less than 100	25	23.1	23.1
101 to 1000	34	31.5	54.6
More than 1001	49	45.4	100
Total	108	100.0	

Table 15. What is your age?

	Frequency	Percent
Less than 30	3	2.8
30 to 39	18	17.0
40 to 49	43	40.6
50 to 59	31	29.2
60 or over	11	10.4
Total	106	100.0

Table 16. With which sex do you identify?

	Frequency	Percent
Female	82	76.6
Male	25	23.4
Total	107	100.0

Table 17. Task Coverage

	Frequency	Percent
Adequately	53	59.6
Completely	35	39.3
Inadequately (please specify why)	1	1.1
Total	89	100.0

Table 18. Knowledge Statement Coverage

	Frequency	Percent
Adequately	47	54.7
Completely	39	45.3
Total	86	100.0

Table 19. What percent of your time in the Technical Role is spent in each of these area?

	N	Min.	Max.	Mean	SD
Analyze	80	1	100	24.9	17.9
Design/Build/Test	79	0	60	22.6	13.9
Implement into Production	80	0	80	18.9	14.0
Support and Troubleshoot	82	0	75	27.4	16.8
Disaster Continuity Planning	78	0	30	6.5	6.6

Table 20. Reliability - Task

		Reliability (consistency)		
		Between Tasks	Between Respondents	# of
Survey Subsection	N	(Coefficient Alpha)	(Intraclass Correlation)	Tasks
Analyze	98	0.926	0.976	10
Design/Build/Test	92	0.950	0.948	19
Implement into Production	93	0.902	0.963	11
Support and Troubleshoot	91	0.955	0.901	17
Disaster Continuity Planning	90	0.911	0.977	8
Total	83	0.981	0.959	65

Table 21. Reliability – Knowledge Statement

		Reliability (consistency)		
		Between Topics	Between Respondents	# of
Survey Subsection	N	(Coefficient Alpha)	(Intraclass Correlation)	Topics
Technical Knowledge: Health Data Management	82	0.915	0.944	11
Technical Knowledge: Health Information Technology & Systems	83	0.949	0.956	25
Non-Technical Knowledge: Hard Skills	82	0.965	0.960	32
Non-Technical Knowledge: Soft Skills	85	0.926	0.939	12
Total	73	0.980	0.954	80

Demographic Questions (Open-ended Question Responses)

Which of the following best describes your primary job level category? – Other (please specify)

1. Account Manager
2. and Systems Administrator for our EHR
3. Application Analyst
4. Auditer
5. CDI Specialist
6. clinical analyst
7. Clinical Applications Analyst (Build and Support)
8. Clinical Data Analyst
9. Clinical Documentation Specialist
10. Clinical Informaticist
11. Clinical IT
12. Clinical Nurse Educator
13. Clinical System Analyst
14. Clinician (RN) working as a Tech Implementation/Support Analyst/Specialist
15. Coder
16. coding compliance auditor
17. Combination of IT PM and System Administrator
18. Credentialed Epic Trainer
19. Demand Management Analyst
20. Director of Finance in a Department
21. Director, Audits and Special Projects
22. Epic Trainer
23. Graduate Medical Education Residency Program Coord
24. health information exchange
25. HIM Assistant Director
26. HIM Educator
27. HIT Adviser on the Iowa Health Information Network IHIN
28. I am an RN in a Neonatal Intensive Care Unit
29. Informatics Manager
30. Joint Venture Integration Manager
31. Meaningful Use and Performance (i.e. Quality) Specialist
32. Medical Transcriptionist
33. NLU Adoptions Specialist
34. Nurse Informaticist
35. PCMH Manager
36. Performance Mangement Specialist/currrently installing EPIC
37. Physician Coding Educator Liaison
38. Practice Coach
39. Programmer analyst
40. Programmer, not Healthcare related

41. Project Coordinator
42. Project Manager (2)
43. Quality
44. Quality abstractor
45. receptionist
46. Reimbursement Coordinator
47. Revenue Cycle specialist
48. RN Clinical App analyst, implement clinical programs process
49. Strategist (Informatics Strategist)
50. telehealth clinical technician
51. Trainer (3)

What other certifications do you hold? - Other (please specify)

1. A+, Network+, Epic ASAP, Medical Assistant, Emergency Medical Technician
2. AAPC
3. Administrative Assistant
4. ANCC Board Certification - Nursing Informatic
5. Approved AHIMA ICD-10 trainer
6. BPMP
7. CASCC, CRC
8. CBCS, CHI, CMAA, CERHS
9. CBCS, CMAA, CHI, CEHRS
10. CCDS, CDIP, CIC, COC
11. CCHT
12. CCMA
13. CCRN
14. CDIP (3)
15. CDIP, CCDS
16. CEHRS
17. Certified Health Education Specialist (CHES)
18. Certified Healthcare Compliance (CHC)
19. Certified Training Generalist
20. CHAM
21. CHC (3)
22. CHDS (2)
23. CHDS (Certified Healthcare Documentation Specialist (AHDI)
24. CHDS, CPEHR
25. CHP
26. CHTS-CP
27. CHTS-IM (2)
28. CIT
29. COC (5)
30. Comptia A+ and Network +
31. CompTIA A+ and Network+
32. CompTIA Healthcare
33. CPA, EA, QPA
34. CPC
35. CPC-I
36. CPHIE, CPEHR, CPHIT
37. CPHQ (8)
38. CPHQ, CHCA
39. CPHT
40. CPMA, CEMC,
41. CPMSS; CPCS
42. CPRP
43. CPT - phlebotomy
44. CRC CDM CFPP CPhT
45. CRCR
46. CSBI, LSSGB
47. CSM
48. CSM, CSPO, Ahima approved icd-10 cm trainer
49. CSSBB
50. CSSYB
51. CTR
52. CVRN, PCMH-CCE
53. EPIC Certifications
54. EPIC's Epiccare Ambulatory and MyChart Certifications
55. ERMp
56. Health Information Security Professional
57. HIPAA - CHTS certification expired
58. ICD 10 CM AND PCS TRAINER APRROVAL
59. Informatics Nurse
60. McIT
61. MCSE, MCSA
62. MHA, CHPQ, FNAHQ, FAHIMA
63. Midas+ Certified System Manager
64. mos
65. NetSmart System Administrator
66. NextGen Certified Professional (NCP)
67. OCSA
68. PMP (6)
69. PMP, scrum
70. Post Bacc. Paralegal certificate
71. PRO-TS
72. Project+
73. RAC-CT
74. RN Board Certified - Informatics
75. RN-BC
76. RN-BC, CDIP, CCDS
77. RNC-NIC, IBCLC
78. Security+, Healthcare IT Technician, A+, Network+
79. Six sigma yellow belt
80. SSMBB, CPHQ, PCMH CCE
81. will be sitting for RHIA exam soon

What licenses do you hold? - Other (please specify)

1. CCDS
2. CERTIFICATE IN HEALTH INFORMATION TECH
3. Certified Pharmacy Tech
4. Clinical Laboratory Assistant
5. CMT
6. CNM
7. coa
8. CPA
9. EMT-A (former)
10. EMT-P
11. formerly EMT/Paramedic credential retired
12. Health Life & Accident
13. Licensed Nursing Home Administrator
14. LMT
15. Medical Assistant
16. Medical interpreter
17. PharmD
18. PMP
19. PMP, Scrum
20. Property & Causality Insurance License
21. RHIT
22. RRT PCT
23. RT
24. RT(R)(CT)
25. RTR

Survey Comments

Survey Adequacy
How well do you feel the task list covered the important job tasks in the Technical Role? - Inadequately (please specify why)

(None)

Were any important job tasks in the Technical Role omitted from the survey?

1. I primarily do build, and participate in projects. rarely do I project manage.
2. I think perhaps I could endorse emphasis on Server Management, HL7, Interface design (assuming its a vendor supported system with a receiver and processor to do insert / update) and Interface Management (almost all of them have errors that need to be traced out/resolved somehow). For example, a basic definition of interface parts: The Messages, the HL7 format, some of the basic HL7 message types and segnments, sending applications (ususally part of the software), Interface Engines (usually owned by the organization), receivers, and processors (the parts that insert into the database) would be really nice.   Also, if the role warrants, "interoperability assessments" with other systems and data is extremely critical.
3. I think there is always an element of monitoring compliance to regulations and government programs.
4. Migration planning and lean six sigma for process stability
5. There may need to be a differentiation between Hardware and Software/Application support.
6. Tracking and evaluating emerging technology

How well do you feel the knowledge and skills list covered the important knowledge and skills in your role? - Inadequately (please specify why)

1. I am not employed in the healthcare industry. I do not have experience, in spite of my certification.
2. I feel like the questions were geared toward a healthcare delivery facility employee or contractor. It is frustrating that AHIMA focuses so much attention at hospitals when there are so many other areas of health IT.
3. I haven't used any of the knowledge and skills yet. I can't really answer the questions. I haven't found any job requires or need to use the knowledge.
4. not currently employed.
5. The certification is a joke that no one recognizes.
6. This is a clerical role.

Were any important knowledge and skills omitted from the survey?

1. AHIMA CEU Grab.
2. Continuing education
3. How to develop a continuing educational program to continue to make yourself relevant to the ever changing HIT environment.
4. I believe those of us who are professional, accredited coders have been required to attain and demonstrate so many more skills and informational competencies.This survey is very general and really could benefit by focusing on specific HIM roles. What exactly is the point of this survey?
5. I was a systems analyst when I obtained the CHTS credential. At that time, the credential was very relevant to my job. I have since retired and do coding on a per diem basis. The CHTS credential is not relevant to my current role.
6. Just a comment. I hope that AHIMA does not eliminate the CP designation from the CHTS credential. It is valuable to demonstrate expertise in front end data capture and how data are then extracted from the system for reporting purposes. I just think that is getting lost in the shuffle.
7. Keeping up with current technology
8. Literature reviews
9. multitasking problem solving business ethics
10. need an option in the beginning that says N/A for not currently employed.
11. negotiations
12. No, my issue is getting to use the skills I have.
13. Public health
14. Quality Reporting Programs - VPPM, PQRS, MIPS
15. The questions about Projectors, Microsoft office and PC skills are way out of line. Those are basic competencies to the other skill sets listed; akin to being able to read and write before entering high school... It should be more like "Basic PC and User Profile management"...

Appendix C. Task Ratings in Survey Order

Task Ratings and Percent Performing in Task Order

No.	Task Statement	N	Mean	SE	SD	% Perform
T1	1. Perform current workflow and process analysis	99	2.37	0.069	0.67	95.0
T2	2. Perform a current-state assessment	99	2.27	0.077	0.74	93.9
T3	3. Identify end-user needs and expectations	98	2.57	0.060	0.58	95.9
T4	4. Inventory current hardware and software	99	2.08	0.090	0.76	72.7
T5	5. Inventory network infrastructure	99	2.04	0.106	0.78	54.6
T6	6. Evaluate future processes, hardware, and software needs	99	1.96	0.092	0.84	84.9
T7	7. Perform gap analysis	99	2.11	0.086	0.77	81.8
T8	8. Identify the problem areas	99	2.37	0.073	0.70	95.0
T9	9. Identify interface and interoperability requirements (e.g., ancillary systems)	99	2.18	0.078	0.72	87.9
T10	10. Translate user's request into system capabilities	99	2.42	0.072	0.70	93.9
T11	11. Define user requirements	95	2.32	0.077	0.73	94.7
T12	12. Apply role-based user access as defined	95	2.33	0.075	0.71	92.6
T13	13. Develop technical specifications	95	2.04	0.093	0.78	74.7
T14	14. Develop interface specifications	95	1.84	0.083	0.68	71.6
T15	15. Create technical knowledge database	95	1.96	0.091	0.76	72.6
T16	16. Document workflow changes	94	2.31	0.075	0.70	93.6
T17	17. Build the product	94	2.05	0.109	0.84	62.8
T18	18. Define testing requirements	95	2.09	0.083	0.73	81.1
T19	19. Develop test script	95	1.96	0.092	0.76	71.6
T20	20. Assemble users to participate in functionality testing	95	2.04	0.091	0.81	83.2
T21	21. Perform functionality testing of hardware and software	94	2.29	0.083	0.77	90.4
T22	22. Identify and remediate testing and build issues	94	2.28	0.081	0.73	86.2
T23	23. Develop new tools or features within the product	95	2.04	0.095	0.78	71.6
T24	24. Redesign workflow as warranted by need/issue	95	2.23	0.083	0.77	91.6
T25	25. Validate standardized operating procedures	95	2.21	0.083	0.75	86.3
T26	26. Develop back-out plan (i.e., "go-no go" plan)	95	1.92	0.091	0.73	66.3
T27	27. Participate in go-live planning	95	2.46	0.075	0.70	91.6
T28	28. Participate in contingency planning	95	2.29	0.087	0.77	83.2
T29	29. Participate in down-time planning	95	2.13	0.091	0.82	84.2
T30	30. Develop a training plan and documentation (e.g., functional user guides)	94	2.23	0.079	0.74	93.6
T31	31. Participate in delivery of training	94	2.22	0.086	0.79	90.4
T32	32. Develop a scope of work and timeline for installation	93	2.23	0.088	0.76	80.7
T33	33. Install hardware and software	94	1.90	0.115	0.81	53.2
T34	34. Serve as liaison with vendors and users	94	2.44	0.070	0.66	94.7
T35	35. Perform functionality testing of the installed hardware and software	94	2.26	0.083	0.78	93.6
T36	36. Identify resources for support activities	94	2.16	0.080	0.73	87.2
T37	37. Participate in a transition meeting	94	2.19	0.080	0.75	94.7
T38	38. Implement changes to hardware	94	1.93	0.112	0.82	57.5
T39	39. Implement release changes to software	94	2.14	0.097	0.81	73.4
T40	40. Document changes to hardware and software	94	2.04	0.091	0.80	81.9
T41	41. Monitor system performance (e.g., error reports) on a defined schedule	92	2.11	0.097	0.84	80.4
T42	42. Perform troubleshooting	92	2.41	0.078	0.70	89.1

No.	Task Statement	N	Mean	SE	SD	% Perform
T43	43. Research, respond, and document issues from end-users	92	2.46	0.074	0.68	92.4
T44	44. Conduct a "lessons-learned" meeting	92	2.10	0.085	0.75	84.8
T45	45. Implement change control process	92	2.03	0.086	0.76	84.8
T46	46. Identify upgrade requirements	92	2.20	0.088	0.77	82.6
T47	47. Participate in on-going status meetings	92	2.30	0.075	0.70	94.6
T48	48. Track user issues to establish trends	92	2.20	0.073	0.67	91.3
T49	49. Identify and track enhancement requests	92	2.13	0.087	0.79	90.2
T50	50. Evaluate effectiveness of enhancements	92	2.20	0.083	0.75	88.0
T51	51. Participate in change-control process	92	2.22	0.081	0.73	90.2
T52	52. Institute audit/version control for changes	92	1.99	0.092	0.77	76.1
T53	53. Review release notes (e.g., updates)	92	2.25	0.085	0.79	92.4
T54	54. Perform mock upgrades in the test environment	92	2.29	0.094	0.80	78.3
T55	55. Perform technical analysis for test patches, enhancement and/or upgrades	92	2.13	0.102	0.85	76.1
T56	56. Communicate with end-users regarding changes or modifications	92	2.42	0.074	0.68	92.4
T57	57. Update patching, enhancement, and upgrade specification documentation	91	2.16	0.097	0.81	76.9
T58	58. Provide input on policies and procedures related to risk management	92	1.93	0.091	0.78	80.4
T59	59. Participate in defining a disaster plan for specific work environments	92	1.97	0.099	0.80	71.7
T60	60. Identify how disaster plans relate to one another	92	1.81	0.102	0.77	62.0
T61	61. Comply with security protocols (e.g., cyber security, biometrics, HIPAA compliance)	92	2.30	0.082	0.74	90.2
T62	62. Maintain disaster plan hardware	92	1.64	0.117	0.76	45.7
T63	63. Perform disaster drills on a regular basis	91	1.68	0.115	0.73	44.0
T64	64. Validate redundancy systems	92	1.76	0.106	0.71	48.9
T65	65. Create device management documentation (e.g., mobile, IT restrictions, equipment inventory)	91	1.86	0.108	0.71	47.3

Appendix D. Task Ratings in Descending Percent Not Performing Order

Task Ratings in Ascending Percent Performing Order

No.	Task Statement	N	Mean	SE	SD	% Perform
T63	63. Perform disaster drills on a regular basis	91	1.68	0.115	0.73	44.0
T62	62. Maintain disaster plan hardware	92	1.64	0.117	0.76	45.7
T65	65. Create device management documentation (e.g., mobile, IT restrictions, equipment inventory)	91	1.86	0.108	0.71	47.3
T64	64. Validate redundancy systems	92	1.76	0.106	0.71	48.9
T33	33. Install hardware and software	94	1.90	0.115	0.81	53.2
T5	5. Inventory network infrastructure	99	2.04	0.106	0.78	54.6
T38	38. Implement changes to hardware	94	1.93	0.112	0.82	57.5
T60	60. Identify how disaster plans relate to one another	92	1.81	0.102	0.77	62.0
T17	17. Build the product	94	2.05	0.109	0.84	62.8
T26	26. Develop back-out plan (i.e., "go-no go" plan)	95	1.92	0.091	0.73	66.3
T14	14. Develop interface specifications	95	1.84	0.083	0.68	71.6
T19	19. Develop test script	95	1.96	0.092	0.76	71.6
T23	23. Develop new tools or features within the product	95	2.04	0.095	0.78	71.6
T59	59. Participate in defining a disaster plan for specific work environments	92	1.97	0.099	0.80	71.7
T15	15. Create technical knowledge database	95	1.96	0.091	0.76	72.6
T4	4. Inventory current hardware and software	99	2.08	0.090	0.76	72.7
T39	39. Implement release changes to software	94	2.14	0.097	0.81	73.4
T13	13. Develop technical specifications	95	2.04	0.093	0.78	74.7
T52	52. Institute audit/version control for changes	92	1.99	0.092	0.77	76.1
T55	55. Perform technical analysis for test patches, enhancement and/or upgrades	92	2.13	0.102	0.85	76.1
T57	57. Update patching, enhancement, and upgrade specification documentation	91	2.16	0.097	0.81	76.9
T54	54. Perform mock upgrades in the test environment	92	2.29	0.094	0.80	78.3
T41	41. Monitor system performance (e.g., error reports) on a defined schedule	92	2.11	0.097	0.84	80.4
T58	58. Provide input on policies and procedures related to risk management	92	1.93	0.091	0.78	80.4
T32	32. Develop a scope of work and timeline for installation	93	2.23	0.088	0.76	80.7
T18	18. Define testing requirements	95	2.09	0.083	0.73	81.1
T7	7. Perform gap analysis	99	2.11	0.086	0.77	81.8
T40	40. Document changes to hardware and software	94	2.04	0.091	0.80	81.9
T46	46. Identify upgrade requirements	92	2.20	0.088	0.77	82.6
T20	20. Assemble users to participate in functionality testing	95	2.04	0.091	0.81	83.2
T28	28. Participate in contingency planning	95	2.29	0.087	0.77	83.2
T29	29. Participate in down-time planning	95	2.13	0.091	0.82	84.2
T44	44. Conduct a "lessons-learned" meeting	92	2.10	0.085	0.75	84.8
T45	45. Implement change control process	92	2.03	0.086	0.76	84.8
T6	6. Evaluate future processes, hardware, and software needs	99	1.96	0.092	0.84	84.9
T22	22. Identify and remediate testing and build issues	94	2.28	0.081	0.73	86.2
T25	25. Validate standardized operating procedures	95	2.21	0.083	0.75	86.3
T36	36. Identify resources for support activities	94	2.16	0.080	0.73	87.2
T9	9. Identify interface and interoperability requirements (e.g., ancillary systems)	99	2.18	0.078	0.72	87.9
T50	50. Evaluate effectiveness of enhancements	92	2.20	0.083	0.75	88.0

No.	Task Statement	N	Mean	SE	SD	% Perform
T42	42. Perform troubleshooting	92	2.41	0.078	0.70	89.1
T49	49. Identify and track enhancement requests	92	2.13	0.087	0.79	90.2
T51	51. Participate in change-control process	92	2.22	0.081	0.73	90.2
T61	61. Comply with security protocols (e.g., cyber security, biometrics, HIPAA compliance)	92	2.30	0.082	0.74	90.2
T21	21. Perform functionality testing of hardware and software	94	2.29	0.083	0.77	90.4
T31	31. Participate in delivery of training	94	2.22	0.086	0.79	90.4
T48	48. Track user issues to establish trends	92	2.20	0.073	0.67	91.3
T24	24. Redesign workflow as warranted by need/issue	95	2.23	0.083	0.77	91.6
T27	27. Participate in go-live planning	95	2.46	0.075	0.70	91.6
T43	43. Research, respond, and document issues from end-users	92	2.46	0.074	0.68	92.4
T53	53. Review release notes (e.g., updates)	92	2.25	0.085	0.79	92.4
T56	56. Communicate with end-users regarding changes or modifications	92	2.42	0.074	0.68	92.4
T12	12. Apply role-based user access as defined	95	2.33	0.075	0.71	92.6
T16	16. Document workflow changes	94	2.31	0.075	0.70	93.6
T30	30. Develop a training plan and documentation (e.g., functional user guides)	94	2.23	0.079	0.74	93.6
T35	35. Perform functionality testing of the installed hardware and software	94	2.26	0.083	0.78	93.6
T2	2. Perform a current-state assessment	99	2.27	0.077	0.74	93.9
T10	10. Translate user's request into system capabilities	99	2.42	0.072	0.70	93.9
T47	47. Participate in on-going status meetings	92	2.30	0.075	0.70	94.6
T11	11. Define user requirements	95	2.32	0.077	0.73	94.7
T34	34. Serve as liaison with vendors and users	94	2.44	0.070	0.66	94.7
T37	37. Participate in a transition meeting	94	2.19	0.080	0.75	94.7
T1	1. Perform current workflow and process analysis	99	2.37	0.069	0.67	95.0
T8	8. Identify the problem areas	99	2.37	0.073	0.70	95.0
T3	3. Identify end-user needs and expectations	98	2.57	0.060	0.58	95.9

Appendix E. Task Ratings in Ascending Mean Task Rating Order

Task Ratings in Ascending Mean Task Rating Order

No.	Task Statement	N	Mean	SE	SD	% Perform
T62	62. Maintain disaster plan hardware	92	1.64	0.117	0.76	45.7
T63	63. Perform disaster drills on a regular basis	91	1.68	0.115	0.73	44.0
T64	64. Validate redundancy systems	92	1.76	0.106	0.71	48.9
T60	60. Identify how disaster plans relate to one another	92	1.81	0.102	0.77	62.0
T14	14. Develop interface specifications	95	1.84	0.083	0.68	71.6
T65	65. Create device management documentation (e.g., mobile, IT restrictions, equipment inventory)	91	1.86	0.108	0.71	47.3
T33	33. Install hardware and software	94	1.90	0.115	0.81	53.2
T26	26. Develop back-out plan (i.e., "go-no go" plan)	95	1.92	0.091	0.73	66.3
T38	38. Implement changes to hardware	94	1.93	0.112	0.82	57.5
T58	58. Provide input on policies and procedures related to risk management	92	1.93	0.091	0.78	80.4
T6	6. Evaluate future processes, hardware, and software needs	99	1.96	0.092	0.84	84.9
T15	15. Create technical knowledge database	95	1.96	0.091	0.76	72.6
T19	19. Develop test script	95	1.96	0.092	0.76	71.6
T59	59. Participate in defining a disaster plan for specific work environments	92	1.97	0.099	0.80	71.7
T52	52. Institute audit/version control for changes	92	1.99	0.092	0.77	76.1
T45	45. Implement change control process	92	2.03	0.086	0.76	84.8
T5	5. Inventory network infrastructure	99	2.04	0.106	0.78	54.6
T13	13. Develop technical specifications	95	2.04	0.093	0.78	74.7
T20	20. Assemble users to participate in functionality testing	95	2.04	0.091	0.81	83.2
T23	23. Develop new tools or features within the product	95	2.04	0.095	0.78	71.6
T40	40. Document changes to hardware and software	94	2.04	0.091	0.80	81.9
T17	17. Build the product	94	2.05	0.109	0.84	62.8
T4	4. Inventory current hardware and software	99	2.08	0.090	0.76	72.7
T18	18. Define testing requirements	95	2.09	0.083	0.73	81.1
T44	44. Conduct a "lessons-learned" meeting	92	2.10	0.085	0.75	84.8
T7	7. Perform gap analysis	99	2.11	0.086	0.77	81.8
T41	41. Monitor system performance (e.g., error reports) on a defined schedule	92	2.11	0.097	0.84	80.4
T29	29. Participate in down-time planning	95	2.13	0.091	0.82	84.2
T49	49. Identify and track enhancement requests	92	2.13	0.087	0.79	90.2
T55	55. Perform technical analysis for test patches, enhancement and/or upgrades	92	2.13	0.102	0.85	76.1
T39	39. Implement release changes to software	94	2.14	0.097	0.81	73.4
T36	36. Identify resources for support activities	94	2.16	0.080	0.73	87.2
T57	57. Update patching, enhancement, and upgrade specification documentation	91	2.16	0.097	0.81	76.9
T9	9. Identify interface and interoperability requirements (e.g., ancillary systems)	99	2.18	0.078	0.72	87.9
T37	37. Participate in a transition meeting	94	2.19	0.080	0.75	94.7
T46	46. Identify upgrade requirements	92	2.20	0.088	0.77	82.6
T48	48. Track user issues to establish trends	92	2.20	0.073	0.67	91.3
T50	50. Evaluate effectiveness of enhancements	92	2.20	0.083	0.75	88.0
T25	25. Validate standardized operating procedures	95	2.21	0.083	0.75	86.3
T31	31. Participate in delivery of training	94	2.22	0.086	0.79	90.4

No.	Task Statement	N	Mean	SE	SD	% Perform
T51	51. Participate in change-control process	92	2.22	0.081	0.73	90.2
T24	24. Redesign workflow as warranted by need/issue	95	2.23	0.083	0.77	91.6
T30	30. Develop a training plan and documentation (e.g., functional user guides)	94	2.23	0.079	0.74	93.6
T32	32. Develop a scope of work and timeline for installation	93	2.23	0.088	0.76	80.7
T53	53. Review release notes (e.g., updates)	92	2.25	0.085	0.79	92.4
T35	35. Perform functionality testing of the installed hardware and software	94	2.26	0.083	0.78	93.6
T2	2. Perform a current-state assessment	99	2.27	0.077	0.74	93.9
T22	22. Identify and remediate testing and build issues	94	2.28	0.081	0.73	86.2
T21	21. Perform functionality testing of hardware and software	94	2.29	0.083	0.77	90.4
T28	28. Participate in contingency planning	95	2.29	0.087	0.77	83.2
T54	54. Perform mock upgrades in the test environment	92	2.29	0.094	0.80	78.3
T47	47. Participate in on-going status meetings	92	2.30	0.075	0.70	94.6
T61	61. Comply with security protocols (e.g., cyber security, biometrics, HIPAA compliance)	92	2.30	0.082	0.74	90.2
T16	16. Document workflow changes	94	2.31	0.075	0.70	93.6
T11	11. Define user requirements	95	2.32	0.077	0.73	94.7
T12	12. Apply role-based user access as defined	95	2.33	0.075	0.71	92.6
T1	1. Perform current workflow and process analysis	99	2.37	0.069	0.67	95.0
T8	8. Identify the problem areas	99	2.37	0.073	0.70	95.0
T42	42. Perform troubleshooting	92	2.41	0.078	0.70	89.1
T10	10. Translate user's request into system capabilities	99	2.42	0.072	0.70	93.9
T56	56. Communicate with end-users regarding changes or modifications	92	2.42	0.074	0.68	92.4
T34	34. Serve as liaison with vendors and users	94	2.44	0.070	0.66	94.7
T27	27. Participate in go-live planning	95	2.46	0.075	0.70	91.6
T43	43. Research, respond, and document issues from end-users	92	2.46	0.074	0.68	92.4
T3	3. Identify end-user needs and expectations	98	2.57	0.060	0.58	95.9

Appendix F. Mean Significance Ratings for Tasks by Region

Task Ratings by Region

The "C" column shows the count of subclasses with mean significance less than 1.90.

No.	West N	West Mean	West SE	Midwest N	Midwest Mean	Midwest SE	Southeast N	Southeast Mean	Southeast SE	Northeast N	Northeast Mean	Northeast SE	C*
T1	9	2.44	0.176	15	2.47	0.165	42	2.31	0.116	22	2.32	0.138	0
T2	9	2.33	0.236	15	2.33	0.187	40	2.18	0.123	23	2.26	0.157	0
T3	9	2.22	0.222	16	2.63	0.125	42	2.57	0.091	22	2.77	0.091	0
T4	7	1.86	0.261	10	2.20	0.200	34	2.06	0.133	17	2.18	0.214	1
T5	5	2.20	0.374	8	1.88	0.227	25	2.00	0.163	12	2.17	0.241	1
T6	7	2.14	0.261	13	2.08	0.211	38	1.95	0.136	21	1.86	0.210	1
T7	6	2.33	0.333	15	2.27	0.182	36	2.00	0.144	18	2.06	0.171	0
T8	9	2.44	0.242	16	2.38	0.180	42	2.33	0.111	22	2.41	0.157	0
T9	7	2.43	0.202	15	2.07	0.182	40	2.25	0.117	20	2.15	0.182	0
T10	7	2.29	0.286	16	2.31	0.176	42	2.45	0.103	22	2.41	0.170	0
T11	8	2.13	0.295	16	2.25	0.171	40	2.38	0.111	20	2.30	0.193	0
T12	7	2.14	0.261	15	2.20	0.175	40	2.28	0.113	20	2.50	0.170	0
T13	7	2.00	0.378	11	2.09	0.211	31	2.03	0.135	16	2.00	0.224	0
T14	6	1.83	0.307	12	1.75	0.179	32	1.94	0.127	14	1.71	0.194	3
T15	5	2.00	0.447	11	2.00	0.234	33	1.94	0.130	15	2.00	0.195	0
T16	8	2.25	0.250	16	2.19	0.188	39	2.36	0.107	19	2.26	0.185	0
T17	6	2.00	0.447	11	2.45	0.157	24	1.96	0.185	14	1.79	0.214	1
T18	6	2.33	0.333	16	2.13	0.180	32	2.13	0.125	18	1.89	0.196	1
T19	6	2.17	0.401	14	2.07	0.195	33	1.76	0.131	11	2.27	0.195	1
T20	7	1.86	0.261	14	2.00	0.210	35	2.14	0.137	18	1.94	0.221	1
T21	8	1.88	0.350	16	2.31	0.176	37	2.35	0.118	18	2.28	0.211	1
T22	7	2.00	0.309	16	2.38	0.180	36	2.25	0.115	17	2.35	0.209	0
T23	5	2.00	0.447	12	2.00	0.174	31	1.94	0.153	16	2.31	0.198	0
T24	7	2.14	0.340	16	2.06	0.170	38	2.18	0.135	20	2.40	0.169	0
T25	7	2.00	0.309	15	2.00	0.169	35	2.29	0.133	19	2.21	0.181	0
T26	5	2.20	0.200	11	1.73	0.141	29	1.86	0.155	14	2.07	0.195	2
T27	7	2.29	0.286	15	2.33	0.187	40	2.48	0.113	19	2.53	0.160	0
T28	6	2.17	0.307	13	2.15	0.222	36	2.39	0.121	19	2.16	0.206	0
T29	6	2.00	0.365	11	1.73	0.237	38	2.21	0.126	19	2.11	0.201	1
T30	8	2.00	0.267	15	2.20	0.175	38	2.32	0.126	21	2.14	0.159	0
T31	8	1.88	0.227	15	2.07	0.206	38	2.18	0.135	18	2.50	0.167	1
T32	7	2.14	0.340	13	2.15	0.191	33	2.36	0.129	18	2.06	0.189	0
T33	6	2.00	0.365	7	1.57	0.202	24	1.79	0.170	10	2.30	0.260	2
T34	8	2.38	0.263	16	2.31	0.151	40	2.50	0.107	19	2.37	0.157	0
T35	7	1.86	0.340	16	2.25	0.171	39	2.31	0.128	20	2.30	0.193	1
T36	7	2.00	0.309	13	1.92	0.178	36	2.17	0.129	20	2.30	0.164	0
T37	7	2.14	0.261	16	2.25	0.144	39	2.15	0.135	21	2.14	0.173	0
T38	7	1.86	0.340	6	2.17	0.167	25	1.88	0.167	13	1.92	0.265	2
T39	7	2.00	0.378	11	2.36	0.203	30	2.10	0.147	17	2.18	0.214	0
T40	7	1.86	0.404	12	1.92	0.193	37	2.00	0.129	16	2.25	0.214	1
T41	6	1.83	0.401	13	2.15	0.249	33	2.00	0.138	18	2.17	0.202	1
T42	7	2.43	0.297	13	2.62	0.140	37	2.32	0.117	19	2.42	0.176	0
T43	8	2.25	0.313	14	2.50	0.139	37	2.43	0.113	20	2.45	0.170	0
T44	7	2.00	0.309	15	1.80	0.175	34	2.09	0.129	16	2.31	0.198	1
T45	7	2.29	0.286	16	1.75	0.171	31	2.03	0.135	18	2.11	0.196	1
T46	7	2.00	0.378	15	1.93	0.182	32	2.19	0.138	16	2.50	0.158	0

No.	West			Midwest			Southeast			Northeast			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T47	7	2.14	0.261	16	2.50	0.129	38	2.29	0.119	20	2.15	0.182	0
T48	7	1.86	0.261	16	2.13	0.180	36	2.22	0.106	19	2.26	0.168	1
T49	7	2.43	0.297	15	1.93	0.182	36	2.08	0.134	19	2.05	0.195	0
T50	7	2.00	0.218	13	1.85	0.222	36	2.22	0.120	19	2.26	0.185	1
T51	7	2.43	0.297	16	2.06	0.170	34	2.18	0.123	20	2.25	0.190	0
T52	6	2.67	0.211	11	2.00	0.191	31	1.87	0.145	16	2.00	0.204	1
T53	7	2.57	0.202	14	2.14	0.206	37	2.32	0.129	21	1.95	0.189	0
T54	6	2.17	0.401	12	2.33	0.188	31	2.19	0.157	17	2.35	0.191	0
T55	5	2.20	0.374	10	1.80	0.249	34	2.06	0.152	16	2.38	0.202	1
T56	8	2.25	0.250	15	2.27	0.182	36	2.42	0.115	20	2.50	0.154	0
T57	6	2.00	0.447	8	1.88	0.227	33	2.18	0.134	18	2.11	0.212	1
T58	6	2.00	0.365	13	1.85	0.191	29	1.93	0.156	20	1.90	0.161	2
T59	6	2.17	0.307	7	2.00	0.309	29	1.93	0.156	18	1.83	0.185	1
T60	5	2.20	0.374	7	2.00	0.309	23	1.74	0.157	17	1.65	0.191	2
T61	7	2.43	0.297	15	2.27	0.182	36	2.31	0.131	20	2.20	0.172	0
T62	5	1.40	0.400	4	1.50	0.289	20	1.60	0.169	10	1.80	0.249	4
T63	4	1.75	0.479	5	1.60	0.245	20	1.65	0.167	9	1.56	0.242	4
T64	4	2.00	0.408	7	1.43	0.202	18	1.94	0.171	13	1.54	0.183	2
T65	4	2.00	0.408	5	1.80	0.200	21	1.67	0.144	10	2.20	0.249	2

Appendix G. Mean Significance Ratings for Tasks by Years of Work Experience

Task Ratings by Years of Work Experience

The "C" column shows the count of subclasses with mean significance less than 1.90.

No.	0 – 5 years			6 – 15 years			16 years or more			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T1	26	2.46	0.138	26	2.46	0.127	24	2.33	0.143	0
T2	25	2.32	0.150	26	2.38	0.148	24	2.21	0.147	0
T3	26	2.77	0.084	28	2.64	0.106	24	2.50	0.135	0
T4	21	2.00	0.183	21	2.14	0.173	18	2.17	0.167	0
T5	17	2.12	0.208	13	2.08	0.239	13	2.08	0.211	0
T6	25	1.88	0.176	23	2.04	0.194	18	2.17	0.185	1
T7	20	2.25	0.190	22	2.23	0.160	22	2.05	0.139	0
T8	25	2.48	0.131	28	2.25	0.142	24	2.46	0.134	0
T9	26	2.35	0.146	25	2.12	0.156	21	2.24	0.136	0
T10	26	2.50	0.139	27	2.37	0.152	22	2.50	0.127	0
T11	26	2.38	0.148	25	2.36	0.162	22	2.23	0.160	0
T12	25	2.40	0.129	24	2.17	0.155	21	2.43	0.163	0
T13	22	2.00	0.186	19	2.11	0.186	17	2.00	0.171	0
T14	23	1.96	0.160	17	1.59	0.173	16	2.00	0.129	1
T15	20	2.05	0.198	18	1.89	0.196	18	2.06	0.151	1
T16	25	2.52	0.131	23	2.35	0.149	22	2.14	0.151	0
T17	15	2.07	0.248	18	1.94	0.206	16	2.06	0.193	0
T18	22	2.05	0.154	21	2.05	0.189	20	2.30	0.128	0
T19	18	1.78	0.207	19	2.00	0.171	19	2.32	0.134	1
T20	22	1.95	0.167	23	2.09	0.188	18	2.06	0.189	0
T21	23	2.52	0.139	25	2.00	0.191	22	2.36	0.124	0
T22	25	2.24	0.166	21	2.33	0.187	21	2.38	0.129	0
T23	21	1.90	0.194	19	2.00	0.187	18	2.22	0.152	0
T24	25	2.20	0.163	25	2.28	0.147	21	2.29	0.171	0
T25	25	2.16	0.160	22	2.23	0.173	21	2.29	0.156	0
T26	16	1.94	0.170	18	1.78	0.173	17	2.18	0.176	1
T27	24	2.63	0.132	25	2.36	0.151	22	2.36	0.155	0
T28	22	2.36	0.181	23	2.35	0.173	20	2.35	0.150	0
T29	23	2.13	0.192	23	2.04	0.183	19	2.37	0.157	0
T30	24	2.50	0.147	25	2.36	0.140	21	2.00	0.154	0
T31	24	2.46	0.159	23	2.26	0.169	20	2.05	0.185	0
T32	22	2.45	0.171	24	2.29	0.153	15	2.13	0.192	0
T33	15	1.80	0.223	15	1.93	0.206	11	2.09	0.251	1
T34	24	2.63	0.132	26	2.50	0.127	22	2.23	0.130	0
T35	25	2.28	0.178	26	2.19	0.157	21	2.33	0.159	0
T36	24	2.17	0.167	24	2.29	0.153	19	2.05	0.162	0
T37	24	2.17	0.177	26	2.27	0.152	21	2.24	0.136	0
T38	14	1.86	0.231	18	1.89	0.212	11	2.09	0.251	2
T39	22	2.14	0.165	20	2.20	0.186	15	2.27	0.228	0
T40	20	2.10	0.176	22	1.95	0.180	20	2.25	0.160	0
T41	23	2.09	0.165	22	1.95	0.192	19	2.16	0.191	0

No.	0 – 5 years			6 – 15 years			16 years or more			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T42	23	2.43	0.138	24	2.38	0.157	22	2.32	0.153	0
T43	25	2.60	0.115	24	2.46	0.147	22	2.41	0.142	0
T44	21	1.95	0.176	23	2.26	0.157	20	2.15	0.167	0
T45	22	1.82	0.182	23	2.13	0.170	19	2.16	0.158	1
T46	21	2.10	0.181	22	2.41	0.157	19	2.16	0.175	0
T47	24	2.33	0.155	26	2.42	0.138	21	2.33	0.144	0
T48	24	2.21	0.147	24	2.33	0.143	21	2.19	0.131	0
T49	23	2.13	0.181	24	2.04	0.175	21	2.29	0.156	0
T50	22	2.23	0.146	23	2.22	0.177	21	2.29	0.156	0
T51	23	2.26	0.157	25	2.36	0.162	21	2.14	0.159	0
T52	19	2.11	0.169	20	2.05	0.185	18	1.94	0.189	0
T53	23	2.26	0.180	26	2.31	0.155	21	2.24	0.168	0
T54	18	2.44	0.185	21	2.29	0.197	19	2.37	0.157	0
T55	19	2.21	0.196	19	2.05	0.223	19	2.05	0.195	0
T56	25	2.48	0.131	25	2.52	0.131	21	2.33	0.159	0
T57	23	2.17	0.174	18	1.94	0.206	17	2.29	0.166	0
T58	21	1.95	0.176	20	2.20	0.172	19	1.84	0.191	1
T59	20	1.85	0.196	17	1.94	0.201	19	2.16	0.191	1
T60	17	1.59	0.193	15	1.87	0.165	16	1.94	0.232	2
T61	25	2.28	0.158	23	2.43	0.138	20	2.35	0.182	0
T62	14	1.64	0.225	9	1.67	0.236	11	1.91	0.251	2
T63	12	1.50	0.230	10	1.70	0.213	11	2.09	0.211	2
T64	15	1.53	0.165	11	1.82	0.226	10	2.20	0.200	2
T65	14	1.79	0.214	11	1.91	0.163	11	2.00	0.270	1

Appendix H. Mean Significance Ratings for Tasks by Highest Level of Education

Task Ratings by Highest Level of Education

The "C" column shows the count of subclasses with mean significance less than 1.90.

| No. | HS - Associate | | | Baccalaureate | | | Masters or above | | | C* |
	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T1	26	2.46	0.138	26	2.46	0.13	24	2.33	0.14	0
T2	25	2.32	0.150	26	2.38	0.15	24	2.21	0.15	0
T3	26	2.77	0.084	28	2.64	0.11	24	2.50	0.13	0
T4	21	2.00	0.183	21	2.14	0.17	18	2.17	0.17	0
T5	17	2.12	0.208	13	2.08	0.24	13	2.08	0.21	0
T6	25	1.88	0.176	23	2.04	0.19	18	2.17	0.19	1
T7	20	2.25	0.190	22	2.23	0.16	22	2.05	0.14	0
T8	25	2.48	0.131	28	2.25	0.14	24	2.46	0.13	0
T9	26	2.35	0.146	25	2.12	0.16	21	2.24	0.14	0
T10	26	2.50	0.139	27	2.37	0.15	22	2.50	0.13	0
T11	26	2.38	0.148	25	2.36	0.16	22	2.23	0.16	0
T12	25	2.40	0.129	24	2.17	0.16	21	2.43	0.16	0
T13	22	2.00	0.186	19	2.11	0.19	17	2.00	0.17	0
T14	23	1.96	0.160	17	1.59	0.17	16	2.00	0.13	1
T15	20	2.05	0.198	18	1.89	0.20	18	2.06	0.15	1
T16	25	2.52	0.131	23	2.35	0.15	22	2.14	0.15	0
T17	15	2.07	0.248	18	1.94	0.21	16	2.06	0.19	0
T18	22	2.05	0.154	21	2.05	0.19	20	2.30	0.13	0
T19	18	1.78	0.207	19	2.00	0.17	19	2.32	0.13	1
T20	22	1.95	0.167	23	2.09	0.19	18	2.06	0.19	0
T21	23	2.52	0.139	25	2.00	0.19	22	2.36	0.12	0
T22	25	2.24	0.166	21	2.33	0.19	21	2.38	0.13	0
T23	21	1.90	0.194	19	2.00	0.19	18	2.22	0.15	0
T24	25	2.20	0.163	25	2.28	0.15	21	2.29	0.17	0
T25	25	2.16	0.160	22	2.23	0.17	21	2.29	0.16	0
T26	16	1.94	0.170	18	1.78	0.17	17	2.18	0.18	1
T27	24	2.63	0.132	25	2.36	0.15	22	2.36	0.15	0
T28	22	2.36	0.181	23	2.35	0.17	20	2.35	0.15	0
T29	23	2.13	0.192	23	2.04	0.18	19	2.37	0.16	0
T30	24	2.50	0.147	25	2.36	0.14	21	2.00	0.15	0
T31	24	2.46	0.159	23	2.26	0.17	20	2.05	0.18	0
T32	22	2.45	0.171	24	2.29	0.15	15	2.13	0.19	0
T33	15	1.80	0.223	15	1.93	0.21	11	2.09	0.25	1
T34	24	2.63	0.132	26	2.50	0.13	22	2.23	0.13	0
T35	25	2.28	0.178	26	2.19	0.16	21	2.33	0.16	0
T36	24	2.17	0.167	24	2.29	0.15	19	2.05	0.16	0
T37	24	2.17	0.177	26	2.27	0.15	21	2.24	0.14	0
T38	14	1.86	0.231	18	1.89	0.21	11	2.09	0.25	2
T39	22	2.14	0.165	20	2.20	0.19	15	2.27	0.23	0
T40	20	2.10	0.176	22	1.95	0.18	20	2.25	0.16	0
T41	23	2.09	0.165	22	1.95	0.19	19	2.16	0.19	0

	HS - Associate			Baccalaureate			Masters or above			
No.	N	Mean	SE	N	Mean	SE	N	Mean	SE	C*
T42	23	2.43	0.138	24	2.38	0.16	22	2.32	0.15	0
T43	25	2.60	0.115	24	2.46	0.15	22	2.41	0.14	0
T44	21	1.95	0.176	23	2.26	0.16	20	2.15	0.17	0
T45	22	1.82	0.182	23	2.13	0.17	19	2.16	0.16	1
T46	21	2.10	0.181	22	2.41	0.16	19	2.16	0.18	0
T47	24	2.33	0.155	26	2.42	0.14	21	2.33	0.14	0
T48	24	2.21	0.147	24	2.33	0.14	21	2.19	0.13	0
T49	23	2.13	0.181	24	2.04	0.18	21	2.29	0.16	0
T50	22	2.23	0.146	23	2.22	0.18	21	2.29	0.16	0
T51	23	2.26	0.157	25	2.36	0.16	21	2.14	0.16	0
T52	19	2.11	0.169	20	2.05	0.18	18	1.94	0.19	0
T53	23	2.26	0.180	26	2.31	0.15	21	2.24	0.17	0
T54	18	2.44	0.185	21	2.29	0.20	19	2.37	0.16	0
T55	19	2.21	0.196	19	2.05	0.22	19	2.05	0.19	0
T56	25	2.48	0.131	25	2.52	0.13	21	2.33	0.16	0
T57	23	2.17	0.174	18	1.94	0.21	17	2.29	0.17	0
T58	21	1.95	0.176	20	2.20	0.17	19	1.84	0.19	1
T59	20	1.85	0.196	17	1.94	0.20	19	2.16	0.19	1
T60	17	1.59	0.193	15	1.87	0.17	16	1.94	0.23	2
T61	25	2.28	0.158	23	2.43	0.14	20	2.35	0.18	0
T62	14	1.64	0.225	9	1.67	0.24	11	1.91	0.25	2
T63	12	1.50	0.230	10	1.70	0.21	11	2.09	0.21	2
T64	15	1.53	0.165	11	1.82	0.23	10	2.20	0.20	2
T65	14	1.79	0.214	11	1.91	0.16	11	2.00	0.27	1

Appendix I. Mean Significance Ratings for Tasks by Certifications Held

Task Ratings by Certifications Held

The "C" column shows the count of subclasses with mean significance less than 1.90.

No.		CP			IM			IS			PW			TR			TS		C*
	N	Mean	SE	N	Mean	SE	N	Mean	C*	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T1	16	2.56	0.128	34	2.35	0.119	20	2.55	0.114	31	2.45	0.138	14	2.64	0.133	15	2.33	0.187	0
T2	16	2.44	0.182	33	2.36	0.122	21	2.48	0.148	29	2.34	0.134	14	2.57	0.173	15	2.20	0.223	0
T3	15	2.67	0.159	33	2.67	0.083	20	2.65	0.109	31	2.58	0.111	14	2.79	0.114	15	2.73	0.118	1
T4	11	1.91	0.211	29	2.21	0.125	18	2.56	0.121	25	1.76	0.156	11	2.45	0.207	11	2.18	0.182	0
T5	8	2.38	0.263	22	2.23	0.146	18	2.22	0.173	19	1.84	0.175	11	2.36	0.203	8	2.13	0.295	0
T6	12	2.08	0.260	32	2.16	0.136	21	2.33	0.174	27	1.81	0.151	13	2.38	0.241	13	2.23	0.231	0
T7	12	2.25	0.218	30	2.13	0.124	21	2.00	0.169	26	2.12	0.160	12	2.58	0.149	13	2.31	0.175	0
T8	15	2.40	0.163	35	2.51	0.111	20	2.50	0.170	32	2.31	0.122	13	2.77	0.166	14	2.71	0.125	0
T9	12	2.33	0.188	31	2.29	0.133	19	2.42	0.159	30	2.10	0.139	14	2.50	0.174	15	2.47	0.165	0
T10	14	2.64	0.133	33	2.30	0.119	20	2.60	0.134	32	2.47	0.127	14	2.50	0.174	15	2.60	0.131	1
T11	15	2.40	0.190	31	2.26	0.131	20	2.35	0.167	31	2.32	0.134	13	2.46	0.183	14	2.36	0.199	0
T12	13	2.46	0.183	31	2.42	0.111	21	2.38	0.161	31	2.32	0.142	13	2.46	0.215	15	2.13	0.215	0
T13	12	2.08	0.193	23	2.09	0.139	17	2.35	0.170	27	1.93	0.150	12	2.33	0.188	12	2.25	0.250	0
T14	12	1.50	0.151	22	1.95	0.123	17	2.06	0.135	26	1.81	0.136	12	2.25	0.179	12	1.92	0.193	0
T15	11	2.27	0.237	24	2.04	0.153	17	2.35	0.147	27	2.07	0.150	11	2.45	0.247	12	1.92	0.229	0
T16	14	2.43	0.173	30	2.40	0.123	21	2.33	0.144	31	2.39	0.128	13	2.62	0.140	14	2.29	0.194	0
T17	7	1.71	0.360	23	2.09	0.139	12	1.83	0.241	23	2.13	0.181	10	2.20	0.249	10	2.10	0.277	0
T18	12	1.92	0.193	28	2.11	0.119	18	2.28	0.177	28	2.14	0.133	12	2.25	0.218	14	2.14	0.206	0
T19	8	1.88	0.295	24	2.00	0.135	15	2.13	0.192	24	1.88	0.151	9	2.22	0.278	12	2.25	0.218	0
T20	11	2.27	0.237	29	2.07	0.121	19	2.05	0.209	30	2.00	0.144	10	2.30	0.260	14	1.93	0.221	0
T21	15	2.53	0.192	30	2.17	0.145	17	2.53	0.174	30	2.33	0.130	13	2.77	0.122	14	2.57	0.173	0
T22	11	2.36	0.203	31	2.16	0.124	16	2.50	0.183	32	2.31	0.122	12	2.58	0.193	14	2.43	0.202	1
T23	10	2.00	0.258	25	2.12	0.156	14	2.14	0.231	27	2.15	0.148	10	2.50	0.269	9	1.89	0.200	0
T24	14	2.50	0.139	31	2.26	0.131	18	2.28	0.177	31	2.32	0.142	13	2.46	0.183	14	2.14	0.206	0
T25	15	2.07	0.182	29	2.31	0.132	18	2.50	0.146	29	2.21	0.144	13	2.38	0.180	13	2.15	0.191	0
T26	10	1.70	0.260	23	2.13	0.145	18	1.83	0.167	23	1.96	0.147	10	2.30	0.213	12	1.83	0.167	0
T27	14	2.64	0.169	31	2.48	0.122	20	2.60	0.134	29	2.59	0.127	13	2.69	0.175	14	2.50	0.174	0
T28	12	2.75	0.131	30	2.17	0.152	20	2.60	0.134	27	2.41	0.144	12	2.58	0.229	12	2.58	0.149	0
T29	14	2.57	0.173	30	2.17	0.145	19	2.63	0.114	28	2.00	0.163	11	2.64	0.203	13	2.15	0.249	0
T30	15	2.40	0.190	31	2.32	0.117	20	2.35	0.182	30	2.07	0.135	13	2.38	0.213	14	2.29	0.194	0
T31	15	2.60	0.163	29	2.38	0.126	20	2.50	0.170	30	2.07	0.159	13	2.62	0.180	14	2.21	0.214	0
T32	11	2.45	0.247	28	2.29	0.124	20	2.35	0.167	25	2.20	0.163	12	2.50	0.195	14	2.50	0.174	0
T33	7	2.43	0.297	22	1.95	0.167	14	2.36	0.225	19	1.53	0.177	7	2.29	0.360	9	2.22	0.278	0
T34	15	2.40	0.190	32	2.38	0.125	18	2.78	0.101	31	2.55	0.102	13	2.77	0.166	15	2.67	0.126	2
T35	14	2.43	0.137	32	2.31	0.138	18	2.61	0.164	31	2.19	0.142	13	2.77	0.122	15	2.27	0.228	3
T36	14	2.43	0.173	31	2.13	0.120	19	2.47	0.160	30	2.20	0.121	11	2.45	0.247	13	1.92	0.239	3
T37	14	2.64	0.133	32	2.19	0.130	20	2.30	0.179	30	2.07	0.143	13	2.46	0.183	14	2.29	0.194	1
T38	8	2.25	0.313	25	1.72	0.169	14	2.36	0.225	19	1.89	0.186	8	2.13	0.350	7	2.43	0.297	1
T39	9	2.00	0.289	27	2.11	0.172	15	2.60	0.163	25	2.08	0.162	10	2.60	0.221	12	2.42	0.229	0
T40	9	2.11	0.261	32	2.13	0.133	17	2.65	0.147	28	1.89	0.157	10	2.60	0.221	13	2.31	0.208	0
T41	11	2.18	0.226	29	2.03	0.145	17	2.41	0.193	25	2.04	0.178	12	2.25	0.250	14	2.21	0.214	0
T42	14	2.29	0.221	30	2.43	0.124	17	2.65	0.170	28	2.29	0.153	12	2.67	0.188	15	2.67	0.159	0
T43	15	2.27	0.228	31	2.55	0.112	18	2.67	0.140	28	2.50	0.121	13	2.92	0.077	15	2.73	0.118	1

No.	CP			IM			IS			PW			TR			TS			
	N	Mean	SE	N	Mean	SE	N	Mean	C*	N	Mean	SE	N	Mean	SE	N	Mean	SE	C*
T44	11	2.09	0.211	30	2.27	0.126	19	2.26	0.150	25	2.16	0.138	12	2.25	0.218	13	2.08	0.211	0
T45	13	1.69	0.208	29	2.17	0.132	18	2.39	0.164	26	2.08	0.135	12	2.08	0.260	14	2.00	0.182	1
T46	11	2.55	0.207	27	2.30	0.139	18	2.72	0.109	27	2.07	0.159	12	2.50	0.230	15	2.47	0.192	1
T47	14	2.29	0.221	31	2.32	0.117	19	2.42	0.139	29	2.21	0.125	13	2.54	0.183	15	2.47	0.165	0
T48	13	2.31	0.175	31	2.16	0.105	18	2.44	0.145	29	2.07	0.140	13	2.54	0.144	15	2.20	0.145	0
T49	13	2.08	0.239	31	2.16	0.147	17	2.59	0.150	30	2.00	0.144	11	2.64	0.152	14	2.43	0.202	0
T50	14	2.14	0.206	31	2.23	0.129	17	2.59	0.123	27	2.11	0.145	12	2.42	0.193	14	2.50	0.174	0
T51	14	1.93	0.221	30	2.33	0.121	18	2.61	0.118	29	2.21	0.135	12	2.33	0.225	14	2.50	0.174	0
T52	11	1.82	0.226	28	1.89	0.139	17	2.29	0.166	24	1.83	0.155	10	2.30	0.213	13	2.15	0.222	1
T53	14	2.21	0.261	31	2.19	0.135	19	2.63	0.157	29	2.21	0.144	11	2.55	0.247	15	2.67	0.187	0
T54	13	2.08	0.239	28	2.32	0.146	18	2.67	0.162	23	2.48	0.152	11	2.55	0.247	15	2.47	0.215	0
T55	9	2.22	0.278	30	2.10	0.154	17	2.59	0.150	24	2.13	0.184	9	2.78	0.147	13	2.38	0.241	0
T56	15	2.60	0.131	31	2.32	0.126	18	2.78	0.101	28	2.43	0.130	13	2.46	0.215	15	2.60	0.163	0
T57	12	2.00	0.275	29	2.14	0.138	17	2.65	0.170	25	2.24	0.166	10	2.70	0.213	11	2.55	0.207	0
T58	14	2.21	0.214	28	2.11	0.139	17	2.24	0.182	27	1.85	0.157	12	2.33	0.225	12	2.00	0.246	0
T59	11	2.55	0.207	27	2.15	0.127	17	2.29	0.187	25	1.88	0.167	9	2.67	0.167	12	1.92	0.260	1
T60	9	2.11	0.309	25	1.84	0.149	16	2.00	0.204	20	1.70	0.179	8	2.13	0.350	8	1.75	0.313	0
T61	12	2.42	0.229	30	2.40	0.123	19	2.47	0.177	29	2.34	0.151	13	2.46	0.183	15	2.47	0.215	0
T62	8	1.88	0.350	16	1.88	0.202	15	1.87	0.192	14	1.36	0.199	8	2.13	0.350	7	1.43	0.297	0
T63	7	2.00	0.309	17	1.88	0.189	13	1.69	0.208	11	1.55	0.207	6	2.33	0.422	4	1.50	0.500	0
T64	7	1.86	0.261	19	1.84	0.158	15	2.00	0.169	14	1.57	0.173	10	2.10	0.277	5	1.80	0.374	0
T65	6	2.17	0.167	20	2.00	0.145	15	2.20	0.175	14	1.57	0.173	7	2.43	0.202	8	1.88	0.350	0

Appendix J. Mean Significance Ratings for Tasks by Job Title

Task Ratings by Job Title

The "C" column shows the count of subclasses with mean significance less than 1.90.

No.	Director/Executive			Manager			Technical			Other			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T1	12	2.42	0.149	8	2.00	0.267	30	2.23	0.141	44	2.52	0.089	0
T2	12	2.33	0.142	8	2.00	0.267	29	2.14	0.155	44	2.39	0.109	0
T3	12	2.67	0.142	8	2.38	0.183	30	2.57	0.104	44	2.59	0.094	0
T4	9	1.89	0.261	7	2.29	0.184	24	2.08	0.146	32	2.09	0.151	0
T5	7	2.00	0.309	5	2.00	0.000	17	1.88	0.189	25	2.16	0.170	0
T6	9	1.78	0.278	8	1.88	0.295	26	2.04	0.162	41	1.98	0.137	1
T7	8	2.25	0.313	8	2.00	0.189	25	2.08	0.162	40	2.13	0.125	0
T8	12	2.08	0.229	8	2.13	0.227	28	2.39	0.119	46	2.48	0.106	0
T9	10	2.00	0.211	7	1.86	0.261	29	2.28	0.130	41	2.22	0.118	0
T10	12	2.42	0.193	8	2.00	0.267	30	2.33	0.121	43	2.56	0.107	0
T11	11	2.36	0.152	8	2.00	0.267	29	2.34	0.134	42	2.36	0.122	0
T12	10	2.40	0.163	8	2.00	0.189	29	2.21	0.125	41	2.46	0.121	0
T13	9	1.89	0.309	6	1.83	0.167	22	2.09	0.160	34	2.09	0.142	1
T14	8	1.63	0.263	6	1.83	0.167	24	1.92	0.133	30	1.83	0.136	3
T15	8	1.88	0.227	6	1.83	0.167	23	1.87	0.158	32	2.06	0.148	1
T16	10	2.20	0.133	7	2.14	0.261	29	2.31	0.132	42	2.36	0.117	0
T17	8	1.38	0.263	6	2.00	0.000	19	2.00	0.202	26	2.31	0.164	1
T18	9	1.67	0.289	7	2.14	0.261	24	2.13	0.151	37	2.16	0.113	1
T19	7	1.86	0.340	7	2.00	0.309	23	1.91	0.153	31	2.00	0.139	0
T20	9	1.78	0.278	8	2.13	0.295	26	2.04	0.171	36	2.08	0.128	1
T21	10	1.90	0.277	8	1.88	0.295	28	2.39	0.139	39	2.41	0.115	0
T22	8	2.00	0.267	8	1.88	0.295	28	2.32	0.146	37	2.41	0.106	0
T23	9	2.00	0.289	7	1.71	0.184	22	2.00	0.186	30	2.17	0.136	1
T24	11	2.09	0.211	8	2.00	0.267	28	2.11	0.149	40	2.40	0.123	0
T25	11	2.18	0.182	7	2.00	0.309	27	2.15	0.166	37	2.30	0.115	0
T26	8	2.13	0.227	7	1.71	0.184	20	1.80	0.156	28	2.00	0.154	2
T27	10	2.40	0.163	8	2.13	0.227	29	2.45	0.137	40	2.55	0.113	0
T28	10	2.30	0.153	8	1.88	0.295	26	2.38	0.137	35	2.31	0.147	0
T29	11	2.18	0.182	8	1.88	0.295	28	2.07	0.154	33	2.21	0.155	0
T30	11	2.18	0.122	8	2.25	0.250	27	2.30	0.158	42	2.19	0.119	0
T31	11	2.18	0.182	7	2.29	0.286	28	2.21	0.166	39	2.23	0.130	0
T32	9	1.78	0.222	8	2.13	0.227	24	2.46	0.147	34	2.21	0.139	1
T33	4	1.75	0.479	4	2.00	0.000	19	1.68	0.172	23	2.09	0.188	2
T34	11	2.18	0.182	8	2.25	0.250	28	2.68	0.116	42	2.38	0.102	0
T35	11	2.00	0.191	8	2.00	0.267	29	2.31	0.158	40	2.35	0.122	0
T36	11	1.91	0.211	8	2.25	0.250	28	2.07	0.145	35	2.29	0.120	0
T37	11	2.09	0.163	8	2.38	0.263	28	2.04	0.158	42	2.29	0.114	0
T38	6	1.83	0.307	6	1.33	0.211	18	1.83	0.167	24	2.17	0.187	3
T39	7	2.00	0.309	6	1.83	0.307	23	2.26	0.157	33	2.15	0.152	1
T40	7	1.86	0.340	7	2.00	0.309	26	2.12	0.150	37	2.03	0.137	0
T41	9	2.00	0.236	8	2.00	0.327	24	2.08	0.169	33	2.18	0.154	0
T42	10	1.90	0.233	8	2.00	0.267	27	2.59	0.110	37	2.51	0.114	0
T43	11	2.00	0.234	8	2.38	0.183	28	2.50	0.131	38	2.58	0.104	0
T44	8	2.25	0.164	8	2.00	0.267	24	2.13	0.151	38	2.08	0.133	0
T45	10	2.10	0.233	7	2.29	0.184	24	2.00	0.159	37	1.97	0.131	0
T46	8	2.13	0.227	7	2.29	0.286	25	2.16	0.160	36	2.22	0.133	0

No.	Director/Executive			Manager			Technical			Other			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T47	11	2.00	0.191	8	2.50	0.189	29	2.24	0.137	39	2.38	0.114	0
T48	10	2.30	0.213	8	2.38	0.183	28	2.18	0.127	38	2.16	0.116	0
T49	10	2.20	0.249	7	2.00	0.309	28	2.11	0.149	38	2.16	0.133	0
T50	11	2.09	0.211	7	2.00	0.309	27	2.22	0.134	36	2.25	0.134	0
T51	11	2.09	0.251	8	2.25	0.313	26	2.15	0.143	38	2.29	0.113	0
T52	8	2.50	0.189	7	1.86	0.261	23	1.96	0.160	32	1.91	0.145	0
T53	11	1.91	0.211	8	2.13	0.295	28	2.43	0.140	38	2.24	0.133	0
T54	8	2.00	0.267	8	2.13	0.295	21	2.43	0.177	35	2.31	0.135	0
T55	6	2.17	0.307	7	2.00	0.309	25	2.16	0.180	32	2.13	0.154	0
T56	10	2.40	0.163	8	2.25	0.250	29	2.38	0.126	38	2.50	0.118	0
T57	8	1.75	0.313	7	2.00	0.309	24	2.33	0.143	31	2.16	0.154	1
T58	11	2.27	0.237	7	2.29	0.286	22	1.68	0.153	34	1.91	0.136	1
T59	9	2.56	0.176	7	2.14	0.340	23	1.57	0.152	27	2.07	0.150	1
T60	8	2.38	0.263	7	1.57	0.297	18	1.56	0.166	24	1.88	0.151	2
T61	10	2.60	0.163	7	2.00	0.309	29	2.17	0.141	37	2.38	0.125	0
T62	5	1.60	0.400	4	1.75	0.250	15	1.67	0.187	18	1.61	0.200	4
T63	7	1.57	0.297	3	2.00	0.000	15	1.67	0.211	15	1.67	0.187	3
T64	7	1.71	0.286	4	1.75	0.250	14	1.86	0.206	20	1.70	0.164	3
T65	5	1.80	0.374	3	2.00	0.000	17	1.65	0.147	18	2.06	0.189	2

Appendix K. Mean Significance Ratings for Number of Employees

Task Ratings by Number of Employees

The "C" column shows the count of subclasses with mean significance less than 1.90.

No.	Less than 100			101 – 1,000			1,000 or more			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T1	19	2.21	0.164	32	2.38	0.117	42	2.43	0.103	0
T2	19	2.21	0.196	30	2.37	0.112	43	2.21	0.118	0
T3	20	2.40	0.152	31	2.58	0.101	42	2.64	0.082	0
T4	18	1.89	0.196	24	2.21	0.134	29	2.10	0.152	1
T5	14	2.07	0.195	21	2.10	0.168	18	1.89	0.196	1
T6	20	1.95	0.198	29	1.90	0.152	34	2.03	0.149	1
T7	18	2.17	0.202	26	2.00	0.147	36	2.17	0.129	0
T8	20	2.40	0.184	31	2.26	0.122	42	2.43	0.103	0
T9	20	2.30	0.164	30	2.13	0.124	36	2.14	0.127	0
T10	20	2.15	0.196	31	2.48	0.112	41	2.49	0.100	0
T11	17	2.29	0.187	31	2.52	0.102	41	2.22	0.124	0
T12	17	2.53	0.174	29	2.41	0.093	41	2.22	0.124	0
T13	18	2.00	0.214	24	2.00	0.135	28	2.11	0.157	0
T14	16	2.13	0.180	25	1.80	0.129	26	1.69	0.133	2
T15	15	2.13	0.215	24	1.92	0.133	29	1.86	0.147	1
T16	17	2.18	0.176	29	2.48	0.094	41	2.22	0.124	0
T17	13	1.92	0.265	20	1.75	0.176	25	2.32	0.150	1
T18	15	2.13	0.192	25	1.88	0.133	36	2.19	0.125	1
T19	12	1.75	0.250	22	1.64	0.140	33	2.21	0.121	2
T20	18	1.89	0.212	24	2.08	0.146	36	2.08	0.140	1
T21	16	2.13	0.221	28	2.18	0.137	40	2.43	0.118	0
T22	16	2.25	0.214	25	2.20	0.141	39	2.36	0.113	0
T23	13	2.00	0.277	24	1.96	0.153	30	2.10	0.130	0
T24	18	2.00	0.214	28	2.43	0.120	40	2.20	0.125	0
T25	16	2.13	0.202	28	2.25	0.132	37	2.22	0.129	0
T26	11	1.91	0.251	23	2.13	0.145	28	1.75	0.132	1
T27	16	2.25	0.214	29	2.66	0.090	41	2.39	0.115	0
T28	14	2.29	0.244	28	2.50	0.109	36	2.11	0.137	0
T29	14	2.07	0.245	30	2.23	0.141	35	2.03	0.139	0
T30	18	2.00	0.198	30	2.37	0.112	39	2.23	0.124	0
T31	16	2.25	0.194	31	2.26	0.146	37	2.19	0.133	0
T32	17	2.24	0.202	28	2.36	0.128	29	2.07	0.148	0
T33	15	1.87	0.215	19	1.95	0.195	15	1.80	0.200	2
T34	17	2.41	0.173	31	2.52	0.112	40	2.38	0.106	0
T35	18	2.00	0.229	30	2.37	0.122	39	2.28	0.122	0
T36	17	2.18	0.214	30	2.23	0.124	34	2.09	0.122	0
T37	17	1.88	0.208	31	2.29	0.124	40	2.23	0.116	1
T38	15	1.87	0.215	21	2.05	0.176	17	1.76	0.202	2
T39	17	2.18	0.176	24	1.96	0.153	27	2.26	0.174	0
T40	18	1.89	0.212	24	2.17	0.155	34	2.00	0.134	1
T41	16	1.88	0.221	23	2.17	0.162	34	2.18	0.149	1
T42	16	2.44	0.203	25	2.20	0.153	40	2.53	0.095	0
T43	16	2.44	0.182	28	2.36	0.147	40	2.53	0.095	0

No.	Less than 100			101 – 1,000			1,000 or more			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	
T44	15	2.20	0.200	25	2.16	0.149	37	2.03	0.125	0
T45	16	2.13	0.202	26	2.08	0.146	35	1.94	0.129	0
T46	17	2.12	0.225	25	2.24	0.133	33	2.18	0.134	0
T47	17	2.06	0.181	29	2.28	0.130	40	2.43	0.107	0
T48	17	2.00	0.192	27	2.33	0.119	39	2.21	0.105	0
T49	17	2.06	0.201	27	2.00	0.151	38	2.24	0.128	0
T50	16	2.25	0.194	27	2.07	0.140	37	2.27	0.126	0
T51	16	2.25	0.171	28	2.11	0.149	38	2.26	0.117	0
T52	15	2.13	0.192	22	1.91	0.160	32	1.97	0.145	0
T53	17	2.35	0.191	27	2.07	0.159	40	2.30	0.120	0
T54	13	2.46	0.243	21	2.24	0.168	37	2.24	0.131	0
T55	16	2.38	0.221	21	2.05	0.176	32	2.06	0.155	0
T56	16	2.31	0.218	28	2.43	0.120	40	2.48	0.101	0
T57	16	2.06	0.232	24	2.25	0.162	29	2.10	0.143	0
T58	17	1.94	0.201	25	2.16	0.160	31	1.74	0.131	1
T59	16	1.88	0.221	21	2.29	0.156	28	1.79	0.149	2
T60	15	1.80	0.223	19	1.89	0.169	23	1.74	0.157	3
T61	18	2.39	0.183	27	2.41	0.134	37	2.16	0.126	0
T62	15	1.67	0.211	16	1.81	0.209	10	1.40	0.163	3
T63	11	1.73	0.273	14	1.93	0.195	15	1.40	0.131	2
T64	12	1.83	0.241	18	1.78	0.152	14	1.64	0.199	3
T65	14	2.00	0.210	16	1.88	0.180	12	1.67	0.188	2

Appendix L. Mean Significance Ratings for Knowledge Statements

Knowledge Ratings by CHTS Role

The "C" column shows the count of subclasses with mean significance less than 1.70.

No.	Management			Technical			Trainer			Consultant			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	
K1	151	2.25	0.059	82	2.34	0.082	86	2.26	0.076	71	2.21	0.094	0
K2	149	2.14	0.060	80	2.24	0.082	81	2.12	0.077	71	2.17	0.090	0
K3	149	2.36	0.059	81	2.35	0.081	87	2.25	0.077	69	2.41	0.088	0
K4	133	1.94	0.068	69	1.96	0.098	77	2.03	0.092	58	1.86	0.106	0
K5	149	2.26	0.057	80	2.35	0.078	87	2.18	0.079	71	2.24	0.084	0
K6	151	2.38	0.056	80	2.53	0.069	89	2.42	0.067	70	2.39	0.085	0
K7	138	1.94	0.067	76	1.89	0.093	84	2.06	0.085	66	1.92	0.095	0
K8	148	2.04	0.061	80	2.09	0.080	87	2.06	0.084	69	2.04	0.096	0
K9	143	2.37	0.059	81	2.43	0.080	81	2.44	0.077	69	2.42	0.084	0
K10	130	1.85	0.070	71	1.87	0.096	78	1.99	0.088	61	1.97	0.104	0
K11	149	2.11	0.067	82	2.12	0.091	87	2.28	0.078	69	2.25	0.096	0
K12	148	2.07	0.065	83	2.11	0.092	92	2.22	0.082	66	2.05	0.095	0
K13	156	2.53	0.051	85	2.60	0.063	92	2.52	0.066	71	2.49	0.077	0
K14	135	1.96	0.070	76	2.21	0.090	81	1.99	0.087	60	2.00	0.111	0
K15	159	2.53	0.052	86	2.60	0.067	94	2.51	0.067	72	2.67	0.066	0
K16	153	2.16	0.061	84	2.20	0.084	89	2.17	0.086	67	2.25	0.091	0
K17	112	1.69	0.074	65	1.80	0.106	67	1.82	0.102	50	1.50	0.104	2
K18	144	2.17	0.063	81	2.15	0.086	88	2.18	0.083	70	2.10	0.094	0
K19	155	2.38	0.056	86	2.49	0.070	90	2.41	0.067	72	2.38	0.078	0
K20	154	2.32	0.060	84	2.46	0.075	90	2.30	0.080	70	2.34	0.088	0
K21	133	1.91	0.071	77	2.00	0.094	78	1.90	0.092	61	1.89	0.102	0
K22	143	2.15	0.066	79	2.25	0.087	83	2.16	0.079	66	2.14	0.089	0
K23	134	1.94	0.068	75	2.11	0.092	76	1.96	0.089	59	1.86	0.101	0
K24	145	2.15	0.063	82	2.28	0.078	86	2.06	0.083	68	2.06	0.093	0
K25	145	2.27	0.061	83	2.33	0.077	83	2.18	0.081	68	2.24	0.094	0
K26	143	2.27	0.056	81	2.28	0.075	86	2.24	0.077	69	2.25	0.076	0
K27	141	1.85	0.059	80	1.96	0.082	79	1.84	0.085	63	1.71	0.092	0
K28	138	1.91	0.065	79	1.95	0.092	77	1.99	0.093	60	1.80	0.103	0
K29	156	2.56	0.049	85	2.56	0.070	91	2.49	0.067	71	2.45	0.080	0
K30	157	2.40	0.054	85	2.46	0.068	91	2.40	0.073	72	2.56	0.068	0
K31	144	1.88	0.064	78	1.96	0.090	84	1.96	0.085	60	1.68	0.090	1
K32	121	1.67	0.067	68	1.79	0.095	67	1.70	0.097	50	1.58	0.103	2
K33	113	1.97	0.077	70	2.14	0.098	67	2.01	0.103	48	1.88	0.125	0
K34	128	1.98	0.066	76	2.11	0.085	69	2.04	0.091	56	1.98	0.107	0
K35	129	1.77	0.067	76	1.91	0.090	69	1.83	0.099	56	1.75	0.103	0
K36	104	1.78	0.076	66	1.88	0.093	62	1.76	0.094	45	1.73	0.116	0
K37	136	2.18	0.066	74	2.12	0.088	83	2.28	0.083	64	2.27	0.100	0
K38	149	2.10	0.064	78	1.99	0.092	91	2.34	0.075	69	2.26	0.089	0
K39	143	1.98	0.064	76	1.99	0.087	89	2.07	0.084	69	2.04	0.098	0
K40	152	2.36	0.056	83	2.34	0.077	92	2.41	0.068	72	2.42	0.076	0
K41	124	1.88	0.070	58	1.79	0.104	74	1.80	0.096	61	1.82	0.106	0
K42	149	2.28	0.059	78	2.28	0.081	84	2.19	0.080	70	2.31	0.088	0
K43	153	2.36	0.056	82	2.49	0.070	86	2.42	0.073	72	2.54	0.074	0
K44	108	1.57	0.069	51	1.63	0.105	63	1.70	0.100	53	1.53	0.096	4
K45	114	1.61	0.071	60	1.65	0.097	75	1.77	0.092	54	1.59	0.101	3
K46	144	2.24	0.062	78	2.19	0.082	87	2.33	0.080	66	2.32	0.092	0

No.	Management			Technical			Trainer			Consultant			C*
	N	Mean	SE	N	Mean	SE	N	Mean	SE	N	Mean	SE	
K47	149	2.23	0.063	79	2.14	0.090	88	2.28	0.074	72	2.38	0.078	0
K48	120	1.83	0.076	56	1.70	0.102	74	1.78	0.095	58	1.83	0.105	1
K49	149	2.17	0.065	82	2.02	0.090	87	2.22	0.081	70	2.23	0.089	0
K50	117	1.63	0.069	64	1.73	0.098	73	1.73	0.096	57	1.63	0.099	2
K51	151	2.09	0.064	80	1.98	0.091	90	2.22	0.077	69	2.07	0.093	0
K52	141	2.03	0.064	75	1.99	0.086	85	2.05	0.084	67	1.90	0.093	0
K53	150	2.05	0.063	82	2.11	0.085	86	2.10	0.083	70	1.99	0.090	0
K54	151	2.12	0.061	80	2.14	0.085	87	2.18	0.078	69	2.16	0.087	0
K55	155	2.46	0.050	85	2.45	0.064	91	2.46	0.069	73	2.62	0.061	0
K56	156	2.37	0.059	85	2.29	0.082	94	2.30	0.078	70	2.46	0.083	0
K57	143	1.83	0.064	74	1.88	0.092	82	1.96	0.086	69	1.99	0.089	0
K58	149	2.15	0.060	79	2.16	0.079	89	2.26	0.072	70	2.29	0.079	0
K59	152	2.34	0.056	81	2.30	0.075	92	2.36	0.068	73	2.49	0.068	0
K60	144	2.25	0.064	80	2.26	0.085	84	2.29	0.082	73	2.44	0.080	0
K61	139	1.99	0.065	75	1.96	0.088	86	2.03	0.087	65	1.98	0.102	0
K62	141	2.01	0.065	71	1.99	0.095	81	2.05	0.088	65	2.02	0.092	0
K63	143	2.00	0.064	75	2.04	0.088	83	2.11	0.086	67	2.04	0.089	0
K64	108	1.67	0.072	63	1.71	0.097	71	1.82	0.097	50	1.68	0.105	2
K65	122	1.69	0.068	63	1.76	0.100	75	1.79	0.094	60	1.70	0.096	2
K66	142	2.11	0.062	74	2.07	0.087	93	2.37	0.075	67	2.12	0.096	0
K67	147	2.16	0.063	77	2.17	0.088	93	2.27	0.080	68	2.09	0.095	0
K68	156	2.42	0.054	82	2.45	0.065	90	2.43	0.071	72	2.57	0.071	0
K69	154	2.51	0.053	84	2.58	0.068	93	2.52	0.069	73	2.48	0.085	0
K70	157	2.71	0.038	84	2.73	0.049	94	2.71	0.049	73	2.74	0.055	0
K71	153	2.37	0.057	82	2.33	0.080	91	2.42	0.072	70	2.46	0.090	0
K72	154	2.27	0.061	82	2.20	0.089	90	2.39	0.077	72	2.33	0.095	0
K73	154	2.39	0.056	82	2.40	0.079	89	2.44	0.075	73	2.38	0.084	0
K74	149	2.44	0.055	82	2.51	0.072	89	2.45	0.073	71	2.37	0.086	0
K75	156	2.49	0.051	82	2.50	0.070	93	2.57	0.066	73	2.53	0.081	0
K76	142	1.99	0.065	78	2.06	0.086	87	2.05	0.086	67	1.99	0.094	0
K77	153	2.30	0.060	82	2.28	0.084	92	2.34	0.082	72	2.29	0.092	0
K78	156	2.58	0.050	85	2.51	0.072	94	2.73	0.055	72	2.64	0.069	0
K79	156	2.62	0.045	85	2.58	0.068	93	2.68	0.055	72	2.67	0.069	0
K80	157	2.71	0.042	86	2.73	0.058	95	2.74	0.052	73	2.68	0.070	0

Appendix M. Exam Specifications and Detailed Content Outline

	Cognitive Level			
American Health Information Management Association **Certified Healthcare Technology Specialist (CHTS)** *Technical Role* **Detailed Content Outline**	**Recall**	**Application**	**Analysis**	**Total**
1. Analyze	**4**	**15**	**6**	**25**
A. Perform current workflow and process analysis				
B. Perform a current-state assessment				
C. Identify end-user needs and expectations				
D. Inventory current hardware and software				
E. Inventory network infrastructure				
F. Evaluate future processes, hardware, and software needs				
G. Perform gap analysis				
H. Identify the problem areas				
I. Identify interface and interoperability requirements (e.g., ancillary systems)				
J. Translate user's request into system capabilities				
2. Design/Build/Test	**7**	**13**	**15**	**35**
A. Define user requirements				
B. Apply role-based user access as defined				
C. Develop technical specifications				
D. Identify interface specifications				
E. Create technical knowledge database				
F. Document workflow changes				
G. Define testing requirements				
H. Develop test script				
I. Assemble users to participate in functionality testing				
J. Perform functionality testing of hardware and software				
K. Identify and remediate testing and build issues				
L. Develop new tools or features within the product				
M. Redesign workflow as warranted by need/issue				
N. Validate standardized operating procedures				
O. Participate in go-live planning				
P. Participate in contingency planning				
Q. Participate in down-time planning				

	Cognitive Level			
American Health Information Management Association **Certified Healthcare Technology Specialist (CHTS)** ***Technical Role*** **Detailed Content Outline**	**Recall**	**Application**	**Analysis**	**Total**
3. Implement into Production	**4**	**14**	**7**	**25**

A. Develop a training plan and documentation (e.g., functional user guides)
    B. Participate in delivery of training
    C. Develop a scope of work and timeline for installation
    D. Serve as liaison with vendors and users
    E. Perform functionality testing of the installed hardware and software
    F. Identify resources for support activities
    G. Participate in a transition meeting
    H. Implement release changes to software
    I. Document changes to hardware and software				

4. Support and Troubleshoot	**9**	**22**	**9**	**40**

A. Monitor system performance (e.g., error reports) on a defined schedule
    B. Perform troubleshooting
    C. Research, respond, and document issues from end-users
    D. Conduct a "lessons-learned" meeting
    E. Assist with implemention of the change control process
    F. Identify upgrade requirements
    G. Participate in on-going status meetings
    H. Track user issues to establish trends
    I. Identify and track enhancement requests
    J. Evaluate effectiveness of enhancements
    K. Participate in change-control process
    L. Institute audit/version control for changes
    M. Review release notes (e.g., updates)
    N. Perform mock upgrades in the test environment
    O. Perform technical analysis for test patches, enhancement and/or upgrades
    P. Communicate with end-users regarding changes or modifications
    Q. Update patching, enhancement, and upgrade specification documentation
    R. Comply with security protocols (e.g., cyber security, biometrics, HIPAA compliance)
    S. Participate in disaster management				

Total	**24**	**64**	**37**	**125**

Testable Knowledge

High Priority

- Accreditation standards
- Analytical skills
- Audio/visual skills (e.g., LCD projector)
- Best practices
- Change management
- Clinical and operations workflow
- Communication skills (written & oral)
- Computer systems
- Conflict resolution
- Cultural competency
- Culture of health care
- Data analysis
- Database structures (e.g., SQL)
- EHR/EMR/PHR principles
- Facilitation skills
- Flowchart applications
- Gov't agencies associated with healthcare
- Health care delivery systems
- Health care regulation
- Health informatics
- Health information exchange
- Health information management concepts & principles
- Health information systems
- Health IT applications
- HL7
- Implementation life cycle
- Industry trends
- Information governance
- Interface integration
- Interoperability
- Issue management
- IT fundamentals
- IT security principles
- Leadership
- Linguistic competency
- Meaningful use
- Medical terminology
- Operations management
- Organizational culture
- Organizational structure
- PC skills (e.g., Microsoft Office, internet)
- Performance improvement
- Presentation skills
- Process improvement
- Project management
- Quality control
- Quality improvement
- Quality of patient care
- Risk management
- Software development life cycle
- Standard technical language
- Time management
- Training methodologies
- Virtual training or meeting tools
- Work flow improvement & management
- Working with teams

Medium Priority

- Adult learning principles
- Basic statistics
- Health care revenue cycle
- Legal and ethical issues
- Network technology (e.g., VPN, cloud-based)
- Nomenclatures
- Peripheral devices (e.g., printers)
- Platforms and operating systems (e.g., Windows, Mac, Linux, Mobile devices)
- Report writing principles
- Resource management
- Technical specs (hardware, software)

Low Priority

- Budget management
- Consumerism and patient engagement
- Diagnostic and procedural coding (e.g., ICD-CM/PCS, CPT, HCPCS)
- General hardware maintenance
- Medical sciences
- Public health
- Servers
- Simulation technology
- Telehealth and telemedicine
- Writing test scripts

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