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Risk-Based MES Implementation Using Hazard Analysis and Critical Control Points (HACCP)

by Tineke Bos, Paul Irving, and Philip Rees

This article presents the benefits of replacing a paper-based production system with Manufacturing Execution System (MES).

Introduction

"Beauty is truth, truth beauty," – that is all ye know on earth, and all ye need to know.[1]

The above lines, from John Keats, are possibly the most succinct and famous expression of neoclassical poetic elegance. The search for beauty and truth in manufacturing continues up to the present time, and this article presents a case study of a recent implementation of a Manufacturing Execution System (MES) according to the latest industrial standards from ICH and ISPE's GAMP® 5 with particular emphasis on the application of Hazard Analysis and Critical Control Points (HACCP) risk assessment methodology.

MES Project and Background

The MES project was intended to provide an information system to support the management of Master Batch Records (MBR) and Electronic Batch Records (EBR) for the manufacturing processes performed in the plant in shop-floor logistics, weighing and dispensing, manufacturing, packaging, and quality control functions, fully integrated with the existing Enterprise Resource Planning (ERP), Laboratory Information Management System (LIMS) and weighing scales - *Figure 1*.

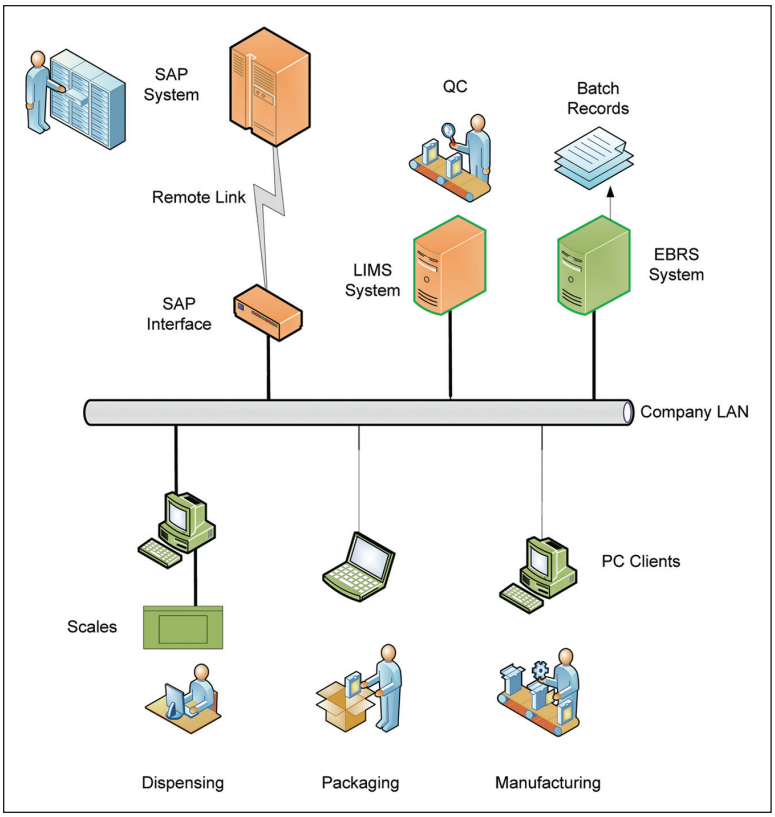

Figure 1. MES project overview.

The planning, development, and testing of MES was based on a life cycle model with analysis of domains of related manufacturing functions that integrate business and process controls, information flow, and human interaction to facilitate operation of the enterprise. GAMP 5 was used as a reference for the project, in the application of scientific principles and the assessment of risk to data integrity, product quality, and patient health.

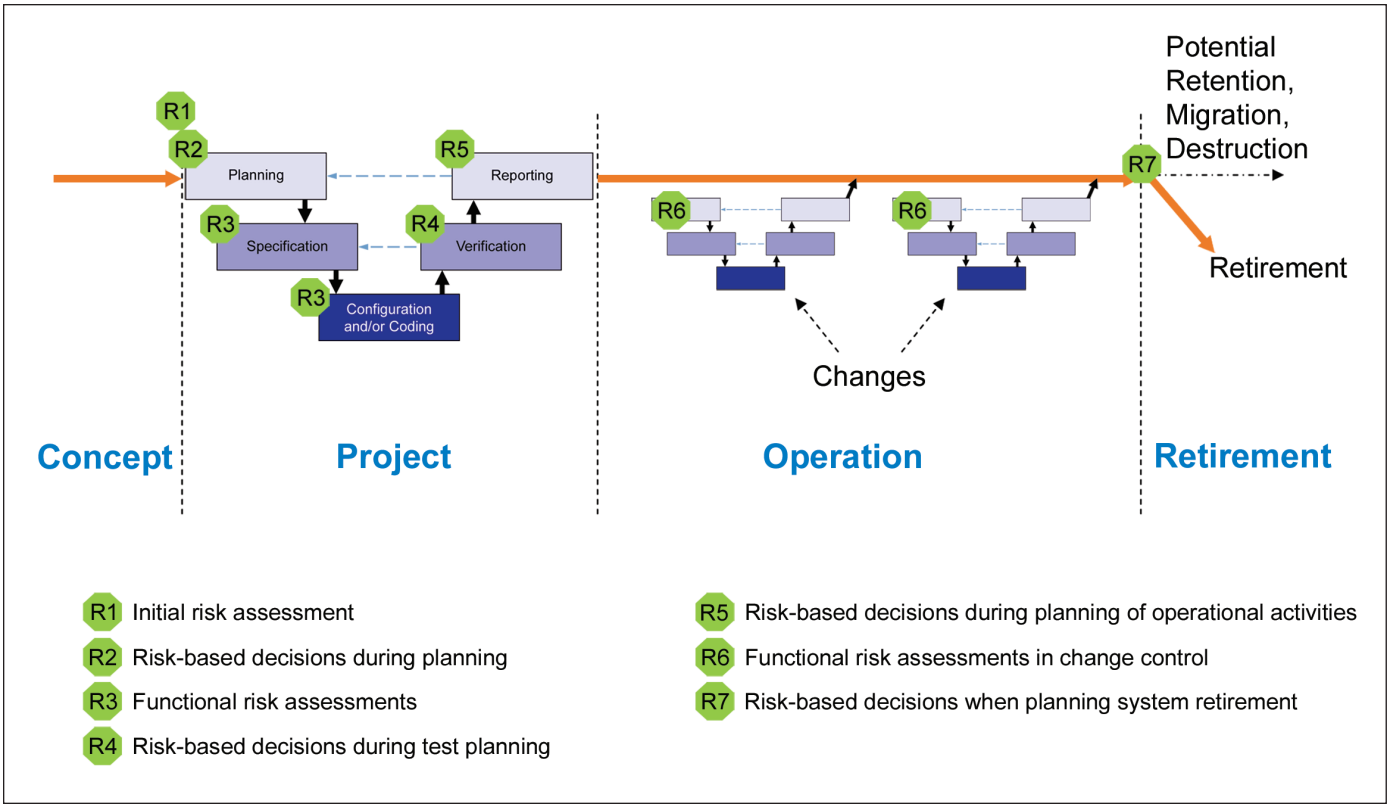

Figure 2. Risk management within the life cycle. (Source: GAMP 5)

Quality risk management was applied throughout the computerized system life cycle from concept to retirement, as illustrated in Figure 2 from GAMP 5.

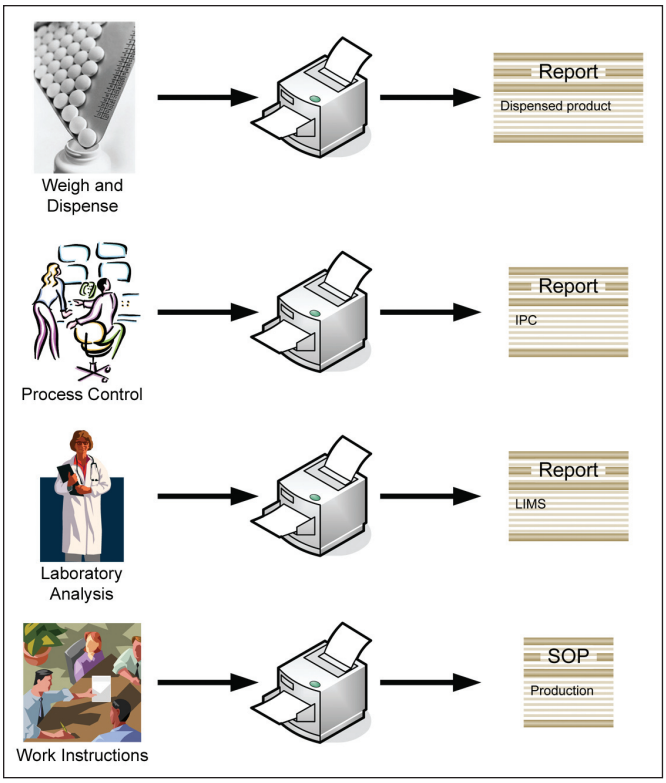

Figure 3. Paper batch record operations.

Electronic Batch Record System (EBRS) in the MES Project

The paper-based production batch record contained data from various sources - *Figure 3*.

The Electronic Batch Record System (EBRS) was introduced as part of the MES to replace the paper-based system as it offered not only reduction of data error and improved the control, but also advantages in regulatory compliance, such as:

- automated distribution of recipes to production areas
- enforced sequencing of required tasks
- recording of data and approval with automatic time/date stamp
- online production data for disposition, investigation, and analysis
- review and approval of electronic master batch records stored in the system, before release
- review and approval of electronic production batch records within the system with review by exception – only critical exceptions/deviations to the process are examined, and all other data from normal operations is also available in the record

Business Processes in the MES Project

The MES project included both manufacturing and packaging areas of the plant, where approximately 10,000 batches per year in 10 bulk formulations and 1,000 packaging presentations were made.

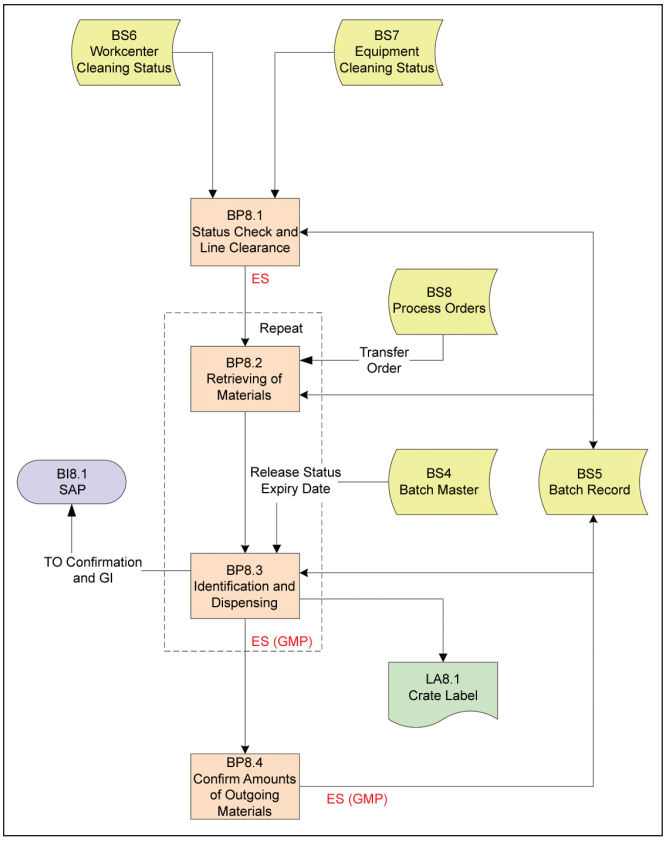

Figure 4. Business flow diagram for packaging dispensing.

The business processes included in the scope of the MES were as follows:

- Master Batch Records
- Cleaning
- Weighing and Dispensing
- Electronic Batch Recording
  - Production
  - Packaging
- Deviations, Exceptions, and Event Management
- Key Performance Indicators
- Integration with ERP and LIMS

The business flow of each process was analyzed and broken down into components, as shown in the example in Figure 4, for dispensing in the packaging area. This diagram shows four types of components each of which is described in detail in the corresponding URS.

- process blocks (such as status checks in BP8.1)
- interfaces to other functional areas (such as SAP in BI8.1)
- linked system areas for data exchange (such as batch master in BS4)
- creation and printing of labels (such as crate labels in LA8.1)

This flow diagram includes three separate Electronic Signatures (ES), two of which are required by GMP predicate rules. Deviations to the process, if they occur, are captured and stored in the electronic batch record within each process block. Each deviation requires justification at the moment of its occurrence and approval by QA and Production during batch record review.

MES Interfaces

The MES had direct interfaces with the company's ERP system, LIMS, and weighing scales for exchange of data. This enables full integration with all of the major systems included in the MES domain. Details of data exchange with the ERP system (SAP) are shown as an example in Figure 5.

MES Quality Risk Management – HACCP Method

Quality risk management was an integral part of the MES project management with systematic assessment, control, communication, and review of risks. The risk management model from ICH Q9 was followed, as illustrated in the diagram in Figure 6, taken from this standard.

The chosen risk management method was Hazard Analysis and Critical Control Points (HACCP) in order to build on product and process understanding and support identification of critical control points for the project. Analysis of both GMP risk and business risk was completed.

This method had strong acceptance from management and allowed project resources to:

- build close integration with known business process flows

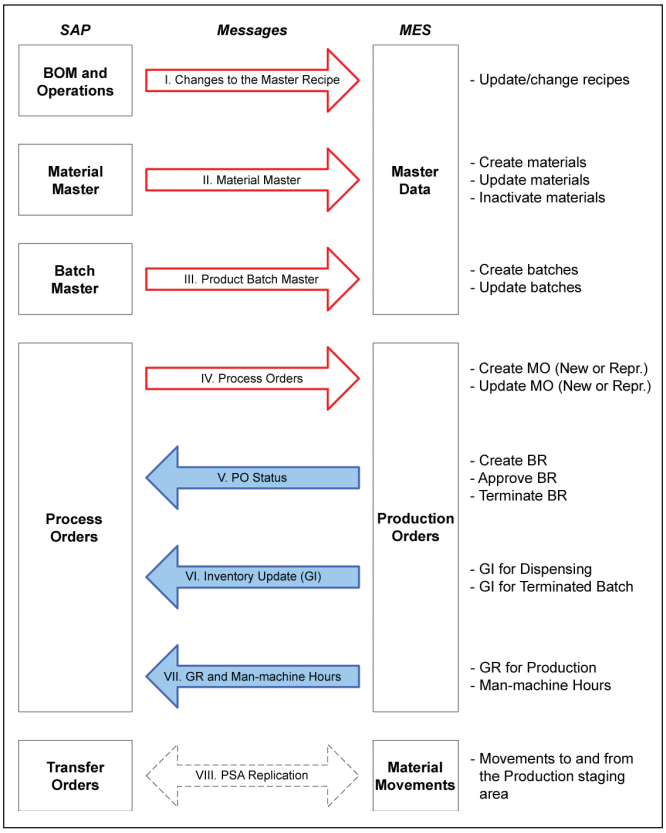

Figure 5. SAP interfaces.

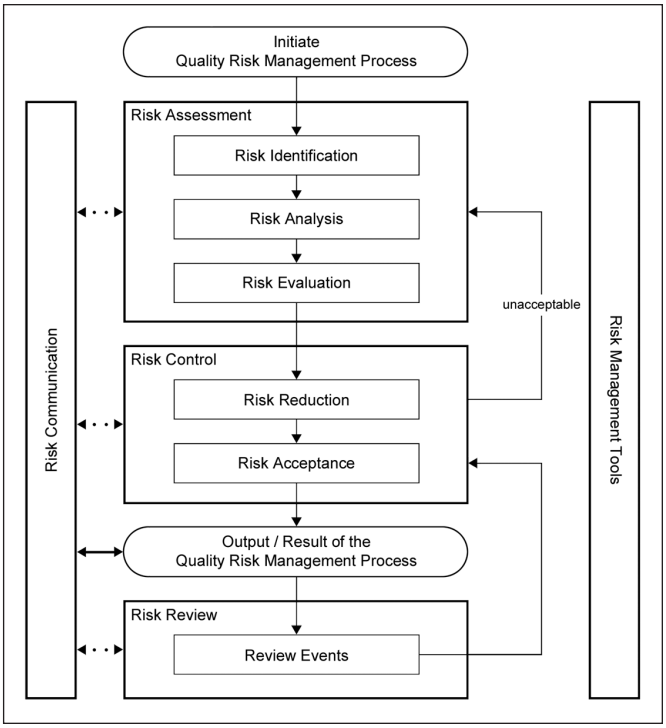

Figure 6. Overview of the quality risk management process. (Source: ICH Q9)

- focus on hazards that lead to risk
- feed back to URS and system development
- prioritize risks in a systematic manner
- reduced validation activity

The HACCP Method

HACCP offered a structured approach to the scientific analysis, evaluation, prevention, and control of hazards inherent in the design, development, production and use of products. It is the only method accepted by the FDA for analysis of food safety, is accepted by FDA in risk assessment of medical devices according to ISO 14971, and in the risk management of pharmaceutical quality according to ICH Q9. HACCP also agrees with the risk assessment and management process described in GAMP 5.

The HACCP method starts with the identification of potential hazards, defined as "any circumstance in the production, control, and distribution of a pharmaceutical which can cause an adverse health effect" (WHO definition). Examination of the harm that can be caused by such adverse health effects, when they occur, is achieved by risk analysis, defined as "the qualitative or quantitative process of linking the likelihood of occurrence and severity of harms" (ICH definition).

The HACCP method was developed according to the following seven steps:

1. Conduct a hazard analysis and identify preventive measures for each step of the process.
2. Determine the critical control points.
3. Establish critical limits.
4. Establish a system to monitor the critical control points.
5. Establish the corrective actions to be taken when monitoring indicates that the critical control points are not in a state of control.
6. Establish a system to verify that the HACCP system is working effectively.
7. Establish a record-keeping system.

The HACCP method is based on the identification and management of control points within the manufacturing process, rather than examination of failure modes, which can be done using the FMEA method. The behaviour of the system during use is constantly monitored, and corrective actions applied and verified as necessary. This approach ensures the detectability and recording of deviations during the process.

The next section explains how analysis and identification of hazards allowed proper containment and effective management of the risks associated with the MES project.

1. Hazard Analysis

Starting from the flow diagrams for each business process and the corresponding sections of the URS, potential GMP and systemic hazards were evaluated by the risk assessment team, including subject matter experts from QA, QC, Production, and Information Management. In this way, a full list of hazards was built up with the description of each hazard according to business area. The approved URS, current GMP regulations from FDA and EU, and the intended use of the EBRS system were used as references.

The analysis of each hazard required estimation of the following:

- severity (impact of its occurrence on product quality or patient safety)
- likelihood (how likely is the occurrence of the event during use of the system)
- cause (conditions which create the hazardous situation)
- measures (containment or elimination of harmful effects)

The evaluation of the intrinsic risk of each hazard was performed according to the risk matrix shown in Figure 7.

		Severity		
		Minor	Moderate	Major
Likelihood	High	M	H	H
	Medium	L	M	H
	Low	L	L	M
	Negligible	L	L	L

Figure 7. Risk matrix.

In this matrix, the following levels of acceptability were defined:

L (Low) – acceptable within the context of the project and managed according to existing procedures.

M (Medium) – unacceptable, corrective action is required to reduce the risk according to identified control points.

H (High) – completely unacceptable, risk must be eliminated using at least two independent control mechanisms.

The matrix was developed by the company's risk assessment team in order to allow suitable assessment of the likelihood of occurrence and severity typically encountered in the company's manufacturing context. Other companies may find that different definitions or levels would better suit their processes. The following likelihood categories were defined and used in the MES project:

High	Event seen often (> 1 in 100)
Medium	Event has been seen occasionally (1 in 1.000)
Low	Event has been seen rarely (1 in 10.000)
Negligible	Event has not yet been seen (< 1 in 100.000)

2. Determine Critical Control Points (CCP)

For each pharmaceutical quality hazard, controls were identified to prevent or eliminate the hazard or reduce it to an acceptable level. These controls were only applied to medium and high level risks, as the low level risks were acceptable by definition.

The controls were divided into the following two types:

1. **Critical Control Points (CCP)** which will be tracked and controlled during development, implementation, validation, and release.
2. **Good Practice** for which a procedure must be followed.

3. Establish Target Levels and Critical Limits

The CCP were further analyzed so as to identify the critical limits associated with the underlying hazard, which in most cases led to programmed solutions within the software.

A critical limit is defined as a criterion that must be met for each preventative measure associated with the CCP. There may be more than one measure that must be controlled to ensure prevention, elimination, or reduction of hazards to acceptable levels.

In the case of physical variables, target levels are defined to ensure that critical limits are not exceeded. For example, target levels of 3.2 ± 0.2 bar may be defined for IPC of vessel pressure in a freezing process. The control system would then produce a warning alarm and automated corrective action if the pressure reached 3.4 bar. It is important to note that critical limits must be defined for each CCP, but are not always quantitative.

4. Monitoring System for each CCP

Each CCP must be monitored according to an agreed mechanism with measurement against the critical limits. System software was developed specifically to address these areas with programming of different types of monitoring, such as:

- Operator entries or calculated values are compared to limits.
- Input value read from a barcode is compared to an expected value.

The results of the monitoring are recorded and included in the batch record and are available for review at a later stage in the process. If an alarm is produced, for example, in the case of an IPC which gives an OOS result, this will be recorded as a deviation.

(1) GMP Hazards

Hazard	Severity	Likelihood	Risk	Measure
The batch number of the starting material is not recorded properly for each container.	Moderate	Medium	M	System must be designed to enforce checking of pallets and containers.
Contamination of product from damaged containers.	Major	Low	M	System must be designed to require that damage to containers of materials is followed up by production supervisor and the results of the investigation recorded.
Calculated IPC results are outside the defined range in the processing or packaging instructions, but no alarm is generated or recorded.	Major	Medium	H	System must be designed to compare the calculated value of the IPC with the predefined limits, and produce an alarm if there is a discrepancy. System must force an authorizing signature from a responsible person in production if the IPC is outside the acceptable range.

(2) Business Hazards

Hazard	Severity	Likelihood	Risk	Measure
Major network failure leads to unavailability of system and production stops.	Major	Medium	H	Continuous network management.
Product recipes, MBR, and other industrial secrets are compromised.	Major	Low	M	System must be closed.

Table A. Examples of hazard analysis.

"In some cases, the residual risk was found to be unacceptable and was further mitigated by introduction of specific procedures designed to fully contain the risk."

5. Corrective Actions in Case of Deviations

When monitoring of the CCP shows that it is not under control, corrective action must be taken. The correction can be automated in some cases, for example, when a control system is programmed to correct for a drift in a measured IPC by compensating in another physical area of the system. In all cases, there is an investigation into the cause of non-compliance and determination of the disposition of any non-compliant product or process output.

A vital part of the corrective action system built into the system was to ensure that all corrective actions are recorded and followed up where necessary, as explained in the section on Review by Exception.

6. Verification Procedures

The procedures and mechanisms developed for verification of the implementation and monitoring of the critical control points were as follows:

- traceability of CCP to FS from Supplier
- document CCP implementation during installation
- verify CCP functionality during testing
- verify CCP before system release, including interfaces

7. Documentation and Record Keeping

The documentation and recording of CCP over time is possibly the most important part of the project and is managed as follows:

- Deviations are recorded and investigated by QA as part of Review by Exception.
- Corrective actions are fully recorded and followed up.
- Changes to process steps are managed under Change Control.
- Changes to associated hazards are subject to full HACCP, as per the present method.
- Changes to critical limits are assessed for compatibility with HACCP results before implementation.
- Verification procedures and schedules are regularly reviewed by QA.

Residual Risk

After completion of HACCP, the residual risk from each hazard was further assessed with verification of the following three conditions for each:

1. The CCP must have been implemented as indicated.
2. Monitoring of the CCP must have been implemented.
3. Corrective actions must have been implemented.

In some cases, the residual risk was found to be unacceptable and was further mitigated by introduction of specific procedures designed to fully contain the risk.

Examples of Residual Risk

- MBR does not match the registration dossier.
  - Procedures must be followed to ensure that approved

(1) GMP Risk

Cause	CCP	Critical Limit
System does not enforce checking of pallets and containers.	Software must force operator to confirm the batch number by scanning the barcode on each container.	As defined in warehouse management SOP; check barcode against batch number for that lot.
Damaged containers not detected and investigated.	Software must force supervisor to document and explain damage to product containers if recorded by operator, on receipt into manufacturing.	As defined in SOP for the process; check container status.
Out of Spec. IPC not detected.	System must generate a warning message when calculated IPC result is equal to or more than the target level.	Calculated value compared to upper and lower limits from MBR.

(2) Business Risk

Cause	CCP	Critical Limit
Inadequate network planning, management or configuration.	Ensure adequacy of network design with redundancy and built-in failsafe operational modes. Ensure rigorous system testing and validation of critical network functions and controls.	Network manager with defined job responsibilities with problem escalation process for the business.
Unauthorized persons have access to EBR functions.	Only authorized persons within the organization have access to critical functions.	Security compared to access control list defined by system owners.

Table B. Examples of CCP and critical limits.

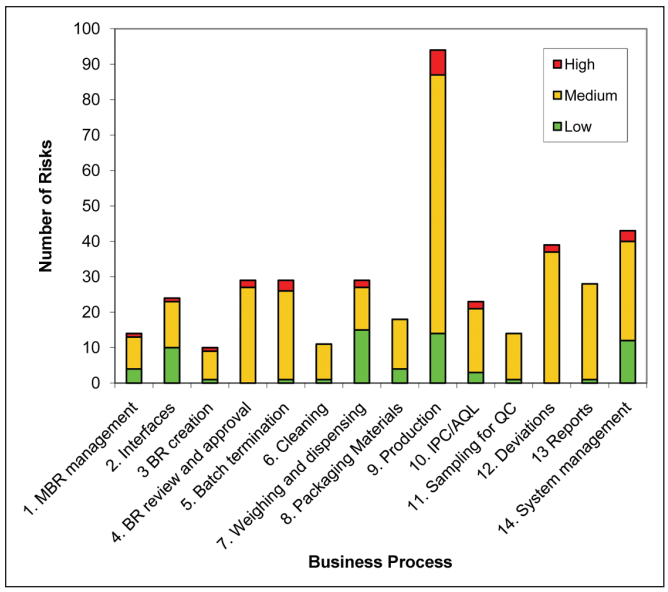

Figure 8. Intrinsic risk overview before HACCP.

master production records conform to the registration dossier for the marketed drug product.

- Data not protected by backing-up at regular intervals at a separate and secure location.
  - Procedures must be followed by IS and periodically checked by QA to ensure that system data is copied to a secure location.

Results of HACCP

Application of the HACCP risk management method produced a significant reduction in risk for the MES project and almost all of the identified risks were reduced to an acceptable level. The distribution of the intrinsic risks within the various business processes involved in the MES Project is shown in Figure 8.

The distribution of the residual risks, after application of the HACCP method to the MES Project, is shown in Figure 9.

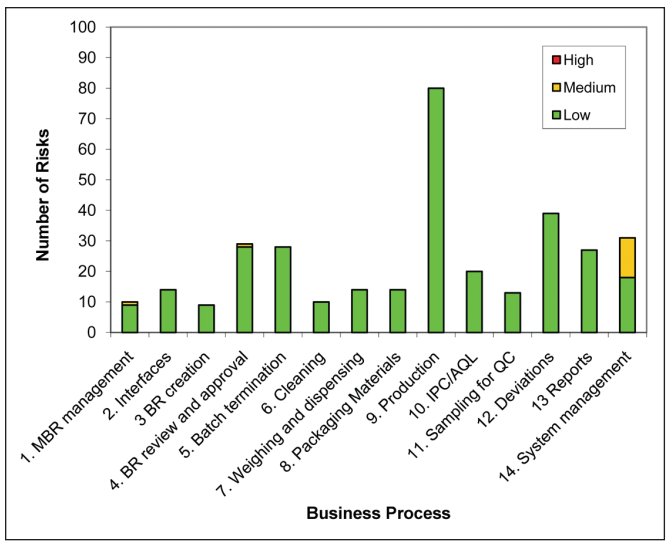

Figure 9. Residual risk overview after HACCP.

A total of 811 controls were identified for the entire MES Project with:

- 709 software-based CCP controls
- 102 procedure-based "good practice" controls

Application of this method ensured that 96% of the residual risks were classified as acceptable (that is 'Low') and the others, almost all in the area of System Management, were successfully mitigated.

Review by Exception

The principle of Review by Exception (RBE) was applied to review of the Electronic Batch Records (EBR) with automatic software filtering of production data to:

- Include critical exceptions/deviations to the process.
- Exclude normal operations data/events or alerts not required to support critical exceptions.

Extensive use of RBE functionality was justified in the MES project due to the rigorous application of the HACCP method according to ICH Q9.

Further information on RBE can be found in GAMP 5 and in the GAMP Good Practice Guide: Manufacturing Execution Systems.

Regulatory Expectations for RBE

Current regulatory guidelines allow QA review of exception reports for batch records managed under the following conditions, all of which have been met in the MES Project:

1. Functionality is clearly defined in requirements and specification documents.
2. Reference data is retained for the appropriate time period.
3. The computerized means of review is as comprehensive and accurate as the manual review.
4. Accuracy and reliability is demonstrated through qualification and validation.

Benefits of RBE

Application by QA and production managers of RBE to the review of electronic production records in the MES project had significant benefits and also represented a cost saving which helped to justify the cost of the project.

The principal benefits to the company were that:

- Time consuming verification of the complete batch record is not needed, as critical control points are monitored and controlled by validated systems.
- Production resources and QA are focused on issue resolution and investigation.

Risks of RBE

Application of RBE to the review of electronic production records was not without risk. As for the other parts of the

Hazard	Severity	Likelihood	Risk	Measure
The system does not record deviations related to use of major equipment for the production.	Major	Low	M	System must be designed to record and display deviations from the planned use of major equipment, with justification.
The system does not record deviations related to discrepancies in the calculated composite values of blended sublots of intermediates as compared to the authorized Manufacturing Formula and Processing Instructions for the product.	Major	Medium	H	System must be designed to calculate and indicate as a deviation any discrepancy between calculated composite values of blended sublots of intermediates and the defined acceptable range for the product.
The system allows production to continue after a deviation to a significant step in the execution of the batch has been disapproved.	Major	Low	M	System must be designed to ensure that production operations and use of materials cannot continue if a corresponding deviation has not been approved.

Table C. Examples of RBE hazards.

business processes within the scope of MES, the potential hazards associated with the use of RBE were assessed and fully mitigated.

In general, the risks of failure to capture deviations within the software and to correctly manage such deviations after review were considered to be the most significant.

Conclusions

EBRS was designed as a system to improve compliance and the batch review process. HACCP is a powerful method to identify and mitigate GMP and business risks, building on product and process understanding and identification of critical control points, allowing application of Review by Exception, significant cost savings, and improved accuracy and reliability of production data records.

Abbreviations

The following technical terms have been abbreviated in this article:

AQL Acceptable Quality Level
BOM Bill of Materials
BI Business Interface
BP Business Process
BR Batch Record
BS Business System
CCP Critical Control Points
EBR Electronic Batch Record
ERP Enterprise Resource Planning
ES Electronic Signature
FMEA Failure Mode Effects Analysis
FS Functional Specification
GAMP Good Automated Manufacturing Practice
GI Goods Issued
GMP Good Manufacturing Practice
GR Goods Returned
HACCP Hazard Analysis and Critical Control Points
ICH International Conference on Harmonisation
IPC In-process Control
ISO International Standards Organisation
LA Labels
LIMS Laboratory Information Management System
MBR Master Batch Record
MES Manufacturing Execution System
MO Manufacturing Order
OOS Out of Specification
PO Production Order
PSA Production Staging Area
QA Quality Assurance
QC Quality Control
RBE Review by Exception
URS User Requirements Specification
WHO World Health Organisation

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About the Authors

Tineke Bos has a background as a pharmacist (University of Groningen) and a PhD in pharmaceutical technology. Bos has more than 20 years of experience working in the pharmaceutical industry in several functions related to manufacturing. Bos was production pharmacist for Astellas Meppel. In this function she participated in the EBR implementation team and was involved in the risk management of this project. Currently, Bos is Associate Director Pharmaceutical

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Applying GAMP 5 to Validate an ERP System

by Stephen R. Ferrell

This article discusses how the GAMP 5 quality risk management strategy was applied to an actual case study of a validated Enterprise Resource Planning (ERP) system.

Introduction

Risk management concepts in the industry are maturing and harmonizing as reflected in ICH Q9 Quality Risk Management. GAMP 5® provides direction in applying these concepts in the development, implementation, and maintenance of computerized systems. Risk to the patient and product quality continue to be the primary areas of concern. This article shows how such risk-based approaches can be effectively applied to ERP validation and compliance.

Typically, Commercial Off-the-Shelf Software (COTS) packages, including those used as the basis for most ERP implementations, will be carefully tested by the suppliers before commercial release. Therefore, there is no intrinsic value in attempting to test every mouse click or every submenu in this context and it is not a regulatory requirement. The focus should be rather on ensuring that the configuration of the product is defined, holistic (in terms of GxP[1,2] and Part 11[3] compliance), follows actual business processes, and is verified to be fit for intended use.

The regulated company should focus on managing potential risk to patient safety and product quality, and ensuring compliance with the relevant GxP regulations, including 21 CFR Part 11. Additionally, they also should consider the impact to the overall business process.

GAMP 5 defines a computerized system as: "A computerized system consists of the hardware, software, and network components, together with the controlled functions and associated documentation."[4] Based on this definition, a holistic approach was used in the implementation of the ERP system as described below.

Case Study

Overview

The ERP system discussed in this article, SAP®, was a legacy system. The system had not been previously used for GMP purposes. Therefore, the documentation surrounding the system was essentially non-existent in that it did little to support the use of the system in a regulated environment.

An important element when purchasing a computer product or service is supplier assessment, which may include supplier audit. In this case, however, while the system was new to the GMP manufacturing plant, it had been in use supporting the business for 15 years. As a result, a decision was made, justified, and documented with the rationale for why an audit would not occur. The organization acknowledged that the vendor is an established and recognized business solution provider with a large user base in the industry. The project team defined and included relevant intended use risks in the Risk Assessment.

Process

Validation Strategy

Creating a Computerized System Validation Plan is a fundamental building block of any validation project because it outlines the strategy for the entire project. Keep in mind, however, that every system, implementation, organization, and site is different, so rather than focus on "what goes in a validation plan," focus rather on the various document components that do exist based on the legacy history of the ERP system to determine the rationale, and the approach used to outline a testing strategy. This strategy can be incorporated into any validation plan or equivalent.

GAMP 5 Based Risk Assessment

For the purpose of this case study, the risk was broken down into the following three components:

1. System Risks[5]
2. Criticality of User Requirements[6]
3. GMP T-Codes (Transaction Codes)[7]

Each function in the system has an associated code. Using a transaction code enables quicker access to any task in the system.

System Risks

A system Risk Assessment (RA) was prepared early in this project before the URS was written. It was essential that the project team agreed on the specific high level risks and functions that one would expect an ERP system to control. The project team used the SAP® whitepaper *"Complying with US FDA Title 21 CFR Part 11 for the Life Sciences Industry,"*[22] as a starting point for the team providing insight into SAP® functionality. The concepts in the whitepaper were easily translated by the non-SAP® specialist business units and then filtered for applicability to our business model. It is very beneficial to leverage what is available from the vendor on the specifics of the ERP system as the requirements are created.

Risk Assessment Workshops were formed and risk was discussed in the context of the functions that would be relevant to the business units going forward. Representation at the workshops included Manufacturing, Production Planning, Quality Assurance, Quality Control, Distribution, Sales, Customer Service, IT, and Validation.

Ultimately, the following four themes repeated themselves as potential remedial actions were developed:

1. ensure configuration is well defined
2. ensure configuration is adequately tested
3. ensure configuration is managed post-go live
4. ensure users are trained on said configuration

The company was able to apply the four themes in the context of their own business model to develop the following:

- Define
  - create the user, configuration, functional and design specification
- Test
  - build validation scripts
- Manage
  - create ERP friendly SOPs
- Train
  - teach the business how to use the system

The Risk Assessment included key GMP risks and other business risks, including those related to Sarbanes-Oxley (SOX).[8] All risk considerations were evaluated and where applicable, remedial actions were identified based on criticality. Each risk identified was clearly designated as GMP or otherwise. As the project progressed, the Risk Assessment was revisited twice; once after the User Requirements were defined and again after the Business Blueprinting or Functional Specifications were written.

One of the challenges with any Risk Assessment process is the assignment of H/M/L and the dependencies between justifying one risk as higher than any other. GAMP 5[9] provided the following error occurrence by transaction: 100=L, 1000=M, 10000=H. GAMP 5 suggests that a scientific approach to Risk Assessment be applied. After much debate, the approach agreed upon was to rely on the knowledge and collective experience of the workshop teams to create a baseline for H/M/L assignation and then to consistently apply it to the system.

This assessment was additionally used to provide priority targeting for remediation, and the results broke down as follows: 105 High / 84 Medium / 57 Low priority for remediation. Ultimately, the RA was revisited at the conclusion of the project to ensure all remedial actions were traced regardless of priority.

Risk-Based Criticality of User Requirements[10]

The seven step process below describes how the team leveraged the regulations and utilized the existing system documentation to aid in building the User Requirements. This process aided in the risk analysis and testing required to execute the project.

Step 1 – The Regulations

Many regulations clearly apply in this case, including: 21 CFR Part 11, Part 210 Part 211, Part 820, and EU Vol. 4 Annex 11.[23]

An ERP system plugs into almost every part of the business process. The project team reviewed the functionality of the system and assessed the functions and filtered through the main GMP (Part 820). This early exercise enabled the development of very low level GMP-centric user requirements that the system would have to conform to be compliant. This activity was done internally by the validation team prior to user requirement workshops. This created a first pass "must haves" that the business could build the system around to be GMP compliant.

Step 2 – Recycle

Most GMP regulated operating companies will already have an ERP or similar system in place. If a company has been regulated for a while, there may already be a validation package from a previous system that could be recycled, and perhaps a number of change control packages to use. In this case study, using a high level Risk Assessment system, the company was able to discern which parts and pieces of our original URS (which was system neutral) were applicable to the current business process.

Step 3 – Business Needs/User Requirement Workshops

In order to make the process as focused as possible, User Requirements workshops were formed with the various functional groups. All user groups were given the skeleton URS two weeks in advance of the first workshop and were encouraged to add, subtract, edit, and comment. The com-

mented URSs were consolidated and ultimately yielded in excess of 3000 user requirements, some duplicated, some ambiguous, some bizarre.

Next, three half day workshops per week for four weeks were scheduled, each and every URS was reviewed, and a unique identifier for traceability (like PP-164 or OH-23) was captured. Each URS was given a criticality number directly correlating to its impact on the GMPs and Part 11. These were:

- Mandatory URS Ranked as a "1" – GMP or GMP and Business Critical
- Beneficial URS Ranked as a "2" – non-GMP, but Business Critical
- "Nice to have" URS Ranked as a "3" – non-GMP Non Business Critical

At the end of the four weeks, the following user requirements were captured:

- 396 level "1"
- 1157 level "2"
- 198 level "3"

This approach achieved two key goals. First, by virtue of the risk and criticality process, the GMP testing burden was reduced to a little less than 400 requirements and second, a requirements document was now available for the ERP analysts to build from. This document was developed by all key stakeholders, including QA.

Step 4 – Blue Printing

In order to translate the neutral user requirements into ERP centric functional requirements, a suite of Process Design Documents (PDD) (Functional Specifications) was created. The goal of the PDDs was to define the system in a way that could be understood by both the analysts and business. Each PDD was traceable back to as many as 30 URSs and all business processes were defined graphically using MS Visio.

The process flows integrated into PDDs gradually formed a picture of what the system would look like post go-live and the use of the ERP integrated into our business process started to take shape. Later, the flows were used as a basis for PQ and the PDDs were tied to the new SOPs, which then in turn formed the baseline for process change control.

In addition to the process flows, the ERP Implementation Team translated URS into functional processes broken down by Functions, Data, or Interfaces.

Step 5 – Functions[11]

Each collection of URSs was translated into the appropriate function set in the ERP; any inputs, outputs, calculations, configuration, or security considerations were captured here.

Step 6 – Data[12]

The data section was mainly focused on those data elements necessary to be considered for the function set in scope to execute correctly. Within SAP®, Master Data plays a very important role and can cause significant system issues if not formatted or defined correctly. Where possible, Master Data considerations were included in this section.

Step 7 – Interfaces[13]

Beyond a bar-coding system, the ERP instance does not have any major peripheral interfaces; due to the nature of the formation of sub teams (by ERP Module); however, there was reference to the ERP Modules that any particular function set was or could impact. This facilitated the sub team communications as cross functional processes were developed.

GAMP 5 Based System Configuration[14]

This posed a challenge as the legacy ERP system was already in place. As previously described, the system had been used for non-GMP purposes; therefore, documentation that had been created while valuable to the ERP team was not easily translated into the regulated context.

The configuration definition process[15] was split into two parts. For the servers, operating systems and core ERP build, System Configuration Specification (Core SCS) was created. This allowed verification to occur simultaneously thereby qualifying the hardware and core software, while the ERP analysts were translating the user requirements. For the actual configuration or customization of the ERP, the decision was made to use the legacy system as a baseline, documenting all changes that were necessitated by our compliance requirements utilizing additional Configuration Documents (CFD).

Part 1 – Hardware and Core Software SCS[16]

GAMP 5 *Appendix D3* provides a check list for SCS content. Also, the team utilized the *"IT Infrastructure Control and Compliance Guide."*[17] Depending upon the roles and responsibilities defined in your organization, the documentation can be managed effectively with well defined roles and responsibilities assigned to each business unit within the company. For this project, splitting the configuration documentation allowed the team to engage a completely separate resource pool at the component level and frame a schematic of the system. Specific sections of the SCS have been chosen to highlight some key information that was gathered and documented.

ERP Infrastructure Hardware Configuration

The server setup is considered standard and consists of the following four environments:

1. Development
2. Sandbox
3. Quality (Test)
4. Production

Note that this vendor recommends installing the application server and central database server on separate machines and placing them in a separate subnet. It is beneficial to seek affirmation and supporting information from the vendor on installation requirements.

ID	Item	Description
SCS-01.	Host	Prod007
SCS-02.	Model	IBM P570
SCS-03.	Operating System	AIX 5.3.7.0, 64 bit
SCS-04.	Other applications installed:	DB2 9.3.1
SCS-05.	Processors (CPU)	1 – 16 POWER5/POWER6
SCS-06.	CPU Speed	1.0 – 4.7 GHz CPU clock rate
SCS-07.	RAM	12 – 28 GB
SCS-08.	Disk Space	660 – 1200 GB
SCS-09.	Network Ports	Minimum 1 Network Port
SCS-10.	Logical Partition	Yes
SCS-11.	LPAR Details	4 FC Adapter 2 Network Adapter

Table A. ERP infrastructure hardware configuration.

Table A illustrates how each server was broken down. Table B illustrates how each switch was broken down.

ERP Infrastructure Environmental Conditions

It may seem redundant to capture and verify environmental conditions, especially considering the servers had already been used in support of the application. However, failure to ensure a temperate and sustained environment for your servers can have a significant business impact - *Table C*.

Physical Security

All of the Physical Security attributes were defined and later formally verified for the various data centers around the globe.

Database Security Profiles

An important and easily overlooked component to any client/server system is database security, i.e., who has access to your back-end tables. Typically, application security will not address those accessing your servers from outside the application. For this ERP system, the Administrator Accounts, Administrators Roles, Role Mapping, Data Exchange Account, and Unix Access were defined. Again, the "buckets" are not as important as the content, and who can access the data. It is important to understand who can do what, define it, and control the access to the data.

ID	Item	Description
SCS-12.	Model	Cisco 3750G
SCS-13.	Serial Number	CAT0923ABC2 CAT0923 ABC 1 CAT0923 ABC W CAT0923 ABC L
SCS-14.	Number of Ports	24

Table B. Server configuration.

Network Topology

Table D describes the various components that were mapped and later qualified.

Transport Management

Figure 1 illustrates how the transport process flow is managed from Sandbox to Development, from Development to QA, and then ultimately into production. It is important to define and control the transport method and flow. This should be incorporated into the change control system.

Peripheral System Interfaces

The last key element to discuss in the Core SCS are Peripheral Systems. It is important to understand the data input into the ERP, the data source, and the controls around that source. Equally, one must understand what system the ERP output data is sent to for use. Those interfaces and the associated systems should be carefully evaluated to determine GMP use and subsequently their validation status. Examples from this implementation included a barcode system, a LIMS, and a Labeling System.

Part 2 – Customizing the Application and Configuration Documents (GAMP 5 Appendix D3 – 3.3.5 Software Design)

As described earlier, the ERP system was used for non-GMP purposes; therefore, the configuration documentation was not very reliable. The idea of examining and categorizing all of the various customizations of the past would prove to be a non-value added exercise, and it became very apparent that doing so would not be practical, due to the required customization to further achieve compliance.

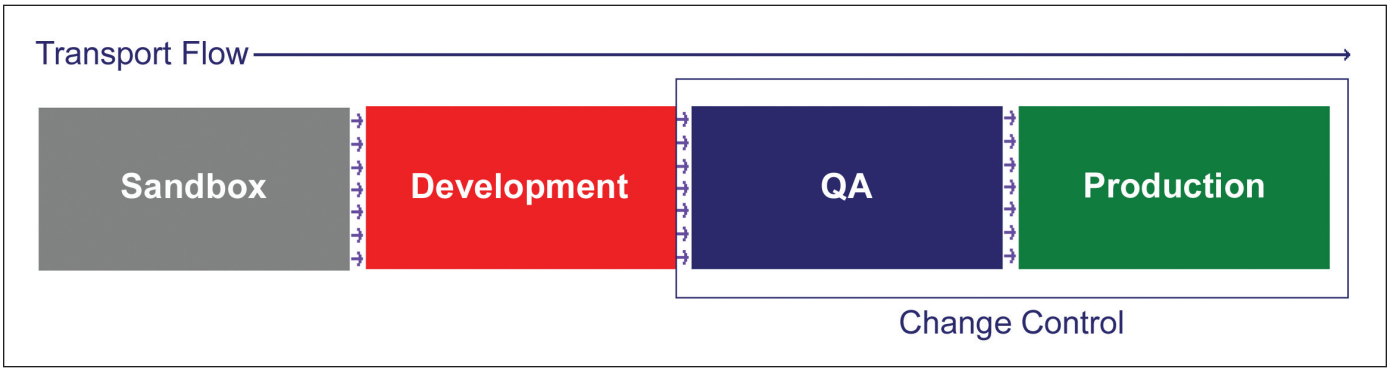

Figure 1. Transport management.

ID	Hardware	Requirement
p 570 Servers		
SCS-15.	Operating Temperature	5°C to 35°C (41°F to 95°F)
SCS-16.	Relative Humidity	8% to 80%
SCS-17.	Operating Voltage	200 to 240 VAC 50/60 Hz

Table C. ERP infrastructure environmental conditions.

Configuration Documents (CFD)

Setting static configuration within the ERP application is typically limited to the ERP Analysts. It is not recommended to allow all user levels to have this privilege since without checks and balances (change control) chaos can quickly become the order of the day.

One of the ways to capture your configuration is by a screen shot. In fact, by adopting the screen shot approach, it is possible to quickly show both the before and after configuration, especially important when revising a "living" system.

Before and after screen shots provided a brief description of the change in scope, its reason for being, and the data objects and modules affected.

Since they were close to 300 CFDs, an additional "Custom SCS" document was created to act as an anchor. CFDs were individually numbered and titled using the Master SCS number, this would help later during verification.

Non-GMP T-Codes (Transaction Codes)

The SOX[18] and business requirements and segregation of duties for user access had previously been defined by the Internal Audit Group and had been administered and analyzed since the inception of the SOX[19] rule. Therefore, no additional work in relation to those T-Codes was necessary.

GMP T-Codes (Transaction Codes)

In addition to the CFD indexing, the "Custom SCS" also included a list of GMP T-Codes. T-Codes are short macros which SAP® uses to execute a series of commands against user or system provided input. Typical out of the box ERP systems provide several hundred T-Codes and additional customized T-Codes can be created as needed.

GMP T-Codes were identified for two reasons: first, to make sure they were all defined for subsequent testing, second to create a basis for user administration post-validation. The list of T-Codes came from the following two sources: 1. SAP®'s Whitepaper[22] and 2. the segregation of all of the security centric user requirements translated into T-Codes.

IQ Strategy Phase 1

IQ was broken down into two discrete phases. The first phase verified by way of test cases based on what had been defined in the Core SCS. This was done as a parallel activity and began while the ERP Analysts were still working on translating the User Requirements into Process Design Documents. This approach yielded the following benefits:

- All servers identified by the network topology were qualified.

Legend	
Legend Subtitle	
Symbol	Description
	PC
	Switch
	Library
	Lan
	User
	Router
	Server

Table D. Network topology.

- Server hardware placed under change control early.
- Validation resources fully engaged.
- Activity complete before OQ authoring began.
- IQ uncovered issue with backup configuration that would have caused delay in system recovery time.

IQ Strategy Phase 2

IQ Phase 2 was perhaps the most challenging part of the project from a resource and testing perspective. Early on, it was decided to focus the configuration verification only on those changes that were necessary to achieve GMP compliance. With the 300 CFDs in hand, the documents were verified against the system. An onshore/offshore model was used to reduce costs. Somewhere, the phrase "document the system" got lost in translation.

As the verification process began, there were a number of situations where the configuration in the system didn't match the CFDs. Each time that occurred, the issues were fed through the deviation system to determine whether the system was correct, the document was correct, or both required revision and synchronization.

Though under significant time pressure, the validation team refused to let the OQ commence until CFDs were correct and there was a verified configured baseline to execute the OQ on. Ultimately, the pain of having to create deviations and recreate CFDs drove a "right first time" mentality which prevailed through the end of the project.

OQ Strategy

Regulators are focused on ensuring that a company's computerized quality systems and business intended use are GMP compliant. Regulators are not focused on a company's business or financial goals, but the quality and safety of the product for public use.

The test cases were focused exclusively on the URSs ranked as "1" or "GMP" to satisfy the regulators and the business requirements ranked as "2". As with all validation efforts, the test cases' authors were tasked with ensuring complete coverage to the URS and were tasked with completing the relevant sections of the traceability matrix as they wrote tests.

An independent approach to review and approval was practiced to ensure that as soon as test cases were ready, they were pre-approved and executed. While we started with Test Case 1 and went all the way to Test Case 85, they were not executed in numerical order, but on a first come, first served basis. Since at this point the traceability matrix was a living document, it was easy to discern where any regression testing was necessary and ultimately very little had to be done.

The design of the ERP test cases, though compliant with the SOPs, does differ slightly from the usual template. Due to the prominence of T-Codes in the SAP® landscape, a T-Code column was added into the test case directly after the instructional step. This allowed the reaction of T-Codes against the configuration to be tested over and over again. It also served as a training tool for the business as they continued to familiarize themselves with the application.

Typical to any OQ, it contained positive and negative testing,[20] ensured the integrity of audit trails verified and captured screen shots, and executed queries. Additionally, where a business process had been really well defined and was SAP® heavy, a third party application captured a screen shot and transactional data as a user moves through the system. That raw process flow was then used as the basis for SOPs, work instructions, and ultimately training.

There were surprisingly few deviations and our OQ covered all of GMP requirements across the following modules: Production Planning (PP), Quality Management (QM), Sales and Distribution (SD), Customer Service (CS), Warehouse Management (WM), and Material Management (MM).

Finance (FI) and Controlling (CO) also were tested though not to the GMP level. (GDP requirements and objective evidence were left to the discretion of the business).

PQ Strategy

In a traditional PQ, one would execute the production system and then after its successful completion, "go-live." However, that was not possible since the non-GMP North American facilities were already utilizing the live system. Having previously qualified the transport tools, the technical team could port an identical likeness of the QA box[21] (without data) into the production environment. Verification occurred in the QA box, indicating the business process worked in the QA environment; therefore, they would surely work in production.

Relying on the Process Design Descriptions and creating cross module test cases, the new ERP interactive business processes were verified. Where the OQ scripts could be more easily defined by module, the PQ was far more integrated and was executed during production using the correct resources from the business with the own login IDs and authorization levels. Focus on PDDs. This activity also was tied to SOPs and served as a further pre-go live training exercise.

By the final stage in the process, the team did not expect many deviations and were rewarded with only human, not system errors. After 18 months of effort, a couple of million dollars, the input and interaction of all facets of the business, and three consulting companies, the system went live 5 January 2009. It worked. Most of the team had participated in at least three ERP implementations and validation. Like our veteran ERP team I expected issues. We had set up a war room and validation triage, and waited. After being open only three days our field hospital was closed due to lack of patients.

Traceability Matrix

Since the risk management approach was split into two parts (Risk Assessment and the Criticality Ratings in the URS), the Traceability Matrix was too.

The first matrix, as described earlier, was built by the testers as they completed the OQ, and traced URS to OQ. The second matrix traced the high level risks driven from the Risk Workshops to the PQ and our SOPs ensuring that each risk identified had a completed verifiable remedial action. This approached allowed the gap to be filled in which can sometimes occur between the RA and the URS and ensured that the process had adequately addressed all of the risks and requirements.

Conclusion

To summarize:

- Most deviations centered around poor documentation.
- The system went live on time and on budget.
- Minimal to no impact to business post-go live.
- Increased perception of value in validation.
- Only five Moderate changes in first two weeks, all low impact.

Since January, one full regression test cycle has been conducted further proving the integrity of the validation and the sustainability of the change control system.

A key item to note is that it started with a user community who lacked SAP® knowledge, with an approach that was outside SAP® and looking in. If a similar effort was conducted today, the approach would be more focused on SAP® looking out, focusing more on the use of T-Codes in relation to the business process. This may produce the same result with perhaps a little less effort.

In conclusion, GAMP 5 as a tool for your ERP implementation and validation is strongly recommended. A good validation is not a hundred binders and rooms full of paper, it's a succinct risk-based effort that focuses on the FDA and other regulators' core concerns of product quality and patient safety, and ultimately delivers a system that is as robust as it is compliant.

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Scaling of Quality Measures When Using a Configurable Manufacturing Execution System

by Rolf Blumenthal

This article focuses on scalability of activities in the life cycle of computerized systems and outlines the level of service standards that pharmaceutical customers can expect from computer system suppliers.

Introduction

Almost gone are the days when pharmaceutical companies generated tons of paper by printing manufacturing records as by-products of drug manufacture. Today, pharmaceutical documentation is instead handled as an electronic process. This does not only save paper, but also considerably reduces the effort involved in reviewing and subsequently verifying documents. Computerized systems are used to run routine checks on entered data, while QA personnel can concentrate on exceptions and assessing the effects they may have on the quality of the pharmaceutical product (known as "Review by Exception"). The use of computerized systems has a wide-ranging impact on established manufacturing procedures. It requires that such systems are automatically subject to validation procedures based on national and international legislative regulations governing the pharmaceutical sector. The objective of validation is to ensure that these systems satisfy the highest quality standards in terms of development and operational processes.

The Good Automated Manufacturing Practice (GAMP®) guide is a comprehensive document and provides helpful and practical recommendations on appropriate methods and procedures for software development. It deals with the complete software life cycle – from the planning process through implementation and operational stages to eventually retiring the system – and illustrates its recommendations with practical examples and hands-on templates. The latest version, GAMP 5, now recommends that companies scale their validation efforts for deployment of configurable systems based on a risk analysis and to incorporate supplier documents to a much greater extent in the validation process.

What is new in GAMP 5?

The GAMP 5 Guide was issued in March 2008. When compared to earlier versions, it becomes evident that – apart from many improvements in the details – there has been a fundamental shift in the way of thinking. GAMP 5 puts emphasis on the scalability of the procedures and methods being applied, which results in more efficient quality measures, while not diverting from the key objective: patient safety.

This article focuses on the recommendations regarding scalability of activities in the life cycle of computerized systems, and in this context attempts to outline the level of service standards that pharmaceutical customers can expect today from their computer system supplier.

Pharmaceutical Company and System Supplier are Getting Closer Together

Originally, the GAMP Guide was intended to help suppliers of computerized systems understand the specific regulatory requirements of the pharmaceutical industry, and as a consequence, deliver higher-quality computerized systems. However, the editors of the latest version of the Guide, GAMP 5, communicate a sense of changing awareness in the pharmaceutical sector. They have had to acknowledge that most computer system suppliers have already significantly improved both the quality of their systems and related internal software development methods and procedures. This results in a recommendation to embrace the knowledge and activities of the supplier and to integrate them into the pharmaceutical customers' in-

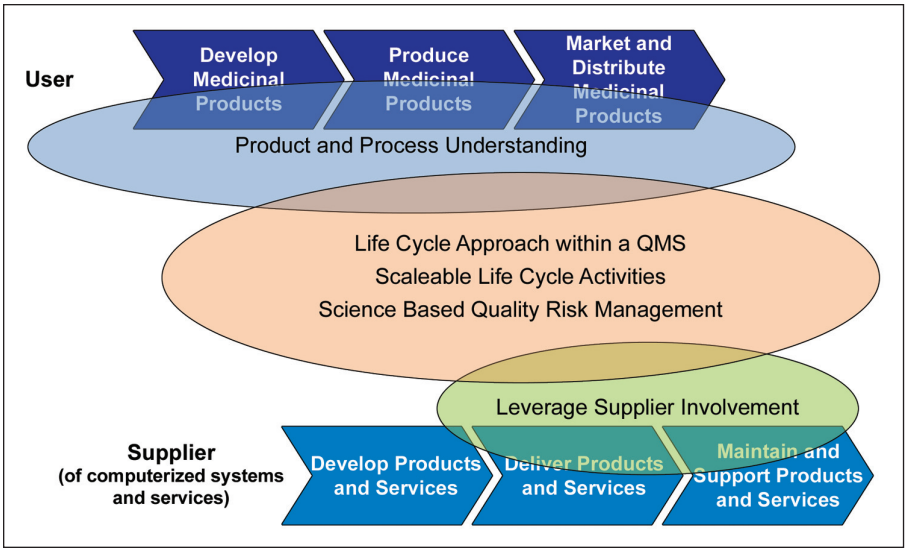

Figure 1. The worlds of pharmaceutical manufacturer and system supplier move closer together. (Source: GAMP 5)

ternal procedures to a much greater extent - *Figure 1*.

So why not take advantage of the work that system suppliers have already done when introducing new computerized systems? Why should a GAMP-based functional test already carried out at a supplier's premises not be allowed to replace a test at the customer's site – or at least serve as the basis for internal follow-up checks? Basically, customers should make use of existing documentation, tests, and test equipment of suppliers and determine how such resources can be directly incorporated into their own software life cycle management processes.

But there are also a number of advantages for the supplier. For example, pharmaceutical companies can get involved in a supplier's functional tests well before a system is delivered. If, during this process, a pharmaceutical company notices that the system does not meet the specified requirements, further cost-intensive delivery procedures can be postponed until both parties are satisfied that all requirements of the end user are definitively fulfilled. For this purpose the following requirements need to be met on both sides – by the customer and the supplier.

Established Quality Management System

A well-designed and well-functioning quality management system that supports day-to-day activities – and is helping rather than hindering the process – is an essential prerequisite in taking full advantage of the software and services provided by the supplier.

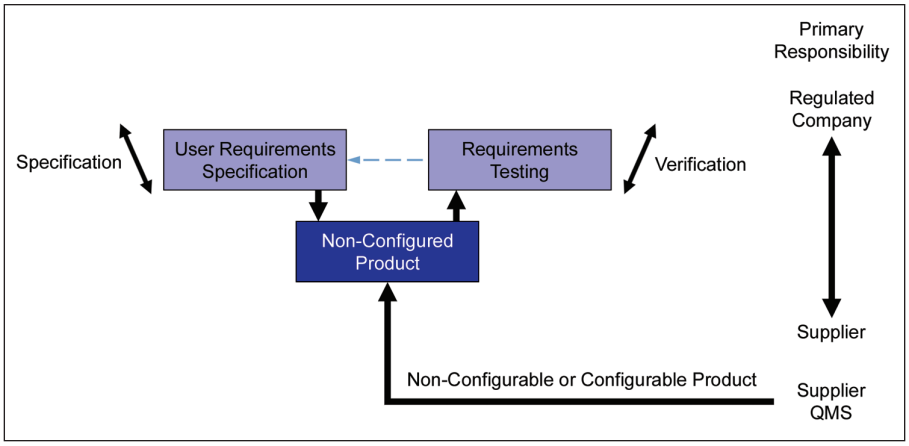

Figure 2. Approach for Category 3 Systems: Non-Configured Products. (Source: GAMP 5)

The pharmaceutical customer should audit this quality management system at the system supplier's site to establish a benchmark for determining the quality of the supplier deliverables at a later time.

Process Understanding

A system supplier needs a good understanding of his customers' processes to be able to contribute significantly and actively to a successful collaboration between supplier and customer. In order to develop a system that really meets the customer's needs, the system supplier must have clear knowledge of how the customer's manufacturing processes work. Software specifications in particular require exact knowledge of the processes at the customer's facility because this information is a major factor in defining the functions that will support the end user's activities. Writing clear, unambiguous, and understandable user requirements is an essential part of this, and is seen as a fundamental prerequisite in all versions of the GAMP Guide.

Precise Description of all Processes to be Supported by a Computerized System

The use of graphics to describe how the process will be defined in the system can be equated to the way an architect uses drawings to give his customer an impression of what a building will eventually look like. Many established standards and tools can be exploited to generate graphical elements that can be applied to develop a language that is understood by both parties.

System Understanding

At various points in a product's life cycle, a pharmaceutical customer is required to provide input to the supplier, even though a complete system has been bought. For example, the pharmaceutical company is involved in the first audit, in the process of defining system requirements, in conducting a risk analysis and assessment of processes and functions, and in running tests. The better the customer understands how such systems are developed, the more efficient these activities will be.

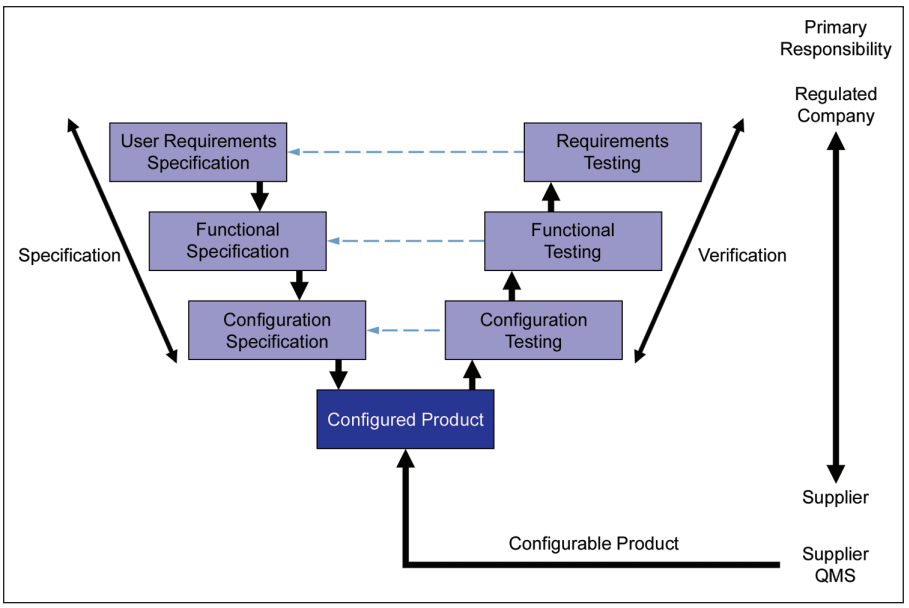

Figure 3. Approach for Category 4 Systems: Configured Products. (Source: GAMP 5)

The GAMP Guide uses the term "subject matter experts" in this context, and suggests that they should play a greater role.

By following the recommendations for customer-supplier collaboration, a pharmaceutical company can avoid duplication of efforts and achieve the greatest possible increase in efficiency by making good use of a supplier's QA activities. In this respect, patient safety, product quality, and data integrity are some of the criteria a drug manufacturer should keep in mind as the primary yardstick.

The Category of a System Determines the Scale of Life Cycle Activities

According to GAMP 5, the classification of the system influences the required life cycle activities, along with the results of supplier and risk assessments. The category of a system now has an impact on the well-known life cycle approach. This already becomes clear when looking at the various physical manifestations of V-models for different categories.

In the case of an non-configured category 3 system (Figure 2), the approach requires fewer activities than for systems in Categories 4 or 5, which can be modified by changing the configuration or by customization.

In a configurable system (Category 4), the configuration also has to be defined, described, and tested - *Figure 3*. In a customized system (Category 5), software specifications, software development and related tests also have to be considered - *Figure 4*.

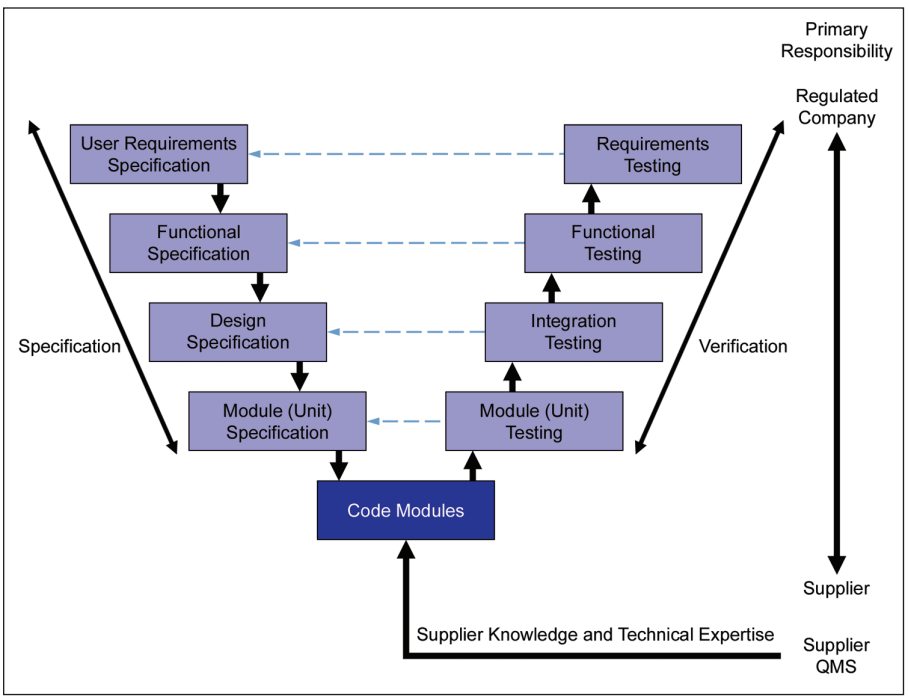

Figure 4. Approach for Category 5 Systems: Custom Applications. (Source: GAMP 5)

Patient Safety – The Benchmark for Risk Assessment

GAMP 5 follows a risk-based approach to computerized systems, based on that developed by the US FDA a number of years ago when it launched its initiative "Pharmaceutical cGMPs for the 21st Century: A Risk-based Approach." This approach requires making risk assessments on different planning levels. For example, it is recommended to start a project with an initial risk assessment of the system, which should then be followed by more detailed risk assessments of user functions during the specification phase. This means that GAMP 5 recommends basing decisions on a risk analysis and using these results as a starting point for mitigation activities. Risk assessment needs to be scientific. To this end, companies should use methods that take into consideration factors such as probability of occurrence, range of potential consequences, reasons for an error, and the difficultly in mitigating the identified risks. Life cycle activities and associated documents can then be scaled in line with the risk involved, the complexity, and the degree and type of customization required.

A completely new aspect of risk analysis, as described in GAMP 5, is the relativization of risks with respect to patient safety, product quality, and data integrity. There is actually a benchmark for risk outside the system being studied. This means that risks that are classified as serious inside a system may

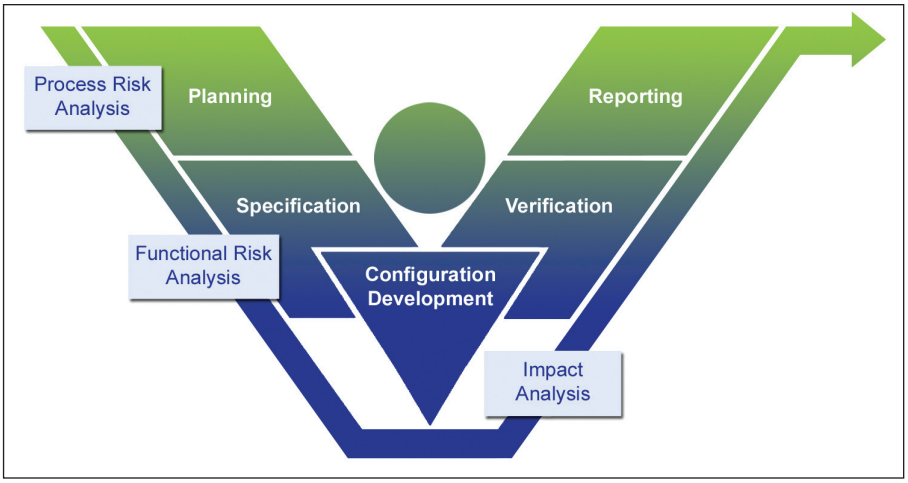

Figure 5. Risk analysis in different phases of the software life cycle.

be negligible when considering them from a patient safety perspective. For example, a miscalculation of product costs does not affect patient safety and is therefore not classified as a high-risk factor, although such an error would certainly constitute a high risk from a business perspective.

If it is assumed that the risk level is based on a Gaussian distribution, the inclusion of patient safety criteria will make it possible to significantly reduce the measures needed in the analysis. However, this does not release suppliers from the contractual obligations to test their systems.

The MES as a Case Study for a Configurable Software System

In the pharmaceutical industry, Manufacturing Execution Systems (MES) are employed to perform tasks in a number of different areas, e.g., creating pharmaceutical manufacturing records or controlling and tracking input material or equipment used in production. They support and facilitate on-site routine checks of data collected and entered. As a result, QA personnel can fully concentrate on exceptions and assessing the effects they may have on the quality of the pharmaceutical product (Review by Exception).

With this type of task definition, it is quite obvious that MES systems may include functions that could carry particular risks with regard to patient safety and product quality. In addition, MES systems need to comply with national and international legislative regulations governing the pharmaceutical sector, because the regulatory requirements on traditional paper-based procedures – such as the FDA requirements for current Good Manufacturing Practices (cGMP) compliance, also do apply to electronic procedures.

As a result, this places high demands on the quality of the development process and the subsequent verification of an MES system. The following sections describe methods that can be applied to meet these demands in an MES environment, in accordance with the recommendations given in GAMP 5.

Life Cycle Approach with Risk-Based Scaling

Today, MES systems can only be operated in a cost-effective manner if they are based on an existing product, not custom built. They can be adapted to meet specific customer requirements by configuring the product, and – only to a limited extent – by customizing the software. If the approach suggested by GAMP 5 is used, life cycle activities must be in line with the recommendations for a category-4 system, i.e., a "configured product" to be able to support the continuously ongoing development of a product using as far as possible the same methods all the time, a variant of the approach may be useful. In this variant, the specified requirements can be met both by making configuration changes and/or software modifications - *Figure 5*.

As MES systems provide an increasing number of complex functions, risk-based scaling of life cycle activities can make a significant contribution toward achieving clear efficiency gains.

The first risk assessment, should be performed for the processes supported by the MES, rather than for the functions to be implemented. However, special expertise and knowledge from the pharmaceutical industry is needed to assess process risks. Only a pharmaceutical specialist – a "qualified person" – of the company is able to make a final decision about the GMP relevancy of a given process step. An example for such a process step is the review and approval of a manufacturing document (21 CFR Part 211§192 Production Record Review).

With this first assessment, the focus moves toward GMP-critical procedures. The scaling potential associated with this is based on the external benchmarks of patient safety and product quality. As the process risk analysis takes place very early in the planning phase, the response to an identified high GMP risk may even result in changing defined user requirements.

The next level of detail in the risk assessment process focuses on the functions of the MES that will be used and needs to be considered in relation to the first risk assessment step. As this is a purely technical assessment, the software supplier can carry it out on his own, but a subsequent review by the pharmaceutical manufacturer is always necessary. In the assessment process, the probability of occurrence, the probability of detection, and the anticipated consequences of an error are evaluated first, and based on the obtained results, the identified risks are then classified as low, medium or high. Apart from differentiating "user errors" from "system errors" different actions can be initiated to mitigate the risk, such as defining type and scope of a test or introducing a new operational procedure for the pharmaceutical employee. The test procedures described in the risk analysis should be worded in such a way that they can be used "as is" in test specifications. This means that the functional risk analysis has a direct impact on the functional test

and determines the level and scale of testing activities required.

In the development phase, there is an additional third risk assessment process to estimate the impact a change will have on the stability of an existing system. Wide-ranging changes (with considerable side effects) require more extensive or comprehensive measures than small adjustments which may only call for minor editing of a manageable code sequence.

However, the most significant reduction in effort can be achieved, by using pretested product software for which risk minimization activities have already been performed for all functions that remain unchanged in a project. For example, if a login function has already been tested as part of the product, the performed test can be referenced in the risk assessment process of the project. Therefore, the need for additional customer tests is therefore removed or can at least be significantly reduced.

Process Knowledge as a Prerequisite for Configurable Software

As their name already suggests, Manufacturing Execution Systems are designed to provide optimal support for processes involved in the manufacture of products. The word "manufacture" includes the chemical or biopharmaceutical production of active ingredients as well as the production and packaging of medical drugs in different dosage forms.

It is quite obvious that people involved in the development of software functions to support such processes must have extensive knowledge of the relevant industry sectors. The greater the focus on reusable product software, i.e., software that is used repeatedly with different configurations, the more comprehensive this understanding of the processes needs to be. In this case, it is not sufficient for software architects to be merely familiar with a process. They also should be well-versed in all process variations, i.e., know all the right buttons to push to provide an appropriate configuration.

It is advisable to use a clear and unambiguous process description language, which is an excellent way to ensure common understanding between subject matter experts and software architects. The need for effective and accurate communication at this level is reflected by the many different process description languages and associated tools on the market. The Business Process Modelling Language (BPML) is a widely-known process language, which uses graphical elements to describe processes - *Figure 6*.

It is important to note that this type of description requires the correct level of detail to make certain that user and developer can communicate in a simple but clear manner and arrive at a common understanding of the processes to be supported, identifying the necessary functions without getting lost in details.

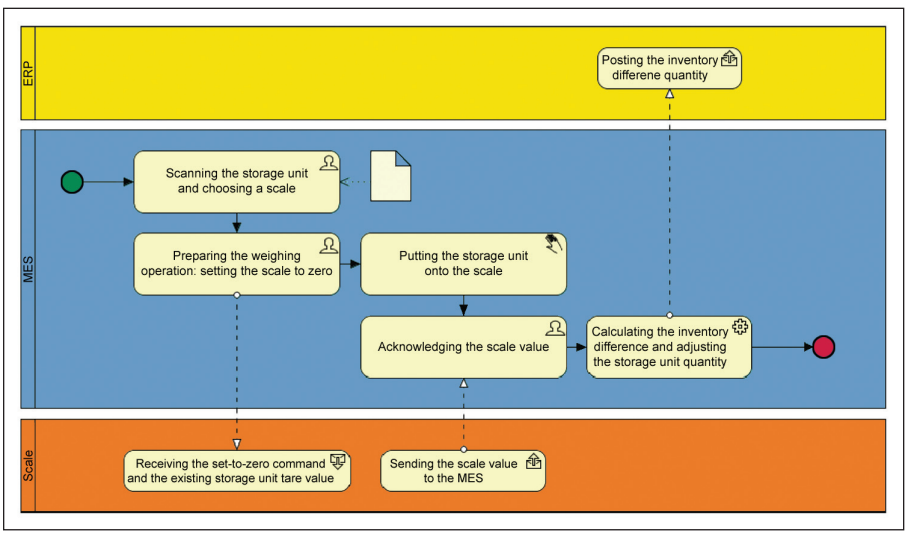

Figure 6. Example of a process description using BPML.

For configurable product software, this type of process description can be applied to describe how the functions of the standard system work. This graphical description model gives the software supplier an excellent tool for communicating, at process level, what the customer should regard as a standard workflow, configuration procedure, or development effort.

When the process description has been thoroughly discussed, the required functions can be specified, the functional risk analysis can be performed, and the individual test phases can be executed. With this procedure, configurations and changes can easily be tracked because it is possible to link them immediately to the process description.

Pharmaceutical MES – More Than Just Software

A configurable, standard product obviously consists of more than just the supplied process description – it also includes an appropriate functional specification, a risk analysis and the test specifications derived from it. A "fit/gap analysis" can be conducted early on in the project to compare the described standard processes with the existing or desired processes. The pharmaceutical customer can then decide to implement the standard process ("Best Practice") or to make necessary changes ("Best Fit"), whereby the risk involved in such changes is determined at the same time based on the customer's understanding of the process.

The results of the fit/gap analysis help the customer to arrive at decisions regarding configuration and adaptation of the software and resulting documents. The pharmaceutical customer uses his deep understanding of the process to decide on the appropriate degree of scaling in a very early life cycle phase.

Virtual Factory – Product Development Based on Realistic Processes

For best results, the supplier should base the complete software development model on the process description – starting with the configurable standard product. With the software

that is configured and parameterized to fit standard processes it is possible to carry out tests as realistically as possible in a so-called "Virtual Factory." Consequently, even test results obtained with the standard software can generally be utilized for subsequent functional tests of the application at the customer site.

GAMP 5 Encourages the Scaling of Life Cycle Activities

The focus of this article was to illustrate how it is possible to scale life cycle activities for a complex computerized system that is used to support GMP-critical processes. It was assumed that there is a well-documented standard product with a clear and understandable process description to depict its usage, and that a risk analysis, a test specification, and executed tests do exist that are based on this process description. When such a product is to be implemented, the first step is a fit/gap analysis, followed by configuration or customization of both the software and all associated documents. Since much of the preliminary work is done in phases preceding a specific project, project activities can be limited to dealing with possible changes. All this is done based on GAMP 5 recommendations for system categorization, risk-based approaches, and the integration of supplier activities with the customer. GAMP 5 encourages the use of economic analysis of computerized system projects without neglecting compliance issues. The goal is to make a new software implementation project cost effective, while minimizing risks to product quality.

The GAMP® Good Practice Guide: Manufacturing Execution Systems – A Strategic and Program Management Approach, helps facilitate efficient and effective planning, development, and testing of Manufacturing Execution Systems (MES) used to support manufacturing in pharmaceutical organizations.

About the Author

Rolf Blumenthal is Senior Director International Consulting with Werum Software and Systems AG. He has a degree in mathematics and computer sciences from Dortmund University, Germany. Rolf Blumenthal has been working with Werum since 1979, and he is one of the 15 employees who took over the company after the death of the company founder in 1982. He has many years of experience in the execution of large-scale software projects for the pharmaceuticals industry. For more than five years Blumenthal has managed the product development for Werum's MES software suite PAS-X. In this context, compliance with GMP and FDA requirements is of prime importance. Since Blumenthal is a renowned industry expert with hands-on experience and comprehensive technical expertise, he started international consulting activities in 2005. In this current role, he advises PAS-X customers on the following major topics: IT architectural blueprints, system integration, computer system validation, optimized use of PAS-X, and efficient creation of master batch record libraries. Blumenthal is a member of the GAMP D-A-CH Forum where he is actively participating as an editor and reviewer of new guidance documents. Since 2002, he has been a member of the GAMP DACH Steering Committee. In this function he has initiated a special interest group for "Alternative Software Development Methodologies" (SIG ASDMM). He can be contacted by telephone: +49-4131-8900-400 or by email: rolf.blumenthal@werum.de.

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Dr. Johannes Roebers provides insight into Elan's work on current and potential therapies for Alzheimer's, Parkinson's, and Multiple Sclerosis and discusses the state of biosimilars today.

PHARMACEUTICAL ENGINEERING Interviews

Dr. Johannes Roebers, Senior Vice President, Head of Biologic Strategy, Planning and Operation, Elan Pharmaceutical International Ltd.

by Catherine Middelberg, *ISPE Pharmaceutical Engineering Committee*

Q What led you into a career in biotechnology?

A After graduating from Clemson University with a PhD in chemical engineering, I joined Bayer AG in Leverkusen Germany in 1991. My first assignment at Bayer was in Engineering of the traditional Colours and Dyes Division. In 1994, I was transferred to Clayton, North Carolina where I joined the Biologics Division of Bayer USA. This division developed and produced biopharmaceuticals based on human blood plasma. Here, I developed a new Manufacturing Plant for Human Antibodies called IGIV. After six years in Clayton, I then had a challenging opportunity to join the exciting and fast growing biotech company IDEC Pharmaceuticals in San Diego, California. IDEC Pharmaceuticals' claim to fame was the discovery and initial development of Rituxan®/MabThera®, which was the first monoclonal antibody approved for the treatment of cancer, Non-Hodgkin's Lymphoma. To this day, Rituxan® is still one of the most successful monoclonal antibodies ever developed and commercialized. IDEC Pharmaceuticals later merged with Biogen to form Biogen-IDEC Inc. I was responsible for the engineering, construction, and start-up of the New IDEC Manufacturing Operations (NIMO) Campus in Oceanside, which was sold to Genentech in 2007 for the Manufacturing of Avastin®. After successful FDA licensure of the NIMO Operation, which was awarded "ISPE Facility of the Year" in 2007, I had the wonderful opportunity to join Elan Pharmaceutical International Ltd. as Head of Biologic Strategy, Planning and Operation in Dublin, Ireland.

Q What is your current involvement with ISPE? How has ISPE contributed to your career?

A I am a member of the ISPE International Leadership Forum (ILF) which advises ISPE on a variety of strategic topics. I am also a member of the Ireland Affiliate and previously served as a board member and vice chapter chair for the ISPE San Diego Chapter when I lived there. Early in my career, I attended many ISPE educational seminars and I always enjoyed the vast networking opportunities at ISPE meetings. I have not missed an Annual Meeting since 1995.

Q What is your current role with Elan?

A I lead the technical (CMC) development and manufacturing oversight team for large and small molecules.

"Future facilities will need to be more flexible to make multiple biopharmaceutical products. They will use smaller bioreactors, use more single-use technology, and will need to use more novel manufacturing technologies upstream and downstream. All of this will lead to lower cost and faster to build facilities compared to the former industry standard, the stainless steel 'six pack.' "

Q What does Elan specialize in, what therapy areas do they focus?

A Elan has always had great science and has developed a monoclonal antibody, Tysabri®, which is a very effective therapy for Multiple Sclerosis (MS). In addition, we focus on the development of disease modifying neurodegenerative drugs and therapies for Alzheimer's, Parkinson's, and Multiple Sclerosis.

Q What opportunities are there for biosimilars in the biopharm industry? What are the likely targets?

A Biosimilars are already a reality in Europe and soon will be in the US. There are many opportunities; however, I believe it will be a very competitive field. Biosimilar companies will develop all biologics as they come off patent. They will first develop replacement proteins, such as EPO, and thereafter develop more complex biologics, e.g., interferons, fusion proteins, and monoclonal antibodies. I believe that sooner or later there will be a biosimilar for every branded product on the market. However, it will not be an easy road for the biosimilar companies.

Q What are the potential issues in developing, manufacturing, and commercializing biosimilars or biobetters?

A The challenges for biosimilar companies will be to technically and clinically prove comparability of the biosimilar product to the originator compound. This is easier said than done as many of the originator processes were developed with older cell lines, expression, and manufacturing technologies that are not readily used today. In addition, the development of biosimilars is technically and clinically expensive. This will be a major hurdle for commercialization of biosimilars. Biobetters promise improved commercialization potential if they are "truly better" than the original product. However, they will be considered as New Molecular Entities (NME) and will therefore have to be developed in the same pathway as any other novel biopharmaceuticals, including full clinical trials.

Q Will the approval process for biosimilars be different than it is for generics?

A Yes, absolutely different! Biosimilars will require some shape or form of human clinical trials for approval. Europe has a clear pathway for biosimilar approval and the EMA continues to develop specific guidelines for different biologic classes which will be helpful. As we know, in the US, the regulatory pathway is still in development.

Q Are current regulations adequate for biosimilars or are they evolving?

A European regulations are in place and are being developed for certain classes of Biologics. The US regulations are still in development.

Q Have any biosimilars been approved to date?

A Yes and no. There are some biologics recently approved in the US that may be called biosimilars, but these were approved through complex existing regulatory pathways. In Europe, we have a good number of biosimilars approved to date.

Q Will the approval of biosimilars accelerate with the approval of the Patient Protection and Affordable Care Act signed this year?

A There has been great progress made towards defining the regulatory pathway for biosimilars and it is encouraging for the biopharmaceutical research industry to know that there will be an exclusivity period of more than 12 years for novel biologics in the future. This is part of the Patient Protection and Affordable Care Act. This Act will, after full development of the regulatory pathway for biosimilars by the FDA, accelerate the approval of biosimilars.

Q How do you see health care reform affecting research, development, and manufacturing of biopharmaceuticals?

A In general, the health care reform has already put more cost pressure on biopharmaceutical companies in all functional areas: sales, marketing, manufacturing, development, and research. The regulatory pathway and approval of biosimilars will put price pressure on approved biopharmaceuticals.

Q What does the biopharmaceutical facility of the future look like?

A Great question, I could talk about this for a few hours! Future facilities will need to be more flexible to make multiple biopharmaceutical products.

They will use smaller bioreactors, use more single-use technology, and will need to use more novel manufacturing technologies upstream and downstream. All of this will lead to lower cost and faster to build facilities compared to the former industry standard, the stainless steel "six pack."

Q What technology and process improvements are needed to advance biopharmaceutical manufacturing capabilities?

A There have been great improvements made over the years in upstream processing leading to ever increasing manufacturing titres. At 5g/L or above titres, a further increase of manufacturing titre will not lead to decreases in the cost of goods; therefore, improvements will more likely need to be made in the downstream purification area. In downstream, we need "lean processes" that use fewer process steps, less buffers, less resins, and less water.

Q Elan currently collaborates with several major pharmaceutical companies that funded late stage development and then commercialized. Why were these strategies pursued verses in-house manufacturing or utilizing a CMO?

A Our marketed asset Tysabri® is a 50/50 collaboration with Biogen IDEC. The Tysabri drug substance is being manufactured by Biogen IDEC. All of our other clinical development compounds are developed and manufactured at CMOs or by Elan's Drug Technology Division (EDT). Considering the diverse development pipeline of Elan, we believe this to be strategically the best approach and also the most cost effective approach.

Q What is Elan's long-term manufacturing strategy?

A In our BioNeurology business, we will continue to work with contract manufacturing organizations. However, the Elan Drug Technology (EDT) division has major development and manufacturing capabilities for conventional, controlled release and nanotechnology in solid dosage area in King of Prussia, PA, Gainsville, GA, and Athlone, Ireland.

Q Elan has been researching Alzheimer's disease for more than 25 years. What are the current therapies under development?

A Current potential therapies for Alzheimer's disease in development include:

ELND005, an Amyloid Beta Aggregation Inhibitor

The small molecule ELND005 is a beta amyloid anti-aggregation agent. ELND005 has been shown to be orally bioavailable, cross the blood-brain barrier, and achieve levels in the brain and cerebral spinal fluid shown to be effective in animal models of Alzheimer's disease. ELND005 has completed a Phase 2 clinical study in humans, and we intend to move ELND005 into Phase 3.

Beta Amyloid Immunotherapies

Beta amyloid immunotherapy pioneered by our scientists involves the potential treatment of Alzheimer's disease by inducing or enhancing the body's immune response in order to clear toxic species of beta amyloid from the brain. In almost a decade of collaboration with Wyeth, now Pfizer, our scientists developed a series of therapeutic monoclonal antibodies and active vaccination approaches that may have the ability to reduce or clear beta amyloid from the brain. These new approaches have the potential to alter the underlying cause of the disease by reducing a key pathway associated with it.

The AIP includes multiple compounds being evaluated for slowing the progression of Alzheimer's disease. The lead compound (bapineuzumab), administered intravenously once every three months, is in Phase 3 clinical trials. A subcutaneous formulation, administered once a week, is in Phase 2 trials. In addition, a vaccine for Alzheimer's disease (ACC-001) is in Phase 2 trials.

Elan and Johnson & Johnson announced on 17 September 2009, that Alzheimer Immunotherapy, a Johnson & Johnson affiliate, had acquired substantially all of Elan's assets related to the Alzheimer's Immunotherapy Program (AIP).

Note: As Elan's assets from the AIP were transferred to Janssen AI in September 2009, Janssen AI and Pfizer now operate this program. All questions about the program should be answered by Janssen AI or Pfizer. I am listing these potential therapies as they are currently in clinical development and originated at Elan.

Q Does Elan participate in the Alzheimer's database collaboration between industry, government, and academia or in the Alzheimer's Disease Neuroimaging Initiative?

A Elan does not currently participate in the Alzheimer's database collaboration between industry, government, and academia, but is exploring the possibility of joining the collaboration created by the Coalition Against Major Diseases (CAMD).

Elan is an active participant in the Alzheimer's Disease Neuroimaging Initiative.

Q Elan has contributed to the fundamental knowledge of Parkinson's disease. Does Elan work with the Michael J. Fox Foundation in any of their research? How has this Foundation advanced research in Parkinson's disease?

A Yes, Elan does work with the Michael J. Fox Foundation. Since 2006, Elan's efforts with the Michael J. Fox Foundation for Parkinson's Research have included a grant program, "Novel Approaches to Drug Discovery," designed to identify and fund promis-

ing research projects and help them advance more quickly. With a strong focus on the development of disease-modifying therapies for Parkinson's disease, Novel Approaches to Drug Discovery provides funding for projects of up to one year's duration. Novel Approaches provides awardees from both academic and biotech institutions with a clear opportunity for follow-on funding and collaboration for further development. Elan has an option for a right of first negotiation for any promising approaches or materials that arise out of this program. In 2009, the program funded six research projects.

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This article discusses risks and mitigation strategies that need to be considered between healthcare companies and outsourced IT suppliers.

IT Outsourcing and Offshoring: Recognizing and Managing Risk

by Arthur D. Perez, PhD and Glenn Morton

Introduction

Hardware is less expensive although we are using more if it. The power of the internet has led to the rise of third party data centers that can serve many client companies so well that users are not even aware that the equipment and staff are no longer in the basement of their building.

Software is more powerful, and we are more reliant on it. Software suppliers have recognized the needs of healthcare companies, so there are now frequently multiple commercially available applications to perform functions where once the lack of choice meant that user companies had to develop their own software. As a result, healthcare companies may be able to employ a smaller staff of software developers. At the same time, this means that they may not have the resources to do occasional software development to meet unique needs or to gain a market edge.

These conditions have led to a proliferation of contracts between healthcare companies and outsourced IT suppliers for both infrastructure management and software development. This article discusses many of the risks and mitigation strategies that need to be considered when engaging such partners. Some of these risks are unique to our industry, and some are generic to any company looking for an IT services partner. GAMP® 5[1] includes an appendix describing some outsourcing issues, and this article focuses on risks that need to be managed prior to and during an engagement.

IT service has increasingly been seen in the past decade as a commodity, and as companies search for ways to focus business energy and resources on core activities, they often turn to outsource partners, both domestic and foreign, as a way of reducing costs and effort on non-core activities. The burden on regulated industries such as healthcare increases the challenge to getting this right.

Why Outsource?

The biggest driver, which is probably greatest for smaller firms, is the difficulty in funding and supporting staff with the expertise for management and execution of IT tasks. Even large firms with hundreds of IT staff cannot match the economies of scale achievable by a huge IT services company. Such providers are able to consolidate computing resources and staff functions to a degree that no healthcare company can hope to match. They may be able to manage a 10-fold larger data center for only double the cost of that at a large pharmaceutical firm.

In addition, the large global IT service companies can leverage the cost benefits of conducting operations in countries with low labor costs, an option not available to firms whose data centers are located in Europe or North America. India, for example, while having labor costs a fraction of those in Europe and North America, actually has a larger, better educated labor pool of IT professionals than do those regions. In theory, leveraging these economies should eventually lead to improved service.

Outsourcing also provides the healthcare company with greater flexibility to execute projects. Doing a major global SAP upgrade? Add 50 ABAP programmers for a year. Closing a manufacturing site? Reduce the support to the appropriate level.

Disadvantages to Outsourcing/Offshoring IT Services

As with any outsourced activity, control is surrendered. There is also a considerable reduction in transparency into how activities are executed.

These factors require a degree of trust that some regulated companies may find difficult to grant.

Finding the right service level in contract negotiations can be tricky. If requirements are too great, the savings are reduced. If too little, the IT Department risks the wrath of users, possibly requiring bringing in additional resources at increased cost, resulting in unhappy users and reduced savings. If the outsourced partner decides to change internal business practices, this also can have a large effect on the regulated company, possibly introducing increased risk and unanticipated expense.

The bottom line is that lower apparent cost can be a very seductive lure into an outsourcing arrangement. Failure to completely understand and evaluate the client firm's needs vis à vis the contracted firm's capabilities can easily erase anticipated cost reduction.

It's All about the Data

As recently as 15 years ago, electronic data was reasonably secure simply by virtue of the fact that it was fairly isolated. Data from manufacturing, quality control results, clinical studies, and various other critical information generally resided on a hard disk in the corporate data center and was inaccessible to non-employees or anyone outside the company network. This is clearly no longer the case.

Today, information is shared within the company across multiple sites, and some of it may be transmitted over public infrastructure (most company WANs involve the internet). Contract employees may have access to the company network via their own PCs. The proliferation of media like USB flash drives means that even if they don't have direct access, they may have indirect access through full time employees, who may share data in unapproved ways. The bottom line is that there are a number of pathways for company data to find its way onto a contractor's laptop, where the company has no effective control over it.

Companies also may share data with other companies who provide services, e.g., a trucking company that needs distribution data or a Clinical Research Organization. Outsourced IT service providers may have company data on their own servers. This is complicated enough with domestic partners, but becomes even more so with off-shore partners who are bound by different national laws. Nowhere is the difference in national laws more apparent than the highly critical and highly visible problem of protection of Personally Identifiable Information (PII). This clearly affects healthcare companies who must handle clinical study records, employee records, etc.

Finally, there is the case of the business partners of business partners. The trucking company mentioned above may contract out their IT services so that an unwary healthcare company's data may be residing on equipment belonging to a firm they have never heard of.

Three Principal Risks to Data

There are three points of concern regarding data that must be protected when considering engaging an outsourced partner:

1. **Integrity:** the data is what it is and it needs to remain that way. For example, audit trails must remain intact, precision and accuracy must be preserved, and of course

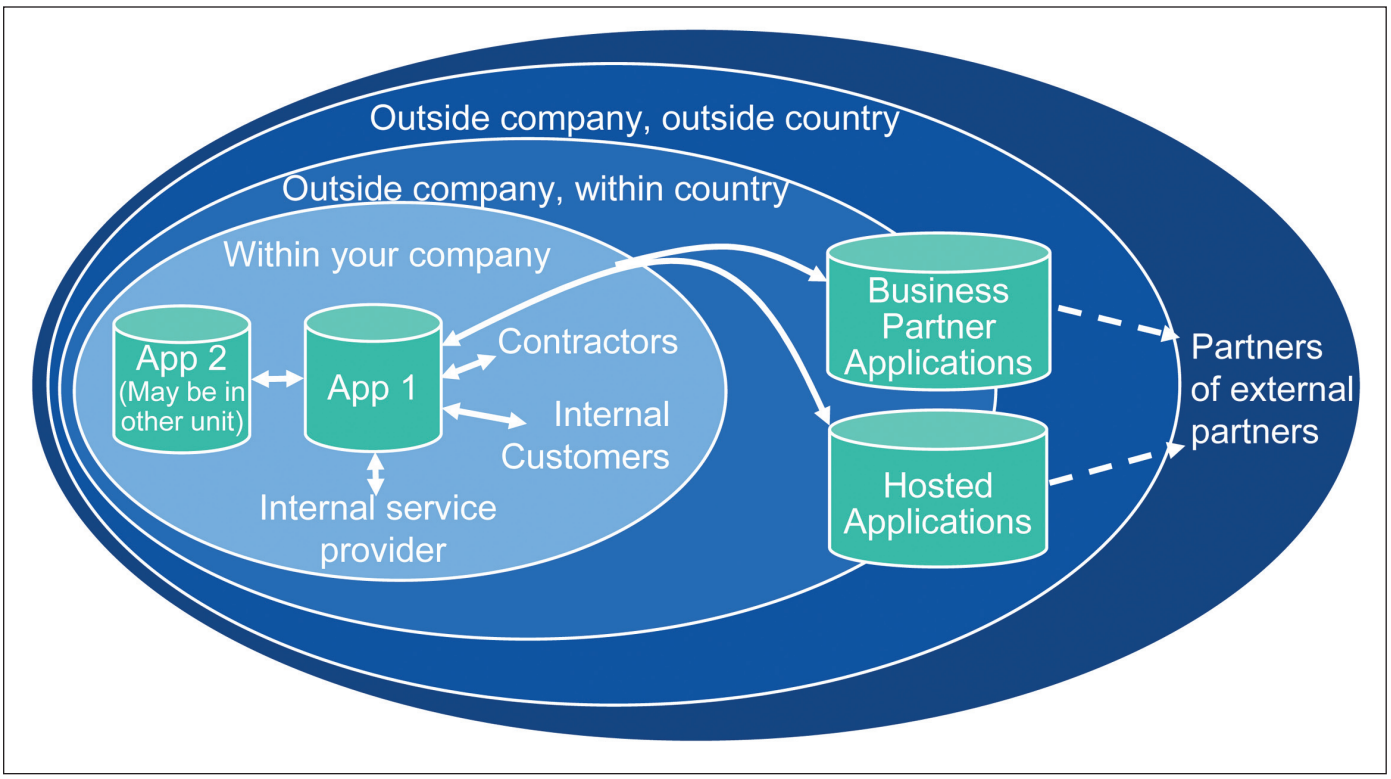

Figure 1. It's all about the data: who has it, who can access it, and how is it protected?

records must not be lost or deleted until their retention period is over.
2. **Availability:** the data needs to be available when it is needed, where it is needed, and only to those with a legitimate need for it.
3. **Confidentiality:** some data are exceptionally sensitive and it is essential that it is protected from unwarranted exposure. This includes Intellectual Property (IP), PII, privileged attorney-client communications, and a range of other business information.

Five Risk Areas

Understanding that these are the issues of focus, there are five areas where risk needs to be evaluated.

- Governance
- Country
- Company
- Contract
- Nature of Contracted Work

The remainder of this article will examine these risk areas in detail.

Risk #1: Governance

Governance is essential to ensure that the contracting healthcare company has some visibility into all activity and related risks, adherence to the contact terms, and to identify changes to the services to support business needs. There are a variety of approaches to achieving that, ranging from close supervision and reporting to reliance on auditing. The approach will depend heavily on the degree of trust between the parties. Ideally, the contracting company should be confident that the partner adheres to standard processes, makes optimum use of available resources and tools, and manages risks appropriately, including notification of the client when critical incidents occur. Effective governance also will play a very large role in the identification, mitigation, and control of risks in the other four areas.

Governance scope must include all divisions and geographic locations and cover IT, information protection, and related activity initiated in business units. Governance practices must include participation from all relevant/interested parties, documentation of activities, and reporting of results - *Figure 2*. To be effective, the governance team must have full understanding of laws and regulations in all affected jurisdictions.

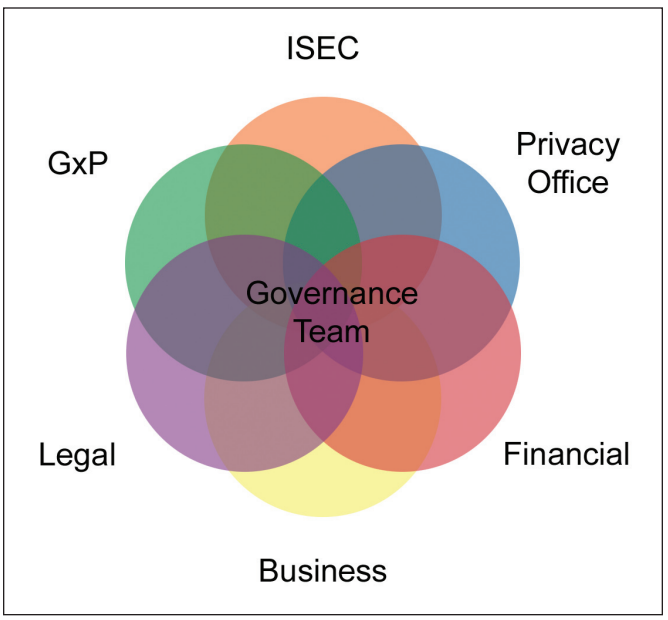

Figure 2. Governance includes wide scope of responsibilities.

Risk #2: Country

Legal/Regulatory

It is important to understand how national laws may affect the manner in which engaging an outsourced partner should be approached. In general, as Figure 3 illustrates, in the absence of strong national laws protecting corporate information, the contracting healthcare company will probably need to introduce some risk mitigation. Stronger laws generally provide more protection and will mean less mitigation is needed.

Specific laws and regulations that need to be considered obviously include GxP regulations, which are fortunately fairly uniform around the world. Protection of Intellectual Property (IP), on the other hand, is not uniform. In some nations, IP is not patentable. If there is an information breach, this could cost the company millions or even billions. Another consideration relates to compulsory licensing. Could the government of the nation where the data resides force the business partner to release information for use by a local low-cost manufacturer?

Data privacy laws vary greatly between nations. EU laws are generally more protective than US laws, while India is less protective than the US. Even within the USA, the requirements of state laws concerning data privacy differ substantially. It is imperative that the company understands what data is involved and what the laws are concerning that data in both the country where the data is stored or manipulated and in all of the jurisdictions where the people it concerns reside. If adequate controls cannot be established, in order to comply with the pertinent law, it might be necessary to keep a database with PII internal to the healthcare company rather than outsource its management.

Financial regulations, such as the US Sarbanes-Oxley law, may introduce additional risk. For example, if a control requires limited access to data, and an IT service supplier wants its entire UNIX Support staff of 70 to have admin rights on the servers with the financial applications, there is obviously a disconnect related to understanding of the controls required to comply with US law that needs resolution.

Figure 3. Laws that protect your data generally mean you'll need less risk mitigation.

Finally, rules regarding e-discovery in support of legal suits need to be understood. For example, US law is quite clear regarding protection of information falling under attorney client privilege. This right may not exist in other countries. Therefore, the corporate legal department should be involved in structuring any outsourcing agreements.

Any of the above factors could influence mitigation actions ranging from encryption of sensitive data to a decision not to store or use certain data in some countries.

Other Country Risks

When evaluating an offshore partner, other factors not related to the data should be considered:

- Is the legal system generally regarded to be efficient and independent of politics?
- Is the tax policy clear or is it possible that the contracting company could be hit with a large and unanticipated tax increase? Is one partner counting on a tax break that may suddenly disappear, leaving the contracting company with a large unanticipated expense, or a partner who can no longer afford to operate?
- Are there dangerous macroeconomic factors? Is the local currency unstable or does the country have an unsustainable dependence on foreign aid? Is the balance of payments a threat to government stability?
- Is there a danger to security in the form of potential for war, insurrection, terrorism, or violent crime?
- Is the government politically stable? Could it turn unfriendly?
- If the government is friendly and stable, is it effective? Could there be problems with corruption or conflicting vested interests?
- Does the country have a stable infrastructure (electric power, phone, internet, roads, etc.) capable of meeting business needs? Is it unusually vulnerable to disaster?
- Does the labor market meet business needs? Is there a plentiful supply of workers with the needed skills? Are workers generally happy or unhappy? Are there national laws preventing layoffs? Does the country's legal infrastructure enable effective pre-employment background checks?

Mitigating Country Risks

Strategies for addressing country-specific risks primarily involve a very deep effort at due diligence. When evaluating offshore partners, the healthcare company's strategic sourcing department must be involved. It is also strongly recommended to involve the Legal Department, possibly including outside counsel with knowledge of the country in question. There are consulting firms that specialize in evaluating risks like this, and engaging such a firm may be beneficial. Industry research sources and careful perusal of news reports also can contribute to the decision process. When negotiating the contract, some protections designed to mitigate country risks can be included. For example, requiring approval before allowing data access by contractor staff in another country will offer the ability to assess whether the new country's IP and data privacy laws are adequate, and to intervene if they are not.

This ultimate decision when evaluating country risk often comes down to "Do we want to do business here?" However, there may be some other levels of mitigation that will allow the engagement, such as restricting the type of work that can be done at a particular location or adding additional data protection like encryption.

Risk #3: Company

Not all potential partners are created equal. Some companies are better run, some are more stable, and some very good ones are hungry and looking to make a deal that will get them the work. Unfortunately, some are also poorly run or don't take compliance seriously, or both.

When evaluating an outsourcing partner, it is important first and foremost to understand how stable the company is. If a firm is contemplating moving its data center operations to an outsourced facility, those doing the planning had better be reasonably sure that their partner is not going to declare bankruptcy, dismiss the staff, and sell off all of the servers. This will involve thorough due diligence work prior to commitment, plus continual monitoring of the financial stability of the company. Corporate leadership at the partner should be evaluated for stability and effectiveness as well. A company that has had three CEOs over a two-year period may have some very fundamental problems.

Many of the large IT service companies have operations at multiple sites and some of these may be offshore. Chances are that the partner company will want to maximize the use of lower cost offshore resources, which brings country risk into play. Data privacy can be a major concern in such cases. In general, it is advisable to have a contract prohibition against moving data to a different location without permission, which should not be granted without first evaluating all of the risks associated with such a move.

Even within one nation, it is possible that the service provider may not follow the same processes at different sites. Another site issue may be related to location. Is the site vulnerable to natural disaster? Chances are the healthcare company would rather not have its main data center at the foot of an active volcano or on the banks of a river that floods every spring.

The experience of the partner company is relevant, especially in light of the need to comply with GxP and other regulations and data privacy requirements. Companies that have never worked in a regulated environment may claim that they'll do what is needed and compliance will not be an issue, but experience has shown that the amount and rigor of documentation that is expected almost always come as a surprise to inexperienced partners. It can take years for them to accept and settle in to the requirements, and this is exacerbated by the fact that they are not operating under the watchful eye of GxP SMEs as is the case within healthcare companies. In this regard, the healthcare companies need to be wary of inexperienced firms that seem to be offering bargain basement prices. It may be that they don't realize what they

are getting into, or worse, it may be that they don't take the requirements seriously because they are not directly exposed to liability for failure to comply.

There are several risks related to staff at the partner company. The contracting healthcare company needs to recognize that it is their sensitive data at risk, and that their partner's employees should meet the same minimum standards as their own employees. Background checks should be routine, at least within the capabilities of the national infrastructure. Employee turnover rate is an important concern. In some developing economies, turnover is remarkably high even in skilled jobs, as high as 30%. This means that staff will always be on the steep part of the learning curve and employee efficiency will be low. The resulting lack of continuity is likely to negatively impact the quality of compliance documentation, too. Finally, staff should be trained in the required regulations and should understand the contracting company's business requirements. This training should be provided by the partner.

The same economies of scale that make outsourcing attractive introduce a new risk: segregation of duties. Does it matter if work is being done for a competitor in the next cubicle? Does it matter if the same individual is also doing work for a competitor?

The contract can provide for compensation if an outsourced partner makes a mistake that costs the healthcare company a large amount of money. However, a partner worth $10 million is not going to be able to pay for a data theft that leads the loss of intellectual property worth $100 million. This might influence the kind of work assigned to such a company.

Mitigating Company Risks

The key to recognizing and avoiding or mitigating company-related risks is again applying all due diligence. Do the homework. Research as much about the company as possible. Go to their facility and do a thorough audit. If possible, try to find and talk to both satisfied and unsatisfied customers.

Have the courage not to engage potentially unsatisfactory partners, even if there is substantial pressure to go with the lowest cost partner or to simply "get it done." *Caveat emptor:* realize that if the bargain seems too good to be true, it probably is. Finally, write the contract carefully. It is remarkable how difficult it can be to get a partner to do tasks that they interpret as falling outside of contracted services (see next section).

Risk #4: Contract Risks

One of the biggest enemies of cost savings (and thus a significant financial risk) can be a lack of specificity in the contracted service levels, as well as unclear articulation of *all* of the measures that need to be in place to achieve desired service levels. Due diligence up front will result in a firmer, more realistic price and reduce subsequent "nickel and dime" costs. Excessive nickels and dimes that add up to a significant fraction of total cost of service are a mark of a weak contract.

Several specific risk scenarios need to be directly addressed in the contract. These scenarios should detail expectations for actions if they arise, and it may be advisable to include penalty clauses if expectations are unmet or the healthcare company suffers damage. Of course the prospective partner is very likely to resist penalty language in the contract so it is imperative to understand just how much trust should be allowed. In some cases, refusal to accept penalty clauses might be sufficient to disqualify a supplier.

Some of the risks that should be addressed include those below, but there may be others:

- **Protection of Intellectual Property (IP):** measures need to be defined as to how it is kept safe, including whether it needs to be segregated from other data. It is advisable to have specific agreements on who has access and under what circumstances, as well as how it is granted and managed.
- **Breach Notification:** in the event of exposure or loss of information, the healthcare company needs to know about it right away. The contract should stipulate what constitutes a breach and how quickly it must be reported. It also should define the responsibilities of both parties for investigation and mitigation activities.
- **Indemnification:** in the event of a data breach or other serious event, the healthcare company will want financial compensation to help defray losses, and the partner company should have the financial capacity to pay.
- **Right to Audit:** the contracting healthcare company must retain the right to audit the partner company in order to verify compliance to the contract. The contract can specify requirements for notification, frequency of general audits, and guidelines for "for cause" audits.
- **Continuity/Disaster Recovery:** the business continuity clauses in the contract need to ensure the continuity of the healthcare company. From this point of view, the business continuity of the partner is of secondary concern. The healthcare company does not want to wait in queue behind two banks, a retailer, and a nail salon to bring its systems back on line. If this means that a provision is needed to temporarily transfer the data and operations elsewhere, that should be specified. One aspect that may be overlooked is the partnership of system owners at the healthcare company with the IT supplier for DR testing. This may require a different working paradigm for DR testing than the service provider wants to have for routine operations. However, disasters are anything but routine, and that must be recognized. Putting it in the contract may avoid problems with this crucial activity.
- **Background Checks:** if the healthcare company requires pre-employment background checks, it is only reasonable that they would want such a precaution for their partner's employees. This should be stipulated, especially if it is a practice not routinely followed.
- **Separateness:** even beyond IP considerations, the healthcare company may want to have its data segregated from that of other firms. For example, if a company outsources its ERP application, is it acceptable to have its data pooled with that of other firms or do they need an isolated database? Another consideration is staff deployment. If it is unac-

ceptable to have employees working on another account simultaneously with that of the healthcare company, the contract should stipulate this.

- **Stability:** consider what happens to data, applications, and even staff if the partner company goes out of business. If applications are running on the partner's hardware, what happens if the company fails? Presumably many of the subject matter experts that the healthcare company relies upon are employed by the partner so their fate is an issue. While it may be difficult to build protections against business failure into the contract, it may be possible to include financial reporting clauses that would provide warning that the partner is on shaky ground. What protection does the healthcare company believe may be required to ensure that its business is not unduly affected if the partner slashes staff as a cost cutting measure?
- **Exit Strategy:** the healthcare company needs to ensure that it can execute a reasonably problem-free disengagement from the partnership if necessary. By the same token, they need to ensure that if the partner decides to terminate the relationship, there are provisions to facilitate a smooth transition back to the company or to a different supplier. Timelines for notification of termination should be in the contract, including supporting the transition of services to another party.

Mitigation of Risks Related to Contract

Certain parties and activities that should be involved in supplier selection also can be very helpful in developing the most advantageous contract. The Sourcing and Legal Department should certainly be engaged. They will have the most experience with negotiating contracts, and with contract language, which is terribly arcane to most mortals. Consultants also can be very helpful in understanding capabilities of suppliers. Internal subject matter experts need to be very heavily engaged. These SMEs should represent the full range of internal IT customers, plus other authorities like QA. It is too easy to involve only a small team in the process and miss critical requirements of the business. This can manifest in the refusal of the service supplier to do tasks they feel are outside the contract without additional compensation, when chances are that the task would not even have raised eyebrows if added to the requirements list for the contract.

References from other clients, industry research, and an effective Request for Proposal (RFP) process are powerful tools both for deciding whether the right supplier has been chosen and for selecting some of the contract stipulations. Supplier assessment, including a direct audit, also helps highlight supplier weaknesses that should be addressed in the contract.

Risk #5: Nature of the Work

The type of data being handled and what is being done with it have a decided impact on risk. In light of the prevalence of identity theft and the attention of lawmakers to the issue, handling of PII can be a major risk. Included in this category are personnel records, records that include Social Security numbers, contact information, and patient information. The latter includes even such data as disease states, medication, birth date, etc. Different jurisdictions have different interpretations of what is personally identifiable. Ergo when deciding whether such records should be handled by a partner, and what controls are needed, it is imperative to understand the requirements of the jurisdiction where the individuals reside as well as the location where the data may reside and/or be handled.

Other confidential information needs to be considered as well. There are types of business information that have the ability to cause significant company harm if breached, such as merger and acquisition data or documents protected under attorney-client privilege. Perhaps less directly damaging, but still important to competitive advantage would be information on marketing campaigns, sales figures, banking, and of course intellectual property.

Mitigating Risk Due to the Nature of the Work

Several key internal stakeholders should be involved in deciding what work can be done outside the company. This group should include the legal department, information security, the privacy office, Quality Assurance for GxP applications, and of course the business owner. It is important to recognize that the risk analysis and steps taken for mitigation may change over the life of the engagement.

It is a good idea to have predefined criteria for classes of data with strategies defined for each class. For example, for certain sensitive information, risk may be reduced by limiting access to such sensitive data to a small number of the partner's employees or by technical controls such as encryption.

The Risk Equation

Overall risk for a given application or data set can therefore be "quantified" as the sum of four sources of risk, all viewed through a lens of effective governance:

Country Risk
Company Risk
Contract Risk
+ Nature of Work and Data
= Overall Risk

When all of these are considered, there are four potential modes of response. As illustrated in Figure 4, this fits nicely into a 2 × 2 grid plotting risk impact vs. probability. These potential responses are:

- Ignore the risk, allowing the service supplier to manage it as they see fit (while understanding that liability and accountability cannot be outsourced).
- Accept the risk and delegate mitigation to the supplier. Risk mitigation efforts should be monitored and reported.
- Accept the risk and manage mitigation within the healthcare company. Risk mitigation responsibility in this case is considered too critical to leave to the supplier so the solution is developed by the client.

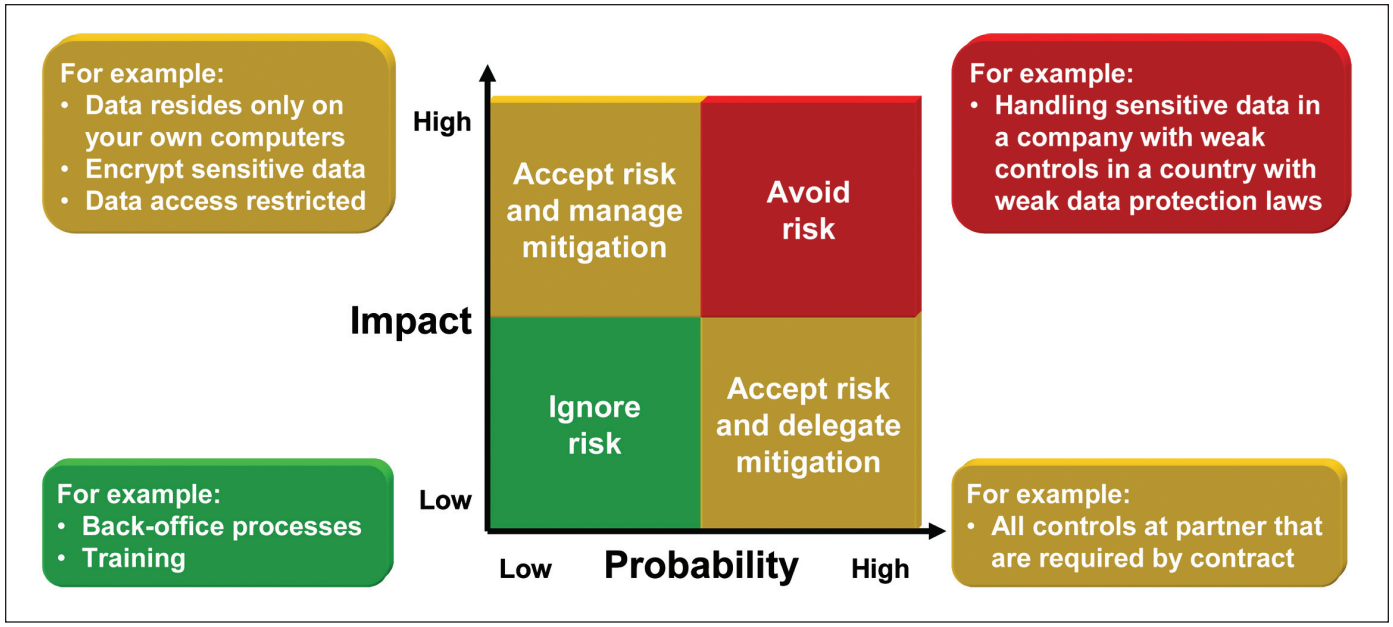

Figure 4. Risk scenarios and possible responses.

- Avoid the risk entirely. Typically this entails retaining and managing the data internally. Another potential route would be to use an alternative supplier where the risks are considered lower, shifting the risk profile from high impact/high probability to high/low or low/high.

Lessons Learned

When navigating the waters of IT outsourcing, several lessons should be taken to heart:

Responsibility and accountability cannot be abdicated. Consultants can add considerable value to the process of selecting suppliers and helping to evaluate them, but in the end the business expects the same service, reliability, and level of risk as they have been getting from local IT, and IT will be held accountable for shortcomings.

Due diligence must be performed. The supplier needs to be audited, both before and during the engagement. Require metrics and reports to demonstrate efficiencies. Monitor the financial health of the service supplier. Use defined change management processes to identify when significant changes occur either at the client or with the provider to ensure the level of risk is still acceptable.

Awareness must be ensured through training and governance. It is fallacy to assume that all local IT staff can be eliminated. In reality, while some staff reduction is possible, new local IT responsibilities will include the governance of the outsourcing effort and the local management of projects involving the supplier. Cutting local IT staff too far will result in a dysfunctional relationship with the service suppliers and unsatisfied customers within the healthcare firm.

The healthcare company should take advantage of every opportunity to reduce risks that are within its control. At the same time, it must be understood that there are some risks that they cannot efficiently or effectively control. These kinds of risks may be better delegated to management by the supplier.

The nature of the work considered for outsourcing needs to be clearly understood, classified, and documented. Depending on risk tolerance, there may be some things that simply should not be done off-shore in some countries or perhaps even outsourced at all. In any case, access should be provided only to that data required for the engagement.

Requirements and expectations should be thoroughly documented. If an activity is important, it should probably be in the contract. However recognize that in a major outsourcing effort, it is unlikely that all needs will be identified in advance so build some flexibility into the contract. If the contract requires maximum effort by the supplier as written, chances are good that when something is discovered that wasn't covered the supplier will be unable to deliver the extra effort needed.

Collaborate with the supplier on solutions. Recognize that they are the experts in the services that they deliver. To maximize the value of the relationship, expect them to be thought leaders, not order takers.

Include close-out and transition considerations. All good things come to an end, and failure to have a defined exit strategy will cause no end of angst when it is time to end the relationship.

Internal Risks

This article deals primarily with risks related to engaging outsourced business partners. However, there are also internal risks that a company will have to address as they transition to an outsourced IT model. Three examples of internal risks traceable to outsourcing are:

- Managing external resources is always time consuming. This will have the potential impact of requiring an adjustment of project management resources, and in some cases,

may necessitate some travel to the supplier. Additionally, while IT may cut back on "traditional" staff, some new positions will likely become necessary to manage the interface between business customers and the IT service suppliers. These new positions will require both a grounding in the technical aspects of IT as well as understanding of business priorities and requirements.

- Staff reductions result in the loss of local expertise. Incidents once addressed locally now depend on external resources. Bureaucracy is likely to increase, especially if the support staff is in a different time zone. There is a risk of customer frustration at the amount of extra time and effort required to solve problems, which can encourage the rise of "shadow IT."
- "Shadow IT" is a significant threat. If getting a project done through the IT department becomes onerous due to outsourcing/offshoring, there will be a temptation on the part of business managers to cut out the middle man and develop their own outsourced solutions. This can lead to non-standard infrastructure, unrecognized support requirements or unsupported systems, and increased risk to data integrity, confidentiality, availability, and accessibility.

Conclusion

There are real potential benefits to be realized by outsourcing or off-shoring routine IT activities. However, there are accompanying risks that must be monitored and in some cases mitigated. You cannot go far wrong if you remember this mantra:

It's all about the data.

The bottom line is that the most important asset of a pharmaceutical or biotech company is its information. Placing that information in the hands of a third party service provider automatically assumes a level of risk. How high that risk is depends on country issues relating to legal and political factors, company issues, contract issues, and the nature of the data and the work to be done by the supplier.

Finally, as we are constantly reminded by regulators, whatever is done in the name of the healthcare company is at day's end the responsibility of the client company. Hence, the fifth risk factor, governance of the outsourcing/off-shoring program.

Legal Disclaimer: The opinions expressed in this article are solely those of the authors and not necessarily those of Novartis Pharmaceuticals Corporation ("NPC"). NPC does not guarantee the accuracy or reliability of the information provided herein.

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Europe

Denmark

Danish Medicines Agency Publishes FAQ on Clinical Trials[1]

Danish Medicines Agency published a document answering questions on clinical trials that can be found at http://www.dkma.dk/1024/visUKLSArtikel.asp?artikelID=17578.

The Danish Medicines Agency's Expectations for Audits of API Manufacturers[2]

The Danish Medicines Agency published expectations for audits of API manufacturers in accordance with GMP in the EU. Expectations cover the following areas: auditors, audit reports, assessment of API manufacturers, and ongoing assessment of API manufacturers.

Danish Medicines Agency Publishes Statistics in Denmark 2005 – 2009[3]

The Danish Medicines Agency published the following statistics: total sales; sales within the different ATC groups – primary healthcare sector; and sales within the different ATC groups – hospital sector. These statistics can be found at http://www.dkma.dk/1024/visUKLSArtikel.asp?artikelID=11739.

European Union

European Medicines Agency Welcomes Adoption of New Pharmacovigilance Legislation by European Parliament[4]

The European Medicines Agency welcomes the adoption of the new pharmacovigilance legislation by the European Parliament. This is a major step toward the legislation coming into force, currently expected for mid-2012. The new Directive and Regulation propose a number of changes that will strengthen the way the safety of medicines for human use is monitored in the European Union (EU). The impact on the work of the Agency is expected to be considerable. The proposed changes include enhanced monitoring of the benefits and risks of medicines post-authorization, replacement of the Pharmacovigilance Working Party with a Committee, and an increased level of transparency of safety information. The Directive and Regulation are still awaiting adoption by the Council of the European Union.

European Medicines Agency Publishes First Review of Orphan Designation[5]

The European Medicines Agency has published the first of its "review of orphan designation" documents. These documents summarize the review of the orphan designation carried out by the Committee for Orphan Medicinal Products (COMP) whenever an orphan medicine reaches marketing authorization. The review is carried out to check that the criteria underpinning the medicine's orphan designation still apply.

The publication of these documents has been introduced in order to increase transparency over the Agency's orphan designation process. The documents summarize the COMP's position on whether the orphan designation for a medicinal product that is receiving marketing authorization should be maintained or revoked, and include a discussion on the justification of benefit over other authorized treatments.

European Medicines Agency and U.S. Food and Drug Administration Extend Confidentiality Arrangements Indefinitely[6]

The European Medicines Agency (EMA) and the U.S. Food and Drug Administration (FDA) have extended their confidentiality arrangements related to medicinal products for human and veterinary use, following the positive experience gained since the initial arrangements were signed in September 2003. This cooperation will now continue indefinitely without the need for further renewal.

The confidentiality arrangements allow both Agencies to exchange confidential information as part of their regulatory and scientific processes. Their aim is to promote public and animal health and to protect European and U.S. patients. The types of information covered by the arrangements relate to scientific advice, orphan drug designation, pediatric development, Good Manufacturing Practice (GMP) and Good Clinical Practice (GCP) inspection planning and reports, marketing authorization procedures, and subsequent changes to the marketing authorizations together with post-marketing surveillance.

European Medicines Agency Issues News Bulletin for Small and Medium Sized Enterprises Issue 13[7]

The European Medicines Agency issued the 13th issue of its News Bulletin for Small and Medium Sized Enterprises, which can be found at http://www.ema.europa.eu/docs/en_GB/document_library/Newsletter/2010/09/WC500096488.pdf.

European Medicines Agency Publishes Guide to European Medicines Agency[8]

This Guide to the various Units, Sectors, and Sections at the European Medicines Agency gives the names of the Heads of Unit, Heads of Sector, and Section Heads. It also gives a general description of what each Unit does within the Agency. It can be found at http://www.ema.europa.eu/docs/en_GB/document_library/Other/2009/12/WC500017950.pdf .

137th Session of the European Pharmacopoeia Commission[9]

The 137th session of the European Pharmacopoeia Commission was held in Strasbourg on 29 and 30 June 2010. The Danish delegation consisted of Professor Steen Honoré Hansen from the Faculty of Pharmaceutical Sciences of the University of Copenhagen and Erik Wolthers from the Danish Medicines Agency.

Eight new monographs and texts were adopted, as were 19 minor revisions. Thirty-four changes and 72 requests for revision of existing and initiation of 47 new monographs were sent to the relevant expert groups. This unusually large number of requests for revisions and initiations primarily concerned veterinary vaccines and homeopathic substances. There were 27 new and 27 replacement batches of reference substances approved.

During the session, the Commission elected two new Vice-Chairs for the coming three years. Since only two candidates had been nominated and both of them had already expressed their wishes to be elected 1st and 2nd Vice-Chair, respectively, the "election"was only held to secure enough votes in compliance with the "Rules of procedure." Thus, the Commission elected Prof. Dr Jos Hoogmartens (Belgium) and Mrs. An Le (France) as new Vice-Chairs, both of whom are known for their competent and diligent involvement in the EDQM organization.

EMA and US FDA Seek Potential Candidate Companies for Joint GMP Inspection Program[10]

The European Medicines Agency (EMA) and the U.S. Food and Drug Administration (US FDA) continue to seek potential candidate companies for a joint GMP inspection pilot program for manufacturers of medicinal products. Companies that have submitted in parallel two equivalent marketing authorization applications for the same medicinal product to both the EMA and the US FDA can request to participate in the pilot program for joint pre-approval inspection should such an inspection be considered necessary by both agencies.

The overall objective is to see whether greater international collaboration can help to distribute inspection capacity allowing more manufacturing sites to be monitored and reducing unnecessary duplication.

Sweden

The New Organization at the Swedish Medical Products Agency (MPA)[11]

The MPA has during the past year undergone a thorough survey of processes followed by a reorganization. The new organization; with partly new units and areas, have been in operation since 1 September 2010.

The purpose of the reorganization is to create better conditions for more efficient work processes and improved coordination between different functions at the MPA. One of the main changes is the establishment of four new assessor departments, Efficacy and Safety 1-4, responsible for clinical and preclinical assessments of new applications or variations. These departments also are responsible for continuous follow-ups of the products. The new Pharmacovigilance department is handling adverse events reports, monitoring signals, and is responsible for pharmacovigilance inspections. The former Regulatory Department is divided into one unit for regulatory administration and one unit for product information.

United Kingdom

The British Standards Institute Publishes Braille on Packaging for Medicinal Products[12]

The British Standards Institute has recently published BS EN 15823:2010 Packaging, Braille on the packaging of medicinal products. This specifies the requirements and provides guidance for the application of Braille to the labelling of medicinal products. Where compliance with this standard has been shown, such packaging will meet the regulatory provisions in article 56(a) of Council Directive 2001/83/EC [as amended].

Relocation of Britain's MHRA Head Office[13]

The MHRA head office in Vauxhall, London, will be moving to a new London location in October 2010. The new location of the MHRA head office will be 151 Buckingham Palace Road which is in Victoria, Central London.

Asia/Pacific

China

Commissioner Shao Mingli Meets Director of Singapore Health Sciences Authority[14]

On 17 August 2010, Shao Mingli, Commissioner of the State Food and Drug Administration, met the visiting Dr. John Lim, Director of Singapore Health Sciences Authority and his party. Both parties discussed China's new revised version of GMP, the progresses on information technology application in drug supervision in China and the latest trends of drug supervision in Singapore, and exchanged views on deepening exchanges and cooperation of both parties.

Japan

PMDA participated in China-Korea-Japan Director-General Meeting and APEC Multi-Regional Clinical Trials Seoul Workshop Highlighting Korea, China, and Japan Tripartite Symposium[15]

Achievements of the DG meeting are summarized as follows:

1. Terms of Reference of the Working Groups (WG) were finalized to be published.

2. The objectives and outline of the joint research on ethnic factors in clinical data were confirmed, and the Research Group composed of experts from China, Korea, and Japan was established to discuss the details as well as the timeline of the joint research project.

3. Exchange of information on clinical trials was discussed as another work item of WG.

North/South America

USA

U.S., Ukraine Agree to Share Standards for Quality of Medicines[16]

With the mutual goal of improving the quality of pharmaceuticals worldwide, the U.S. Pharmacopeial Convention and the Ukraine Scientific Pharmacopoeial Center for the Quality of Medicines have entered into an agreement to share standards for the quality, purity, strength, and identity of medicines. Specifically, the Center will have a five-year, renewable right to include written standards from the United States Pharmacopeia–National Formulary in the Ukraine Pharmacopoeia and its companion journal, Pharmacom. The standards may either be included entirely as they are published in the USP–NF, in translation ("adopted"), or modified to better suit the Center's requirements for the Ukraine ("adapted").

Chinese Commissioner Shao Mingli meets Commissioner of the U.S. Food and Drug Administration[17]

On 11 August 2010, Shao Mingli, Commissioner of the State Food and Drug Administration, met with the visiting Dr. Margaret Hamburg, Commissioner of the U.S. Food and Drug Administration. Both sides reviewed the progress of the cooperation since the signing of the Agreement on the Safety of Drugs and Medical Devices in 2007, and had in-depth discussions on the further enhancement of cooperation in drug and medical device safety supervision and better ensuring drug safety for the public of both countries.

FDA Issues Assessments of the 510(k) Program and Use of Science in Decision-Making[18]

The U.S. Food and Drug Administration issued two comprehensive evaluations containing recommendations that address three key objectives of the Agency's public health mission as it relates to medical devices – foster device innovation, create a more predictable regulatory environment, and enhance device safety.

The FDA's Center for Devices and Radiological Health assessment consists of two preliminary reports. One report focuses on ways to strengthen and clarify a premarket review process called the 510(k) program for medical devices that do not need to undergo a full premarket approval review. The other evaluates CDRH's use of science in decision-making with an eye toward adapting to new scientific information, while maintaining regulatory predictability necessary for innovation.

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Letter from the Past Chairman

Discovering the True Value of Membership

In the last few weeks, I have encountered two professionals in our industry that will be successful in their career no matter what the economic climate is. They are different ages, speak different languages, and live on opposite sides of the world. Both understand a critical factor for career success.

Mark has been in our industry more than 20 years. He is a senior manager on a manufacturing and development site. Last year, we discussed two issues that concerned him. The first was the need for his business to achieve greater recognition for the technical capabilities of its staff; the second was to find guidance for a particular challenge his business was facing.

To help with his first concern, my advice to him was to offer his staff as potential contributors to ISPE education events as subject matter experts. As for the second, I connected him with some ISPE industry thought leaders who were preparing guidance on this subject. This connection turned out to be the key to solving both of his issues within a year of our conversation.

The emerging guidance concepts helped Mark solve the professional challenge he was facing, and because he had engaged with the concepts while they were still in development, he was in a position to present one of the first case studies on the subject at an ISPE education conference, thus highlighting the technical abilities of his staff. He can now rightly claim his team is at the leading edge of dealing with one of our industry's most difficult issues, assessing the risk of manufacturing multiple products in the same facility.

David's story is different from Mark's, but it is a similar tale of ISPE being pivotal to his success. I met David in China last year when I presented Sichuan University ISPE Student Chapter with an award for their work in translating GAMP® 5 into Chinese. Recently, I noted that David had progressed from being a student to working with a prestigious Chinese biotechnology institute. It is evident to me that the extracurricular work David performed during his student Membership with ISPE was an important factor in distinguishing David from other student candidates.

Both of these very different professionals understand that engaging with ISPE gives them the opportunities and means to develop their technical knowledge, exchange practical experience within their community, and enhance their professional skills that are so important in today's marketplace.

These truly are challenging times for our industry. However, as you consider your organization's needs and priorities, think about Mark and David's stories. Can you and your team afford not to engage with ISPE? In my travels as your chair over the past year, I have had the opportunity to meet a lot of other people, and I have become more convinced than ever that engagement in ISPE pays handsome dividends personally and professionally. In 2011, consider getting more involved. You won't regret it.

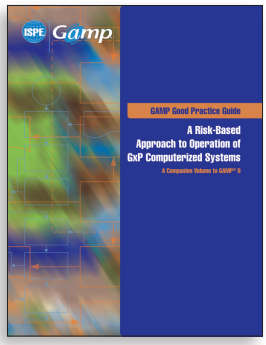
Sincerely,

Alan Mac Neice
Chairman, 2009-2010 ISPE International Board of Directors

GAMP Documents Update

Following the successful publication of GAMP® 5 in 2008, it has been a very busy and exciting period for the GAMP COP, involving both the development of new material to support and expand on the content of GAMP 5, and also the update of existing Good Practice Guides to align with the key concepts and principles of GAMP 5, which is on-going. A summary of this work is listed below. ISPE wishes to thank all those involved in the production and review of these Guides, which are together forming a comprehensive body of knowledge on all aspects of computerized system compliance.

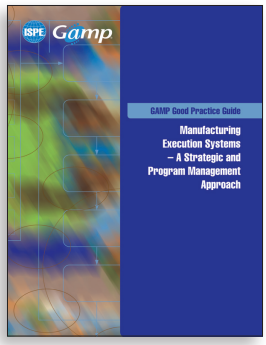
Published Guidance on the Operation of Computerized Systems



The *GAMP® Good Practice Guide: A Risk-Based Approach to Operation of GxP Computerized Systems* provides detailed information to enable organizations to support their systems more effectively during the Operation Phase of the system life cycle. It is intended as a companion volume to GAMP 5, providing comprehensive guidance for maintaining control of regulated systems throughout their operational life (including acceptance and release, system handover, through to system retirement and decommissioning).

The Guide focuses on achieving effective and efficient business processes aligned with regulatory expectations, by providing generic principles which can be applied to regulated systems using a systematic and scalable approach. It is applicable to a range of systems, including laboratory, process control, and IT. A feature of the Guide is the use of process flow diagrams to help make the process steps and their interrelationships clear and accessible.

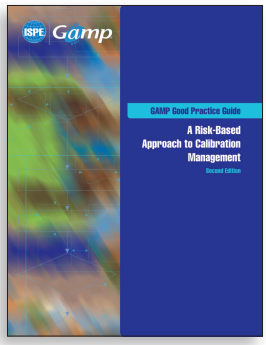
Published Guidance on Manufacturing Execution Systems



The *GAMP® Good Practice Guide: Manufacturing Execution Systems –A Strategic and Program Management Approach*, helps to facilitate the planning, development, and testing of Manufacturing Execution Systems (MES) that may be used to support manufacturing in regulated organizations.

The Guide takes a life cycle approach to examining MES, not as an application, but as a collection or domain of manufacturing related functions that integrates business and process controls, information flow, and human interaction to facilitate the operation of an organization.

Calibration Management Revision



The *GAMP® Good Practice Guide: A Risk-Based Approach to Calibration Management* is due for publication toward the end of 2010.

This new revision has been updated to reflect regulatory and industry developments since publication of the original Guide, and provides guidance in setting up a calibration management system, giving a structured approach to instrument risk assessment, calibration program management, documentation, and corrective actions, essential to regulatory compliance. It aims to cover both process and laboratory instrumentation. The overall intention is that calibration activities are effectively focused on those aspects that pose risks to product quality and patient safety

Process Control System Revision

The *GAMP® Good Practice Guide: A Risk-Based Approach to GxP Process Control Systems* is due for publication at the end of 2010.

This new revision has been updated to reflect regulatory and industry developments since publication of the original Guide, and provides recommended good practice based on a life cycle approach for the development and management of process control systems.

The Guide recognizes that Good Engineering Practice meets most of the applicable compliance requirements. The Guide also emphasizes that in order to be efficient, appropriate specification and verification activities should be an integral part of the normal system life cycle.

The Guide recognizes that many suppliers of systems now have mature quality management systems and system development, test, and support documentation. The Guide promotes the leveraging of supplier documentation and activities to avoid unnecessary duplication, cost, and waste.

Planned Developments

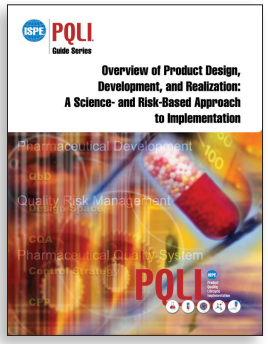
The updating of existing Good Practice Guides covering Laboratory Systems and Testing is underway, both in order to align with regulatory and industry developments since publication of the original Guides, and to provide up to date examples and guidance where appropriate. PE

PQLI Update from Brussels: Case Studies in QbD for Biotechnology and Small Molecule Product Realization

by Dr. Kate McCormick, ISPE European Education Advisor

Leaders: Ranjit Deshmukh (MedImmune) and Beth Junker (Merck)

Opening Presentations



Stephen Tyler (Abbott) previewed the document series "Product Design, Development, and Realization: A Science and Risk-Based Approach to Implementation." The Overview Good Practice Guide is now available in electronic format only. Four Guides will be published in 2011. ICH Q8/9/10 (and future Q11) are visionary, high level documents. Industry needs guidance on reaping benefits, while meeting regulatory expectations that filings will demonstrate enhanced product and process understanding. These guides are aimed at providing practical guidance.

Patrick Swann (US FDA) indicated many applications were received for the Quality by Design (QbD) Pilot Program for Biologicals and discussed types of questions asked by applicants. ICH definitions exist for many key terms and it is not necessary to modify them. He supported the use of a critical analysis tree to classify Critical Process Parameters (CPPs) based on risk. Issues still being debated include the relationship between design space and control strategy; demonstration of process capability; and the balance of regulatory commitment between higher and lower risk items.

Representing the EMA PAT team, Mats Welin (MPA, Sweden) indicated that while there were many QbD-containing small molecule applications, those for biopharmaceuticals with QbD are few. Companies making such applications should consult both the PAT team and the Biologics Working Party. Most QbD applications contain enhanced development data and interaction studies, rather than design space claims. There is need to show product is safe and efficacious, not just a robust process and to demonstrate why some parameters are non-critical. These do not need limits in filings, but principles for setting internal specifications must be clarified.

Interactive Workshops

Rob Hughes (AstraZeneca) compared a conceptual framework for a Pharmaceutical Quality System (PQS) based on moving toward the enhanced Q10 approach with a basic "comply with GMPs" approach and ISO 9000. Key differences relate to management responsibilities and continuous improvement. He also reviewed current work on change management, following the full product lifecycle. The addition of QbD elements should more directly link operation of the PQS to the ability to make changes (for example, movements within design space). The output from this workshop will serve as input to the PQLI team developing Good Practice Guides on Process Performance and Product Quality Management Systems, and Change Management.

Mike Defilippis (Lilly), Beth Junker, and John Berridge (ISPE) used the AMab case study to review QbD concepts. There was consensus that process capability and probability/frequency should be excluded in determining criticality of a quality attribute, the key factors being severity and uncertainty. There also was agreement that ICH standard definitions for CPPs should be used, supplemented by a risk continuum for classification.

Bruce Davis (Global Consulting) and John Lapore (Merck) led a discussion on the use of models to define design space and manage control strategies. Uncertainty management is a key concern. There are few examples of modeling being used to describe design space. In the case of small numbers of data sets, it may be necessary to invoke specialized statistics. For biopharmaceuticals, modeling can be very useful in qualifying scale-down models.

Bill Whitford (Thermo Fisher Scientific) and Line Lundsberg-Nielsen (NNE) dealt with QbD for raw materials. The issue is complex and QbD may be useful in setting raw material standards. Not all raw materials carry the same quality risk to the product Critical Quality Attributes (CQAs) and each case should be considered separately. Raw material control strategy must be integrated with product control strategy.

Closing Presentations

Nirdosh Jagota (Genentech) described his company's implementation of QbD for biologicals. Challenges include maintaining similar flexibility in licenses to that seen with traditional filings and slow uptake of the concept outside US/Europe. There may be lack of supporting data to designate non-CQAs. In practice, about 80% of proposed attributes tend to CQAs. He cautioned against substituting risk assessments for good science.

Concludes on page 7.

Introducing the 2010-2011 Board of Directors

The following pharmaceutical industry professionals have been elected to positions on the 2010-2011 ISPE International Board of Directors:

Chair

Andre Walker, CPIP, Director of Manufacturing Engineering and Facilities, Biogen Idec, Denmark

Mr. Walker is Director of Manufacturing Engineering and Facilities for Biogen Idec's Large Scale Commercial Manufacturing Operation in Hillerod, Denmark, where he is responsible for the maintenance and engineering support of all equipment and utilities, including the metrology and validation functions. He and his family recently relocated to Denmark from the US, where he held a similar role at Biogen Idec's Manufacturing Operations in Cambridge, Massachusetts. He has almost 30 years of experience in process development, scale-up, implementation, validation, and manufacturing support. A chemical engineer by training, his efforts as principal process development engineer won a Corporate award from Duracell International. At Bayer Diagnostics, Walker formed and staffed a new engineering department, oversaw IVD diagnostics manufacturing, and was heavily involved in designing their validation and compliance systems. A member of the ISPE International Board of Directors since 2003, he is currently serving as Vice Chair. He is leading the effort to modify the ISPE business model so that the multitudes of assets within the organization function seamlessly to create member value. His past contributions to the Society include four years on the North American Affiliate Council, two of which he served as chair, and several years on the Boston Area Chapter Board, including terms as vice president, program chair, and president. Walker also holds a CPIP credential.

Vice Chairman

Dr. Author "Randy" Perez, Director, IT Risk Management and Compliance, Novartis Pharmaceuticals, USA

Dr. Perez currently holds the position of Director, IT Risk Management and Compliance for Novartis Pharmaceuticals. His responsibilities at Novartis include a wide range of IT Compliance issues, such as GxP, Sarbanes-Oxley, and data privacy. He serves on several global Novartis teams dealing with computer systems compliance issues, and has authored many of the firm's global GxP compliance policies. During his 27-year tenure at Novartis, he has developed a broad range of experience. Prior to his current position he worked as a chemistry group leader in process research, managed a chemical manufacturing process validation initiative, and ran both a GMP training program and a QA validation group for pharmaceutical operations.

Dr. Perez was a member of the PhRMA Computer Systems Validation Committee from 1995-1999, and was instrumental in the formation of GAMP Americas when that group started in 2000. From 2002-2008 he was Chairman of GAMP Americas and he has been a member of the global GAMP® Council since 2002. He initiated and led the Global Information Systems SIG, who wrote a GAMP® Good Practice Guide that was published in 2005, and was part of the core team that led the development of GAMP® 5, published in 2008. Dr. Perez has been a speaker and a course leader at numerous conferences in the US and Europe, and has been published in industry journals and textbooks. In 2005 he was elected to the ISPE International Board of Directors, most recently serving as Treasurer.

Treasurer

Dr. Charlotte Enghave Fruergaard, Director of Technology, Finished Pharma, NNE Pharmaplan, Denmark

Dr. Enghave Fruergaard is employed as Director of Technology, Finished Pharma at NNE Pharmaplan in Denmark. Previously she was manager of sales and marketing and before that responsible for conceptual designs of new pharmaceutical facilities. Enghave Fruergaard has over 16 years of experience with pharmaceutical projects. She has a broad experience within pharmaceutical manufacturing of sterile products and is a leading expert within isolator and barrier technology and associated sterilisation techniques. Enghave Fruergaard holds an MSc in mechanical engineering and a PhD in measuring technique. She has international experience from an EU-founded project where she was stationed at Physicalische Technische Bundesanstalt in Germany. During this project, she also earned her PhD degree within metrology.

Enghave Fruergaard has been a Member of ISPE since 1995, and is the current Secretary on the International Board of Directors. She is co-founder of ISPE Nordic Affiliate in 2000, and the Affiliate's immediate past Chairman. She is a member of ISPE Sterile Products Processing COP steering committee as well as on the Editorial Board for the magazine Pharmaceutical Engineering. Furthermore she has been the co-chairman of the annual ISPE "Barrier Isolation Technology Conference" in Europe since 1999.

Secretary

Damian Greene, Senior Director, Plant Network Strategy, Pfizer Global Manufacturing, USA

Mr. Greene is Senior Director Plant Network Strategy for Pfizer Global Manufacturing in New York. He has a BE in Chemical Engineering from University College Dublin, and an MSc in Chemical

Concludes on page 7.

ISPE ENGINEERING PHARMACEUTICAL INNOVATION

What is the CPIP Certification and What are the Benefits?

by Jeff Hargroves and Anders Brummerstedt

This is the first of several briefs to describe the Certified Pharmaceutical Industry Professional (CPIP) certification. Each article will provide insights from a unique perspective regarding the value and benefits of the CPIP certification.

The idea for the CPIP Credential arose from a need identified by people from all facets of our industry for a credential to identify those individuals who have a level of experience commensurate with an industry-recognized and industry-respected definition of "Professional."

This Mission of the Professional Certification Program is to provide industry and individuals with competency standards for professionals and to provide a certification process and a credential to those individuals who demonstrate that they meet the competency standards at a specified level.

People with the CPIP Credential will have the potential to become "change agents" in their companies, and thus facilitate innovation within the industry in fields, such as manufacturing process and facility improvements and drug product quality enhancements.

Ultimately, the innovations will lead to a more cost effective and quicker development and manufacturing of drugs, and thus lead to the achievement of improved quality of life for the patients.

With the CPIP Credential, our pharmaceutical and biotech industry now possess a unique and standardized way to demonstrate the knowledge base required to consider oneself an industry professional. The certification program will be ANSI accredited during 2011, and thus a CPIP certificate will be in a class of its own compared to other current certifications in the industry.

The CPIP certification provides a standardized methodology for demonstration of one's Technical Knowledge across a wide range of expertise:

- Product Development
- Facilities and Equipment
- Information Systems
- Supply Chain Management
- Production Systems

"Looking back, the overall feeling of the CPIP credentialing process is that I proved to myself that I had a very wide base of knowledge about the biopharmaceutical industry and all the functions within. It really became helpful on a project as I worked with a client to develop a model of their entire production process."

- Damian Gerstner, CPIP,
Computer Compliance President,
Sys-Tek, United States

- Regulatory Compliance
- Quality Systems

Additionally, the certification demonstrates professional competency in other important areas, such as:

- Leadership and Professionalism
- Integration/Innovation/Change Advocacy
- Quality and Continuous Improvement

This certification can be utilized in many ways:

- a Professional Development pathway to acquire knowledge and skills that can be recognized and used anywhere in the world
- industry-wide recognition of experiences, knowledge and ability
- leverage when seeking career advancement or new opportunities
- personal satisfaction
- competitive advantage for individuals and companies
- a Global industry professional practice standard
- a baseline of expertise for industry consultants to demonstrate competence

If you want a credential to just say you have one, there are other credentials that are easier to attain. If you want a credential that demonstrates a measurable level of commitment and experience with industry wide recognition, you have found your answer.

Eligibility applications can be submitted at any time and exams occur twice a year.

Find out more about how this certification can serve you individually and your employers, clients, colleagues by visiting www.ispe-pcc.org.

Pharmaceutical Engineering Announces Winner of the Article of the Year Award

Pharmaceutical Engineering's "Article of the Year" recognizes the contribution of authors. Articles are evaluated by a panel of volunteer reviewers according to a number of criteria, concentrating on the importance and timeliness of the subject matter and the quality of the presentation. The criteria for judging are as follows:

- Is it directly useful to the readers in their efforts to improve the industry and themselves?
- Does it improve knowledge/understanding of key topics?
- Is it clear, easy to read? (Low jargon usage)
- Quality of artwork, graphs, etc.
- Appropriate length

The finalists for each "Article of the Year" are chosen from the September/October issue of the previous year, through the July/August issue of the current year. The award program was established to express appreciation to all of the authors who submit their work for publication in Pharmaceutical Engineering.

We are pleased to announce the 2009-2010 Roger F. Sherwood Article of the Year Award Winner:

September/October 2009, Volume 29, Number 5

Applied Quality Risk Management: Case Study – Laboratory Computerized Systems

by Ms. Judith Samardelis, Ms. Winnie Cappucci

This article discusses how to apply the GAMP 5 quality risk management strategy to maintain compliance in laboratory computerized systems.

Roger F. Sherwood Article of the Year

PHARMACEUTICAL ENGINEERING®

The winner was selected from this group of finalists and recognized at ISPE's 2010 Annual Meeting.

November/December 2009, Volume 29, Number 6

Construction Quality: the Key to Successful Capital Projects Delivery

by Mr. Jay Lad, Dr. Bruce Beck

This article discusses why Construction Quality Management (CQM) is the key to delivering successful capital projects and outlines some of the challenges encountered from a construction/field execution perspective, rather than design/engineering perspective. It highlights the pivotal role of CQM in ensuring that a facility has good operability and availability as well as high reliability and maintainability.

January/February 2010, Volume 30, Number 1

Case Study: Utilizing Electron Beam Surface Decontamination to Transfer Sterile Syringe Barrels into an Isolated Aseptic Syringe Filling Line

by Mr. Oliver Vogt

This case study presents a project within Hospira, Inc., utilizing an Electron Beam Surface Decontamination system integrated into an isolated aseptic syringe filling line to transfer pre-sterilized syringes into the filling line.

March/April 2010, Volume 30, Number 2

"East is East and West is West" – Managing Capital Investment Projects in China

by Jerry Hourihan, Gordon Lawrence

This article presents some helpful "tips and suggestions" regarding building capital projects in China.

May/June 2010, Volume 30, Number 3

An Exhausting Solution for Fermentors

by Ernest L. Stadler

This article provides various solutions from simple to complex that deal with the removal of water vapor, liquid particles, and solid particles that can escape a fermentor exhaust nozzle and clog the sterile exhaust filter.

July/August 2010, Volume 30, Number 4

Industry Forces Driving Standardization of the Turnover Package

by Roy F. Greenwald and Bill Schaidle

This article provides an overview of the past and present approaches to formatting of turnover packages for equipment and modular assemblies. It highlights the lack of standardization within the industry and presents an example of an approach that could serve as a starting point for an industry standard.

...2010-2011 Board of Directors

Continued from page 68.

Engineering from the University of Missouri at Rolla. Greene began his career with Pfizer as a Production Supervisor at the Terre Haute, Indiana site. He has more than 25 years experience in pharmaceutical and fine chemical manufacture, and has worked for Pfizer in a number of operational, financial and strategic roles, including at the Ringaskiddy Ireland site, at the Groton Connecticut site, and at Pfizer New York Headquarters. Greene has served as Chair of the ISPE Community of Practice Council and as Chair of the API COP. Greene currently serves on the ISPE International Board of Directors.

Re-elected Directors

Stephen Tyler, Director, Strategic Quality and Technical Operations, Global Pharmaceutical Operations, Abbott Laboratories, USA

Dr. Guy Wingate, Vice President and Compliance Officer, Global Manufacturing and Supply, GlaxoSmithKline, United Kingdom

New Directors

Joseph "Joe" Famulare, Global Head of Quality, External Relations and Collaboration, Genentech, Member of the Roche Group, USA

Dr. Gordon Leichter, East Coast Sales Manager, Belimed Infection Control, USA

Stephen "Steve" Williams, Founding Director, Partner, and Senior Consultant, SeerPharma Pty Ltd., Australia

Continuing Directors

Antonio Buendia, Project Engineering Manager, Lilly SA, Spain

Winnie Cappucci, Associate Director, Product Supply IT Systems Compliance, Bayer Healthcare, North America, USA

Doyle Johnson, Senior Director, Facilities and Engineering, Genzyme, USA

Morten Stenkilde, Quality Director, Insulin Filling Plant, Novo Nordisk A/S, China

Andrzej Szarmanski, Quality Director, Polpharma SA, Poland

Past Chairman

Alan MacNeice, Senior Director for Projects, Elan's Biologics division, Ireland

PQLI Update from Brussels...

Continued from page 3.

Beth Junker discussed the business case for QbD, important for both speed to market and quality products and processes. There is significant overlap between QbD activities and the traditional approach to product development. Only marginal costs should be considered. There are many benefits from QbD (e.g., cost avoidance, cost reduction, time benefits); few will become quantifiable before product launch. QbD represents significant cost when compared to current process development, but becomes insignificant when compared to the cost of total product (including clinical) development. Measurement of the cost of failure is a step toward quantifying potential benefits of QbD, but implementation of QbD is essentially a strategic approach.

Summary

John Berridge told delegates the PQLI team output was deliberately controversial, thus gathering global feedback and moving toward consensus. One consensus example is using continuum for risk assessments (e.g., Tool 1 from the AMab case study as an example of best practice for identifying CQAs). He reiterated there is no need to invent definitions where adequate ones already exist in ICH. Finally, he reminded delegates the PQLI task teams want more input from industry professionals. For more information or to get involved, email: PQLI@ISPE.org.

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BioProcess Manufacturing

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Prevent Counterfeiting in the Pharmaceutical Industry

by Janice Abel

Many companies now deploy specialized packaging, applications, and other anti-counterfeiting technologies to help prevent counterfeit products, protect brands, protect customers, and allow rapid and effective response to counterfeit products. ARC would be interested to learn what steps, if any, your company takes.

Overview

The US Food and Drug Administration (FDA) estimates that counterfeit drugs account for 10 percent of all drugs sold in the United States. The World Health Organization (WHO) estimates that, globally, counterfeit drug sales will reach $75B by 2010. The Internet and gray market of distributors and re-packers represent real challenges to manufacturers trying to prevent counterfeit drugs from reaching consumers. As a result, drug manufacturers now deploy specialized packaging, applications, and other anti-counterfeiting technologies to protect brands, protect consumers, and allow rapid and effective response to counterfeit products. Manufacturers in other industries face similar challenges.

What Is a Counterfeit Drug?

The FDA (21 U.S.C. 321 (g)(2)) defines a counterfeit drug as a drug for which "…the container or labeling, without authorization, bears the trademark, trade name, or other identifying mark, imprint, or device, or any likeness thereof, of a drug manufacturer, processor, packer, or distributor other than the person or persons who in fact manufactured, processed, packed, or distributed such drug and which thereby falsely purports or is represented to be the product of, or to have been packed or distributed by, such other drug manufacturer, processor, packer, or distributor."

Counterfeit drugs include those sold under a product name without proper authorization and those without the active ingredient, with an insufficient or excessive quantity of the active ingredient, with the wrong active ingredient, or with fake or mislabeled packaging. Some counterfeit drugs are packaged and labeled or re-labeled to look like real brand name or generic products designed to deceive consumers into thinking that they are buying the authentic product. Consumers, manufacturers, and wholesalers need to know with certainty where drugs have been, who has handled them, and through how many hands they have passed.

Counterfeit Cases

While counterfeiting occurs throughout the world, the percentage is much higher in developing countries. The WHO estimates that 10 percent of all pharmaceuticals in the global supply chain today are counterfeit and that sometimes the fake drugs contain toxic substances and chemicals that could cause death - *Figure 1*. Some counterfeit medicines contain heavy metals; cement, talcum powder, solvents, and even yellow road paint and floor wax (the latter to make them shine).

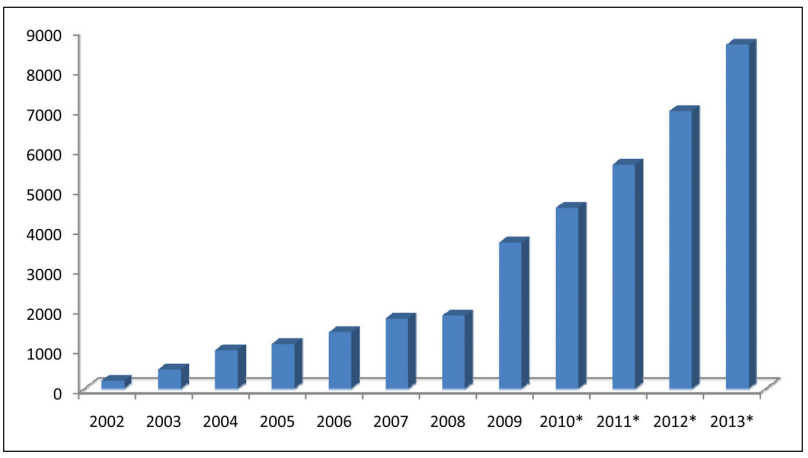

Figure 1. Recorded counterfeit incidents by year (Source: Pharmaceutical Security Institute).

The problem appears to be far less common in the industrialized world (such as in the United States, Australia, Japan, Canada,

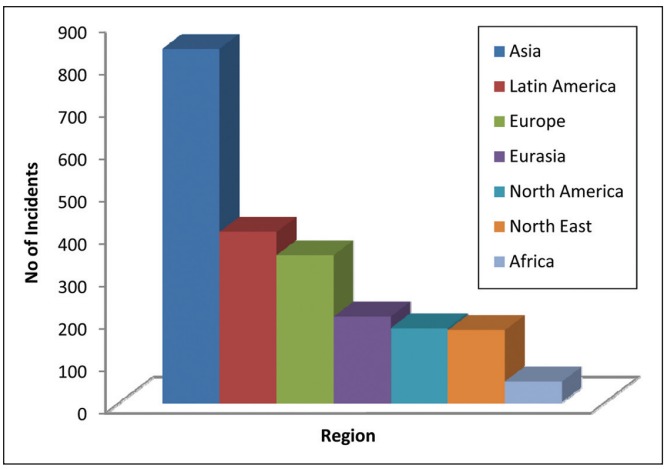

Figure 2. Recorded counterfeiting incidents by regions (Source: Pharmaceutical Security Institute).

New Zealand, and in the European Union), where estimates suggest that from less than 1 percent to 3 percent of medicines sold are counterfeit - *Figure 2*. However, the problem is growing everywhere.

Without a more secure supply chain, counterfeiting will continue to increase. There are several reasons for this. Counterfeiting drugs is a highly profitable activity and actually less risky than illicit drug trafficking. Under the current laws, narcotics traffickers view pharmaceuticals as a safer line of work, with fewer penalties if caught. Furthermore, counterfeiters can now access sophisticated technologies to copy the labels and packaging, including barcodes and other anti-counterfeiting devices. The common (legitimate) practice of repackaging and the existence of illegal drug marketing circuits/networks both facilitate counterfeiting activities. Well-organized counterfeiters have considerable resources. The ability for counterfeiters to sell drugs on the Internet and the willingness of buyers to purchase via this distribution channel also help foster a counterfeit culture.

Global Anti-Counterfeiting Regulatory Initiatives

The US FDA plans to increase prosecutions of pharmaceutical and food industry executives as part of an effort to refocus its criminal division, which has been under attack in Congress and criticized in a new government report.

The FDA released several Guidance draft documents over the past couple of years. The Agency released *Standards for Securing the Drug Supply Chain – Standardized Numerical Identification for Prescription Drug Packages* on 26 March 2010. Amendments to the FD&C Act in 2007 required FDA to take specific actions to secure the supply chain, including developing a Standardized Numerical Identifier (SNI). The guidance addresses SNIs for package-level identification. It provides flexibility in the type of data carrier, does not require incorporation of either batch number or expiry, and is compatible with the GS1 GTIN and AI-21 standards. The SNI is flexible in terms of the technology used. This can be a 2D barcode, Radio Frequency Identification (RFID), or use any other technology that secures the supply chain. However, the data carrier should be both human- and machine-readable.

The FDA also issued draft guidance on 13 July 2009 covering the use of inks, pigments, flavors, and other physical-chemical identifiers (PCIDs) by manufacturers to make drug products more difficult to counterfeit and to make it easier to identify the genuine version of the drug. PCIDs, inactive ingredients that can be detected and authenticated to deter counterfeiting, are added to coatings, capsule shells, encapsulated particles, or tablet layers of Solid Oral Dosage Forms (SODFs) for on-dose protection. PCIDs for SODFs include inks, molecular taggants, pigments, and flavors. The guidance recommends using PCIDs listed in the FDA's Inactive Ingredient Guide,

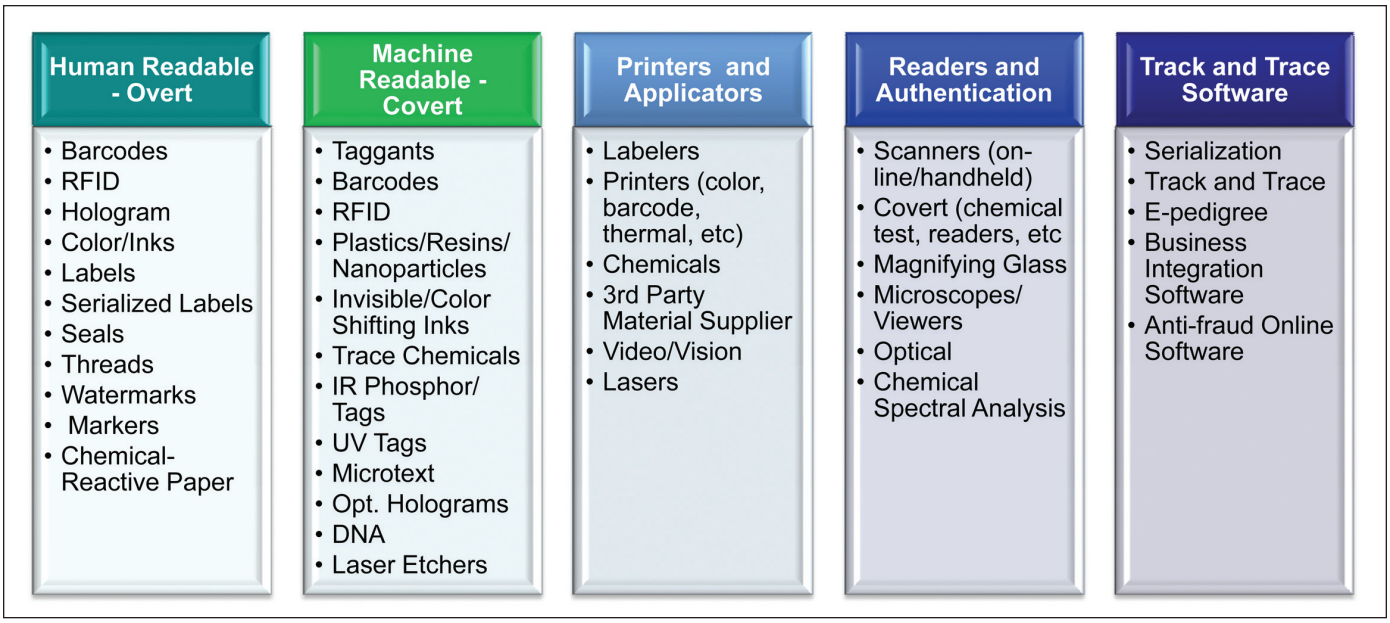

Figure 3. Anti-Counterfeiting technologies.

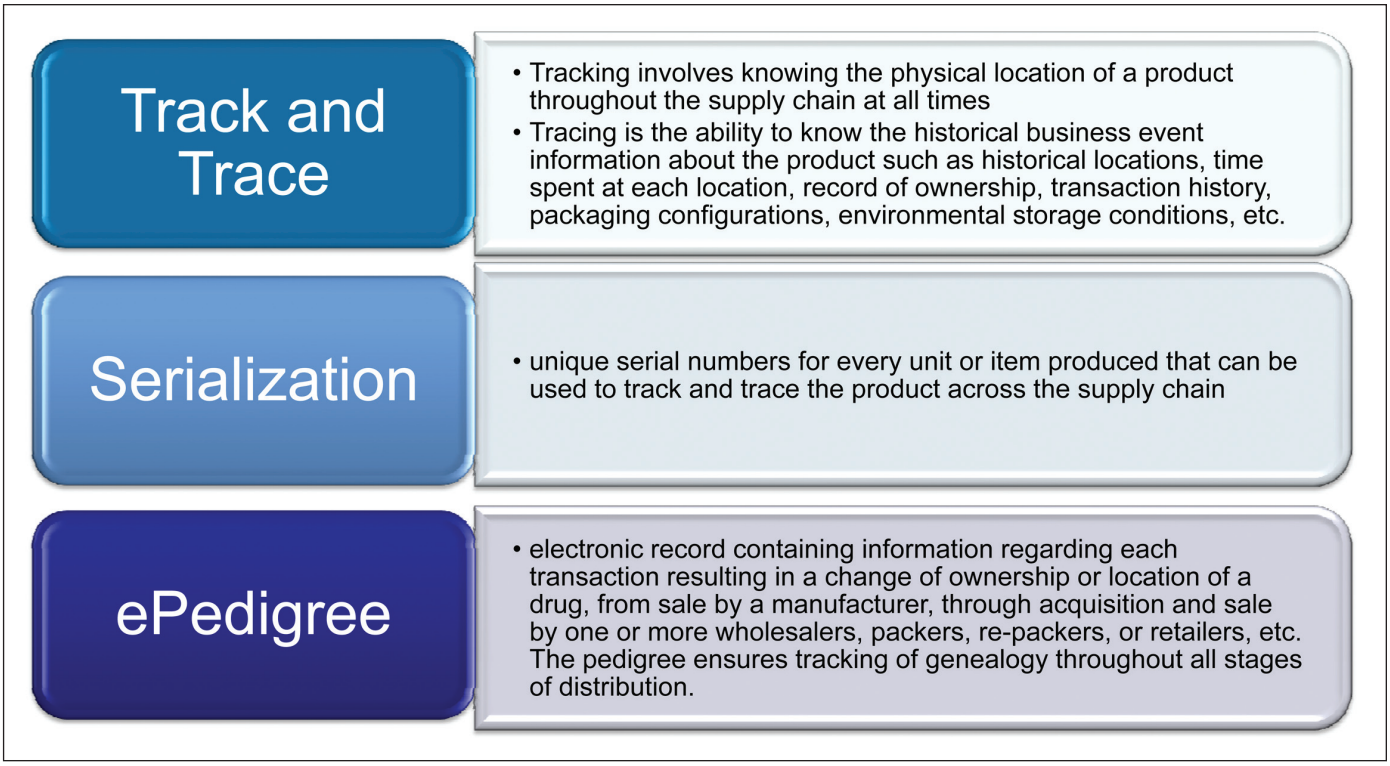

Figure 4. Definitions of epedigree, serialization, and track and trace.

adding the smallest amount possible and placing then on SODFs so that they do not interact with the API or interfere with the drug release.

In response to problems with excipient counterfeiting and a subsequent investigation uncovering the involvement of numerous distributors and brokers, the WHO developed the *Good Trade and Distribution Practices for Pharmaceutical Starting Materials* (GTDP) guidelines in 1998. That same year, the International Pharmaceutical Excipients Council of the Americas (IPEC–Americas) published a position paper on vendor qualification. IPEC-Americas, along with IPEC–Europe and IPEC–Japan, have since published numerous guidelines covering such topics as Good Manufacturing Practices (GMPs); Good Distribution Practices (GDPs), use of Certificates of Analysis (COAs), and significant-change notification to help manufacturers protect their excipient supply chains.

Despite these efforts, supply chain incidents involving excipients occurred again in China in 2005 and in Panama in 2006. These incidents prompted the US FDA to work with industry to develop three basic approaches to track chain of custody through the supply chain. These are paper trails, bar coding, and RFID. Because of the complexity of the excipient industry, the FDA determined that a paper trail would provide the fastest approach with the least disruption to the supply chain.

Although a single program cannot prevent fraud, a pedigree approach – using existing paperwork (or electronic paperwork) to the greatest extent possible – could provide a strong deterrent.

Anti-Counterfeiting Technologies

Most leading manufacturers implement technologies to secure the supply chain to prevent counterfeiting and protect their brands. The technologies range from high- to low-tech applications and solutions. Examples include sophisticated inks (Alpvision), advanced holograms (OpTec Security), taggants and markers (TopFlight Corporation, Microtrace, and 3S Simons Security Systems), labels (Zebra Technologies); lasers (Ingenia), RFID (Oat Systems and Kovia); serialization, authentication, traceability, and (ACSIS, Axway, Systech, Mobia Solutions, Siemens, Videojet, and Verify Brands); plus Internet sleuthing (OpTec Security and MarkMonitor) - *Figure 3*. Typically, these technologies utilize readers that input the data to a management system (SAP, Oracle/JD Edwards, Microsoft, and others).

Many technologies are available to help combat counterfeiting and secure the supply chain - *Figure 4*. Solutions must provide companies with the ability to trace lots all the way to the retail shelf and authenticate that products have moved through a legitimate supply chain. Automatic identification technologies, such as bar coding and RFID, have been touted as valuable assets for implementing effective track-and-trace systems. The FDA has been a driving force behind bar coding and RFID for carrying ePedigree information. New, easier to implement and less costly types of RFID are now hitting the market.

As the demand and volume increases for these technologies, the prices will decline and, in the future, most branded products will be equipped with anti-counterfeiting technologies.

Last Word

Resolving the global counterfeit drug problem requires common practices and a standards-based infrastructure that includes participation and collaboration by all trading partners across the supply chain, adequate legislation and enforcement, and implementation of emerging technologies. Although there is no single magic bullet against sophisticated counterfeiters, the supply chain needs to be more secure for all products.

Please participate in our confidential survey at: http://survey.constantcontact.com/survey/a07e31lwtw2gemvrn56/a01s1gemzx782/greeting.

The purpose of this survey is to develop a better understanding of the best practices being used by manufacturers, distributors and packers to manage the supply chain and address anti-counterfeiting and brand protection. The survey examines methods, technologies and solutions being used for preventing counterfeit product. Technologies that are being considered include various overt, covert, track and trace and epedigree. The survey will be used to better understand best practices for preventing counterfeit products from entering the supply chain.

About the Author

Janice Abel is a principal consultant in ARC's regulated industry group. In this capacity, Abel performs research and provides consulting services for ARC's clients in the pharmaceuticals, biotechnology, medical devices, and other regulated industries. Abel is a valued member of the Hybrid Team at ARC. Abel has been involved with the pharmaceutical and biopharmaceutical, consumer products, and other hybrid industries throughout most of her 25-year professional career. A longtime member of ISPE, she has served as chairperson for several ISPE committees, as well as president of the ISPE Boston Chapter. Abel is a frequent presenter and leader at ARC and ISPE conferences, and has authored numerous articles for *Pharmaceutical Engineering, Pharmaceutical Technology, Control Engineering,* and other industry publications throughout her career. Abel has been with ARC since November 2008. Prior to joining ARC, Abel was the Director of Pharmaceutical Industry Marketing at the Foxboro Company, Validation Technologies, and Invensys. Abel also worked on early cholesterol research at the Boston University Medical School Cardiovascular Institute. Abel has a BS in chemistry from Clark University, an MS in chemical engineering from Worcester Polytechnic Institute, and an MBA from Worcester Polytechnic Institute.

ARC is currently researching how companies deploy specialized applications and technologies, track and trace, epedigree and other solutions to help prevent counterfeit and stolen products from entering the legitimate supply chain. For further information or to provide feedback on this article or anti-counterfeiting solutions please contact jabel@arcweb.com.

2010




Scope of Practice & Compensation Report for the Regulatory Profession

RAPS REGULATORY AFFAIRS PROFESSIONALS SOCIETY
Making better healthcare products possible℠

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Letter from the Executive Director

The two years since the Regulatory Affairs Professionals Society (RAPS) fielded its 2008 Regulatory Scope of Practice & Compensation Survey presented a challenging business climate for the healthcare products sector and the overall global economy. However, the regulatory profession fared well and further demonstrated its importance to a dynamic, global sector. The results of the 2010 survey presented in this report indicate that regulatory professionals are more valued than ever. Regulatory professionals are taking on a wider range of job-related roles and responsibilities, including increased involvement in business-critical functions. Overall compensation for the profession continues on an upward trend at a slightly slower pace than in previous cycles, although some regulatory consultants experienced a decline in compensation. Other noteworthy findings presented here include the continued push toward globalization, increased involvement with multiple product types and the positive impact Regulatory Affairs Certification (RAC) has on compensation. *(continued next page)*

Letter from the Executive Director

The healthcare product regulatory profession has grown, changed and evolved much since RAPS was founded in 1976. At that time, healthcare product companies were just beginning to embrace the importance of establishing regulatory departments to help ensure their products complied with applicable regulations.

Today, regulatory professionals are engaged beyond just submission and compliance. They play integral roles throughout the healthcare product lifecycle—at every stage of the development, distribution, marketing and postmarket surveillance of drugs, medical devices, biotechnology products and other vital medical treatments. Increasingly, they are also engaged in critical business functions, including organizational and corporate strategy, health technology assessment and comparative effectiveness research, legal issues and government affairs.

We have seen the trend toward increasing business involvement develop over the past decade. Engagement in business and management activities has risen among all job levels. More regulatory professionals are seeking graduate business degrees and executive education, a further indication that the regulatory profession occupies an important position at the intersection of business, emerging healthcare innovations and technologies and regulatory strategy. Regulatory professionals are helping to make better healthcare products possible on many levels.

A look at the compensation data from the current and previous surveys provides additional evidence of the value of regulatory professionals within the healthcare products sector. Respondents reported their compensation for 2009, the most recent full year. While the global economy and healthcare-related industries experienced a general downturn, overall compensation for regulatory professionals continued to increase slightly or hold steady for most job levels and among most employers. Not all compensation results reported were positive, however, as those identifying themselves as consultants suffered income declines and professionals at the vice president level saw a drop in total compensation resulting from a decrease in bonuses and other non-salary compensation. But considering the larger, economic picture, a strong case can be made that the regulatory expertise and strategic thinking these professionals bring to their organizations is more valued and important than ever.

An additional compensation finding of the 2010 survey highlights the value of Regulatory Affairs Certification (RAC), the only certification specifically for healthcare product regulatory professionals. Forty-four percent of all survey respondents report being RAC certified. The percentage is even higher among US-based regulatory professionals, 47.2% of whom have the RAC credential. The average total compensation for that group was 6% higher than for their non-RAC-certified peers. Not part of this survey but noteworthy is that registrations for the RAC examination have continued to grow and a fourth RAC credential, the RAC General Scope, was introduced since the last Scope of Practice Survey in 2008. With these factors and evidence of the positive impact on compensation, the RAC credential may become increasingly sought after in the coming years.

Other trends in the regulatory profession that have continued with the 2010 results include the move toward an increasingly multiregional and global focus and involvement in a greater variety of healthcare product types. Regulatory expertise transcends pharmaceuticals, medical devices or biotechnology. More than 68% of respondents are involved with multiple product types, up from 64% in 2008. Biosimilars were added to the survey as a product category for the first time and while only a small fraction report involvement in this area, with new regulatory pathways emerging, it may be an area to keep an eye on going forward. Regulatory practice also transcends national or regional boundaries. It seems few regulatory professionals are focused exclusively on the regulatory requirements of one particular national or regional authority. Instead, they need to be increasingly in touch with multiple regulatory systems around the world. Seven out of 10 respondents report their work is global or multiregional in nature and most report a multiregional or worldwide view when developing regulatory strategy.

Regulatory professionals work in a variety of settings and locations worldwide. The healthcare products sector is more global today than ever before and the regulatory environment is more intricate than ever, requiring a special set of skills and expertise. As we have seen from previous surveys, regulatory professionals are highly educated, with many holding advanced university degrees. They also tend to have significant professional experience outside the regulatory area, an indication that many transitioned into regulatory from another, related field. Most have educational backgrounds in life sciences, clinical sciences or engineering.

All this taken together provides insight into a profession that is vital, highly valued, global, varied, challenging and well-positioned for the future.

Sherry Keramidas, PhD, CAE
RAPS Executive Director

Global Overview

RESPONDENT PROFILE

The 3,120 respondents to the survey included in the data analyses represent a range of professional levels and positions, education, experience and employment settings. They are based in countries around the world and tend to monitor the regulatory environment in multiple geographic regions.

55%

of respondents have a master's or doctorate.

Regional Distribution

Professionals from the 55 countries listed below responded to the survey.

Algeria
Argentina
Armenia
Australia
Austria
Bangladesh
Belgium
Brazil
Canada
China
Colombia
Costa Rica
Croatia
Denmark
Egypt
Finland
France
Germany
Greece
Hong Kong
India
Ireland
Israel
Italy
Japan
Korea, South
Malaysia
Mexico
Netherlands
New Zealand
Nigeria
Oman
Pakistan
Philippines
Poland
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Romania
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Saudi Arabia
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Sweden
Switzerland
Taiwan
Thailand
Turkey
United Arab Emirates
United Kingdom
United States of America
Uzbekistan
Yemen

The majority of respondents (81%) reported being based in the US, while respondents from Europe, Canada and Asia made up 7%, 6% and 4% of the total, respectively. Approximately 3% of respondents reported being based in Latin America, Australia, New Zealand, the Middle East or Africa. This reflects an increase in respondents from outside the US over the previous Scope of Practice survey conducted in 2008, both in terms of overall numbers and percentage of the total.

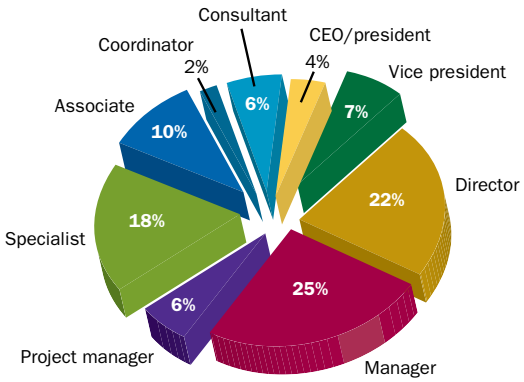
Gender

Overall, 60% of respondents were female; 40% were male, consistent with previous years' surveys.

Job Title and Employment Setting

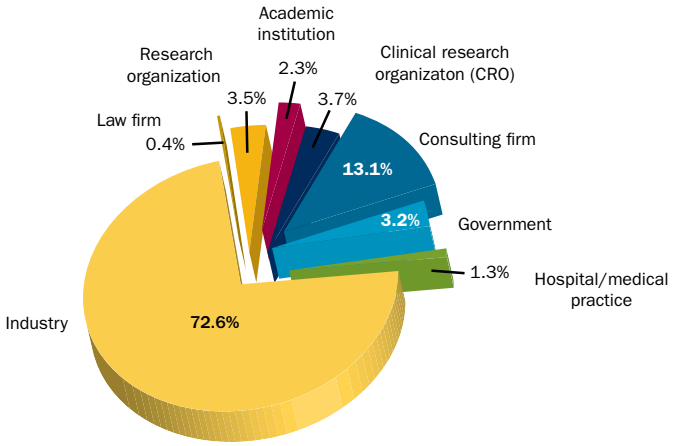
In addition to providing current job titles in a text-entry field, respondents were asked to select from a prescribed list, the job title that most closely aligns with their own. This allows for more effective classification of positions for analysis. Respondents represent a wide range of job titles and levels, as shown in Figure 1. The project manager title was added as an option for the first time, based on review of specific job titles listed in the previous study in 2008.

Figure 1. Job Titles



The majority of respondents are employed in industry (Figure 2). The current survey reflects a slight decline in the proportion of respondents from industry over previous surveys, and increases in respondents from government agencies, clinical research organizations (CROs), research organizations and consultancies.

Figure 2. Employment Setting



Employers represent a wide range when viewed by number of employees (Table 1) and revenue (Table 2), where applicable.

Table 1. Employing Organizations by Type and Number of Global Employees

	1-9	10-49	50-99	100-499	500-999	1,000-4,999	5,000-9,999	10,000+
Academic institution	2.8%	12.7%	2.8%	7.0%	8.5%	19.7%	12.7%	33.8%
Clinical research organization (CRO)	1.7%	10.3%	6.9%	35.3%	6.0%	18.1%	3.4%	18.1%
Consulting firm	65.7%	15.0%	6.9%	4.9%	1.7%	1.7%	1.0%	3.2%
Government	3.0%	3.0%	4.0%	12.1%	7.1%	15.2%	13.1%	42.4%
Hospital/medical practice	2.5%	10.0%	2.5%	12.5%	10.0%	27.5%	7.5%	27.5%
Industry	2.3%	9.1%	5.8%	14.7%	6.7%	16.6%	11.2%	33.7%
Law firm	18.2%	9.1%	0.0%	9.1%	0.0%	9.1%	9.1%	45.5%
Research organization	6.4%	17.3%	7.3%	20.9%	5.5%	7.3%	9.1%	26.4%
ALL EMPLOYERS	**10.8%**	**10.1%**	**5.9%**	**14.1%**	**6.0%**	**14.5%**	**9.5%**	**29.1%**

Table 2. Employing Organizations by Type and Revenue

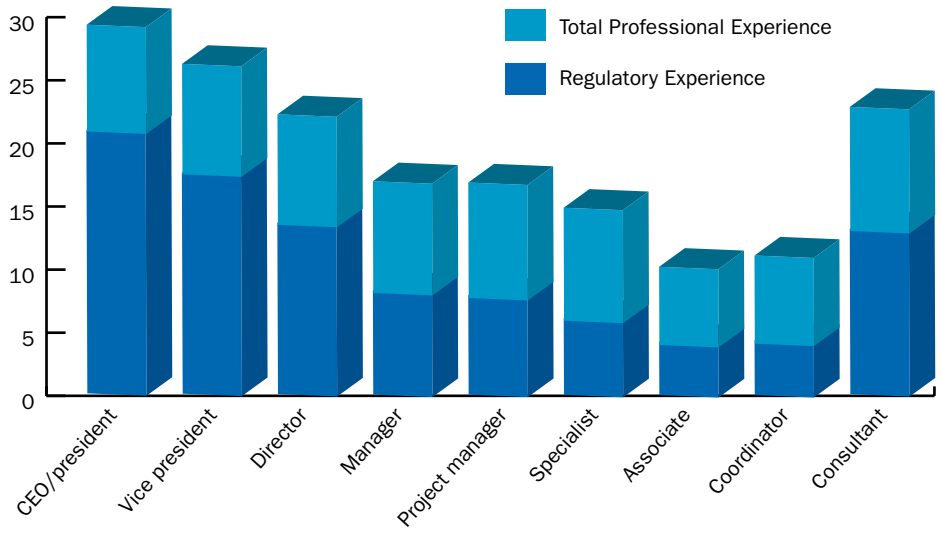
Row Labels	Under $1 million	$1-$9 million	$10-$49 million	$50-$99 million	$100-$499 million	$500-$999 million	$1 billion or more	Does not apply
Academic institution	4.2%	11.3%	9.9%	2.8%	1.4%	5.6%	2.8%	62.0%
Clinical research organization (CRO)	2.6%	22.4%	20.7%	10.3%	13.8%	6.9%	12.9%	10.3%
Consulting firm	53.9%	18.4%	8.1%	0.5%	2.2%	0.7%	3.9%	12.3%
Government	1.0%	2.0%	3.0%	3.0%	4.0%	1.0%	5.1%	80.8%
Hospital/ medical practice	7.5%	17.5%	7.5%	2.5%	12.5%	7.5%	20.0%	25.0%
Industry	6.6%	7.5%	10.2%	5.6%	11.0%	7.5%	44.7%	7.0%
Law firm	9.1%	0.0%	9.1%	0.0%	0.0%	9.1%	54.5%	18.2%
Research organization	12.7%	6.4%	6.4%	4.5%	11.8%	2.7%	26.4%	29.1%
Grand Total	**12.6%**	**9.5%**	**9.9%**	**4.9%**	**9.5%**	**6.2%**	**35.1%**	**12.4%**

More than 75% of respondents reported their employers—including academic, research and government organizations—have locations in multiple regions of the world. This may reflect the increasing global dimensions of the healthcare products sector and the regulatory profession.

Professional and Regulatory Experience

Many enter the regulatory profession with several years of prior professional experience in another, often related, area. On average, there is an approximate ratio of 2:1 total professional experience to regulatory experience (Figure 3). Professional and regulatory experience are correlated with job title and with compensation, as described later this report.

Figure 3. Total Professional and Regulatory Experience by Job Title: All Respondents



There are some regional variations in the level of regulatory experience, with slightly less regulatory experience among professionals in Asia, Africa and Oceania. In Asia, more than 50% of respondents report having five years or less of regulatory experience while only 10% report having 15 or more. This compares to 30–37% with five years of experience or less in Europe and the US and 28% with 15 or more years of experience in both the US and Europe.

The relationship of regulatory experience to job level is also illustrated in Figure 4. Among CEOs and vice presidents, the majority (78% and 66%, respectively) have 15 or more years of regulatory experience. Among directors, nearly 50% have 10–19 years of regulatory experience while 50% of managers have 6–14 years of experience.

Figure 4. Regulatory Experience Range: All Respondents

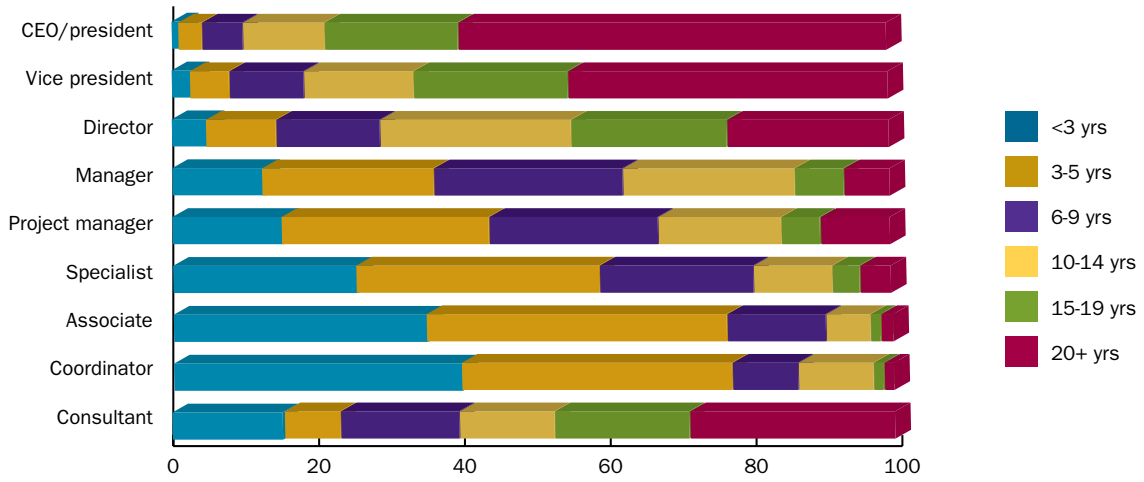


Table 3 presents additional perspectives related to experience, breaking down by position, number of years with current employer, number of years in current position, number of staff supervised, hours worked per week and age, in addition to years of overall and regulatory experience. These data indicate that regulatory professionals are moving among employers during their careers, as evident by comparing professional and regulatory experience with tenure with current employer. Further, data indicate that many professionals are being promoted within their organizations, indicated by comparing years in current position with organization tenure.

The number of direct staff reports indicates that regulatory professionals at all levels may supervise other staff. Among coordinator, associate and specialist levels, less than 25% of respondents directly supervise other staff. Among managers, directors, vice presidents and CEOs, more than 90% have direct reports, with the highest number of staff supervised reported at 700.

On average, regulatory professionals report working 47.2 hours per week. There are no significant variations by geographic location or type of employer.

Table 3. Professional Perspectives: All Respondents

	Professional Experience	Regulatory Experience	Years at Employer	Years in position	Staff Reports	Hours per week	Age
CEO/president	29.8	21.2	9.4	8.6	2.6	47.4	55.5
Vice president	26.8	17.8	6.1	4.5	10.1	54.3	51.7
Director	22.6	13.8	6.7	3.7	4.0	50.1	47.8
Manager	17.4	8.4	5.6	3.0	2.0	47.5	42.7
Project manager	17.3	8.0	6.4	3.3	0.9	46.2	42.4
Specialist	15.3	6.2	5.1	2.8	0.2	45.3	40.8
Associate	10.7	4.3	4.1	2.5	0.1	44.1	36.2
Coordinator	11.6	4.4	5.3	3.0	0.8	42.0	36.9
Consultant	23.3	13.3	6.2	5.4	0.3	39.6	49.0

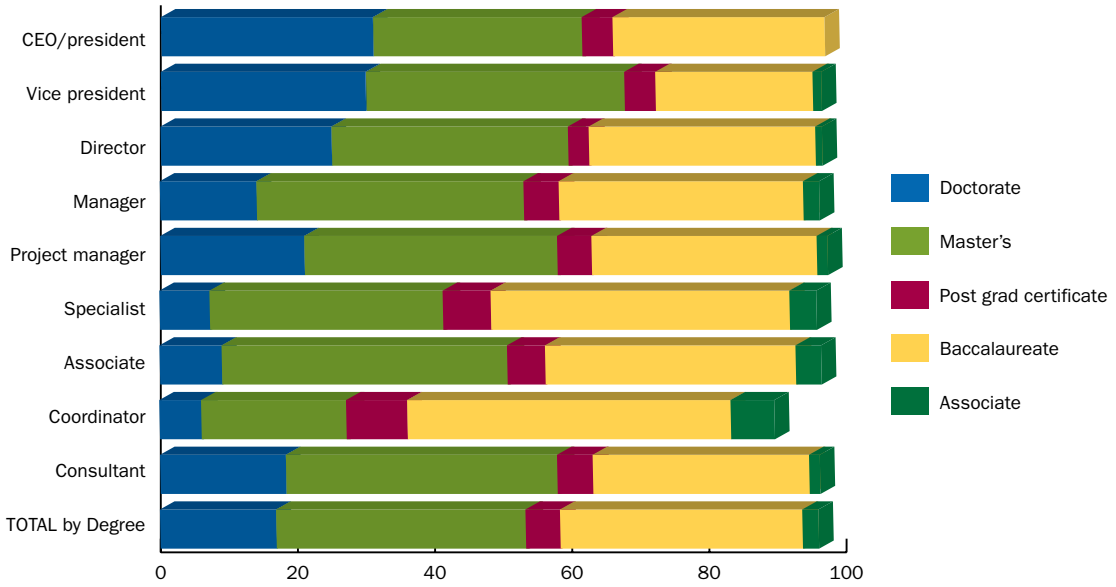
The majority of respondents (80%) work in a regulatory department or unit; 44% in a regulatory unit; 22% in a regulatory/quality unit; 14% in a clinical/regulatory/quality unit. More than 5.4% are in a quality department and 2% are in an executive management unit.

Education Background

The regulatory profession is a knowledge-based and knowledge-driven profession, so it is not surprising that 99% of respondents have a university degree and more than 60% have post-baccalaureate or post-first university degree education credentials (Figure 5).

Education level (degree) is associated with job title and with compensation, with higher-level degrees more prevalent among those in higher positions. Sixty-three percent of CEOs, 69% of vice presidents and 61% of directors have a master's or doctorate. The percentages for managers and project managers were 54% and 59%, respectively. Overall, the percentage of respondents with a master's degree was 37.5%, up from 32% in the previous survey in 2008. There was also an increase in those with postgraduate certificates from 3% in 2008 to more than 5% in 2010. Some respondents reported having graduate-level education focused on regulatory training, particularly those who participated in graduate certificate programs. There was also an increase among those with MBAs.

Figure 5. Highest Earned Degree and Job Title: All Respondents



Degree Areas

More than 86% of respondents hold one or more degrees in the life or clinical sciences, clinical professions and/or engineering. This underscores the need for regulatory professionals to understand the nature of healthcare products and the product lifecycle as a foundation for their work. Further, the educational background of most respondents appears to be linked to their previous career field(s).

Degrees or certificates in regulatory affairs increased from 9.2% in 2008 to 10% in 2010. Specific regulatory education is most evident among new to mid-level professionals: coordinators, associates, specialists, managers and project managers—which represent 75% of those with regulatory certificates or master's degrees.

Table 4. Degree Areas: All Respondents[1]

	Clinical sciences	Public health	Life sciences	Engineer	Tech sci	Regulatory	Business econ	Law	Education	Liberal arts	Social sciences
% with degree in area	17.3	2.6	51.7	14.5	4.1	10	14.5	3.2	1.9	7.2	3.5

Business Education

Overall, 12% of respondents hold MBAs, and the percentages of vice presidents, directors, managers and consultants holding MBAs is up over percentages reported in 2008. Among MBAs, approximately 6% hold a doctorate and 89% also hold degrees in a scientific, clinical or engineering field. In general, there has been a steady increase in business training among regulatory professionals over the past eight years, which may be linked to increasing involvement in business functions within their organizations (see General Scope of Practice section in this report).

The percentage of MBAs is highest among respondents based in the Middle East (22%), Oceania (16%) and the US (13%), although the number of respondents from the Middle East and Oceania was relatively small. In Europe and Latin America 9% hold an MBA as do 8% in Asia. In Canada, the number was less than 5%.

Table 5. Percentage of Respondents Holding MBA by Job Level

	% MBAs
CEO/president	16.9
Vice president	22.7
Director	14.1
Manager	12.2
Project manager	6.4
Specialist	7.6
Associate	4.8
Coordinator	5.2
Consultant	17.6

1 Reflects multiple degree areas indicated by many respondents

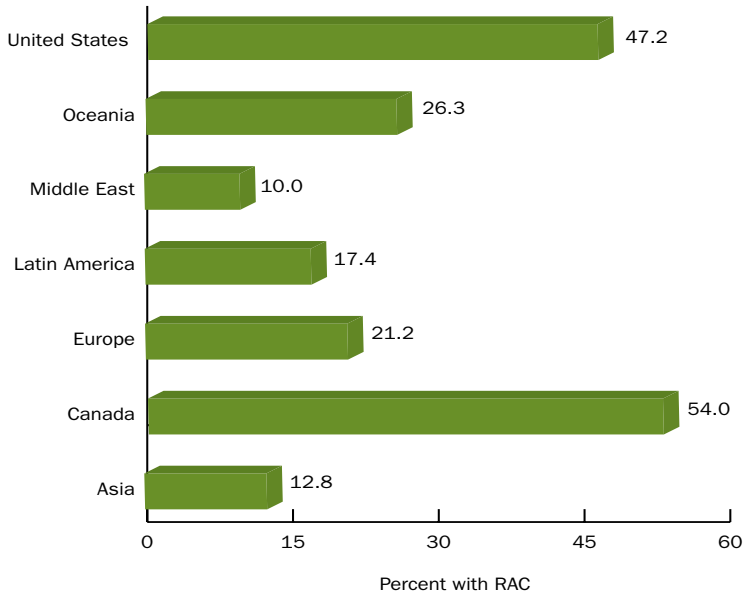
Regulatory Affairs Certification (RAC)

Regulatory Affairs Certification (RAC) is the professional designation for the healthcare product regulatory profession. The RAC is a professional certification, based on successfully passing an examination that tests regulatory knowledge and its application in organizations engaged with healthcare products. The examination is strongly based on application and analysis in a professional setting. There currently are four examinations: US (introduced in 1991); EU (introduced in 2001); Canada (introduced in 2004) and General Scope (introduced in autumn 2009). The examination content is targeted to professionals with at least three years of regulatory-related experience, although individuals with a baccalaureate or higher degree may sit for the examination. Professionals may hold multiple RACs by passing more than one of the individual examinations.

Among all survey respondents, 44% hold the RAC designation. The highest rate of professionals holding one or more RACs was reported among respondents based in the US and Canada, and the combined number of RACs in both countries (Figure 6) is up from 2008. Significant increases also were seen among professionals in Oceania and Latin America and gains were reported among those based in Asia, as well.

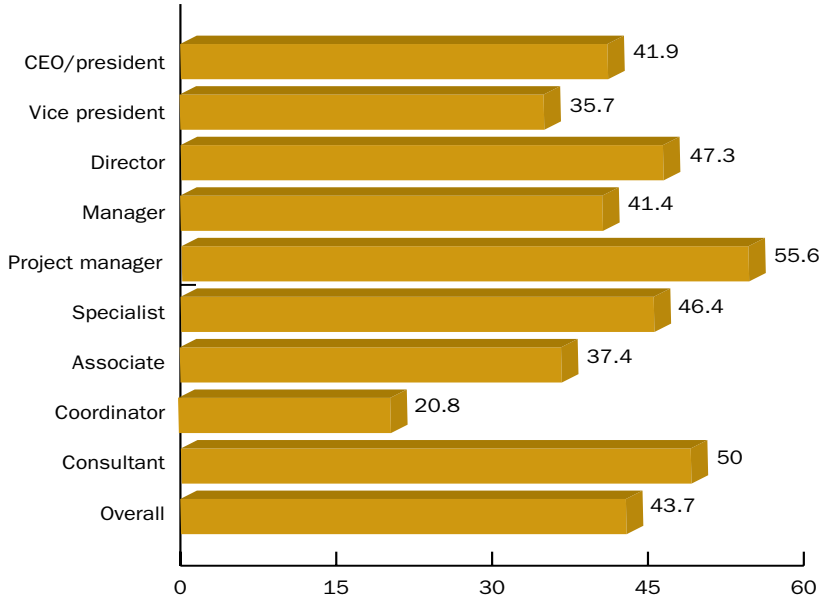
RAC-certification was shown to have a positive impact on compensation, with total compensation for US-based, RAC-certified professionals 6% higher than non-RACs.

Figure 6. Percentage of Respondents With RAC by Work Region



A significant number of mid- and senior-level professionals (manager, project manager, director, vice president and CEO) hold the RAC designation. Figure 7 shows percentage of RACs by job level. Many of these professionals earned the RAC while working at lower-level positions and have progressed in their careers. (RAC requires recertification based on continual learning and professional development appropriate to the job level and scope of responsibilities of the professional). An increasing number of organizations now use the RAC as a career development objective for their regulatory professionals.

Figure 7. Percentage of RACs by Job Level: All Respondents



Gender Perspectives

Approximately 60% of respondents were female and 40% male, continuing a similar pattern from previous surveys.

There are differences in job levels by gender (Table 6), with a higher proportion of males in senior levels (42% at director, vice president or CEO) as compared to females (26.5%). However, many female respondents are newer to the regulatory profession, with 40% having five or fewer years of regulatory experience compared to 35% of men, and 21% of women having 15 or more years of regulatory experience, which compares to 33% of men. The proportion of women (14%) and men (23%) with doctorates also reflects differences in educational level. More women than men reported an associate degree as their highest degree earned: 3% and 1%, respectively.

In the analyses of compensation, gender is not a determinant of salary, while job level, education and experience are correlated.

Table 6. Job Levels: Female and Male Respondents

	Female	Male
CEO/president	2.8%	5.8%
Vice president	4.4%	11.4%
Director	19.3%	25.1%
Manager	26.3%	21.9%
Project manager	6.8%	4.8%
Specialist	20.7%	14.5%
Associate	10.7%	9.1%
Coordinator	3.1%	1.5%
Consultant	5.8%	5.9%

GENERAL SCOPE OF PRACTICE

For this survey, respondents were asked the various key functions they are involved in, whether they are involved in each function on a domestic or international level and how much time they devote to specific areas. The distribution of these key functions and the time devoted to them is known as the scope of practice. Scope of practice was then broken down by job level and compared with previous survey results.

The full breakdown of time allocation by job level among all respondents is detailed in Table 8. Key findings include:

- Regulatory professionals at all levels are engaged throughout the product lifecycle.
- Regulatory strategy is a key time focus at all job levels.
- Regulatory professionals are devoting more time to business-related functions.
- Professionals in mid- to high-level positions are increasingly involved in business areas such as reimbursement, health technology assessment and comparative effectiveness research, and government affairs.

Respondents spend an average of

28%

of their time on business and regulatory strategy.

Full Product-lifecycle Engagement

Regulatory professionals at all levels indicated they are engaged throughout the product lifecycle, beginning with research and development and continuing through postmarketing activities. This includes involvement and/or interface with clinical activities, manufacturing and quality. Senior-level professionals (CEOs, vice presidents, directors) consistently report full lifecycle engagement. More than 80% are involved from the product development stage through registration, manufacturing, compliance and postmarketing—with a relative balance in time among these lifecycle stages, as well as surveillance, reimbursement and health technology assessment (HTA) and comparative effectiveness research (CER). At the manager and project manager levels, the majority of respondents also reported engagement throughout the full product lifecycle but reported varying time spent on pre- or postapproval areas.

Regulatory Strategy is Key

Regulatory strategy is a key time focus at all job levels, although the nature of activities comprising this function changes based on job level. Regulatory professionals at all levels spend an average of about 10% of their time on regulatory strategy. More than 67% of respondents reported involvement in regulatory intelligence functions with the majority conducting work at both the domestic and multinational levels.

Increasing Business Involvement

The most significant change in the allocation of time from the 2008 survey is the proportion of time devoted to business- and management-related activities, including business and corporate strategy, finance, management, personnel, legal, HTA and CER, reimbursement and legal issues. Regulatory professionals at all levels contribute to organizational business functions with the level of involvement directly related to job level. Nearly all senior-level professionals are engaged in business functions. Overall, respondents report spending an average of 18.2% of their time on business functions. Vice presidents devote the most time to business at 30.2%. At mid- and junior levels, professionals may not be involved in all business functions but do spend from 7% to nearly 19% of their time devoted to business issues, depending on job level. At the associate and coordinator levels, respondents reported spending 7.1% and 9.9% of their time, respectively, on business areas, most likely in support of management activities. The percentage of time devoted to business and management functions, by job level, for respondents to the 2010 survey are as follows, with the change from the 2008 survey in parentheses:

Table 7. Business-related Time Allocation by Job Level: All Respondents

CEO	25.7% (no change)
Vice president	31.2% (up 5%)
Director	25.4% (up 4.3%)
Manager	18.7% (up 4.1%)
Project manager	19.2% (N/A)
Specialist	8.1% (no change)
Associate	7.1% (up 1.2%)
Consultant	18.7% (up 4.9%)

Together, the importance of business and regulatory strategy is clear. Overall, respondents devote an average of 28.2% of their time on some combination of business and regulatory strategy-related functions. For senior-level professionals, the percentage is even higher, vice presidents spend more than 40% of their time on business and regulatory strategy.

Importance of Health Technology Assessment, Comparative Effectiveness, Reimbursement, Government Affairs

As government and private healthcare payers around the world are pressing for more information about the value delivered for healthcare dollars spent, the related areas of health technology assessment (HTA) and comparative effectiveness research (CER) and reimbursement have taken on greater importance. Survey respondents indicated an increasing focus on both reimbursement and HTA/CER efforts at all levels, but particularly among mid- and senior-level professionals (percentage of time spent: CEOs, 1.6%; vice presidents, 1.5%; directors, 1,2%; project managers, 1.2%) and among many consultants (average 2.3%). Some consultants reported devoting 10% to more than 50% of time on HTA/CER matters. Overall, about 34% of respondents reported involvement in HTA/CER and/or reimbursement, an increase from 2008 when about 23% reported involvement in these areas. Among directors, vice presidents and CEOs, nearly 45% reported involvement in reimbursement, HTA and/or CER.

Senior-level professionals also are more likely to be involved in government affairs efforts, as 50% report engagement in this area. Among vice presidents, the level of engagement is 60%. Another area of increasing engagement of regulatory professionals is in risk management; overall 60% of respondents reported engagement in this area. At the senior level, more than 75% reported being involved.

Table 8. Time Allocation by Job Level: All Respondents

		CEO	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant
Business Management Related	Business development corporate strategy	6.1%	6.5%	5.1%	3.0%	2.7%	1.9%	1.2%	0.9%	4.1%
	Budget/finance	4.3%	3.6%	2.4%	1.7%	1.5%	0.6%	0.4%	0.5%	2.4%
	Management	7.6%	11.0%	8.3%	7.3%	6.5%	1.6%	1.2%	2.0%	4.3%
	Personnel	2.9%	3.8%	3.7%	2.9%	1.3%	0.5%	0.6%	0.7%	1.6%
	Legal	1.4%	1.9%	2.1%	1.3%	1.0%	1.0%	1.2%	3.0%	3.1%
	Reimbursement	0.8%	0.8%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.7%
	HTA/comparative effectiveness	0.8%	0.7%	0.8%	0.6%	0.9%	0.5%	0.4%	0.3%	1.6%
	Government affairs	1.7%	2.9%	2.7%	1.8%	5.2%	1.9%	1.7%	2.2%	1.0%
	Regulatory strategy	9.6%	8.9%	11.8%	9.2%	10.5%	9.0%	9.6%	8.0%	9.2%
Regulatory Lifecycle Related	Research & development	4.8%	4.1%	4.9%	4.7%	6.9%	5.3%	6.1%	4.4%	2.7%
	Preclinical	3.3%	3.5%	2.3%	1.9%	3.5%	1.9%	2.2%	0.8%	3.0%
	Clinical research	5.6%	7.4%	6.4%	5.9%	7.5%	4.3%	7.0%	17.4%	5.7%
	Domestic/ regional registrations	15.6%	9.4%	12.2%	14.8%	15.3%	18.5%	20.4%	13.6%	13.7%
	International registrations	7.3%	5.5%	7.4%	10.1%	8.2%	13.4%	11.8%	13.5%	7.2%
	Domestic/ regional compliance	7.5%	5.6%	7.1%	8.3%	7.4%	11.3%	7.4%	8.2%	9.3%
	International compliance	4.1%	4.0%	3.9%	4.3%	4.1%	6.5%	4.6%	3.2%	4.0%
	QA/QC	7.0%	8.6%	7.8%	9.6%	5.0%	10.2%	10.3%	11.7%	13.7%
	Postmarketing	3.3%	4.4%	4.8%	5.3%	6.8%	5.4%	6.1%	3.8%	4.9%
	Marketing	2.7%	2.2%	2.1%	2.4%	1.3%	1.8%	1.8%	1.7%	1.9%
	Training	3.6%	3.3%	3.1%	3.7%	4.2%	3.7%	3.6%	3.9%	4.0%
	other	0.0%	1.9%	1.0%	1.3%	0.0%	0.8%	2.0%	0.0%	2.1%

Product Line Involvement

Overall, more than 68% of respondents reported being involved with multiple products types, an increase over the 64% reported in the previous survey. Approximately 65% of respondents reported involvement with medical devices and/or IVDs and 67% are involved with pharmaceuticals, including innovative medicines, over-the-counter drugs (OTCs), generics and/or active pharmaceutical ingredients (APIs). Approximately 42% are involved with biologics, biotechnology and/or biosimilars.

Biosimilars was added to the survey as a category for the first time this year and nearly 6% of respondents reported work with this category, however, there were significant regional variations—22% of Asian and Latin American-based respondents reported working with biosimilars; 12% for those in Canada; 10% in Oceania; 8% in the Middle East; 7% in Europe; and 4.5% in the US.

Other areas of increased involvement compared to 2008 include generic pharmaceuticals, up 3.2%; OTCs, up 1.1%; veterinary products and nutritional products, each up 0.6%; and foods up 1%.

Table 9. Product Line Involvement

Product	% Respondents
APIs	29.4
Innovative/prescription/brand name pharmaceuticals	27.8
Generic pharmaceuticals	17.5
Over-the-counter drugs	12.5
Biologics	27.5
Biotechnology products	21.5
Biosimilars	5.7
Orphan products	15.5
Biomaterials	5.6
Medical devices	55.3
IVDs	13.8
Combination products	28.9
Veterinary products	6.3
Cosmetics	6.3
Nutritional/herbal products	7.6
Foods	4.0

Multiregional and National/Regional Scope

For this survey, a national/regional scope of practice is defined as regulatory responsibilities within the country of work or region (e.g., EU, Asia, Latin America). A multiregional scope reflects responsibilities extending to multiple regions and/or worldwide.

Geographic scope was analyzed directly by asking respondents to classify their scope of practice (Table 10), and then by analyzing activities reported under allocation of time and professional engagement.

Approximately 70% of respondents reported having a multiregional or worldwide focus, which is evident among all job levels. Among the 30% of respondents who classified their scope as national/regional, nearly 50% report engaging in some multiregional functions.

Table 10. Geographic Scope by Job Level: All Respondents

	% Multiregional	% National/regional
CEO/president	71.8	28.2
Vice president	81.7	18.3
Director	75.3	24.7
Manager	63.9	36.1
Project manager	62.0	38.0
Specialist	73.3	26.7
Associate	59.1	40.9
Coordinator	62.3	37.7
Consultant	62.6	37.4

COMPENSATION PERSPECTIVES

Compensation and benefit data were analyzed by country or region and summarized for the US, Canada, Europe, Asia, Oceania and the Middle East in the following sections of this report. Based on currency and regional variations in cost of living and compensation, this study does not attempt to calculate an average global compensation by job level.

Respondents were asked to base their answers on their compensation for the most recent full calendar year, in this case, 2009. In general, base salaries of regulatory professionals reported for 2009 rose at modest rates over 2007 levels. Changes in total compensation varied, particularly among senior-level professionals where total compensation for many declined from 2007 levels. The latter reflected declines in bonus and other cash compensation and may be attributed to economic conditions in 2009.

Average total compensation for RAC-certified professionals in the US was

6%

higher than non-RACs.

Factors Related to Compensation

Several interrelated factors are correlated to compensation of regulatory professionals, including: job level/position; regulatory experience; total professional experience; years in current position; highest earned degree; multiregional or worldwide scope of practice; and staff supervisory roles. The RAC credential has a positive impact on compensation at several job levels. Total compensation is 6% higher for US-based regulatory professionals holding an RAC credential, compared with their non-RAC-certified peers. A similar trend is evident among professionals in other regions. An accurate overall comparison cannot be made because of the difficulty of comparing compensation in different currencies.

Having an MBA degree also has a positive impact on salary at several levels, particularly in regions where the profession is actively engaged in business and management functions.

Benefits

Benefits typically reflect country and/or regional requirements and standards and therefore are presented in later sections of this report. However, it is noteworthy that nearly all respondents who are working full time and are not self employed report receiving multiple employer-provided benefits. The benefits most frequently provided to full time professionals and the percentage of all respondents reporting these is presented in Table 11.

Table 11. Key Employer-provided Benefits

Employer-provided benefits	% Fulltime respondents
Health insurance (or supplemental)	68
Dental insurance (or supplemental)	76
Vision insurance (or supplemental)	61
Life insurance (or supplemental)	72
Retirement	56
Professional dues	69
Tuition	52
Stock options	44*
Telecommuting	25

**Excludes respondents employed in government and academia*

No information was requested on the level of funding offered by the employer for any benefits.

Additional information on compensation, compensation trends and benefits is presented in the regional analysis sections of this report.

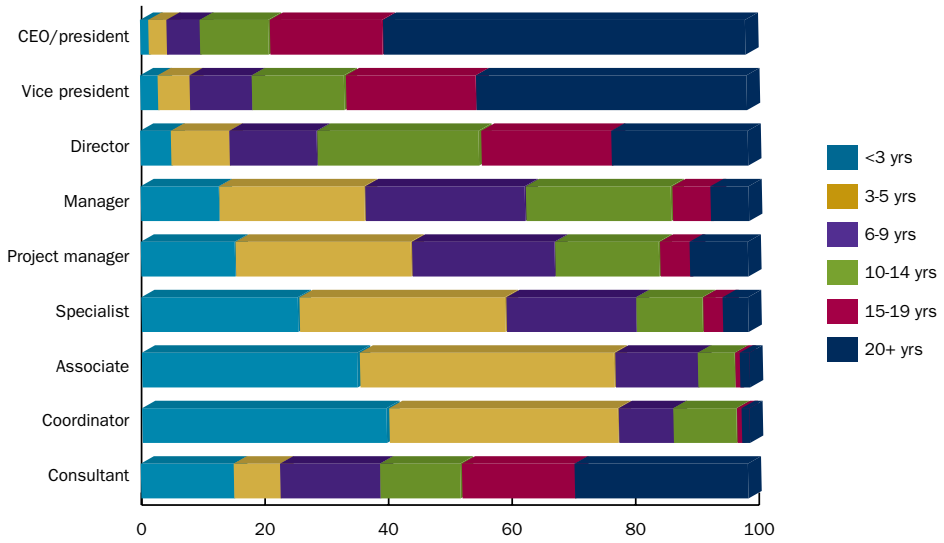
Analysis of US-based Professionals

Respondents based in the US represent the largest segment in this study, totaling 2,540. The demographic profile of respondents by job level and employer type is equivalent to the profile presented of all respondents.

Eighteen percent of US-based respondents are employed by organizations headquartered in Europe, Asia or the Middle East. Among those employed in industry, 18% work for European-headquartered organizations, 4% for organizations based in Asia and 1% for Middle Eastern-headquarterd companies.

US-based professionals generally reflect a 2:1 ratio of total professional to regulatory experience, except at the vice president and CEO levels where the ratio is smaller (see Table 12). The range of regulatory experience at job levels (Figure 8) reflects the high proportion of professionals with more than 15 years of regulatory experience (28%) and the correlation between regulatory experience and job level.

Figure 8. Regulatory Experience Range: US-based Professionals



The Professional Perspectives table shows total professional experience, regulatory experience, years with current employer, years in current position, staff supervised, hours/week and age. Professional perspectives for US-based respondents (Table 12) confirms the previous professional experience that regulatory professionals bring to their current position and the tenure in the regulatory profession increase with job level, with an average ratio of 2:1 of professional to regulatory experience. Overall, these measures show only slight changes from 2008. However, the proportion of respondents who reported being self employed or employed on a part-time basis increased from 6.2% in the 2008 survey to 8.9% in the current study, which may reflect the challenging economic climate in 2009-2010.

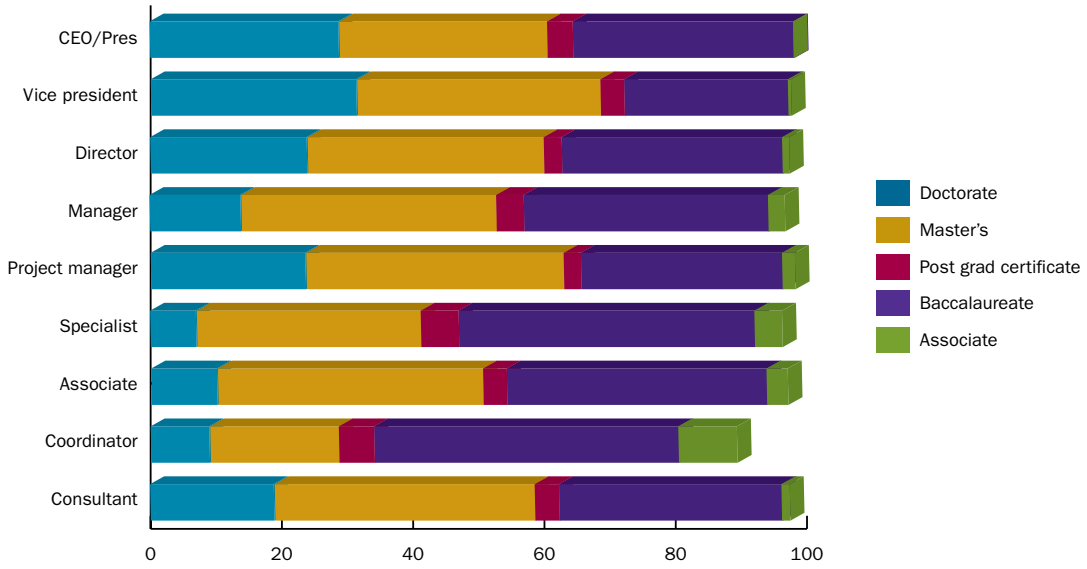
Table 12. Professional Perspectives: US-based Professionals

	Professional experience	Regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
CEO/president	31.0	22.4	9.8	9.2	1.9	47.6	56.5
Vice president	27.7	18.3	6.2	4.4	7.4	54.7	52.8
Director	23.0	13.9	6.5	3.6	3.4	50.4	48.3
Manager	18.1	8.6	5.6	3.0	1.8	47.8	43.6
Project manager	18.2	8.0	6.5	3.2	0.9	47.2	43.5
Specialist	15.7	6.2	5.2	2.8	0.1	45.7	41.4
Associate	11.4	4.3	4.2	2.5	0.1	44.8	36.7
Coordinator	13.7	4.7	6.2	3.2	0.7	42.2	39.3
Consultant	24.5	14.0	6.4	5.7	0.1	39.2	50.3
ALL US-Based	**19.6**	**10.4**	**5.9**	**3.6**	**1.9**	**47.5**	**45.0**

Education Background

More than 60% of US-based professionals have post-baccalaureate education experience and an increase in graduate level degrees among mid- and senior levels (Figure 9). The current study shows a 1% increase in the number of professionals seeking master's degrees and nearly a 2% growth in participation in graduate certificate programs. Among professionals at the vice president level, 70% hold a master's or degree doctorate. This has not changed from the 2008 findings.

Figure 9. Highest Earned Degree by Job Level: US-based Professionals



More than 86% of US-based professionals, like their global colleagues, have educational backgrounds in basic or clinical sciences, clinical professions or engineering.

The percentage of professionals with MBA degrees remained unchanged among US respondents although important shifts in levels are evident, particularly among professionals at the vice president, specialist and coordinator levels and among consultants. If the project manager and manager levels are combined, a significant increase in MBAs is evident over 2008. The increase in regulatory professionals pursuing MBAs may reflect the increasing involvement in business and management functions and previous education and experience, which emphasizes scientific, clinical and technical fields. The graduate business training among junior and mid-level professionals may also reflect preparation for future career advancement to senior and executive regulatory positions.

Table 13. Percent of US-based Professionals With MBAs

	2010	2008
CEO/president	16.2%	19.1%
Vice president	23.9%	19.1%
Director	14.8%	14.8%
Manager	13.1%	12.4%
Project manager	7.3%	–
Specialist	8.6%	6.8%
Associate	5.7%	7.5%
Coordinator	5.5%	<1.0%
Consultant	17.9%	12.4%

Regulatory Affairs Certification (RAC)

More than 47% of US-based professionals hold the RAC credential, including professionals at senior levels. Among professionals with the RAC, 92% have the RAC (US), 8% have the RAC (EU) and 2.5% have the RAC (CAN). More than 8.6% hold multiple RACs. Increases in the proportion of RACs is seen among project managers/managers, specialists, associates and coordinators, who represent the key target audience for the RAC examinations, and among consultants. While professionals at higher job levels do take the RAC examinations, the majority of RAC-credentialed professionals at the director, vice president and CEO levels obtained the credential at an earlier career stage.

RAC-credentialed professionals work across all employment settings. For the past six years there have been steady increases in the number of RAC-credentialed professionals at CROs, clinical and research organizations and at government agencies, where there was a 10% increase in the percentage of RAC professionals from 2008 to 2010 (from 50% to 60%).

Table 14. Percentage of RACs by Job Level: US-based Professionals

	RAC
CEO/president	47.5%
Vice president	38.8%
Director	50.1%
Manager	47.8%
Project manager	61.3%
Specialist	46.6%
Associate	38.4%
Coordinator	21.8%
Consultant	53.8%

Scope of Practice

Just as with the global findings, regulatory professionals in the US at all levels are engaged throughout the product lifecycle, and regulatory strategy is a key focus of their time. They are also devoting significantly more time to business-related functions. The percentage of time devoted to business/management functions, by job level, for US respondents to the 2010 survey is as follows, with the change from the 2008 survey in parentheses:

Table 15. Business-related Time Allocation by Job Level: US-based Respondents

CEO	24.3% (up 0.5%)
Vice president	31.5% (up 3.8%)
Director	25.2% (up 7.7%)
Manager	17.8% (up 5.8%)
Project manager	20.1% (N/A)
Specialist	7.5% (up 2.1%)
Associate	6.4% (up 0.4%)
Consultant	17.8% (up 7.3%)

Table 16. Time Allocation by Job Level: US-based Professionals

		CEO	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant
Business Management Related	Business development corporate strategy	6.0%	7.0%	5.0%	2.5%	2.3%	2.0%	1.0%	0.4%	4.3%
	Budget/finance	3.8%	3.3%	2.4%	1.6%	1.5%	0.6%	0.5%	0.4%	2.5%
	Management	7.2%	11.3%	8.3%	7.4%	7.0%	1.3%	1.3%	0.4%	4.3%
	Personnel	3.2%	4.0%	3.6%	2.8%	1.2%	0.4%	0.5%	0.6%	0.8%
	Legal	1.2%	2.0%	2.2%	1.2%	1.0%	1.0%	1.1%	2.6%	3.1%
	Reimbursement	0.5%	0.8%	0.4%	0.2%	0.3%	0.3%	0.3%	0.2%	0.5%
	HTA comparative effectiveness	0.9%	0.6%	0.7%	0.5%	0.8%	0.3%	0.4%	0.0%	1.6%
	Government affairs	1.4%	2.4%	2.6%	1.5%	6.0%	1.7%	1.3%	1.5%	0.7%
Regulatory Lifecycle Related	Regulatory strategy	9.9%	9.2%	12.2%	9.4%	9.9%	9.3%	9.4%	7.8%	9.8%
	Research & development	5.0%	4.1%	4.9%	5.0%	7.5%	5.5%	6.7%	4.7%	2.4%
	Preclinical	3.8%	3.7%	2.4%	2.1%	3.9%	2.0%	2.4%	0.9%	2.9%
	Clinical research	6.2%	7.6%	6.5%	6.6%	7.7%	4.6%	8.1%	20.9%	5.7%
	Domestic submissions registrations	16.2%	9.6%	12.7%	15.7%	14.1%	19.4%	21.1%	12.6%	14.6%
	International submissions registrations	7.3%	5.1%	7.4%	8.9%	8.1%	12.9%	10.8%	14.3%	7.5%
	Domestic compliance	7.9%	6.1%	7.2%	9.0%	7.6%	11.8%	7.6%	8.6%	9.7%
	International compliance	4.4%	4.2%	3.5%	3.8%	3.8%	6.3%	4.5%	2.7%	4.2%
	QA/QC	6.1%	8.8%	8.0%	10.1%	5.3%	10.0%	11.0%	11.0%	14.4%
	Postmarketing	3.2%	4.5%	4.8%	5.4%	6.6%	5.3%	6.3%	4.4%	5.0%
	Marketing	2.2%	2.1%	2.6%	1.0%	1.9%	2.0%	2.1%	2.1%	
	Training	3.4%	3.5%	3.1%	3.8%	4.5%	3.5%	3.7%	3.8%	4.0%

The survey results showed an increase in US-based professionals with multiregional or worldwide responsibilities from 71% in 2008 to 74% in 2010. Among professionals employed in industry, 76% have multiregional responsibilities (Table 17).

Table 17. Multiregional Responsibilities of US-based Industry Professionals

	Multiregional role
CEO/president	100.00%
Vice president	84.31%
Director	77.97%
Manager	68.01%
Project manager	85.71%
Specialist	79.71%
Associate	66.49%
Coordinator	83.87%
Consultant	70.83%

More than 28% of US-based professionals are engaged in work related to comparative effectiveness, health technology assessment (HTA) and/or reimbursement. At senior levels (director, vice president and CEO), more professionals are involved in these areas and several are allocating increasing time to this area, as compared to levels reported in 2008.

Compensation of US-based Professionals

Compensation trends for regulatory professionals based in the US shows mixed trajectories compared with data from the 2008 survey. For all job levels except coordinator and consultant, base salary increased by between 4% and 6%. Total compensation for CEOs, directors and managers also increased by between 4% and 6%. Total compensation for vice presidents declined from previous levels, with declines in other cash compensation and to a lesser degree in bonuses. However, the trends in compensation (see Figures 10 and 11) indicate steady overall growth in compensation for regulatory professionals. Base salary for mid- and senior-level professionals has grown at an average annual rate of approximately 6% over the period of 1999 to 2009. Prior to 2009, total compensation grew at an average rate of about 9% from 1999 to 2007.

Figure 10. Trends in Base Salary: US-based Professionals

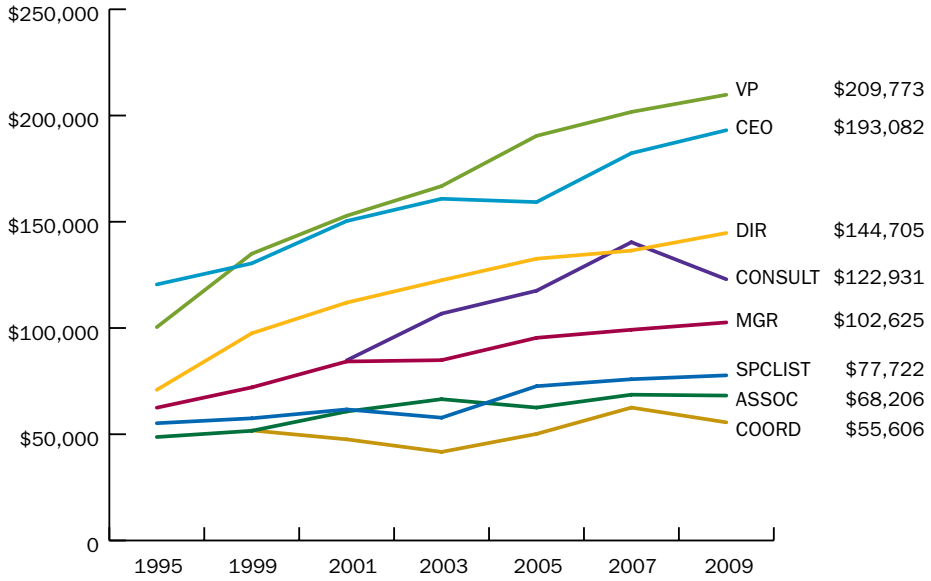
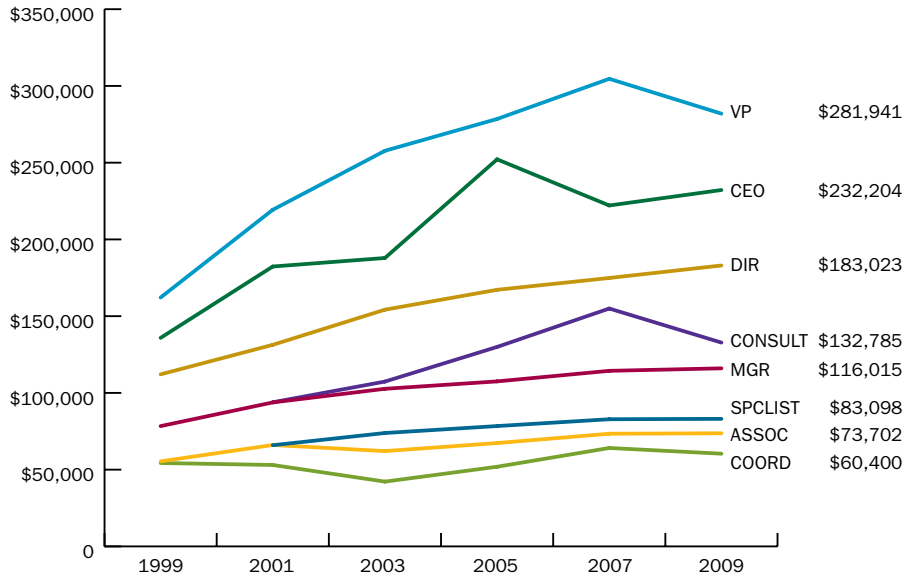


Figure 11. Trends in Total Compensation: US-based Professionals



The steepest decline in compensation was for US-based professionals who identify themselves as consultants. This group reported a 17% decrease in base salary and a 21% drop in total compensation. The current survey also shows an increase in the number of respondents who self-classified as consultants, from 8% in 2008 to 13% in 2010. Among this group, 55% are self employed and 30% have worked as self employed consultants for two years or less. This group may include professionals who became independent consultants as a result of retirement or downsizing due to economic conditions.

Factors Related to Compensation of US-based Professionals

Interrelated factors that are correlated with compensation of US-based professionals include: job level/position; regulatory experience; total professional experience; years in current position; highest degree earned; multiregional or worldwide scope of practice; and Regulatory Affairs Certification (RAC). An MBA degree is linked to compensation from coordinator to director and among consultants, but has no correlation among vice presidents and CEOs.

Many of these variables, particularly job level, professional and regulatory experience, degree and multiregional scope of practice are highly interrelated. Therefore, it is not possible to determine which factor beyond job level has the most impact on compensation.

The following tables provide perspectives on how these variables relate to compensation.

Employer

There are differences in compensation by job level among different types of employers (see Tables 18 and 19) although the employer type is not a leading determinant of compensation. In general, lower salaries and total compensation are reported among professionals working in academic and clinical settings.

Table 18. Base Salary: US-based Professionals by Employer and Job Level

Figures in $(US)								
	Academic institution	Clinical research organization (CRO)	Consulting firm	Government	Hospital/ medical practice	Industry	Law firm	Research organization
CEO/president		140,000	192,287			283,500		
Vice president	174,000	208,200	175,229			215,248		196,141
Director	136,143	128,870	137,907	152,417	105,167	145,565	140,000	164,323
Manager	77,458	82,157	116,522	112,312	87,574	104,352	107,700	93,805
Project manager	74,825	73,857	90,313	97,937	107,000	101,786		100,200
Specialist	47,250	65,760	62,500	98,316	77,357	77,866		75,517
Associate	56,581	57,400	63,888	67,040	86,000	69,169	94,333	64,455
Coordinator	44,541	50,000	66,000		51,400	57,179	35,000	70,000
Consultant	94,000	143,000	129,269	150,000		93,858	75,000	114,000

Table 19. Total Compensation: US-based Professionals by Employer and Job Level

Figures in $(US)								
	Academic institution	Clinical research organization (CRO)	Consulting firm	Government	Hospital/ medical practice	Industry	Law firm	Research organization
CEO/president		155,000	228,500			483,500		
Vice president	174,000	292,200	206,536			294,112		247,016
Director	138,714	142,168	158,556	154,167	114,667	187,381	235,000	204,814
Manager	86,458	95,552	123,261	114,353	88,949	119,142	121,400	99,003
Project manager	75,575	75,064	97,244	100,088	107,000	113,583		100,200
Specialist	54,113	69,061	65,238	104,963	77,571	83,449		79,625
Associate	56,581	60,120	66,094	70,010	86,400	75,503	95,833	67,918
Coordinator	54,404	50,550	68,000		51,560	59,343	35,000	94,110
Consultant	99,000	145,000	139,209	200,000		102,335	76,000	127,250

Highest Earned Degree

Base salary and total compensation are related to highest earned degree, with graduate degrees having a positive impact. In the current survey, a postgraduate certificate does not correlate to higher compensation. However, many individuals with postgraduate certificates are new to regulatory or have less regulatory and professional experience.

Table 20. Base Salary by Degree: US-based Professionals

Figures in $(US)					
	Doctorate	Master's	Post grad certificate	Baccalaureate	Associate
CEO/president	220,621	169,031	177,500	194,091	
Vice president	224,414	186,585	208,000	230,938	96,000
Director	154,689	145,975	139,994	137,636	105,667
Manager	120,694	102,634	98,393	98,166	83,367
Project manager	90,826	98,979	86,750	97,599	98,333
Specialist	96,260	79,606	78,588	75,313	62,500
Associate	81,556	66,913	65,456	66,628	64,500
Coordinator	61,960	58,455	72,000	54,806	49,218
Consultant	146,085	117,407	91,200	120,441	124,500
Average by Degree	**146,668**	**112,848**	**105,420**	**107,574**	**75,395**

Table 21. Total Compensation: Degree for US-based Professionals

Figures in $(US)					
	Doctorate	**Master's**	**Post grad certificate**	**Baccalaureate**	**Associate**
CEO/president	276,655	190,000	245,000	232,515	
Vice president	332,896	248,216	264,143	278,297	96,000
Director	202,108	186,561	160,513	169,757	131,583
Manager	135,907	118,179	107,878	109,840	91,500
Project manager	96,791	104,613	89,875	108,223	116,000
Specialist	104,239	85,298	83,256	80,328	63,724
Associate	89,484	71,874	70,778	71,908	68,500
Coordinator	62,360	66,123	105,000	57,096	51,873
Consultant	159,567	128,566	97,300	127,487	129,500
Average by Degree	**185,405**	**133,600**	**120,653**	**123,410**	**82,140**

An increasing number of regulatory professionals at junior and mid-levels and at the director level have pursued MBA degrees and compensation differentials are apparent (Table 22). As previously noted, the MBA degree has no impact on compensation among vice presidents or CEOs.

Table 22. Compensation: US-based Professionals With MBAs

Figures in $(US)				
	MBA		**No MBA**	
	Base Salary	**Total Compensation**	**Base Salary**	**Total Compensation**
Director	153,724	208,627	143,145	178,595
Manager	111,209	128,815	101,332	114,087
Project manager	116,809	123,206	94,636	102,148
Specialist	83,457	91,199	77,177	82,328
Associate	72,461	76,610	67,943	73,522
Coordinator	68,667	101,817	54,853	58,011
Consultant	142,850	154,739	118,039	127,392
ALL MBAs	**133,453**	**165,853**	**112,464**	**132,130**

Regulatory Affairs Certification

For US-based professionals, the RAC credential is related to higher compensation among all job levels except coordinator, where there was a limited number of RAC-credentialed professionals. Overall, compensation for RAC-certified professionals is 6% higher than for those without the RAC.

The RAC difference in compensation between CEOs with the RAC and without is significant and is evident among both CEOs employed in industry and those in consultancies.

Table 23. Compensation: US-based Professionals With RAC

Figures in $(US)				
	RAC		Non RAC	
	Base	Total	Base	Total
CEO/president	213,957	260,043	173,843	206,549
Vice president	207,137	285,024	211,474	279,951
Director	145,156	184,188	144,258	181,869
Manager	104,122	118,266	101,244	113,938
Project manager	97,221	106,970	94,838	98,534
Specialist	82,187	87,993	73,778	78,775
Associate	71,816	78,495	66,001	70,775
Consultant	127,857	141,024	116,928	122,743

Regulatory Experience

Experience in the profession is closely correlated with job level and compensation (Tables 24 and 25).

Table 24. Regulatory Experience and Salary: US-based Professionals

Figures in $(US)						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president	215,000	200,000	154,800	118,000	164,500	212,677
Vice president	123,333	153,346	184,184	187,444	206,671	235,018
Director	150,548	122,714	128,228	146,407	149,270	156,264
Manager	96,306	98,210	100,516	106,825	107,616	117,328
Project manager	83,600	85,455	94,393	109,418	112,250	120,633
Specialist	73,728	73,764	80,498	83,020	89,183	94,829
Associate	64,209	67,446	73,469	74,556	80,630	103,333
Coordinator	50,986	55,948	61,600	59,786	70,000	92,000
Consultant	94,860	104,667	121,250	115,132	120,996	145,298
Average by Experience	**83,677**	**86,102**	**103,348**	**121,355**	**142,550**	**170,973**

Table 25. Regulatory Experience and Total Compensation: US-based Professionals

Figures in $(US)						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president	241,500	220,000	208,800	147,444	202,938	252,846
Vice president	135,837	186,549	237,947	238,593	304,158	314,160
Director	180,689	146,247	156,818	187,777	189,116	203,461
Manager	111,846	108,030	113,373	123,774	122,337	127,455
Project manager	88,754	87,864	104,235	119,755	120,813	136,337
Specialist	78,650	79,161	85,601	86,980	98,568	103,985
Associate	67,510	73,103	83,706	82,437	85,630	105,333
Coordinator	58,178	58,553	64,940	63,429	70,000	92,000
Consultant	98,110	104,778	131,810	124,604	125,855	163,809
Average by Experience	**92,527**	**94,492**	**118,953**	**146,278**	**179,084**	**213,079**

Multiregion/Worldwide Role

Multiregional knowledge and scope are associated with higher base salary and total compensation, with differentials of 4% to 18% within job levels. These differences in compensation may reflect the increased international and global nature of the healthcare product sector and the importance of multiregional knowledge on regulatory intelligence, regulatory strategy and lifecycle involvement.

Table 26. Multiregional Responsibilities and Compensation: US-based Professionals

Figures in $(US)				
	Multiregion		Domestic	
	Base	Total	Base	Total
CEO/president	200,092	245,645	168,864	185,773
Vice president	215,450	294,880	181,200	216,816
Director	148,098	190,793	133,949	158,387
Manager	105,450	119,705	97,437	109,239
Project manager	100,080	109,654	89,278	92,709
Specialist	78,552	84,028	75,230	80,310
Associate	69,941	76,419	65,315	69,174
Coordinator	56,499	61,487	53,914	58,340
Consultant	126,090	138,440	117,120	122,380
All Positions	**120,542**	**145,629**	**101,849**	**113,804**

Benefits of US-based Professionals

More than 98% of US-based professionals working full time for an organization have access to employer-provided benefits (Tables 27 and 28). The data indicate differences in benefits based on job level and employer type. It is noted that no information was collected on the level or dollar value of benefits.

Approximately 2% of respondents working full time for an organization reported no employer benefits, with most of these individuals working in small consultancies. No information is available from this survey to indicate whether any benefits are available through previous employers or through another source or partner.

There is little change in noncompensation benefits reported by US-based professionals although these data do not indicate if there has been a decrease the amount or value of any category. Compensation-related benefits, including bonuses, stock, profit sharing, retirement and deferred compensation showed decreases in the number and percentage of professionals receiving these benefits in 2010, as compared to 2008.

Table 27. Benefits: US-based Professionals by Job Level

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant	Overall
Bonus	39.0%	70.1%	72.8%	66.5%	46.5%	54.6%	53.2%	34.5%	45.9%	61.4%
Stock	4.9%	71.2%	56.3%	38.6%	24.6%	32.0%	30.8%	25.5%	11.5%	40.7%
Incentive pay	4.9%	9.0%	8.3%	9.2%	7.7%	6.7%	8.0%	1.8%	8.2%	8.0%
Profit sharing	24.4%	13.0%	14.5%	14.8%	12.0%	16.3%	11.4%	7.3%	14.8%	14.4%
Retirement	41.5%	56.5%	61.1%	60.7%	66.2%	60.0%	64.1%	50.9%	44.3%	60.0%
Deferred compensation	7.3%	22.0%	21.2%	7.6%	5.6%	3.3%	2.5%	1.8%	6.6%	10.3%
Health insurance	48.8%	72.3%	72.1%	69.2%	73.2%	72.6%	70.9%	58.2%	52.5%	70.2%
Dental insurance	26.8%	84.2%	89.9%	87.3%	84.5%	88.1%	82.7%	69.1%	63.9%	85.1%
Vision insurance	19.5%	66.1%	73.6%	69.7%	69.7%	77.0%	72.6%	54.5%	41.0%	70.1%
Life insurance	34.1%	74.0%	83.2%	81.0%	77.5%	82.6%	72.6%	58.2%	54.1%	78.1%
Disability insurance	31.7%	70.1%	75.4%	66.7%	60.6%	68.4%	60.3%	54.5%	47.5%	66.9%
Unemployment coverage	24.4%	31.6%	30.8%	30.1%	28.2%	30.3%	25.3%	27.3%	24.6%	29.5%
Professional liability insurance	43.9%	14.1%	9.1%	6.7%	8.5%	7.3%	5.9%	3.6%	13.1%	8.7%
License fees	29.3%	31.1%	26.8%	21.1%	23.2%	25.7%	20.7%	16.4%	16.4%	24.2%
Professional dues	68.3%	85.3%	82.6%	78.5%	52.8%	72.4%	64.6%	47.3%	47.5%	74.0%
Meetings	68.3%	83.6%	79.3%	76.9%	72.5%	68.2%	62.0%	50.9%	54.1%	73.0%
Publications	48.8%	58.2%	45.7%	38.9%	26.8%	35.4%	32.9%	20.0%	23.0%	39.2%
Tuition	19.5%	44.6%	60.0%	60.7%	44.4%	67.8%	59.9%	49.1%	36.1%	58.0%
Release time	9.8%	3.4%	4.9%	4.0%	4.2%	2.5%	1.3%	1.8%	3.3%	3.6%
Flextime	31.7%	29.4%	37.1%	36.8%	46.5%	34.3%	31.6%	36.4%	27.9%	35.5%
Flexiplace	22.0%	10.7%	13.4%	10.4%	26.1%	9.4%	10.1%	5.5%	14.8%	12.1%
Telecommuting	24.4%	24.9%	29.9%	27.6%	40.1%	24.3%	21.5%	10.9%	29.5%	27.0%
Childcare	0.0%	4.0%	4.9%	4.2%	5.6%	4.8%	8.0%	5.5%	1.6%	4.8%
Car	41.5%	8.5%	1.6%	0.7%	0.0%	0.8%	0.8%	0.0%	3.3%	2.3%
Other	0.0%	2.3%	3.1%	2.8%	2.1%	2.1%	1.7%	0.0%	3.3%	2.4%
None	9.8%	0.6%	1.1%	0.5%	1.4%	1.5%	3.8%	7.3%	4.9%	1.7%

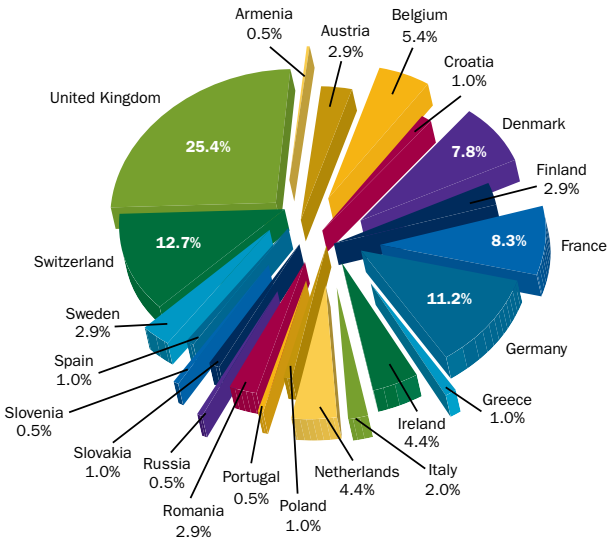
Table 28. Benefits: US-based Professionals by Employer

	Academic	Clinical research organization (CRO)	Consulting firm	Government	Hospital/ medical practice	Industry	Law firm	Research organization
Bonus	3.8%	54.0%	50.3%	27.3%	18.8%	67.2%	71.4%	50.0%
Stock	1.9%	14.0%	8.3%	5.2%	9.4%	48.1%	28.6%	43.2%
Incentive pay	1.9%	7.0%	3.2%	1.3%	0.0%	9.2%	0.0%	4.5%
Profit sharing	3.8%	15.0%	14.6%	2.6%	3.1%	15.2%	14.3%	19.3%
Retirement	62.3%	53.0%	36.9%	68.8%	68.8%	61.8%	57.1%	60.2%
Deferred compensation	7.5%	7.0%	6.4%	5.2%	6.3%	11.2%	0.0%	10.2%
Health insurance	71.7%	65.0%	54.1%	59.7%	81.3%	72.4%	42.9%	67.0%
Dental insurance	81.1%	84.0%	51.6%	64.9%	84.4%	89.2%	71.4%	83.0%
Vision insurance	64.2%	65.0%	34.4%	54.5%	62.5%	74.6%	57.1%	68.2%
Life insurance	60.4%	73.0%	46.5%	67.5%	78.1%	82.5%	57.1%	72.7%
Disability insurance	49.1%	64.0%	37.6%	35.1%	68.8%	71.7%	42.9%	65.9%
Unemployment coverage	32.1%	27.0%	21.7%	11.7%	12.5%	30.9%	42.9%	37.5%
Professional liability insurance	9.4%	10.0%	26.8%	2.6%	12.5%	7.3%	28.6%	6.8%
License fees	15.1%	27.0%	24.8%	9.1%	18.8%	25.0%	14.3%	23.9%
Professional dues	50.9%	74.0%	65.6%	20.8%	43.8%	78.4%	71.4%	70.5%
Publications	30.2%	22.0%	39.5%	11.7%	15.6%	42.1%	28.6%	39.8%
Meetings	56.6%	63.0%	63.7%	75.3%	46.9%	75.2%	57.1%	75.0%
Registration/tuition	60.4%	39.0%	24.8%	32.5%	62.5%	63.0%	57.1%	56.8%
Release time	5.7%	0.0%	5.7%	5.2%	6.3%	3.3%	0.0%	6.8%
Flextime	37.7%	44.0%	35.7%	55.8%	34.4%	34.4%	42.9%	29.5%
Flexiplace	9.4%	12.0%	19.1%	53.2%	3.1%	9.9%	14.3%	12.5%
Telecommuting	22.6%	31.0%	29.9%	49.4%	21.9%	25.8%	42.9%	23.9%
Childcare	3.8%	6.0%	0.6%	5.2%	3.1%	5.2%	0.0%	4.5%
Car	0.0%	3.0%	14.0%	1.3%	3.1%	1.4%	0.0%	0.0%
Other	7.5%	4.0%	1.3%	1.3%	3.1%	2.3%	0.0%	3.4%
None	0.0%	2.0%	5.7%	1.3%	0.0%	1.4%	0.0%	1.1%

Analysis of European-based Professionals

More than 200 usable, complete survey responses were received from professionals based in Europe. Respondents represented 22 European countries (Figure 12).

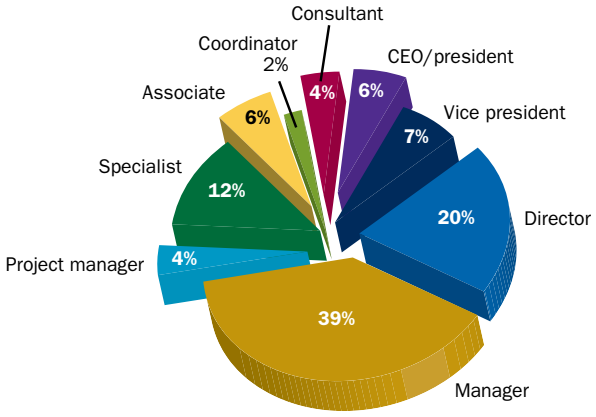
Figure 12. Countries Represented: European-based Professionals



The employment setting of European professionals is equivalent to the mix among all respondents (see Figure 2). Nearly 72% of European professionals are employed by organizations headquartered in Europe, and 26% are employed by organizations headquartered in North America.

Job levels showed some differences from the general distribution, with a slightly higher proportion of CEOs and managers and fewer specialists and consultants (Figure 13).

Figure 13. Job Levels: European-based Professionals



The regulatory experience levels of European-based professionals is similar to the US (Figure 14), with 28% of Europeans having 15 or more years of regulatory experience. The professional perspectives of European respondents (Table 29) parallel general findings and the profile of US professionals.

Figure 14. Regulatory Experience Range: European-based Professionals

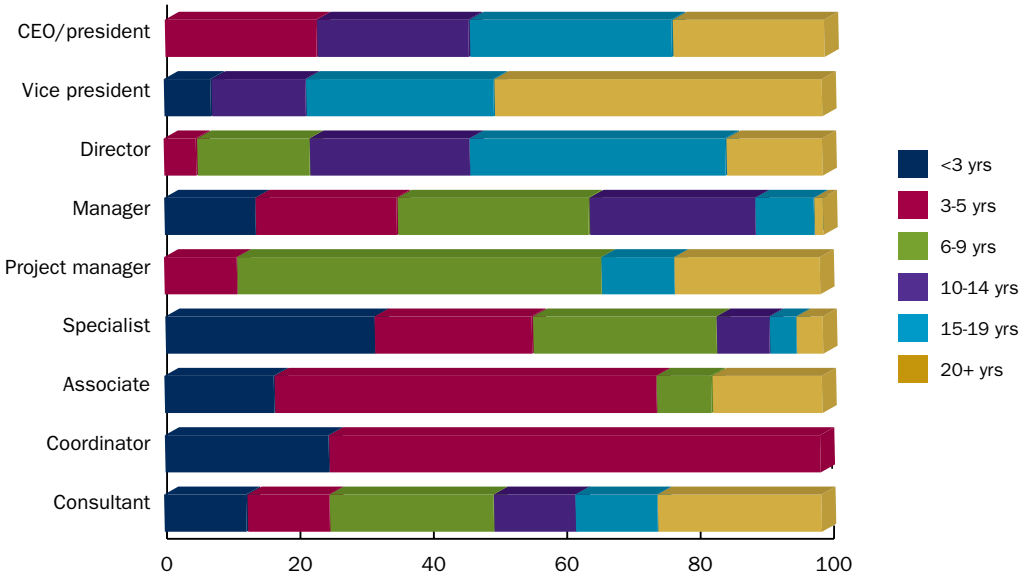


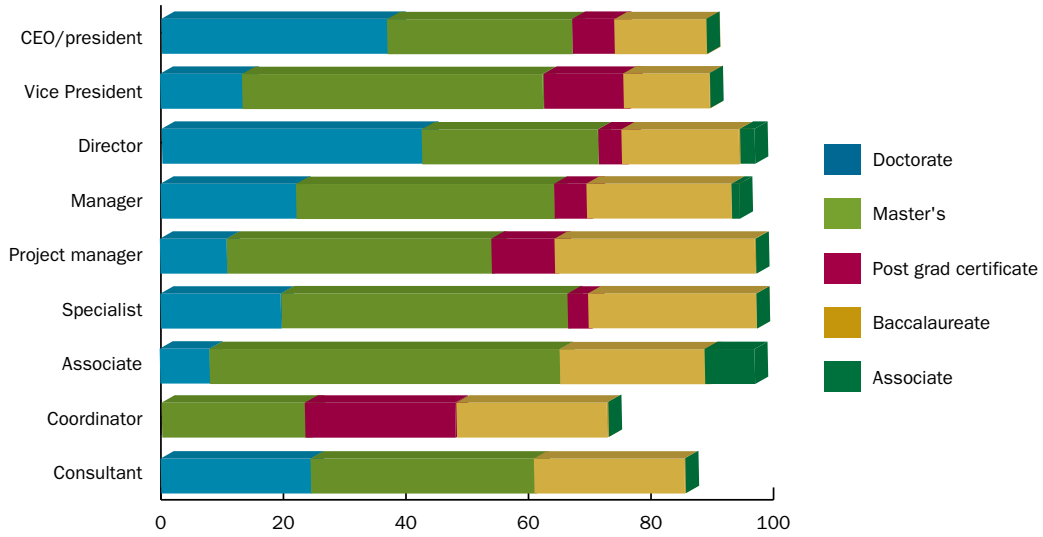
Table 29. Professional Perspective: European-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Age
CEO/president	24.0	14.8	10.5	7.3	8.2	49.4
Vice president	22.5	18.0	7.9	2.4	9.7	45.9
Director	22.1	14.2	8.5	4.6	11.2	46.7
Manager	16.0	7.9	5.4	3.5	2.4	41.1
Project manager	17.3	12.1	4.8	4.6	0.3	41.7
Specialist	14.4	6.3	4.9	2.4	0.6	38.8
Associate	8.5	7.1	4.9	4.5	0.1	33.3
Coordinator	9.0	3.3	2.3	2.8	0.3	36.8
Consultant	19.5	14.4	5.6	5.6	0.6	44.3
All European-based	**17.6**	**10.4**	**6.4**	**3.9**	**4.5**	**42.4**

Education Background

More than 72% of European professionals reported having post-baccalaureate (or first university degree) education, with a significant proportion of CEOs and vice presidents holding master's degrees or doctorates (78%). More than 6.7% of European professionals hold a post graduate certificate (which compares to 4.1% for US-based professionals). However, nearly 3% of European professionals have no university-level education, which is the highest level of non-degreed professionals among all respondents.

Figure 15. Highest Earned Degree: European-based Professionals



Among Europeans with university education, 82% have a degree in the life sciences, clinical professions and/or engineering. Approximately 10% have education in regulatory affairs. Less than 9% of Europeans hold MBA degrees.

Regulatory Affairs Certification (RAC)

Only 21% of European professionals hold the RAC credential, with the highest proportion among specialists and associates. This compares with 44% of all survey respondents. Among European-based individuals with the RAC, 65% have the RAC (EU) and 38% hold the RAC (US) designations; 3% have both US and EU credentials.

Table 30. Percent of RACs: European-based Professionals

	% RAC
CEO/president	23.1%
Vice president	0.0%
Director	24.4%
Manager	13.9%
Project manager	22.2%
Specialist	40.0%
Associate	41.7%
Coordinator	0.0%
Consultant	12.5%

Scope of Practice

Similar to their counterparts in the US and elsewhere, regulatory professionals in Europe at all job levels are engaged throughout the product lifecycle and devote significant time to regulatory strategy. They are also more involved in business-related functions at all job levels except associate. The percentage of time devoted to business/management functions, by job level, for European-based respondents to the 2010 survey is as follows, with the change from the 2008 survey in parentheses:

Table 31. Business-related Time Allocation by Job Level: European-based Respondents

CEO	34.9% (up 11.4%)
Vice president	34.1% (up 6.9%)
Director	28.6% (up 11.5%)
Manager	19.1% (up 4.1%)
Project manager	8.4% (N/A)
Specialist	9.9% (up 1.8%)
Associate	4.4% (down 1.9%)
Consultant	19.4% (up 2.8%)

Other key findings include:

- Involvement in international registrations (outside Europe) remains a strong focus. More than 71% of European professionals report a multiregional or worldwide scope. Among the 29% reporting a European focus, 58% indicate involvement in multiregional lifecycle activities.
- At senior levels (director, vice president, CEO), engagement in issues of health technology assessment and reimbursement and active engagement in government affairs activities is slightly higher than among US-based professionals.
- The title of project manager in Europe does not appear to be at the same level as in US as evidenced by scope, demographics and compensation.

Table 32. Time Allocation by Job Level: European-based Professionals

		CEO	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant
Business Management Related	Business development corporate strategy	4.4%	6.1%	5.2%	3.5%	1.7%	0.6%	1.7%	0.3%	5.5%
	Budget/finance	5.6%	3.4%	2.7%	1.8%	0.2%	1.5%	0.1%	0.3%	2.6%
	Management	11.3%	14.5%	8.8%	6.6%	3.1%	2.7%	0.6%	1.0%	4.2%
	Personnel	3.0%	3.1%	4.0%	3.2%	0.0%	1.5%	0.0%	0.3%	1.9%
	Legal	3.6%	1.5%	2.1%	1.6%	1.4%	0.8%	2.1%	1.5%	1.8%
	Reimbursement	2.2%	0.4%	0.5%	0.5%	0.0%	1.1%	0.0%	0.3%	1.0%
	HTA comparative effectiveness	0.8%	0.9%	1.8%	0.3%	0.0%	0.3%	0.0%	1.3%	0.2%
	Government affairs	3.9%	4.4%	3.6%	1.7%	2.0%	1.5%	0.0%	1.0%	2.0%
Regulatory Lifecycle Related	Regulatory strategy	5.5%	10.2%	10.4%	7.5%	13.8%	12.5%	12.9%	3.8%	10.2%
	Research & development	3.5%	6.6%	6.1%	4.7%	1.6%	6.0%	2.2%	16.0%	3.0%
	Preclinical	1.4%	1.2%	1.6%	1.8%	0.0%	0.7%	1.1%	1.3%	2.7%
	Clinical research	1.6%	6.8%	7.0%	4.4%	9.3%	3.2%	3.3%	13.3%	5.7%
	Domestic registrations	11.8%	6.4%	8.6%	12.6%	13.6%	10.1%	20.3%	9.3%	14.8%
	International registrations	9.4%	12.2%	8.8%	16.7%	10.7%	17.7%	16.7%	16.3%	14.3%
	Domestic compliance	3.4%	3.9%	6.6%	5.7%	7.8%	8.5%	7.3%	9.3%	10.3%
	International compliance	2.8%	4.7%	6.5%	6.0%	12.0%	9.3%	8.3%	16.3%	3.2%
	QA/QC	11.5%	5.3%	6.7%	10.7%	10.3%	11.2%	4.4%	4.5%	6.0%
	Postmarketing	4.2%	5.3%	4.8%	4.9%	8.0%	4.4%	15.9%	1.5%	3.4%
	Marketing	5.9%	1.1%	2.2%	1.6%	3.1%	2.1%	0.6%	2.5%	2.8%
	Training	4.1%	2.2%	2.0%	4.3%	1.5%	4.3%	2.6%	0.3%	4.1%

Compensation of European-based Professionals

The compensation of European-based professionals is presented in Euros. The majority of respondents provided compensation in Euros, with a few reporting in US dollars. The latter was converted to Euros based on an average conversion rate from January 2010 of 0.753805. The survey did not support analysis of compensation by European country and it is not possible to comment on any variations among countries.

Compensation of European professionals showed gains at many levels, and at levels well above those seen among North American professionals. Base salary of European professionals at the CEO, director, manager, specialist, and associate levels increased compared to the previous survey as summarized in Table 33. However, salaries among vice presidents declined by nearly 10%, and their total compensation dropped by nearly 16%.

Table 33. Compensation of European-based Professionals

	Base Salary € (% change from 07)	Total Compensation € (% change from 07)
CEO/president	118,839 (+3.6%)	154,371 (+21.2%)
Vice president	150,499 (-9.8%)	189,521 (-15.8%)
Director	135,680 (+25%)	164,361 (+21.3%)
Manager	85,460 (+17.4%)	95,437 (+7.9%)
Project manager	70,116 (–)	72,354 (–)
Specialist	57,765 (+1.4)	60,461 (- 19.3%)
Associate	45,217 (+37%)	55,341 (+61%)
Coordinator	23,204 *	23,254*
Consultant	79,695 (0%)	91,745 (-43.1%)

**insufficient information*

Factors correlated with compensation among European-based professionals include: regulatory experience, professional experience and multiregional scope. A doctorate degree is associated with higher compensation but other degrees had less influence than regulatory experience. Employment setting did not affect compensation levels and similar levels are seen by job level among industry, clinical research organizations (CROs), government and consultancies.

Table 34. Regulatory Experience and Salary: European-based Professionals

Figures in €						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president		100,000		83,333	150,537	136,961
Vice president	100,000			169,226	164,645	144,280
Director		447,113	98,761	118,824	132,669	111,067
Manager	57,282	67,850	68,250	145,744	78,910	60,000
Project manager		59,000	63,608		41,000	106,500
Specialist	48,703	46,643	70,592	83,500	94,226	
Associate	56,000	41,869				46,151
Coordinator	14,000	26,272				
Consultant	20,000	47,000	62,590	40,000	75,381	165,000

Table 35. Regulatory Experience and Total Compensation: European-based Professionals

Figures in €						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president		201,667		90,000	154,287	180,152
Vice president	100,000			169,226	183,720	211,423
Director		452,867	107,834	168,074	166,510	122,225
Manager	71,059	74,318	73,751	163,154	86,890	65,000
Project manager		61,000	66,038		47,000	106,500
Specialist	51,735	47,633	75,028	83,500	102,894	
Associate	56,750	43,677				94,759
Coordinator	14,200	26,272				
Consultant	26,000	47,400	62,590	40,000	75,381	210,000

Regulatory Affairs Certification (RAC) is associated with higher compensation at mid levels (specialist and manager) but there was an insufficient number of RACs in the current sample to analyze correlation or trends.

Benefits of European-based Professionals

Tables 36 and 37 summarize employer-provided benefits among European-based professionals. Compensation-related benefits (e.g. bonus, stock, deferred compensation) declined slightly from previous studies among industry-based professionals. Support for professional activities (professional dues, meetings) increased slightly from the levels seen in 2008. Employer-provided health, dental and vision insurance, which may have been a primary or supplemental source of coverage, decreased slightly from levels seen in 2008. Analysis of benefits by country shows some variation but data are not sufficient to evaluate the level or importance of country of residence or work.

Table 36. Benefits: European-based Professionals by Job Level

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant	Overall
Bonus	30.8%	64.3%	80.5%	49.4%	44.4%	32.0%	50.0%	0.0%	25.0%	51.2%
Stock	0.0%	57.1%	48.8%	20.3%	33.3%	4.0%	25.0%	0.0%	12.5%	25.4%
Incentive pay	7.7%	14.3%	14.6%	5.1%	0.0%	4.0%	0.0%	0.0%	0.0%	6.8%
Profit sharing	15.4%	35.7%	22.0%	5.1%	22.2%	4.0%	0.0%	0.0%	12.5%	11.7%
Retirement	30.8%	78.6%	70.7%	43.0%	55.6%	56.0%	41.7%	25.0%	25.0%	51.2%
Deferred compensation	0.0%	7.1%	12.2%	3.8%	0.0%	4.0%	0.0%	0.0%	0.0%	4.9%
Health insurance	38.5%	50.0%	63.4%	49.4%	44.4%	56.0%	50.0%	50.0%	12.5%	50.7%
Dental insurance	0.0%	28.6%	12.2%	15.2%	33.3%	8.0%	16.7%	25.0%	12.5%	14.6%
Vision insurance	0.0%	0.0%	7.3%	8.9%	11.1%	4.0%	0.0%	25.0%	12.5%	6.8%
Life insurance	38.5%	50.0%	53.7%	31.6%	55.6%	36.0%	8.3%	25.0%	12.5%	37.1%
Disability insurance	30.8%	50.0%	26.8%	22.8%	11.1%	8.0%	8.3%	25.0%	25.0%	22.9%
Unemployment coverage	7.7%	35.7%	22.0%	13.9%	11.1%	8.0%	16.7%	25.0%	12.5%	16.1%
Professional liability insurance	15.4%	14.3%	22.0%	11.4%	0.0%	0.0%	0.0%	0.0%	37.5%	12.2%
License fees	0.0%	14.3%	17.1%	13.9%	0.0%	12.0%	16.7%	0.0%	12.5%	12.7%
Professional dues	30.8%	57.1%	85.4%	53.2%	55.6%	36.0%	16.7%	0.0%	25.0%	52.2%
Professional meetings	53.8%	78.6%	87.8%	67.1%	55.6%	68.0%	58.3%	0.0%	50.0%	68.3%
Publications	7.7%	57.1%	56.1%	30.4%	22.2%	28.0%	25.0%	0.0%	50.0%	35.1%
Tuition	7.7%	0.0%	19.5%	15.2%	22.2%	12.0%	8.3%	0.0%	0.0%	13.2%
Release time	0.0%	7.1%	9.8%	7.6%	0.0%	0.0%	0.0%	0.0%	25.0%	6.3%
Flextime	46.2%	35.7%	41.5%	38.0%	77.8%	44.0%	58.3%	50.0%	62.5%	43.9%
Flexiplace	23.1%	28.6%	9.8%	13.9%	11.1%	4.0%	16.7%	0.0%	25.0%	13.7%
Telecommuting	7.7%	28.6%	22.0%	20.3%	11.1%	28.0%	0.0%	0.0%	12.5%	19.0%
Childcare	0.0%	14.3%	2.4%	11.4%	33.3%	0.0%	8.3%	25.0%	12.5%	8.8%
Car	53.8%	57.1%	53.7%	17.7%	0.0%	12.0%	0.0%	0.0%	25.0%	27.3%
Other	15.4%	7.1%	7.3%	7.6%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%
None	0.0%	0.0%	2.4%	6.3%	0.0%	12.0%	16.7%	25.0%	37.5%	7.3%

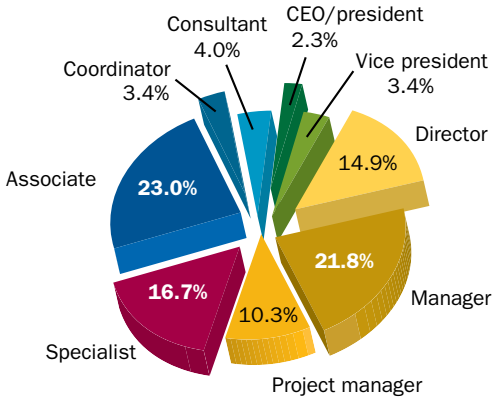
Table 37. Benefits: European-based Professionals by Employer

	Academic institution	CRO	Consulting firm	Govt	Hospital	Industry	Research org
Bonus	25.0%	71.4%	33.3%	0.0%	33.3%	57.1%	50.0%
Stock	0.0%	0.0%	3.7%	0.0%	0.0%	33.1%	0.0%
Incentive pay	0.0%	0.0%	3.7%	0.0%	0.0%	8.4%	0.0%
Profit sharing	0.0%	14.3%	14.8%	0.0%	0.0%	12.3%	0.0%
Retirement	75.0%	42.9%	44.4%	75.0%	0.0%	51.3%	100.0%
Deferred compensation	25.0%	0.0%	0.0%	0.0%	0.0%	5.8%	0.0%
Health insurance	50.0%	71.4%	25.9%	50.0%	33.3%	55.2%	0.0%
Dental insurance	25.0%	28.6%	11.1%	25.0%	0.0%	14.3%	0.0%
Vision insurance	25.0%	28.6%	7.4%	12.5%	33.3%	4.5%	0.0%
Life insurance	50.0%	71.4%	29.6%	25.0%	0.0%	37.0%	100.0%
Disability insurance	25.0%	28.6%	33.3%	25.0%	0.0%	20.8%	50.0%
Unemployment coverage	25.0%	14.3%	14.8%	37.5%	0.0%	15.6%	0.0%
Professional liability insurance	25.0%	0.0%	25.9%	0.0%	33.3%	9.7%	50.0%
License fees	0.0%	28.6%	7.4%	12.5%	33.3%	13.0%	0.0%
Professional dues	25.0%	71.4%	37.0%	37.5%	33.3%	55.2%	100.0%
Professional meetings	75.0%	71.4%	55.6%	62.5%	0.0%	72.1%	50.0%
Publications	25.0%	14.3%	25.9%	37.5%	0.0%	38.3%	50.0%
Tuition	25.0%	28.6%	7.4%	12.5%	0.0%	13.6%	0.0%
Release time	0.0%	0.0%	14.8%	0.0%	0.0%	5.8%	0.0%
Flextime	25.0%	57.1%	51.9%	75.0%	0.0%	41.6%	50.0%
Flexiplace	0.0%	28.6%	29.6%	12.5%	0.0%	11.0%	0.0%
Telecommuting	0.0%	14.3%	18.5%	0.0%	0.0%	20.1%	100.0%
Childcare	0.0%	14.3%	3.7%	0.0%	33.3%	9.7%	0.0%
Car	50.0%	0.0%	40.7%	12.5%	0.0%	26.6%	50.0%
Other	0.0%	0.0%	7.4%	0.0%	0.0%	6.5%	0.0%
None	25.0%	0.0%	7.4%	12.5%	66.7%	5.8%	0.0%

Analysis of Canadian-based Professionals

Canadian respondents reflect variations in job level profile from the overall respondent pool (Figure 16), with a higher proportion of professionals at the associate and project manager levels. Respondents work in all employment settings, in a proportion similar to all other groups. All Canadian CEO respondents work in consultancies.

Figure 16. Job Levels: Canadian-based Professionals



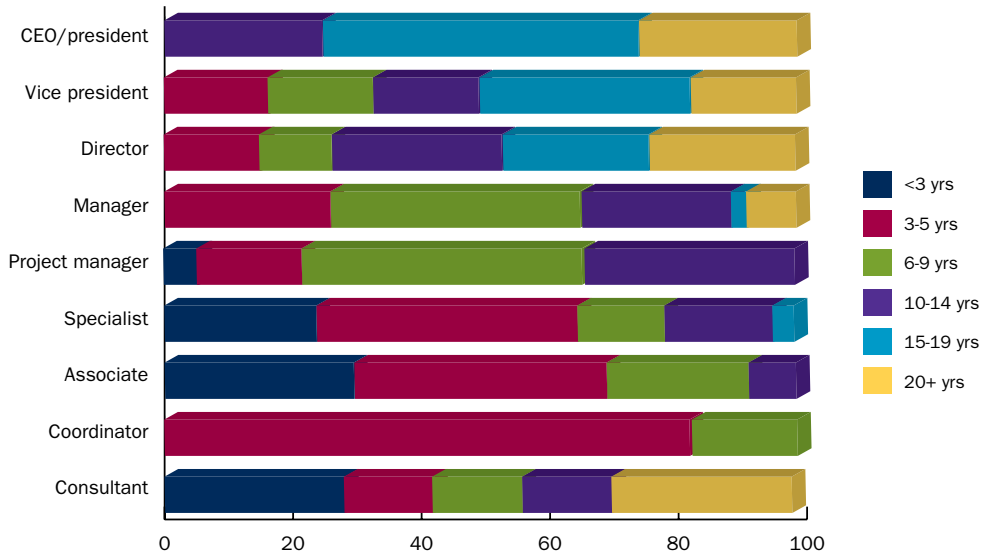
The professional profile of Canadian-based professionals is similar to other respondents (Table 38) although Canadian professionals, on average, have fewer staff reports and work slightly fewer hours.

Table 38. Professional Perspectives: Canadian-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
CEO/president	21.8	15.5	4.0	3.5	1.0	37.0	49.0
Vice president	26.8	13.3	6.4	4.9	2.2	48.3	47.8
Director	22.2	14.0	8.0	3.9	3.8	46.8	47.6
Manager	16.4	9.1	5.3	2.8	2.5	42.5	40.8
Project manager	12.5	7.9	4.8	3.6	0.5	40.6	36.4
Specialist	10.9	5.5	3.6	2.6	0.2	41.7	36.2
Associate	9.1	4.5	4.2	2.3	0.1	41.8	36.3
Coordinator	6.4	4.0	3.8	2.8	0.0	38.8	31.8
Consultant	24.3	9.4	5.3	4.9	0.4	38.2	50.1
All Canadian	**14.7**	**8.2**	**5.1**	**3.1**	**1.3**	**40.1**	**42.4**

Like other regulatory professionals, Canadian respondents had career experience prior to entering the regulatory profession. The range of regulatory experience by job level (Figure 17) indicates that only 14.4% of respondents have 15 or more years of regulatory experience, with more experienced professionals holding senior positions (CEO, vice president, director). More than 54% of professionals have three to nine years of regulatory experience, with most of these professionals at junior and mid levels.

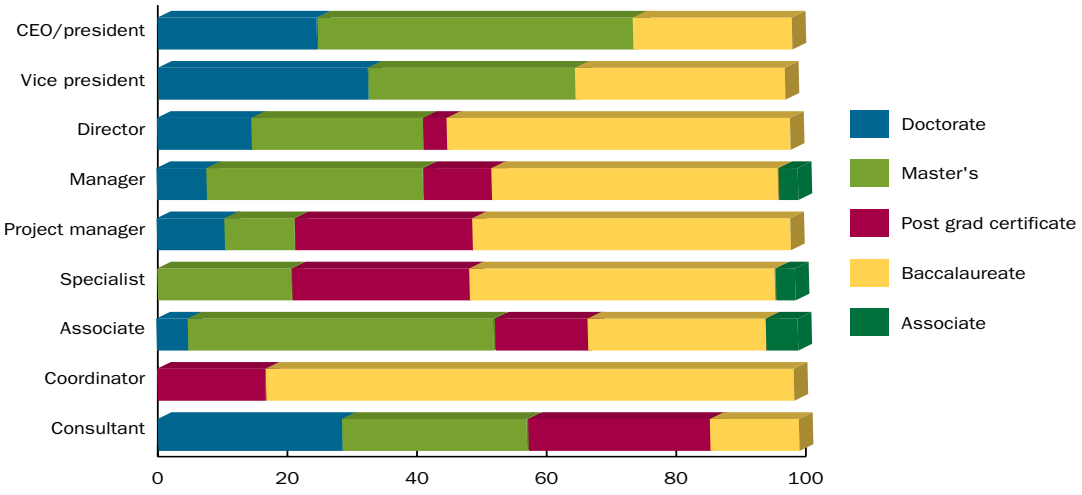
Figure 17. Regulatory Experience: Canadian-based Professionals



Education Background

Nearly 96% of Canadian professionals have degrees in the life sciences, clinical professions or engineering. Fifty-five percent have some graduate education, with 39% holding master's degrees or doctorates, and 16% with postgraduate certificates (Figure 18). Among the Canadian professionals, 22% have a degree or certificate in regulatory affairs.

Figure 18. Highest Earned Degree by Job Level: Canadian-based Professionals



Regulatory Affairs Certification

Canadian professionals have the highest proportion of individuals with Regulatory Affairs Certification (RAC), at 54%. This represents an increase of 7.1% from in the previous survey in 2008. Higher rates of certification are evident among senior professionals at the vice president and director levels and among consultants. The increases from 2008 certification rates among these positions are 26.7% for vice presidents; 1.5% for directors and 14.3% among consultants. Many of the credentialed senior-level professionals earned initial certification earlier in their career and have advanced to higher levels. The highest rate of certification is at the specialist level at nearly 83%, an increase of 17.8% from 2008.

RAC credentialed professionals are employed in industry, academia, clinical research organizations (CROs), consultancies and government.

Table 39. RAC-credentialed Professionals in Canada

	RAC
CEO/president	25.0%
Vice president	66.7%
Director	57.7%
Manager	47.4%
Project manager	44.4%
Specialist	82.8%
Associate	42.5%
Coordinator	33.3%
Consultant	71.4%

Among those with the RAC, 55% hold the RAC (CAN), 60% have the RAC (US) and 9% have the RAC (EU). Twenty-five percent have multiple RAC designations.

Scope of Practice

Like their peers in other regions, Canadian-based regulatory professionals are spending more time on business functions, overall, with exceptions at certain job levels. Increases are particularly evident among directors, managers and consultants. The level of business involvement among vice presidents differs from that of other regions, with low levels of involvement in corporate strategy, budget, general management and personnel. Canadian vice presidents in this survey had very high levels of involvement in QA/QC and manufacturing. Canadian respondents reported less involvement in health technology assessment/comparative effectiveness research (HTA/CER) and reimbursement than US and EU professionals, which may reflect the differences in the Canadian healthcare system structure and processes.

The percentage of time devoted to business/management functions, by job level, for Canadian-based respondents to the 2010 survey is as follows, with the change from the 2008 survey in parentheses:

Table 40. Business-related Time Allocation by Job Level: Canadian-based Respondents

CEO	34.3% (up 8.4%)
Vice president	22.3% (down 1.8%)
Director	25.9% (up 8.3%)
Manager	22.5% (up 10.8%)
Project manager	14.6% (N/A)
Specialist	7.0% (down 1.2%)
Associate	9.3% (up 5.6%)
Consultant	18.0% (up 10.1%)

Table 41. Time Allocation by Job Level: Canadian-based Professionals

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant
Business development/ corporate strategy	11.1%	3.4%	6.0%	4.1%	4.0%	1.0%	1.1%	0.0%	4.4%
Budget/finance	8.3%	3.0%	1.8%	1.8%	1.4%	0.2%	0.3%	0.0%	2.7%
Management	11.1%	5.7%	9.2%	9.2%	3.1%	1.5%	1.1%	0.8%	5.8%
Personnel	0.0%	2.3%	4.8%	3.1%	1.3%	1.4%	0.8%	1.0%	0.0%
Legal	1.9%	3.1%	1.6%	1.3%	0.7%	0.8%	0.8%	0.0%	0.0%
Reimbursement	0.0%	1.4%	0.9%	0.8%	0.5%	0.3%	0.6%	0.0%	0.0%
Health technology assessment/ comparative effectiveness	0.0%	0.5%	0.2%	0.5%	1.7%	0.1%	0.3%	0.0%	5.1%
Government affairs	1.9%	3.1%	1.3%	1.7%	1.8%	1.7%	4.3%	1.9%	0.0%
Regulatory strategy	8.6%	9.7%	9.1%	9.8%	15.7%	6.2%	9.8%	7.1%	5.4%
Research & development	0.0%	4.5%	7.1%	3.2%	3.0%	0.4%	4.8%	0.0%	10.2%
Preclinical	0.0%	5.5%	2.5%	0.8%	2.5%	2.4%	2.0%	0.0%	8.7%
Clinical research	0.0%	5.7%	3.1%	5.7%	7.0%	2.8%	3.5%	18.5%	1.1%
Domestic/regional submissions/registrations	21.3%	6.8%	12.8%	16.0%	30.8%	19.2%	23.2%	13.0%	9.8%
International submissions/ registrations	6.2%	8.2%	8.0%	7.9%	3.2%	6.5%	14.5%	5.8%	3.3%
Domestic/regional compliance	14.8%	4.6%	7.0%	6.9%	4.8%	12.0%	8.1%	8.0%	20.7%
International compliance	0.0%	1.9%	4.7%	3.9%	0.8%	5.3%	5.2%	0.0%	4.4%
QA/QC	11.1%	18.7%	7.9%	9.9%	1.7%	20.4%	9.1%	34.7%	14.6%
Postmarketing	1.9%	4.3%	6.0%	5.8%	9.5%	11.1%	4.9%	3.1%	3.4%
Marketing	1.9%	5.5%	2.7%	3.8%	2.8%	0.7%	1.4%	0.0%	0.0%
Training	0.0%	2.5%	3.3%	3.6%	3.6%	5.9%	4.3%	6.0%	3.9%

Canadian professionals reported more involvement in domestic regulatory processes; 50% are engaged in multiregional or worldwide (Table 42). This is also seen in allocation of time to domestic versus multiregional activities. Multiregional engagement is higher among directors and vice presidents, and increasingly among consultants.

Table 42. Multiregional Versus Domestic Scope: Canadian-based Professionals

	Multiregion	Domestic
CEO/president	25.0%	75.0%
Vice president	83.3%	16.7%
Director	65.4%	34.6%
Manager	52.6%	47.4%
Project manager	38.9%	61.1%
Specialist	37.9%	62.1%
Associate	45.0%	55.0%
Coordinator	16.7%	83.3%
Consultant	57.1%	42.9%

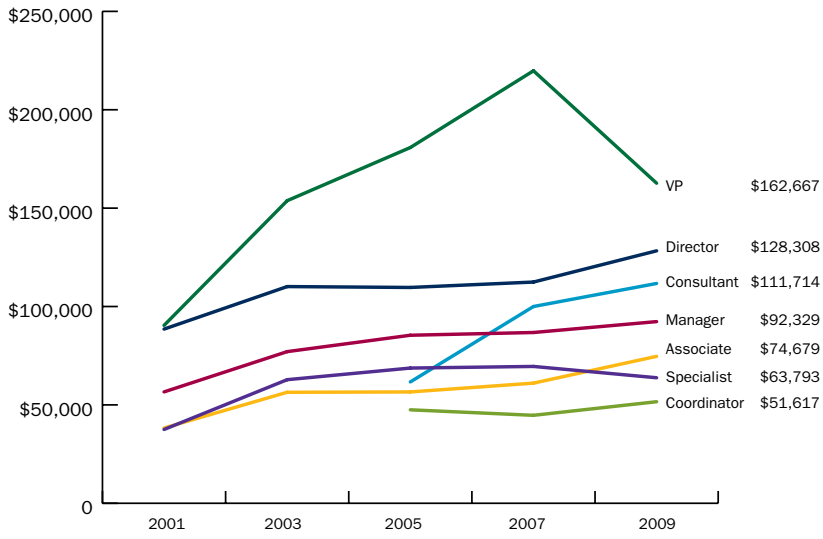
Compensation of Canadian-based Professionals

Compensation of Canadian based professionals (Table 43) in 2009 shows growth among the junior and mid-levels and consultants. The CEO and vice president levels showed significant declines from 2007 income, with CEO compensation dropping 11.3% and vice president compensation falling nearly 26% from the record high levels seen for 2007. Trends in compensation for several job levels from 2001 through 2009 are presented in Figure 19.

Table 43. Compensation: Canadian-based Professionals

Figures in $(CAN)		
	Base Salary	**Total compensation**
CEO/president	151,250	151,250
Vice president	162,667	169,917
Director	128,308	146,862
Manager	92,329	101,442
Project manager	82,356	90,468
Specialist	63,793	66,211
Associate	74,679	79,742
Coordinator	51,617	52,267
Consultant	111,714	119,143

Figure 19. Base Salary: Canadian-based Professionals 2001-2009*



**Data for CEOs are not presented since there are no data points for some years*

The factors associated with compensation among Canadian professionals include regulatory experience, Regulatory Affairs Certification (RAC) and highest degree earned. Multiregional involvement is not correlated to compensation.

Table 44. Base Salary by Regulatory Experience: Canadian-based Professionals

Figures in $(CAN)						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president				250,000	127,500	100,000
Vice president		140,000	180,000	200,000	130,500	195,000
Director		130,250	109,667	119,857	119,333	155,167
Manager		77,100	88,467	103,500	120,000	119,667
Project manager	60,000	75,531	79,351	93,500		
Specialist	60,429	57,300	68,225	77,400	79,500	
Associate	45,950	98,857	65,067	70,333		
Coordinator		51,340	53,000			
Consultant	110,000	100,000	122,000	105,000		117,500
Average by Experience	**58,125**	**82,396**	**83,436**	**105,591**	**119,292**	**140,000**

Table 45. Total Compensation by Regulatory Experience: Canadian-based Professionals

Figures in $(CAN)						
	<3 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-19 yrs	20+ yrs
CEO/president				250,000	127,500	100,000
Vice president		158,500	180,000	200,000	130,500	220,000
Director		133,502	120,000	124,271	143,333	199,083
Manager		82,250	96,792	115,744	153,000	128,567
Project manager	67,900	81,198	89,055	100,750		
Specialist	61,571	58,512	73,369	82,800	79,500	
Associate	47,150	107,669	67,056	77,500		
Coordinator		52,120	53,000			
Consultant	115,000	100,000	122,000	135,000		123,500
Average by Experience	**60,020**	**87,386**	**89,912**	**113,564**	**134,042**	**165,169**

The RAC is associated with higher base and total compensation among all levels of professionals based in Canada and in all employment settings (Table 46).

Table 46. Compensation: Canadian-based Professionals With RAC

Figures in $(CAN)				
	Base Salary		Total Compensation	
	RAC	Non-RAC	RAC	Non-RAC
CEO/president	250,000	118,333	250,000	118,333
Vice president	175,250	137,500	181,500	146,750
Director	136,000	117,818	158,334	131,218
Manager	96,850	87,306	105,166	97,304
Project manager	85,125	80,140	94,050	87,603
Specialist	68,167	59,400	71,337	61,440
Associate	58,875	54,787	67,287	66,492
Coordinator	59,000	47,925	59,650	48,575
Consultant	112,400	110,000	122,800	110,000

A graduate degree, particularly a master's degree, is generally related to higher compensation at all job levels. A postgraduate certificate is not related to higher compensation. However, the majority of individuals with a postgraduate certificate had less total professional and regulatory experience at the time of this survey, which may mask the value of this level of education.

Table 47. Base Salary by Highest Earned Degree: Canadian-based Professionals

Figures in $(CAN)					
	Doctorate	Master's	Post grad cert	Baccalaureate	Associate
CEO/president	100,000	127,500		250,000	
Vice president	190,000	133,000		165,000	
Director	128,000	133,286	130,000	125,786	
Manager	89,333	105,038	78,500	87,412	75,000
Project manager	84,000	83,250	74,162	86,344	
Specialist		60,617	60,925	65,671	79,500
Associate	59,250	89,874	58,053	58,636	67,250
Coordinator			68,000	48,340	
Consultant	110,000	136,000	92,500	105,000	

Table 48. Total Compensation by Highest Earned Degree: Canadian-based Professionals

Figures in $(CAN)					
	Doctorate	Master's	Post grad cert	Baccalaureate	Associate
CEO/president	100,000	127,500		250,000	
Vice president	190,000	142,250		177,500	
Director	130,252	171,229	130,000	140,629	
Manager	100,467	117,175	85,600	94,512	81,000
Project manager	93,000	96,250	80,688	94,055	
Specialist		63,100	62,452	68,743	79,500
Associate	64,500	93,600	76,403	61,536	70,150
Coordinator			68,000	49,120	
Consultant	115,000	136,000	98,500	135,000	

The benefits of Canadian-based professionals by job level and employer are summarized in Tables 49 and 50. These tables show some variation in benefits by job level and by employer type and show similar patterns to other regions.

Table 49. Employer-provided Benefits: Canadian-based Professionals by Job Level

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant	Overall
Bonus	0.0%	33.3%	80.8%	71.1%	66.7%	41.4%	42.5%	66.7%	14.3%	55.2%
Stock		33.3%	34.6%	34.2%	33.3%	27.6%	15.0%	16.7%	0.0%	25.9%
Incentive pay	0.0%	0.0%	11.5%	10.5%	5.6%	10.3%	10.0%	0.0%	0.0%	8.6%
Profit sharing	0.0%	0.0%	11.5%	10.5%	5.6%	13.8%	7.5%	33.3%	0.0%	9.8%
Retirement	0.0%	0.0%	53.8%	57.9%	77.8%	44.8%	42.5%	66.7%	0.0%	48.3%
Deferred compensation	0.0%	0.0%	0.0%	2.6%	5.6%	3.4%	0.0%	0.0%	0.0%	1.7%
Health insurance	0.0%	100.0%	65.4%	76.3%	77.8%	69.0%	57.5%	100.0%	57.1%	68.4%
Dental insurance	25.0%	100.0%	92.3%	92.1%	94.4%	72.4%	77.5%	100.0%	57.1%	83.3%
Vision insurance	0.0%	50.0%	65.4%	76.3%	66.7%	55.2%	55.0%	83.3%	28.6%	60.9%
Life insurance	25.0%	100.0%	76.9%	68.4%	66.7%	62.1%	57.5%	83.3%	14.3%	64.4%
Disability insurance	25.0%	83.3%	69.2%	78.9%	77.8%	58.6%	57.5%	50.0%	42.9%	65.5%
Unemployment coverage	0.0%	33.3%	23.1%	31.6%	22.2%	31.0%	32.5%	16.7%	14.3%	27.6%
Prof liability insurance	0.0%	0.0%	11.5%	15.8%	11.1%	6.9%	5.0%	0.0%	14.3%	9.2%
License fees	0.0%	33.3%	30.8%	42.1%	5.6%	24.1%	20.0%	0.0%	0.0%	24.1%
Professionals dues	25.0%	83.3%	88.5%	78.9%	61.1%	58.6%	50.0%	33.3%	42.9%	64.4%
Publications	0.0%	50.0%	69.2%	42.1%	33.3%	31.0%	17.5%	0.0%	28.6%	35.1%
Tuition	0.0%	16.7%	46.2%	68.4%	55.6%	48.3%	55.0%	50.0%	14.3%	51.1%
Meeting registration	25.0%	66.7%	80.8%	78.9%	83.3%	62.1%	55.0%	33.3%	57.1%	67.2%
Release time	0.0%	16.7%	11.5%	0.0%	5.6%	0.0%	2.5%	0.0%	0.0%	3.4%
Flextime	0.0%	33.3%	30.8%	47.4%	38.9%	41.4%	35.0%	16.7%	14.3%	36.2%
Flexiplace	0.0%	16.7%	15.4%	18.4%	5.6%	10.3%	7.5%	0.0%	0.0%	10.9%
Telecommuting	25.0%	33.3%	7.7%	31.6%	22.2%	13.8%	10.0%	0.0%	0.0%	16.7%
Childcare	0.0%	0.0%	0.0%	2.6%	0.0%	0.0%	2.5%	0.0%	0.0%	1.1%
Car	0.0%	0.0%	11.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%
Other	0.0%	0.0%	3.8%	0.0%	0.0%	3.4%	2.5%	0.0%	0.0%	1.7%
None	75.0%	0.0%	0.0%	0.0%	0.0%	6.9%	12.5%	0.0%	28.6%	6.9%

Table 50. Benefits: Canadian-based Professionals by Employer

	Academic institution	CRO	Consulting firm	Govt	Hospital	Industry	Law firm	Research organization
Bonus	0.0%	0.0%	40.7%	11.1%	50.0%	64.5%	100.0%	100.0%
Stock	0.0%	0.0%	14.8%	0.0%	50.0%	31.5%	0.0%	50.0%
Incentive pay	0.0%	0.0%	11.1%	0.0%	50.0%	8.1%	0.0%	50.0%
Profit sharing	0.0%	0.0%	3.7%	0.0%	0.0%	12.1%	0.0%	50.0%
Retirement	25.0%	0.0%	18.5%	55.6%	50.0%	56.5%	100.0%	50.0%
Deferred compensation	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%
Health insurance	75.0%	100.0%	55.6%	88.9%	100.0%	68.5%	100.0%	100.0%
Dental insurance	100.0%	0.0%	66.7%	100.0%	100.0%	87.1%	100.0%	100.0%
Vision insurance	25.0%	50.0%	55.6%	55.6%	100.0%	62.9%	100.0%	100.0%
Life insurance	50.0%	100.0%	51.9%	55.6%	50.0%	66.9%	100.0%	100.0%
Disability insurance	50.0%	50.0%	37.0%	88.9%	100.0%	70.2%	100.0%	100.0%
Unemployment coverage	50.0%	0.0%	29.6%	66.7%	0.0%	22.6%	100.0%	100.0%
Prof liability insurance	0.0%	50.0%	7.4%	22.2%	50.0%	7.3%	0.0%	50.0%
License fees	0.0%	0.0%	18.5%	11.1%	0.0%	25.8%	0.0%	100.0%
Professionals dues	0.0%	50.0%	59.3%	11.1%	0.0%	72.6%	0.0%	100.0%
Publications	0.0%	0.0%	25.9%	11.1%	50.0%	39.5%	0.0%	100.0%
Tuition	50.0%	0.0%	40.7%	22.2%	50.0%	57.3%	0.0%	100.0%
Meeting registration	25.0%	50.0%	63.0%	66.7%	100.0%	70.2%	0.0%	100.0%
Release time	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	0.0%	50.0%
Flextime	50.0%	0.0%	25.9%	33.3%	50.0%	38.7%	0.0%	100.0%
Flexiplace	0.0%	0.0%	11.1%	11.1%	0.0%	12.1%	0.0%	0.0%
Telecommuting	0.0%	50.0%	7.4%	22.2%	0.0%	18.5%	0.0%	50.0%
Childcare	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%
Car	0.0%	0.0%	3.7%	0.0%	0.0%	1.6%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%
None	0.0%	0.0%	22.2%	0.0%	0.0%	4.0%	0.0%	0.0%

ANALYSIS OF PROFESSIONALS IN OTHER GLOBAL REGIONS

More than 200 professionals based in Asia, Latin America, Oceania, the Middle East and Africa responded to the survey, with 197 complete surveys used for analysis. The largest number of responses was from Asian-based professionals. Demographic, scope of practice and compensation findings and trends are reported here. Where the number of responses limited analysis, comparisons with the other regions is provided to offer general perspectives.

The employment setting of professionals is comparable to the distribution for the overall study, with 70% from industry, 13% with consultancies, nearly 6% at research organizations, 3% from CROs and nearly 2.5% from government.

Professional and Regulatory Experience

General professional demographics by region are presented in Tables 51–54. These tables show similarities to the professionals in other global regions, and with colleagues in North America and Europe, although Table 20 shows slightly less regulatory experience, particularly at mid- and senior levels among this global group.

Professionals based in Asia are slightly younger than their colleagues in other regions and have slightly less professional and regulatory experience. This may reflect the more recent emergence of the regulatory profession in Asia and the general demographic patterns of professionals in the Asian region. These data do show that regulatory professionals come to the profession with prior experience.

Table 51. Professional Perspectives: Asian-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
CEO/president	22.0	15.0	6.3	6.3	6.5	46.0	52.0
Vice president	15.1	10.7	3.2	2.9	3.8	51.6	42.0
Director	14.6	9.2	5.2	2.9	6.6	48.5	38.8
Manager	12.7	6.2	5.0	2.9	3.0	49.3	37.5
Project manager	9.9	4.9	7.3	2.5	2.6	47.4	34.6
Specialist	7.9	3.9	3.4	2.7	1.9	46.8	32.9
Associate	4.1	2.8	2.5	1.9	0.6	38.7	27.4
Coordinator	5.8	3.8	2.3	2.8	3.0	49.5	29.5
Consultant	9.3	6.9	2.3	2.0	1.7	33.7	32.7
Grand Total	**11.5**	**6.6**	**4.4**	**2.8**	**3.4**	**47.1**	**36.2**

Table 52. Professional Perspectives: Latin American-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
CEO/president	29.0	25.0	4.0	4.0	0.0	50.0	49.0
Director	23.3	17.0	6.3	3.7	2.7	45.7	44.7
Manager	15.9	7.4	7.9	3.4	3.6	52.4	38.0
Specialist	17.5	6.3	10.3	5.5	2.0	39.8	46.8
Associate	10.0	8.0	3.0	1.0	4.0	40.0	34.0
Coordinator	5.3	4.4	3.4	1.4	0.3	34.8	28.0
Consultant	7.5	5.0	3.5	2.5	1.5	42.0	29.0
Grand Total	**14.8**	**8.6**	**6.5**	**3.3**	**2.2**	**44.4**	**38.2**

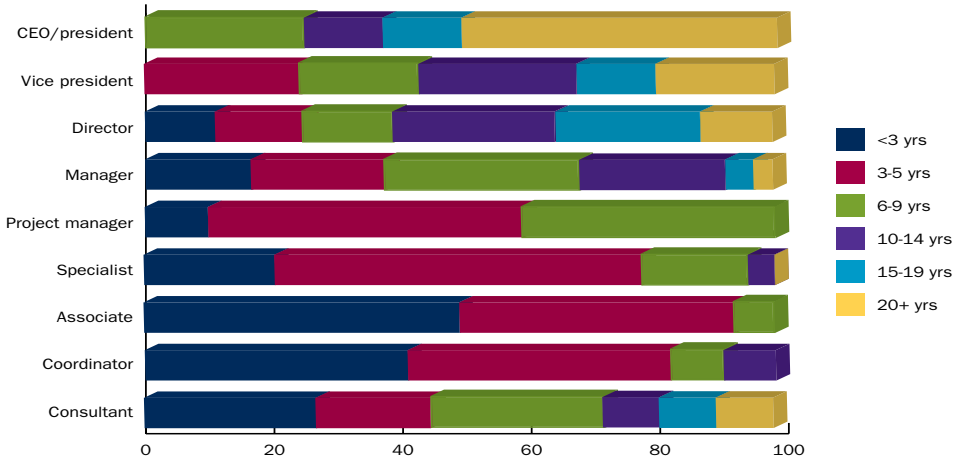
Table 53. Professional Perspectives: Middle Eastern-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
CEO/president	50.0	27.0	4.0	4.0	0.0	20.0	82.0
Vice president	18.6	13.4	3.0	4.2	2.8	49.4	44.2
Director	21.0	12.8	9.9	3.3	2.3	52.8	46.0
Manager	17.7	8.5	5.4	3.7	2.1	48.3	43.0
Project manager	4.0	4.0	1.0	1.0	0.0	49.0	28.0
Specialist	4.5	2.5	2.0	3.0	0.0	28.5	31.0
Consultant	12.5	5.5	1.0	2.0	1.5	50.0	36.0
Grand Total	**18.0**	**10.4**	**5.1**	**3.4**	**1.9**	**47.0**	**43.4**

Table 54. Professional Perspectives: Oceania-based Professionals

	Years of professional experience	Years of regulatory experience	Years at employer	Years in position	Staff reports	Hours per week	Age
Vice president	27.0	7.0	5.0	5.0	7.0	70.0	50.0
Director	30.7	13.7	14.0	7.3	8.3	58.3	57.3
Manager	12.7	9.4	7.4	3.1	2.5	50.0	36.5
Specialist	4.0	3.0	3.0	3.0	0.0	42.0	27.0
Associate	10.0	2.7	2.7	2.7	0.0	46.7	32.3
Grand Total	**15.4**	**8.5**	**7.3**	**3.8**	**3.1**	**51.4**	**39.4**

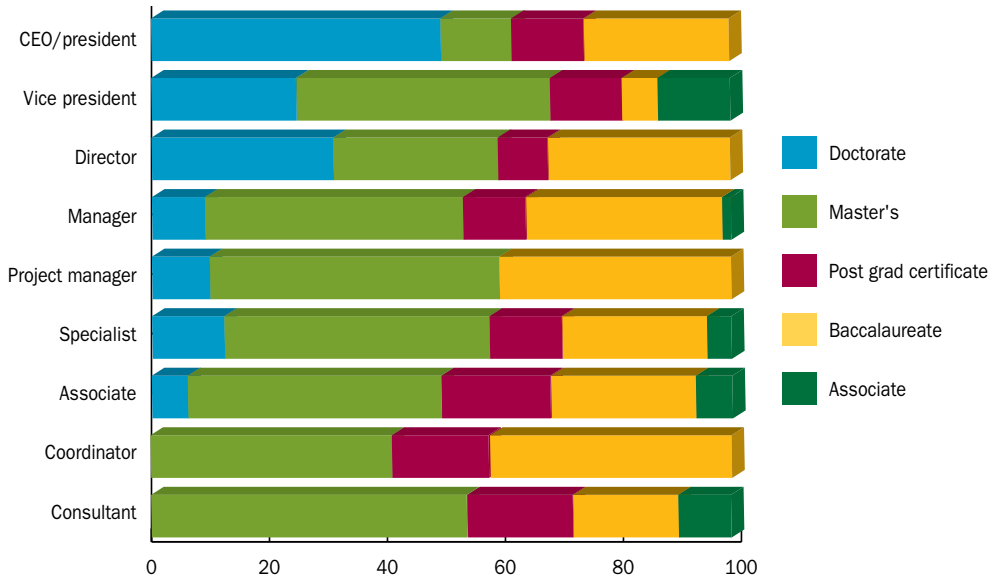
Figure 20. Regulatory Experience: Professionals Based in Asia, Latin America, Middle East and Oceania



Education

Professionals based outside North America or Europe show similar education trends as their colleagues, with nearly 68% having post-baccalaureate education (Figure 20). Among professionals based in Asia, nearly 70% hold a master's degree or doctorate, with more than 19% holding a doctorate. This is particularly evident among senior-level positions. Among professionals based in Latin America, less than 18% hold a master's degree or doctorate, although nearly half report holding a postgraduate certificate. Among professionals in the Middle East, nearly 70% hold a graduate degree, with nearly 62% holding a master's degree. The Middle East also has the largest percentage of survey respondents with MBAs, at 22%. Nearly 85% of professionals in these regions are educated in the life sciences, clinical fields and/or engineering.

Figure 21. Highest Earned Degree by Job Level: Asia, Latin America, Middle East and Oceania



Scope of Practice

General allocation of time by job level and region are presented in Tables 50–53. These tables present information on scope of activities when there were five or more respondents per job level.

Time allocation among Asian-based professionals reflects engagement throughout the product lifecycle, with more emphasis on domestic and regional registration and compliance efforts than on international activities. These professionals are actively engaged in business and management functions. Senior level professionals (director, vice president and CEO) spend on average 28% or more of their time in business and management. Managers average 22.6% of their time on business and specialists and associates spend 19% and 14% respectively. Asian-based professionals reported spending more time on reimbursement and on health technology assessment/comparative effectiveness research (HTA/CER) activities than in 2008, with the largest increases in HTA/CER efforts. These professionals are also actively engaged in government affairs activities.

Table 55. Time Allocation by Job Level: Asian-based Professionals

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant
Business development/ corporate strategy	11.5%	3.3%	6.7%	6.6%	7.2%	2.6%	6.5%	2.1%	2.3%
Budget/finance	10.5%	3.9%	2.7%	1.4%	2.4%	0.9%	0.5%	0.7%	2.3%
Management	2.9%	11.7%	7.0%	4.8%	6.5%	2.7%	0.5%	13.4%	5.1%
Personnel	0.0%	1.9%	3.1%	1.9%	2.5%	0.6%	2.1%	1.2%	19.5%
Legal	0.0%	1.9%	1.8%	0.4%	2.1%	0.0%	0.5%	8.3%	0.8%
Reimbursement	0.0%	0.0%	1.3%	1.2%	0.0%	0.0%	0.3%	1.8%	4.0%
HTA/CER	0.0%	3.7%	1.4%	3.2%	1.7%	4.3%	1.6%	2.4%	0.8%
Government affairs	2.9%	7.5%	3.2%	4.3%	0.0%	8.1%	2.1%	4.1%	4.1%
Regulatory strategy	5.7%	9.1%	11.9%	11.6%	9.3%	4.9%	13.6%	5.4%	4.3%
Research & development	12.9%	2.9%	6.2%	2.4%	10.5%	7.4%	1.4%	2.4%	0.8%
Preclinical	0.0%	3.7%	2.2%	1.4%	1.7%	1.2%	0.9%	1.4%	2.3%
Clinical research	17.2%	9.0%	6.0%	2.6%	2.1%	0.9%	10.8%	2.4%	12.2%
Domestic/regional registrations	7.2%	12.8%	6.0%	8.4%	10.1%	11.8%	10.3%	10.7%	2.3%
International registrations	4.3%	6.7%	9.6%	17.2%	13.1%	25.8%	20.7%	17.3%	4.1%
Domestic/regional compliance	7.2%	3.8%	6.6%	5.4%	8.7%	3.6%	6.1%	5.4%	2.4%
International compliance	4.3%	3.3%	7.4%	7.0%	7.0%	9.0%	3.7%	3.3%	3.2%
QA/QC	5.7%	8.3%	8.0%	4.9%	2.1%	3.3%	13.6%	12.2%	13.7%
Postmarketing	0.0%	0.6%	3.0%	5.3%	5.8%	4.5%	1.4%	0.0%	9.0%
Marketing	0.0%	2.8%	2.1%	0.4%	3.5%	2.7%	0.5%	1.2%	0.8%
Training	7.7%	3.2%	3.7%	3.0%	3.5%	5.8%	2.7%	4.3%	5.6%

The scope of activities among Latin American-based professionals shows engagement throughout the product lifecycle but with some differences from other groups. This group is not involved with reimbursement and/or HTA/CER activities. These professionals are actively involved in other business-related functions, including government affairs. Many professionals are involved with domestic/regional and multiregional registration and compliance.

Table 56. Time Allocation by Job Level: Latin American-based Professionals

	Director	Manager	Specialist	Coordinator	Consultant
Business development/corporate strategy	4.0%	5.7%	3.1%	5.3%	0.5%
Budget/finance	2.4%	5.1%	0.0%	1.3%	0.0%
Management	12.0%	8.5%	11.3%	5.3%	2.9%
Personnel	16.0%	4.1%	1.5%	0.0%	0.5%
Legal	0.8%	4.3%	1.5%	3.3%	24.2%
Reimbursement	0.0%	0.1%	0.0%	0.0%	1.0%
HTA/CER	1.2%	0.0%	0.0%	0.0%	1.0%
Government affairs	6.1%	4.3%	1.9%	6.0%	9.7%
Regulatory strategy	12.5%	3.1%	5.2%	23.8%	12.1%
Research & development	0.0%	2.8%	7.4%	0.0%	1.0%
Preclinical	0.0%	0.0%	0.0%	0.0%	1.9%
Clinical research	1.6%	3.1%	0.0%	0.3%	0.5%
Domestic/regional registrations	11.5%	19.2%	25.8%	25.0%	31.4%
International registrations	5.3%	10.7%	17.0%	10.0%	0.5%
Domestic/regional compliance	7.5%	10.9%	10.8%	6.0%	2.9%
International compliance	8.0%	3.3%	7.7%	1.8%	1.0%
QA/QC	2.4%	4.0%	5.2%	4.3%	2.9%
Postmarketing	2.8%	6.3%	0.0%	3.8%	0.5%
Marketing	2.7%	1.1%	0.0%	0.5%	0.5%
Training	3.2%	3.3%	1.5%	3.8%	5.3%

Professionals based in the Middle East are also involved in the full product lifecycle, with regional and multi-regional involvement. These professionals have limited or no involvement in reimbursement but are engaging in HTA/CER activities. Government affairs involvement is also minimal.

Table 57. Time Allocation by Job Level: Middle Eastern-based Professionals

	Vice president	Director	Manager	Specialist	Consultant
Business development/corporate strategy	4.6%	7.3%	2.5%	2.5%	1.5%
Budget/finance	3.4%	2.0%	2.5%	2.5%	1.5%
Management	7.8%	6.7%	6.4%	2.5%	2.5%
Personnel	2.1%	3.0%	2.5%	0.0%	0.0%
Legal	1.7%	0.2%	2.6%	2.5%	0.0%
Reimbursement	0.0%	0.2%	2.3%	0.0%	0.0%
HTA/CER	3.4%	3.0%	1.8%	2.5%	0.0%
Government affairs	0.0%	3.8%	7.3%	0.0%	0.0%
Regulatory strategy	5.2%	6.7%	6.9%	5.0%	8.5%
Research & development	3.4%	0.8%	8.7%	5.0%	4.0%
Preclinical	6.9%	0.5%	1.2%	1.0%	5.0%
Clinical research	10.3%	6.2%	3.6%	1.0%	7.5%
Domestic/regional registrations	15.4%	11.3%	11.5%	20.0%	4.0%
International registrations	7.4%	13.7%	6.2%	35.5%	10.0%
Domestic/regional compliance	3.1%	7.7%	6.1%	5.0%	5.0%
International compliance	4.0%	8.4%	4.5%	2.5%	10.0%
QA/QC	9.1%	8.5%	5.8%	5.0%	20.0%
Postmarketing	6.9%	3.0%	5.8%	2.5%	16.5%
Marketing	2.4%	2.6%	3.5%	5.0%	0.0%
Training	2.8%	4.6%	3.1%	0.0%	4.0%

Due to the smaller number of responses from Oceania-based professionals (i.e., those in Australia or New Zealand), time allocation is shown for only the manager level. At this level, professionals report full lifecycle engagement. As expected, there is a stronger focus on international activities than on domestic. There is active involvement in business-related activities, although very limited time allocation to reimbursement or HTA.

Table 58. Time Allocation by Job Level: Oceania-based Professionals

	Manager
Business development/corporate strategy	2.6%
Budget/finance	2.1%
Management	16.7%
Personnel	5.2%
Legal	0.3%
Reimbursement	0.6%
HTA/CER	1.0%
Government affairs	2.1%
Regulatory strategy	4.4%
Research & development	4.6%
Preclinical	1.9%
Clinical research	5.3%
Domestic/regional registrations	7.3%
International registrations	17.1%
Domestic/regional compliance	11.0%
International compliance	5.8%
QA/QC	3.5%
Postmarketing	2.6%
Marketing	1.3%

Compensation

Only limited analysis of compensation was possible among respondents outside North America and Europe based on the number of respondents in each region, currency and cost of living variances. This section presents information on factors that are related to compensation and provides some within-region comparisons and general comparisons with North American and European compensation.

Asia

The range of countries represented among Asian-based professionals and wide variations in cost of living and general salary levels limit regional summaries of compensation. However, compensation was assessed by converting all data to US dollars[2] to assess correlated factors and trends.

Compensation among Asian-based professionals is related to country of work, job level, regulatory experience and highest earned degree. Compensation of some respondents is also related to their employer, particularly in the case of multinational companies headquartered in North America or Europe, where senior levels are compensated at rates similar to North America or Europe. Some of these cases may represent foreign nationals with work assignments in Asia.

Review of compensation by country shows variations. In Japan, senior levels (director, vice president and CEO) in industry are compensated at levels similar to those reported for North America or Europe. Salaries at mid- and junior levels are approximately 70% of North American levels. In South Korea and Taiwan, salaries are only 25–30% of those seen in North America or Europe, particularly at junior and mid-levels. At the director level, salaries are about 60% of North American levels. In China and Hong Kong, salaries reported were about 50% of those for European- or North American-based professionals, while salaries of professionals based in Singapore were equivalent to European-based professionals. Salaries in India show the greatest level of within-country variability, ranging from about 20% of North American or European levels to equivalent levels among some directors, vice presidents and CEOs.

2 Conversion to US dollars was used since several respondents reported compensation in US dollars. Other currency used among Asian based respondents included Japanese Yen, Korean Won and Chinese Yuan renminbi and Australian dollars.

Latin America

Compensation among professionals based in Latin America is related to job level, regulatory experience and highest degree earned. Individuals with a postgraduate certificate or master's degree earned 1.5 to 2 times more than individuals with a baccalaureate-equivalent degree. Salaries reported in this group on average were about 75–80% those reported for North American-based professionals.

Middle East

Compensation among professionals based in the Middle East was related to job level, degree and regulatory experience but showed more variability than other regions. The RAC was related to higher compensation among mid- and senior levels. Generally, compensation of professionals based in the Middle East was equivalent to European rates.

Oceania

Compensation among professionals based in Australia and New Zealand was related to job level, regulatory experience, degree and the RAC. A master's degree was related to 1.3 times higher levels of compensation than a baccalaureate, with progressively increasing earnings based on regulatory experience. The RAC credential was associated with a compensation level 1.5 to 2 times higher than non-RAC professionals.

Benefits

Benefits were reviewed from the perspectives of Asian-based professionals, and by professionals in Latin America, Middle East and Oceania. The benefits of Asian-based professionals is summarized in Tables 54 and 55. The widest benefit package is evident in industry but benefits differ from those seen among US- and European-based professionals but reflect regional norms.

Benefits among professionals based in Oceania, the Middle East and Latin America also show fewer benefits offered, with benefits targeted more to supplemental income sources than to insurance or support for other professional or personal benefits. Senior professionals tend to have more benefits than mid- to junior level staff.

Table 59. Benefits: Asian-based Professionals by Job Level

	CEO/ president	Vice president	Director	Manager	Project manager	Specialist	Associate	Coordinator	Consultant	All Asia
Bonus	50.0%	22.2%	47.6%	72.5%	33.3%	28.6%	54.5%	33.3%	50.0%	50.8%
Stock	0.0%	11.1%	33.3%	15.0%	11.1%	0.0%	0.0%	0.0%	0.0%	12.5%
Incentive pay	0.0%	11.1%	28.6%	30.0%	11.1%	0.0%	18.2%	16.7%	0.0%	19.2%
Profit sharing	0.0%	0.0%	0.0%	5.0%	11.1%	0.0%	0.0%	16.7%	16.7%	4.2%
Retirement	0.0%	11.1%	4.8%	22.5%	11.1%	14.3%	27.3%	16.7%	0.0%	15.0%
Deferred compens	0.0%	0.0%	0.0%	0.0%	11.1%	0.0%	0.0%	16.7%	16.7%	2.5%
Health insurance	25.0%	66.7%	42.9%	70.0%	77.8%	64.3%	54.5%	16.7%	0.0%	55.8%
Dental insurance	0.0%	0.0%	19.0%	17.5%	11.1%	7.1%	27.3%	0.0%	16.7%	14.2%
Vision insurance	25.0%	11.1%	0.0%	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%
Life insurance	0.0%	11.1%	28.6%	17.5%	33.3%	57.1%	54.5%	16.7%	16.7%	27.5%
Disability insurance	0.0%	0.0%	9.5%	15.0%	11.1%	14.3%	9.1%	0.0%	0.0%	10.0%
Unemployment coverage	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%
Prof liability insurance	0.0%	0.0%	4.8%	5.0%	11.1%	0.0%	0.0%	0.0%	0.0%	3.3%
License fees	0.0%	11.1%	14.3%	12.5%	11.1%	0.0%	0.0%	0.0%	0.0%	8.3%
Professionals dues	0.0%	44.4%	28.6%	17.5%	11.1%	7.1%	0.0%	0.0%	16.7%	16.7%
Publications	0.0%	0.0%	23.8%	10.0%	11.1%	0.0%	0.0%	0.0%	0.0%	8.3%
Tuition	25.0%	33.3%	52.4%	50.0%	44.4%	35.7%	45.5%	16.7%	50.0%	44.2%
Meeting registration	25.0%	0.0%	28.6%	10.0%	11.1%	14.3%	18.2%	0.0%	16.7%	14.2%
Release time	0.0%	0.0%	4.8%	2.5%	22.2%	0.0%	0.0%	0.0%	0.0%	3.3%
Flextime	0.0%	0.0%	19.0%	22.5%	44.4%	14.3%	9.1%	0.0%	33.3%	18.3%
Flexiplace	0.0%	0.0%	0.0%	5.0%	11.1%	7.1%	0.0%	0.0%	0.0%	3.3%
Telecommuting	0.0%	22.2%	9.5%	17.5%	0.0%	14.3%	18.2%	0.0%	16.7%	13.3%
Childcare	25.0%	0.0%	23.8%	32.5%	0.0%	14.3%	18.2%	16.7%	0.0%	20.0%
Car	0.0%	22.2%	23.8%	7.5%	0.0%	0.0%	9.1%	16.7%	33.3%	11.7%
Other	0.0%	11.1%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%
None	50.0%	11.1%	4.8%	0.0%	0.0%	7.1%	9.1%	50.0%	33.3%	9.2%

Table 60. Benefits: Asian-based Professionals by Employer

	Academic institution	Clinical research organization (CRO)	Consulting firm	Government	Hospital/ medical practice	Industry	Research organization
Bonus	33.3%	50.0%	38.5%	50.0%	0.0%	54.4%	42.9%
Stock	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%
Incentive pay	0.0%	50.0%	0.0%	0.0%	0.0%	23.3%	14.3%
Profit sharing	0.0%	50.0%	7.7%	0.0%	0.0%	3.3%	0.0%
Retirement	0.0%	50.0%	0.0%	50.0%	0.0%	16.7%	0.0%
Deferred compensation	0.0%	0.0%	7.7%	0.0%	0.0%	2.2%	0.0%
Health insurance	33.3%	50.0%	7.7%	75.0%	100.0%	60.0%	85.7%
Dental insurance	0.0%	0.0%	7.7%	0.0%	0.0%	17.8%	0.0%
Vision insurance	33.3%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%
Life insurance	0.0%	50.0%	7.7%	25.0%	100.0%	27.8%	57.1%
Disability insurance	0.0%	0.0%	0.0%	0.0%	0.0%	12.2%	14.3%
Unemployment coverage	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	0.0%
Prof liability insurance	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	14.3%
License fees	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	0.0%
Professionals dues	33.3%	0.0%	7.7%	0.0%	100.0%	18.9%	0.0%
Publications	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	0.0%
Tuition	66.7%	0.0%	23.1%	50.0%	0.0%	48.9%	28.6%
Meeting registration	33.3%	0.0%	7.7%	0.0%	0.0%	15.6%	14.3%
Release time	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	0.0%
Flextime	0.0%	0.0%	23.1%	25.0%	100.0%	18.9%	0.0%
Flexiplace	0.0%	0.0%	0.0%	0.0%	100.0%	3.3%	0.0%
Telecommuting	0.0%	0.0%	15.4%	0.0%	100.0%	14.4%	0.0%
Childcare	33.3%	0.0%	0.0%	0.0%	0.0%	24.4%	14.3%
Car	0.0%	0.0%	15.4%	0.0%	0.0%	13.3%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%
None	0.0%	50.0%	46.2%	0.0%	0.0%	4.4%	0.0%

METHODOLOGY

The data for RAPS' 2010 Scope of Practice & Compensation Report for the Regulatory Profession was collected though a global survey administered on a secure, independent website in March and April 2010. The survey was open to all professionals involved in the healthcare product regulatory process.

The survey asked respondents a series of questions on topics including education and experience; the type, size and location of their employers; the scope of their professional responsibilities; work environments; supervisory responsibilities; the types of product lines with which they are involved; geographic focus; 2009 compensation, including base salary, bonuses and other cash compensation; and employer-provided benefits. Compensation data could be reported in US dollars, Euros, Canadian dollars, Japanese yen, Chinese yuan renminbi, Korean wan or Australian dollars. Respondents were provided access to a salary conversion calculator if needed. No information identifying individuals or organizations was requested or collected.

The survey instrument was based on versions used for previous North American and European studies, with some new variables added. Every attempt was made to phrase questions and response selections in a manner that was adaptable to professionals located throughout the world.

The survey was announced to RAPS members and others in the global regulatory community directly via email, and indirectly through the RAPS website and other electronic communications and through select organizations representing industry, academia and government. RAC-credentialed professionals were eligible to receive two recertification credits for participating. Those electing to receive the credits were asked for an email address and were then sent a special code to be used when they recertify, indicating their participation in the survey.

Response, Confidence Intervals and Measurement Error

The survey received 3,120 usable responses. A response was considered usable if it included title, scope of practice variables, compensation data and geographic location. Responses that did not include these data elements were not used in the analysis. It was not possible to verify information with respondents. Some responses that appeared to be significantly out of range with other similar respondents were not included in compensation calculations.

Based upon the total number of responses to the survey, the margin of error is estimated to be less than 2% at a confidence level of 95%. The same margin of error and confidence level applies to data from US-based respondents. This means that for overall analyses and for results reported for US-based respondents, one can be 95% confident that the figures in individual data cells are within +/- 2 percentage points of the figures for regulatory professionals fitting similar criteria.

Additional Information

If you have any questions about the data contained in RAPS' 2010 Scope of Practice & Compensation Report for the Regulatory Profession, please contact the Regulatory Affairs Professionals Society at +1 301 770 2920 or by emailing raps@raps.org. A version of this report with expanded salary data is available for purchase from the RAPS bookstore. To order copies of this report, visit RAPS.org/bookstore.

ABOUT RAPS

The Regulatory Affairs Professionals Society (RAPS) is an international membership organization of regulatory professionals in the rapidly growing medical device, pharmaceutical and biotechnology sectors. Regulatory professionals play vital roles in making better healthcare products possible. They work throughout the healthcare product lifecycle, ensuring these products are safe and effective, while driving organizational strategy and sound decision-making. RAPS supports these individuals and the regulatory profession by providing education and training, Regulatory Affairs Certification (RAC), professional standards, research, knowledge-sharing, publications, networking, career development opportunities and other valuable resources; and is committed to helping its members continually develop the knowledge and skills they need to excel. RAPS is headquartered near Washington, DC, with offices in Brussels and Tokyo. RAPS.org

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