EVOLUTION OF THE QUTURE HEALTHCARE ANALYTICS COMPANY
Innovating the Needs of Our Customers

Quture International, Inc. ("Q") is the proven and experienced clinical performance and outcome analytics and solutions company in American healthcare. While we do not enjoy national recognition yet as other analytics companies like Truven, Deloitte's Recombinant, Humedica acquired by UnitedHealth Group's Optum, 3M or IBM, Q has pioneered clinical performance and outcomes measurement using clinical data rather than billing and claims data. Quture's experience and expertise in CLINICAL performance and outcomes measurement and the clinical knowledge SOLUTIONS developed for proactive improvement protocols is extraordinarily different from other healthcare analytics companies. This white paper details how Q has evolved to be perfectly positioned in the emerging value-based purchasing healthcare ecosystem.

Introduction:

Analytics can be the game-changer in health care *if* analytics becomes more than the most recent buzzword. Analytics must focus on measuring performance and outcomes and correlating these measures with cost data, not billing data. Laser focus must be on knowing what to measure, where that data resides in disparate databases as both structured and unstructured data, and what to do with it when analytics translates data to information. The core competence of Quture("Q") is clinical performance enhancement to achieve optimal clinical patient outcomes. Analytics must be designed to enhance performance to achieve optimal outcomes in a value-based framework, not simply collecting data. Analytics products must be designed with the goal clearly and correctly in mind. Analytics is capable of delivering knowledge solutions from Q's **QualOptima System** to be instrumental in the transformation of health and health care – in America and globally. QualOptima is the complete solution to achieve *data-driven solutions for success-driven success*.

Analytics companies are proliferating the healthcare ecosystem. This discussion focuses on how Q evolved to become such an experienced and accomplished clinical analytics company. Q is remarkable and unique because its history evolves from measuring and evaluating CLINICAL data. One of Q's driving principles is to measure clinical data, not billing and administrative data, to correlated quality and patient safety to money. So the Company's history and competence is grounded as one of the few clinical performance and outcomes measurement companies in America. Customers have included hundreds of hospitals,

hospital corporations, medical malpractice insurance companies, physician groups and practices, and governmental entities. The ultimate goal of Q's analytics has been to improve clinical processes by measuring against optimal clinical processes, not variance from the mean. While external peer review is about current clinical competence, the ultimate goal must focus clinical process improvement and patient safety. While compliance is essential, Q's history is built on the foundation of exceeding expectations through innovation and mutual trust.

Healthcare analytics have surged to the forefront of new developments because the health care system is broken. The sad truth is that is in America there is no "system," which is in large measure the problem. This unsustainable model is rooted in both costs and quality of care.

The digital transformation of medicine, health and health care will rapidly change the delivery and payment systems. Health care lobbies, illogical commitment to the status quo, and resistance to change and adoption of innovation will no longer prevail. When it reaches maximum impact in the next 3–5 years, it will have changed medicine the way ATM's changed banking.

Quture Evolved from External Peer Review to Performance Measurement

Q's predecessor companies began external peer review engagements with major hospital corporations and their self-insured trusts in 1984 after years of medico-legal consultations. We were asked by the American College of Obstetricians and Gynecologists to sponsor two major week-long conferences focused on medical malpractice in obstetrics and clinical strategies to reduce bad outcomes in delivering babies in America. We had been consulted in major cases with wide publicity, when malpractice insurance became so expensive and difficult to obtain in obstetrics that it was a national crisis. Our conferences Medico-Legal Dialogues in Obstetrics in San Diego and New York, jointly sponsored with prominent medical and law schools, attracted hundreds of obstetricians, hospital administrators, lawyers and insurance company representatives. Our experience and expertise convinced three (3) of the largest hospital systems in the United States to retain us for external peer review consultations.

We were one of the two original external peer review companies in America (and the other company withdrew after a flawed process caused them to withdraw a report in our second year of operations). When Q's predecessor companies emerged as the leading external peer review company in the United States in the 1980's, hospitals handed paper patient charts to peer review physicians and asked: "Tell us what you think of the care in this case." Chart selection was not a scientific process and highly influenced by political forces within the medical staff or between physicians and nurses.

Peer review was such a flawed process that one landmark antitrust lawsuit Patrick v. Burget et al, by a surgeon against a hospital in Astoria, Oregon, for peer review led to federal legislation to solve problems in the review process. Congress enacting the Health Care Quality Improvement Act of 1986 (HCQIA) and created the National Practitioner Data Bank intended to:

1. reduce the occurrence of medical malpractice;
2. improve the quality of medical care;
3. restrict the incompetent physicians to move from one state to another; and
4. remedy the problems through effective professional peer review.

But peer review remained an unstructured process, extraordinarily subjective, and completely anecdotal. Pattern and trend analysis was non-existent, and the question was always whether the case was one of one or one of several. The challenge was to structure the process and simultaneously integrate objectivity and analytics.

We began by having Dr. Janice J. Ophoven manually read thousands of paper records. Her uncanny ability to read and absorb massive amounts of clinical information and organize that data into clinical insight was the catalyst for us to learn how to identify patterns and trends. Early lessons learned (see Quture: Lessons Learned) taught us that the solution to measuring clinical performance and outcomes was to develop our peer review software product.
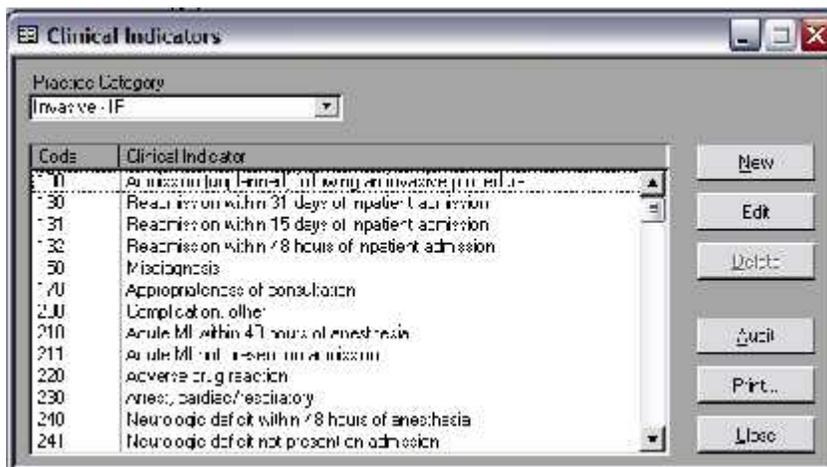
In the mid-1990's, these companies developed the first peer review software product in collaboration with a major medical malpractice company in New York. With software we could structure the process and simultaneously integrate objectivity and analytics and electronically begin to implement electronic pattern and trend analysis.

Identifying Quality Concerns with Clinical Indicators (now "Triggers"):

In the 1990's quality and risk management efforts centered on the selection of cases to screen for potential issues that required review by a physician or practitioner peer. We relied upon multiple sources of expert systems and our own experience to develop the most robust library of clinical indicators that we made available for selection of medical records for performance and outcomes evaluation.

1. Electronic processes with clinical indicators for pattern and trend analysis before focusing on specific perceptions:

We used to describe our consultation engagements as "there's a needle in that haystack, can you find it?" Software design and functionality embedded lessons we had learned in manual processes to standardize optimal evaluation processes. First, clinical indicators and chart selection by the client hospital should not immediately focus on a single physician, potentially singled out for performance deficiencies when other peers may have similar quality and patient safety concerns or where performance is part of a larger cultural issue. Our favorite illustration of this lesson was a gynecologist in a Southern hospital who had cut both an artery and a

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nerve performing a hysterectomy. The department wanted that single physician reviewed, but we began with a systematic review of the entire GYN service.

Our distinguished panel of physician reviewers decided to begin with a review of the Chairman of the department. The first case that hit the table for analysis was a hysterectomy which "fell out" for the clinical indicator excessive blood loss. The case was reviewed internally by the department as "care appropriate". Indeed, there was no problem for blood loss in a hysterectomy with extensive cancer. The reviewers were immediately shocked by a progress note from the chairman of the with such extensive blood loss. The only progress note, the morning following surgery, was printed in all capital, block letters: "FIRST DAY OF DOVE HUNTING SEASON." There were no other progress notes, not even a discharge note. The culture in the department had devolved to a number of quality concerns, including patients who were not seen (or at least without documentation) by their treating physician postoperatively.

Clinical indicators for both inpatient and ambulatory outpatient care are embedded, as used outpatient care by major health maintenance organizations (HMO's) such as Kaiser Permanente.

QualOptima Solution:

QualOptima introduces electronic triggers using machine learning technology to replace the clinical indicator system of case selection. Analytics from electronic technology replaces the limited capabilities of manual use of clinical indicators and electronically imposes triggers to understand patterns and trends and learn from triggers.

2. <u>Case selection should anticipate quality and patient safety concerns not identified by the client as unintended consequences</u>:

Our second embedded lesson focused on case selection with clinical indicators was that perception by the client may not be reality. There may be larger issues, such as the
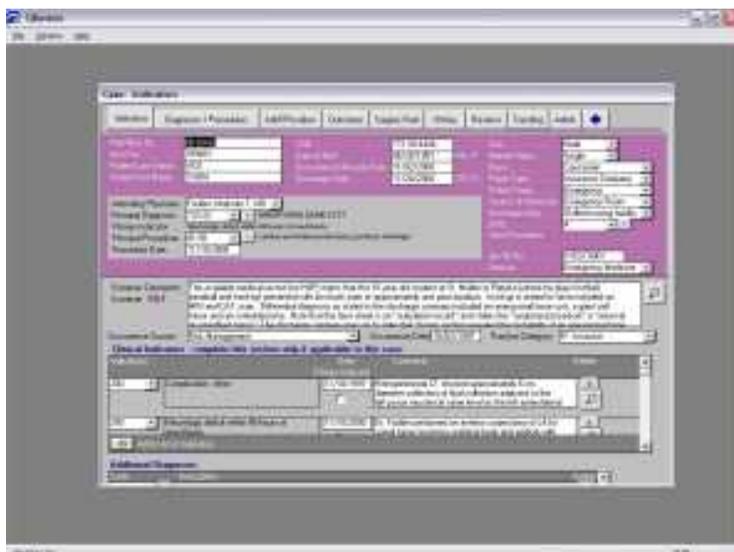
department just described, or where data from case selection can produce evidence of patterns and trends that the quality management department and even the Medical Staff had not recognized. Optimal integration of an electronic system for case selection for screening can identify untended consequences.

We learned in a number of engagements that the perceived problem was not the actual clinical patient care concern. For example, a Medical Staff suspended the clinical privileges of an orthopaedic surgeon because hospital staff

documented post-operative neurological deficits when the surgeon documented none. There were four (4) potential clinical care deficiencies identified for external peer review. Our system of determining patterns and trends identified a fifth: the orthopaedic surgeon never (even in very young patients) operated on a single cervical disk space in spine surgeries but always two (2) or more in every patient. This became such a major violation of the standard of care that it was the focus of action by the Medical Staff rather than their initial perceptions.

3. <u>Systems and clinical processes deficiencies identified in case selection</u>:

We also learned to develop best practice models for each medical specialty and specialty department or multi-disciplinary service. By integrating these evidence-based best practice models into criteria for identifying clinical care quality and patient safety concerns to supplement our clinical indicator system. In an external peer review where the perception was a single anesthesiologist with behavioral concerns (pelvic exams in women with regional blocks), the profound quality and patient safety issues were ultimately determined to be related to how the department compensated its members by the case. Extubation violation of best practices by the anesthesiologists to get to their next patient for compensation was ultimately identified as so significant that the entire contact needed to be changed.

QualOptima Solution:

The Joint Commission no longer requires peer review but has instituted standards for Focused and Ongoing Professional Practice Evaluation (FPPE-OPPE). Peer review is now a tool used in the FPPE processes, and cases for focused peer review are identified through a system of "triggers".

QualOptima now used its extensive system of clinical indicators in natural language processing (NLP) software, which relies on semantic language processing for identified words or word sequencing in narrative text. Rather than use the word drug "overdose" for example, QualOptima searches discharge summaries for the word "Narcan," the drug used to reverse medication overdoses.

QualOptima also uses software technology to machine read and learn, supplementing used of specific word searches with intelligence systems that learn from narrative text machine read. Pattern and trend analysis with QualOptima is no longer anecdotal; machine reading and learning and use of electronic triggers is unique to the QualOptima product. Q has transformed quality and risk management processes to healthcare data science to transform those processes, use staff and resources more meaningfully, and involve volunteer medical staff more meaningfully and engage them in optimal clinical processes to achieve optimal outcomes. If peer review is necessary to validate data analytics or to drill down to identify root causes, case selection and significant data insights are readily available for review.

4. <u>Referral patterns and practitioner relationship to patient care concerns</u>:

We learned that it is essential to distinguish between the roles of physician and practitioners in patient care. Most existing competing software systems for performance and outcomes measurement cannot identify the clinician who is actually involved in the questioned care. If software relies on billing and claims data, the only physician identified for in-patient care
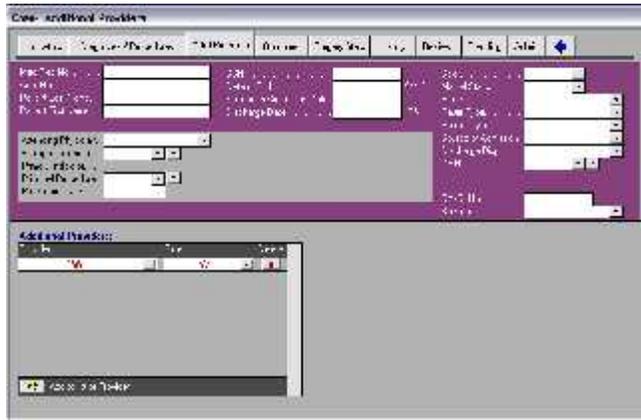
is the "attributed" physician. So we capture the roles of all providers in clinical processes of care.

Not only do we use our system to correctly correlate care to the responsible provider, we collect roles of physician and practitioner for significant relationships. Referral patterns can have unique quality and cost issues, as well as physician selection as assistant surgeons, for example.

Then we carefully select not only the provider involved in the specific quality/patient safety issue but assign a true "peer" from the list of competent peers for review.

We also introduced review of the coordination of care between physicians, practitioners and nurses. One of the major impediments of traditional peer review processes is that nursing peer review is done separately and not integrated into a physician and nursing framework.
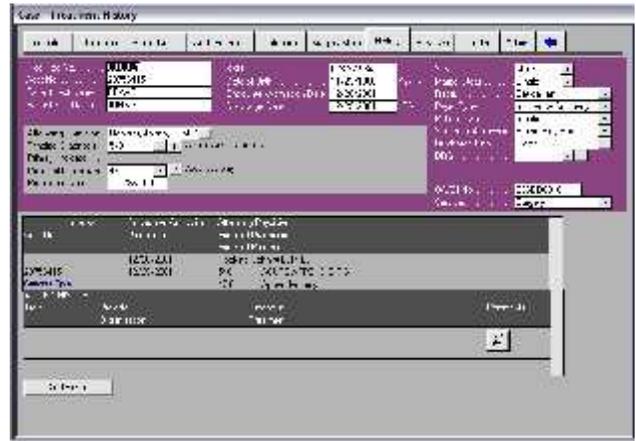
QualOptima Solutions:

Analytics utilize unique algorithms that rely on relationship analysis. The strength of Q and its software is not only knowing what data is significant and where in disparate databases it resides but data relationships for our algorithms and data analytics. Q introduces big data analytics to what was a flawed peer review process. In a healthcare analytics ecosystem of multiple vendors all claiming to derive "actionable insight," Q is significantly different from its lessons learned measuring clinical performance and outcomes for 35+ years. Relationship algorithms are key assets to our intellectual property!

QualOptima integrates performance measurement measuring against optimal nursing care plans with expected outcomes in the format Q learned in our strategic alliance with Excelcare.

5. <u>Significance of longitudinal care with patient history, especially for ambulatory care</u>:

One of the major impediments to health care quality is that frequently treating clinicians do not have access to the longitudinal history of clinical information of the patient. The same impediment is true for measuring performance, because information is not available about the history of care, medications, risk factors, test information, an integrated patient problem list, the whole array of what was known and when it was or should have been known. So we added the ability to enter data as known from other care givers and to integrate historical data if it was done by our client.

Performance and outcomes measurement should not be exclusive to single episodes of care. This lesson is essential to evaluating multiple ER encounters and outpatient episodes of care. The evaluation of what was known and when was it known relies upon longitudinal care insights. Q learned in HMO installations of our software that the most significant data often comes from analysis of patient care across the continuum and not single episodes and encounters. This is particularly true in evaluation of failure or delay to diagnose the patient's condition. The leading cause of medical errors is frequently misunderstood to be medication errors. The most frequent cause of medical errors, and perhaps the least understood and the least focused on is failure or delay to diagnose.
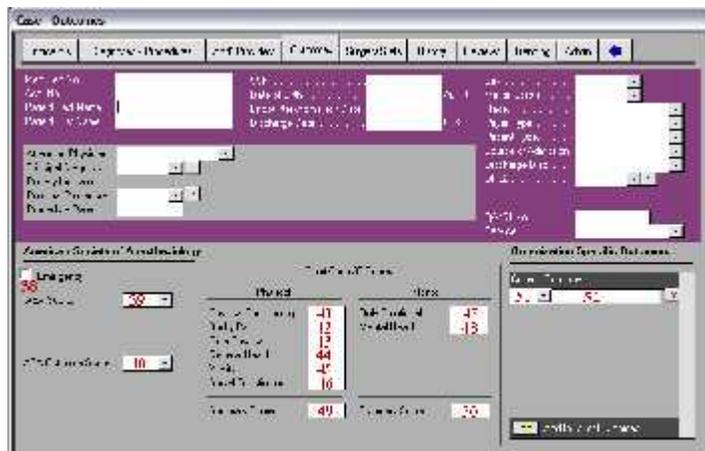
QualOptima Solution:

The QualOptima Connectivity & Analytics system uses the most powerful interface engine available to connect patient care data into the Qualytx database from disparate databases to solve interoperability challenges. The second generation database is designed to collect all patient information in a single common data platform.

6. <u>Independent assessment of perceived quality of care concerns</u>:

Q anticipated that if disciplinary actions were taken resulting in Medical Staff fair hearing proceedings that our methodology would be challenged – especially if indefensible medical care was identified. Rather than defend the indefensible, argue that the process targeted the provider of care. We introduced a series of independent data analytics intelligence systems. For example, in every operative procedure, anesthesia uses a system of measurements of patient condition pre-operatively to quantify the health status of the patient, called the ASA (American Society of Anesthesiologists) score. We capture that score pre-operatively as well as post-operatively.

By comparing those scores, with health pre-operative patients scored from 1 – 4 with patients not healthy post-operatively 7 – 9 or death 10, we independently identify patterns of quality and outcomes concerns that require further analytics. We also began to integrate outcomes measurement with performance measurement back in the 1990's. The relationship of outcomes to performance metrics is one of the extraordinary intellectual property assets of Q analytics.

QualOptima Solution:

Transformation of the peer review process to become performance and outcomes measurement required introduction of health data science for analytics on databases populated with extensive and strategically mapped clinical data. Rather than rely on manual case selection processes for peer review, Q has pioneered analytics on massive databases of strategic clinical informatics using precise performance and outcomes metrics developed from evidence-based best practices.

7. <u>Integrate data existing in disparate databases electronically</u>:

While doing a routine external peer review involving surgery at a hospital in Texas, we were asked the question that is always asked about surgeons: "what are his operative times?" We were about to pull a thousand charts and abstract operative times, when the OR supervisor informed us we could use their surgical scheduling software and electronically collect that data quickly for not only the involved surgeon but with comparative data from all surgeons doing the same surgical procedures. So we developed the software database to upload data captured from other vendor systems into our database.
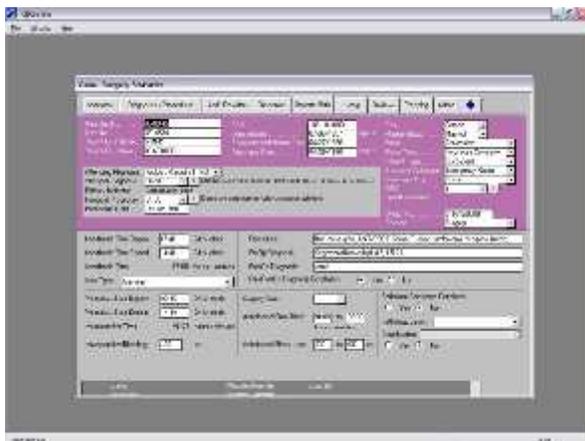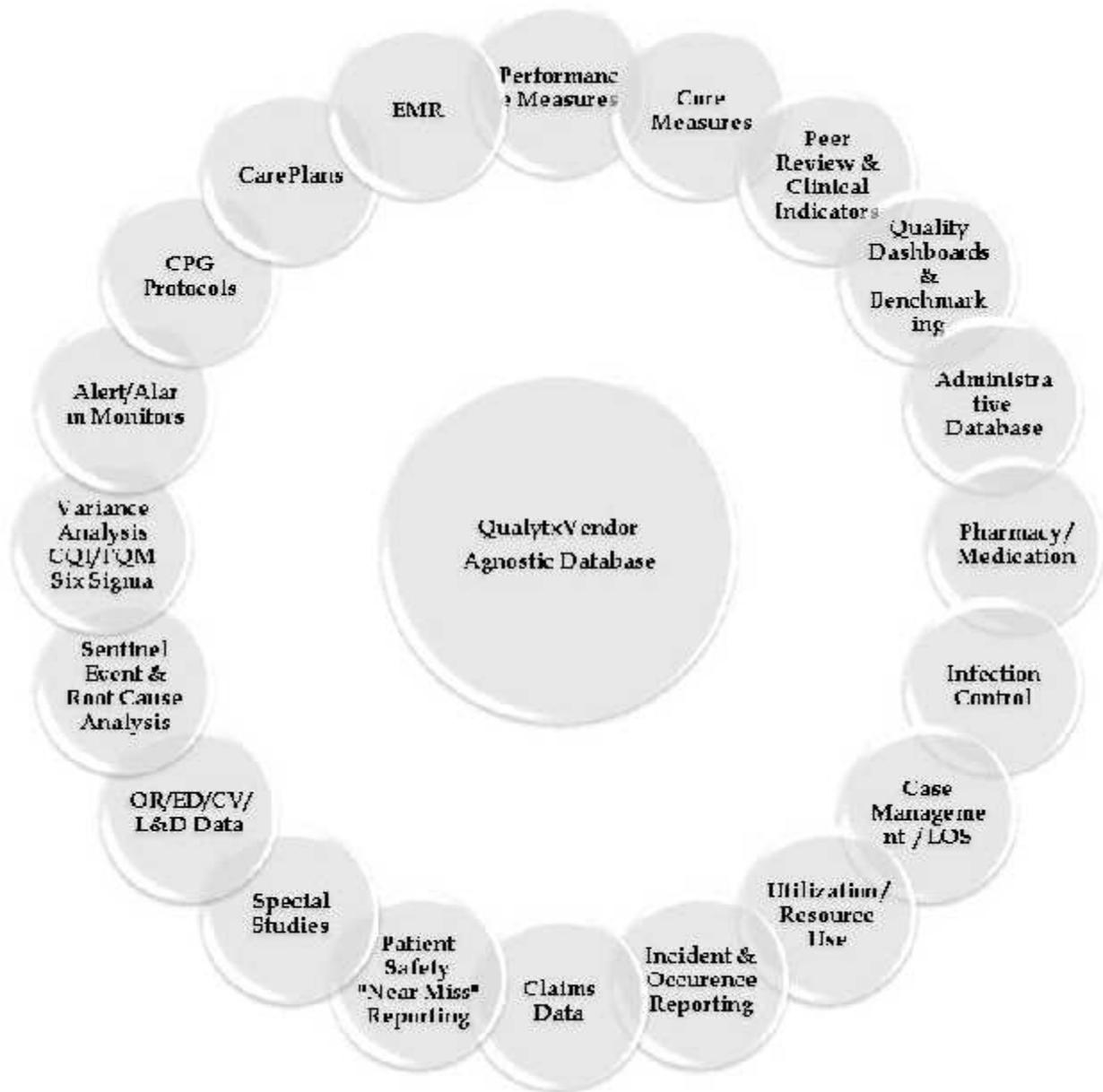

Our original systems required intermediate steps, like creating Excel spread sheets, but it was quick, simple and complete. This allowed us to run regression curves to see if new surgical procedure operative times came down with experience and plateaued at an expected level. We learned the value of data that existed in disparate databases, and we wanted to find technology that would allow us to integrate clinical data. We began to learn what data collection was possible to collect, integrate into our processes, and transform manual peer review to electronic data collection, aggregation, integration, and analytics. We devised and continue to refine our schema of available data in disparate vendor databases.

QualOptima Solution:

The impetus for migrating the former software onto the InterSystems platform was to take advantage of the Ensemble interface engine that now populates our Qualytx database programmed in the Cache database. This strategic technology platform now takes advantage of all the components that power the QualOptima clinical intelligence system.
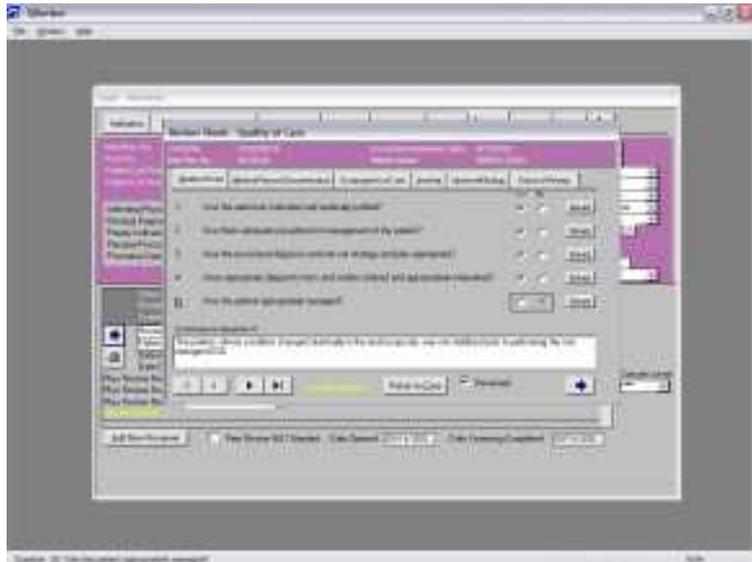
Performance Measures

EMR

Core Measures

CarePlans

Peer Review & Clinical Indicators

CPG Protocols

Quality Dashboards & Benchmarking

Alert/Alarm Monitors

Administrative Database

Variance Analysis CQI/TQM Six Sigma

QualytxVendor Agnostic Database

Pharmacy/ Medication

Sentinel Event & Root Cause Analysis

Infection Control

OR/ED/CV/ L&D Data

Case Management / LOS

Special Studies

Utilization/ Resource Use

Patient Safety "Near Miss" Reporting

Claims Data

Incident & Occurence Reporting

8. <u>Evaluate all patient care, not only the concern identified by the clinical indicator</u>:

All too frequently, physician assessment is limited to the indicator which identified the case. A standardized methodology eliminated this illogical limitation. Once a case is identified for review, the case should be evaluated in the total context of the entire clinical processes of care and not restricted to the indicator. The resources to present this opportunity for medical record review by a peer physician should be maximized. More importantly, the case should not be reported as care appropriate if the record demonstrates inappropriate care or an opportunity to improve care. Recalling the GYN case with the first day of dove hunting season physician note, the indicator was excessive blood loss. There was a major deviation of care, and reporting this case as care appropriate was not acceptable.

9. Introduction of quality of care question sets:

Retrospective chart review is also compromised by the inherent difficulties in distinguishing documentation deficiencies from deficiencies in substantive patient care concerns. The standardized methodology should include a mechanism to consider documentation deficiencies separately and yet within the context of the review for substantive care issues.

Dr. Janice J. Ophoven introduced quality of care question sets long before we developed the peer review software product. First, it imposed a standardized and structure process for every case peer reviewed. Second, it gave us the tool to develop specialty-specific questions that track evidence-based clinical processes – long before others were using evidence-based analytics. And the emphasis on optimal clinical processes for performance measurement transitioned us into what is now our expertise in engineered processes. This clinical process orientation was consistent with the quality processes introduced by Dr. Donald Berwick as the Institute for Healthcare Improvement began to measure variance from processes rather than focusing on individual performance. And the use of failure mode and effect analysis (FEMA) methodology into our clinical processes design was the tool we learned from quality management engineered into manufacturing companies.

10. Performance measurement with precise numerator and denominator metrics:

We changed peer review in America with our structured quality of care question sets. That methodology has now been adopted in other peer review software products and by external consulting companies. But it was still implicit review, not explicit review as recommended by RAND. We were moving to introduce clinical performance measurement against evidence-based optimal clinical processes. And Dr. Ophoven had transitioned us away from measuring variance against the mean, established by the IHI, because that method simply perpetuated mediocrity rather than establishing optimal evidence-based clinical processes and measuring against those metrics.

We no longer focus on peer review, as a product or a service. Peer review is now a drill-down tool in performance measurement methodology, and that is Q's integration of those processes. We still take qualified external peer review engagements, but review performance data with analytics and then case review as indicated. Even though we have the peer review product in our QualOptima software, that functionality should no longer be a stand-alone software product in our opinion. It is essential for our software customers

and QualVal Solutions consultation clients to transition from subjective implicit review to clinical performance measurement explicit review. Q and QualOptima has also transitioned to performance and outcomes analytics implementing precise numerator and denominator metrics established by evidence-based optimal processes of care.

We learned how to make this transition and to introduce structured, explicit clinical performance in health care for the first time in 2001. We were selected by the New York State Attorney General (NYSAG) through competitive bidding to develop evidence for a trial in Federal Court. The NYSAG was defending Governor Pataki and legal entities of New York State in litigation by more than 1700 HIV/AIDS infected prisoners in 70 some prisons in New York State for inadequate care. We were able to use an evidence-based guideline of the New York AIDS Institute with specific metrics at 27 points along an optimal evidence-based care process to explicitly measure clinical performance of care by the interdisciplinary

teams. We then compared this performance with care in the public sector. The metrics were specific down to the gender of the patient as a risk factor for measuring performance.

Data abstraction was manual from hundreds of thousands of pages of medical records delivered in 17 banker boxes of charts. The Excel spreadsheet covered an entire wall, but it permitted comparisons of care between prison HIV/AIDS patients with patient care in the private sector. We learned how to transition to clinical performance measurement if we could engineer software that could collect data electronically from existing clinical data sources.

QualOptima Solution:

With the proliferation of electronic medical records (EMR) largely funded by the HITECH Act, the digital data fields are now available for data collection. HL7 international standards provide access using the QualOptima interface engine API connectors. Structured data from drop-down lists is estimated to provide only 15% of clinical data in digital records. The QualOptima machine reading and learning software collects unstructured performance and outcomes metrics from narrative text.

Q embeds its extensive clinical content, with defined specialty-specific numerators and denominators into QualOptima's intelligence system for its proprietary analytics anticipating the needs of each constituent in the organization. The threshold minimum data for

collection begins with the performance measures portfolio now published by organized medicine, which includes:

- Measurement sets in 47 clinical areas and preventive care
- More than 300 individual measures
- Clinically relevant means for tracking variations in care

Q supplements these measure sets through our QualPRO panels and experience and expertise in performance and outcomes metrics with additional measures for selection by our customers. Q's Clinical Metrics Library enables the organization and its clinicians to select the performance and outcomes measures by medical specialty or clinical service.

11. <u>Root cause analysis to identify potential solutions to performance & outcomes deficiencies</u>:

We learned in the 90's that if we did not evaluate the root causes of sub-optimal outcomes, we could never understand how to correct clinical processes or structure mandatory proactive protocols if the problem involved individual physicians and practitioners or even groups or departments.

We worked with the American Society of Anesthesiologists (ASA), who had published a peer review manual, and worked with the author on their root causes framework. ASA had the basic framework that Q modified with our physician experts to very basic root cause analysis.

Q was already different from other analytics companies through our evolution. We were always engaged to solve sub-optimal clinical outcomes problems. Identifying root causes has been essential to our performance measurement methodologies and software technology solutions. Analytics companies focus on data; Q analytics are laser focused on clinical knowledge solutions.

QualOptima Solution:

PERFORMANCE QUALITY ELEMENTS GRID

Q has worked with all the major root cause taxonomies, particularly the Australian taxonomy referenced in IOM To Err is Human. Now that the Joint Commission specifies a framework for performance measurement, it is easy for us to make minor changes to move our basic framework into the ACGME six areas of competencies: Patient Care, Medical & Clinical Knowledge, Practice Based Learning

& Improvement (judgment is inherent in all three (3) of these competencies), Interpersonal Skills and Communication, Professionalism, and Systems-Based Practice.

12. Data display, data visualization and infographics for actionable insight:

Analytics processes and technology are no better than the information they convey to users and decision-makers. Data visualization and infographics have become essential elements for analytics companies.

Early in our evolution, we discovered data display methods that are unique to Q. In peer review, we learned to display peer review results combining quality of care question sets for display of sub-optimal clinical performance with root cause data in our physician-specific data matrix.

The Q matrix data display shows whether the clinical performance concerns are in one or several categories, and whether those are caused by judgment, technical or vigilance root causes. If the problems with patient care are in a single category and from vigilance causes, for example, those lend themselves to proactive protocols to monitor and even mentor quality of care improvement. However, if the problems are in all seven (7) quality areas and caused by flawed judgment, it is virtually impossible to develop improvement and monitoring protocols in community-based hospitals.
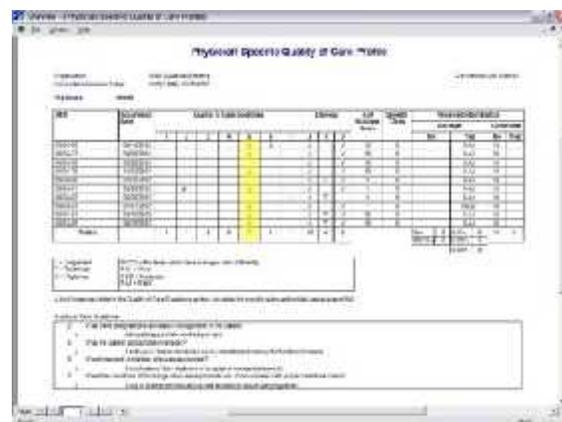
Q has evolved by taking advantage of research discoveries that we could apply to our review processes. An example is performance deficiencies in the framework of overuse, underuse, and misuse developed by the Institute of Medicine. Our peer review technology has used this framework using embedded analytics running in the background. As we move to value-based purchasing and metrics directed at this framework, such as Use of Performance Measures to Decrease Low-Value Services and Achieve Cost-Conscious Care published as part of the American College of Physicians' High-Value Care Initiative.

Overuse was the focus back in 2006 by the National Committee on Quality Assurance performance criteria for overuse of spine imaging and the subsequent work by the National Priorities Partnership to reduce overuse. Q has consistently introduced advances in metrics and display of data for quick reference in dashboards and understanding for proactive protocol performance and outcomes improvement strategies.
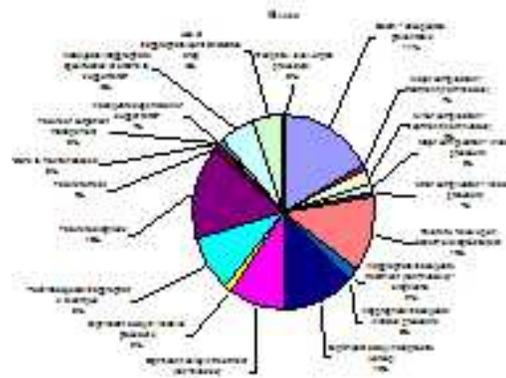
While even the Institute of Medicine states that little is known about misuse, Q has more

experience with misuse in performance and outcomes than any other analytics company. And Q knows what to do with that data for clinical knowledge solutions.

QualOptima Solutions:

Data display, visualization and infographics are embedded for customer selection of desired displays using the DeepSee analytics platform of InterSystems. Dashboards and data graphics models are embedded in QualOptima, and the data relationships of Q differentiate our software evolving from our experience and expertise from hundreds of performance and outcomes measurement engagements.

Known significance of multiple data relationships is a fundamental strength of Q and is the embedded analytics science embedded in QualOptima implementing our algorithms.

13. <u>Risk adjustment for severity of illness to analyze outcomes factored by the patients' medical condition</u>:

We always used billing codes in our peer review processes and collected them in the software for several purposes. In order to evaluate outcomes of medical care, the overall condition of the patient must be factored into the equation. The risks of complications are greater in sicker patients, so determination of complexity of additional illness to the primary condition under treatment is essential. That determination is traditionally done using "risk adjustment" formulas using billing codes to identify all patient conditions putting the patient at greater risk of complications from their care.

A QualVal consultation assignment in New York State demonstrates the limitations in analytics using claims databases and how Q uses billing codes. Our client reported a series of 30 medical records for 7 patients with a retroperitoneal hematoma complicating anterior and posterior spine surgery with instrumentation. In response to two formal letters from the Chairman of Surgery to the spine surgeon, the involved physician had reported that this was a known complication with a similar

incidence or this complication based on discussions with the inventor of the instrumentation he was using.
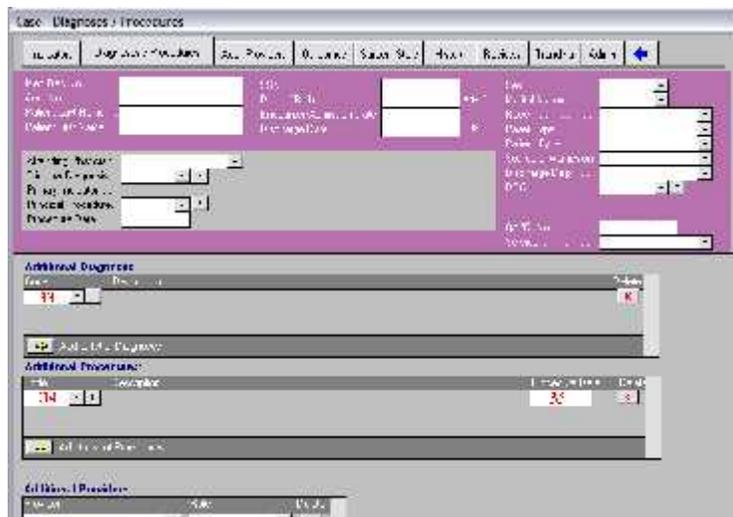
Immediately after meetings in New York, Q used the New York State SPARCS database to recognize that there were probably 27 patients with this complication. The orthopaedic spine surgeon reported a complication rate (over a 3 year period) of 3.2% limited to the retroperitoneal hematoma. Q's peer review consultation independently used specific billing

codes involved for payment were to identify probable cases with the retroperitoneal hematoma complication:

- 81.04 – anterior dorsal (thoracic) fusion
- 81.05 – posterior dorsal (thoracic) fusion
- 81.06 – anterior lumbar fusion
- 81.08 – posterior lumbar fusion

Complication rates of combined anterior and posterior spinal fusions have been reported to occur in 22% to 82% of patients. Perioperative complications were seen in 53% of the cases, with major complications limited to 27% of cases in medical literature. However, only one large hematoma was reported as a complication of this procedure. Q used billing codes to analyze complication rates for a retroperitoneal hematoma at the hospital client:

- 998.12 – hematoma complicating procedure
- 998.13 – seroma complicating procedure
- 54.19 – drainage of hematoma

Using these combinations of codes, QualVal was able to identify medical records with the retroperitoneal hematoma complicating the anterior and posterior spinal fusion surgeries. The complication codes were also used to identify three other cases with laceration of a blood vessel in attempting to solve the root cause of an unreported complication in the medical literature. If Q had relied upon these codes to identify the retroperitoneal complication at this hospital, we would have incorrectly concluded that there were over 60 cases with this complication. Upon examination by peer review, we determined that this number was incorrect by 45%. This percentage of incorrect data analytics for complication rates corresponds with extensive literature by experts in this field such as Lisa Iezzoni, M.D. of Harvard.

QualOptima Solution:

QualOptima uses risk factors directly related to the performance and outcomes measure sets. Patient risk stratification is essential when outcomes are measured, because those factors impact outcomes and must be taken into consideration. When reviewing suboptimal care, the response that "my patients are sicker" must be taken into careful consideration, and QualOptima does not "risk adjust," as competing products function; QualOptima is patient-specific for risk factors.

The power of this clinical intelligence platform is created by the strategic structure of the data elements collected and the relationships of those elements. Data collection is patient-specific and includes the risk factors of those patients, which is essential to measuring clinical performance that relates to those risks which are known and recognized as clinically significant in patient management. Q's clinical content of performance metrics and outcomes measures based on national and international optimal clinical processes is the strategic clinical intelligence system embedded in QualOptima.

QualOptima Patented Analytics System
For Clinical Performance and Outcomes Measurement

14. Analytics Using Search functionality:

One major lesson we learned from the value and use of analytics came from putting peer review data into a searchable database. Fixed reports rely on programmed data fields, and often there are unique data relationships that we wanted to explore and for our customers to explore rather than pay us to develop customized reports.

So we developed what we called "Key Characteristics" to perform analytics on up to combinations of five (5) data points. We believe this was the first software in healthcare peer review to offer true analytics functionality.
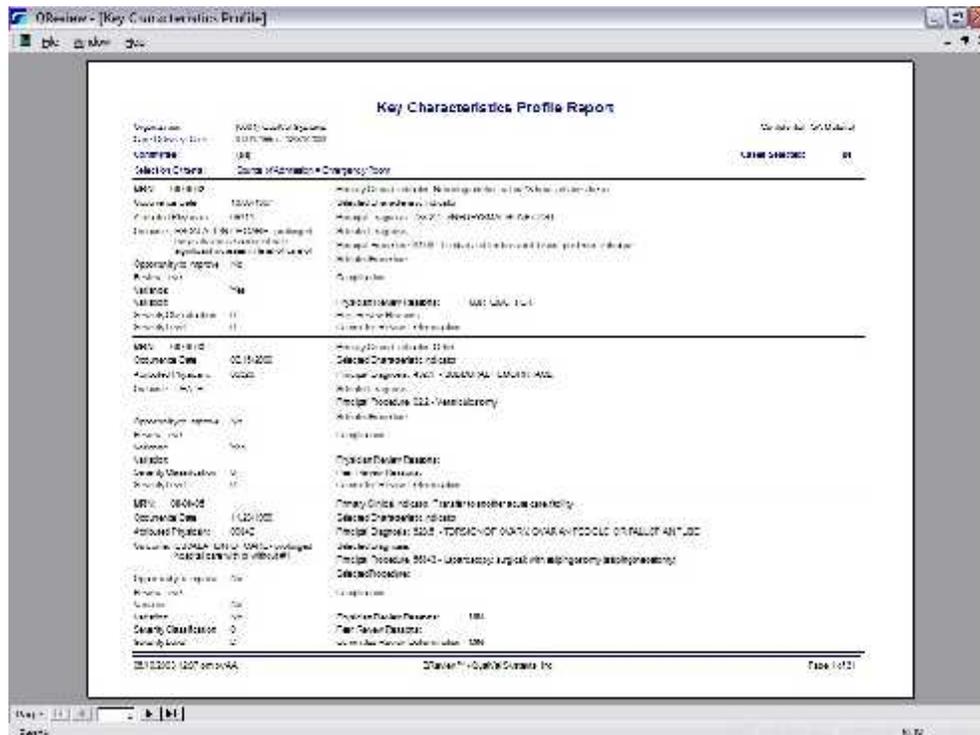
QualOptima Solution:

Q's analytics are now completely flexible with both structured data relationships from algorithms, with the user free to select multiple data points for drag-and-drop functionality.

Combined with machine learning, QualOptima leverages our lessons learned for what our customers need, not only for performance and outcomes measurement but for enterprise management. The common database across the enterprise gives access to clinical data for the total array of users and for all constituents in health and health care.

15. <u>Q's Analytics Intelligence System:</u>

Q's peer review software had a report writer that used our analytics system to derive insight from the data collected in the system. Our reports, as illustrated above for data display, were and remain unique and demonstrated our insights to data relationships. In addition to our reports, the search functionality discussed above provided the ability to work in our software without having to rely on reporting software such as Crystal Reports.

But the strengths of our analytics was in the topics already discussed, such as using clinical indicators, collecting data based on quality of care question sets and using root cause analysis. We were working in clinical data requiring extensive manual data abstraction. Our efforts to capture electronic data for demographics and surgical statistics taught us that the future of performance and outcomes analytics must rely on an interface engine to collect existing data from multiple vendor databases.

Our manual data abstraction also taught us that most of the really valuable performance and outcomes data resides in narrative text. Systems that do not machine read and learn are of limited value and potentially inaccurate and misleading.

We also learned that risk factors must specifically relate to the known evidence-based risk factors rather than existing and seriously flawed risk adjustment systems. And as patient-centered, personalized and individualized care becomes significant in the wellness and fitness movement, fitness factors should be integrated into analytics to prevent inaccurate information about overuse, underuse and misuse. This is becoming even more significant

Finally, as experts in the relationships between quality and cost for value analytics, we were driven by the focus on competitors focused on increasing revenue with systems directed toward "optimizing billing" and revenue cycle management. The future of healthcare analytics will focus on value, not volume, on outcomes not billing codes. And we recognized that all stakeholders in the health and healthcare enterprise will make decisions in the future based on data analytics, especially as data reporting becomes more and more transparent.

QualOptima Solution:

Our experience, expertise and intellectual property defines our assets for healthcare analytics because we know what to measure, where that data resides, significant clinical relationships for our algorithms, and what to do with actionable insight for clinical knowledge solutions.

QualOptima's data model structure, collection, aggregation and integration into our second-generation database is the transformative tool for healthcare analytics.
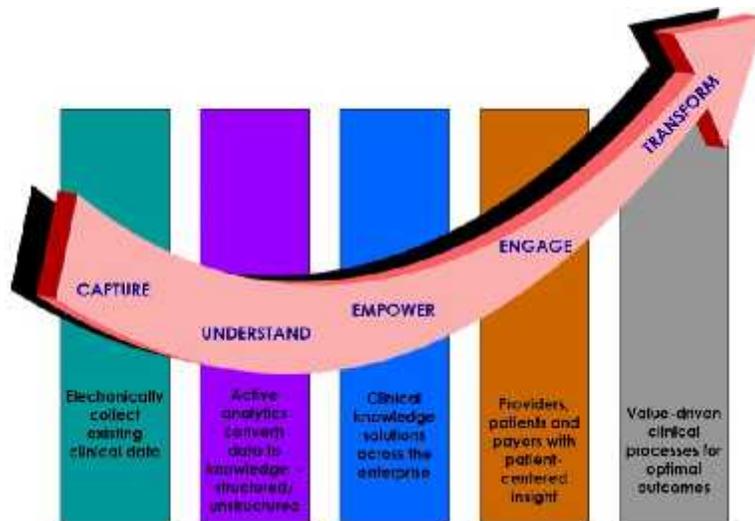
Triggers, using performance and outcomes metrics, remain a core competence of Q from years of developing its lexicon of clinical indicators of potentially significant occurrences. QualOptima technology machine reads narrative text of history & physical examinations, discharge summaries, operative reports, pathology and radiology reports and other digital text, such as infection control, occurrence/events reports, patient satisfaction or even committee minutes to identify potential patterns or single occurrences, such as never events. The natural language processing (NLP) tools of Q transform medical record abstraction to electronic data capture and integration into the second-generation database. This technology not only machine reads but adds the ability to learn and to create categories of potentially significant data findings not specifically programmed into the triggers lexicon. Trigger analysis alone is significant for identification of potentially significant performance monitoring, but these triggers are integrated into case identification and selection for the peer review application in the software.

Outcomes measurement is more complex than measuring performance because it must factor in major influential factors, such as the condition of the patient (co-morbidities), other care givers, and compliance by the patient. Also, there are different ways to measure outcomes, such as clinical perhaps including financial considerations, or patient satisfaction, or combinations of measures. But results-driven care is the ultimate goal of health care.

The ultimate value of healthcare analytics and achieving the potential of QualOptima will expand upon predictive modeling, real-time data collection and analytics, and development of clinical decision support tools from the experience-based insights replacing evidence-based processes and metrics.

Quture Positioned for Value-Driven Healthcare Analytics

Q's core competence and value proposition lies in its embedded evidence-based metrics, clinical content and analytic algorithms developed from over 35 years of measuring performance in hundreds of hospitals, physician organizations and HMO's.

Q's first-to-market clinical intelligence software is the complete solution for healthcare providers, payers, employers, and insurance companies seeking to achieve optimal clinical, financial and operational outcomes.

Q's QualOptima Connectivity & Analytics System empowers value-driven, patient-centered, personalized care focused on real-time and predictive patient management and patient safety, with optimal quality demonstrated by outcomes correlated with resource use and cost.

As the free enterprise solution to improving health and healthcare while reducing costs, Q is positioned through its disruptive technology to become the foremost global provider of value-based clinical intelligence and knowledge solutions.

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