



Quality Core Groups & IT Initiatives Support Evidenced-Based Medicine & Best Practices



Aurora Health Care

Aurora Health Care Highlights

Quality Core Groups Drive Improvement Cycles. Aurora's quality core groups ensure research and outcomes results are put into action as best practices at the heart centers. Through quality improvement initiatives, Aurora has cut post-op sternal wound infection in half, improved average door-to-balloon time by 43%, decreased blood utilization by 50%, and much more.

Multi-City, Multi-Hospital Data Integration. Aurora integrates data from several hospitals in the Aurora System, utilizing interfaces to connect hospital information systems and medical devices to the central database. Data integration allows physicians to access patient reports through the Cerner patient documentation system, and enables quality managers to analyze data from each of the different sites.

Intelligent, Workflow-Focused Deployment. Aurora rolls out each solution in stages, thoughtfully implementing each piece of the CVIS for smooth implementation across campuses. Solutions can be built upon in the future, such as the addition of wireless tablet technology planned for this year.

“Searching the literature, looking for best practices, implementing, and tracking results make Apollo so much more than a traditional documentation system.”

Mia Stone
Cardiac Program Manager
Aurora Health Care

Aurora Health Care System is a not-for-profit Wisconsin health care provider and a nationally recognized leader in improving quality health care to its patients. Aurora is comprised of 14 hospitals, 80 Clinics, and over 100 pharmacies. Of those, five hospitals are located in the Metro Region of the Aurora Health Care system. Currently, three hospitals submit data to the ACC and STS registries: St. Luke's Medical Center (SLMC), Aurora Sinai Medical Center, and Aurora BayCare Medical Center.

Aurora Health Care uses data integration to help implement new technology, research, and operational best practices. Aurora's success in implementing best practices stems from an internal structure in which *quality core groups*, quality managers, and IT teams work together to gather data, recommend changes, implement changes, and monitor the success of quality improvement efforts. This structure ensures that when the data or literature suggests a change, Aurora can implement it in days or months—not decades.

great applications

BUILDING CARDIOLOGY CENTERS OF EXCELLENCE

Aurora's quality improvement efforts span the CV service line. Aurora has used ACC and clinical trial data to successfully:

- Improve clinical quality to reduce hematoma rates
- Identify ways to reduce renal complications
- Standardize procedures for sheath removal and patch use
- Reduce door-to-balloon times from 120 to 68 minutes
- Establish best practices in the use of IIB/IIIA therapy
- Understand and standardize the best combination drug therapy for specific patient populations and procedures
- Improve mortality rates

Aurora has used its STS data to decrease length-of-stay, post-op atrial fib, renal complications, and neural deficits by:

- Creating tighter glucose treatment and therapeutic antibiotic dosing protocols to reduce post-op infection
- Evaluating hydration therapies intra-op and post-op, and using drug therapy to reduce renal complications
- Reducing blood utilization to meet national levels
- Implementing pre-op atrial fib prophylaxis protocols
- Using of cerebral oximetry intra-op for CABG surgery

ST LUKE'S MEDICAL CENTER

Tertiary Access for Aurora Health Care

- 3rd in Nation for Volume of Angioplasties
- 5th in Nation for Volume of Heart Surgeries
- 7th in Nation for Volume of Bypass Surgeries
- Top 10 in Nation for Volume of Heart Transplants
- Top 10 in Nation for Volumes of Interventions
- Best One Year Survival for Heart Transplants among High Volume Heart Centers
- 711 Licensed Beds
- 3,600 Angioplasties in 2003
- 12,000 Heart Catheterizations in 2003
- 1,400 Bypass Surgeries in 2003
- 407 Ablations, 300 ICD Implants, & 421 EP Studies in 2003
- 8,850 ECG in 2003
- 80 Interventional Cardiologists on Staff
- 9 Cardiovascular Surgeons on Active Staff
- 14 Hospitals
- 80 Clinics
- 100 Pharmacies
- 3 Hospitals Submit Data to ACC & STS — St. Luke's, Aurora Sinai, and Aurora BayCare

Plan, Do, Study, Act Methodology

At Aurora Health Care quality teams play a critical role driving improvement initiatives. Cardiac Program Manager Mia Stone explains, "Our dedicated quality core teams are comprised of physicians who provide care directly for the patient population. At these quality improvement meetings we look at patient outcomes, as well as the flow process of the patient, patient satisfaction, and any other factors that can improve care and outcomes for the patient population."

Core groups follow a *Plan, Do, Study, Act* methodology in which the group identifies the problem to be investigated, implements a change, studies the outcomes from the change, and uses the results to determine future steps.

SLMC has two dedicated quality core workgroups for CABG and cardiac interventions. These workgroups are multidisciplinary in membership and involve representation from all areas that care for the patient as well as a physician champion. They meet every two weeks to discuss improvement strategies for patient clinical outcomes, process and flow through the institution, patient satisfaction, and cost-saving strategies. From the CABG Workgroup a subgroup was formed to specifically look for improvements intra-operatively using the Perfusion Module of Apollo. These core workgroups have accomplished numerous improvements, which are shared and celebrated with the physicians and staff.

CV Surgery Core Group Drives Improvement

In 1997 Aurora created its first quality core group in cardiovascular surgery. Since inception, the CV Surgery Core Workgroup has looked at a number of quality improvement strategies.

“We use our STS information to do a logistic regression analysis on factors relating to longer lengths of stay,” says Mia. “Then we take each and every one of those factors, such as atrial fib, renal complications, neural deficits, and come up with action and improvement plans for each area identified.”

Sternal Wound Infections Cut in Half

According to Mia, “Research has shown the importance of glucose control on sternal wound infection and other complications. For example, for sternal wound infection, we know that patients with high glucose levels post-op have a higher infection rate. This is supported in the literature for any type of surgery.

“So we did a PDSA cycle to tighten glucose control in CV surgery. First we looked at the research published and then at other heart center’s best prac-

Improving Care & Outcomes in Cardiac Surgery

Aim: Reduce sternal wound infection by 25%

Background

- Preoperative antibiotic administration reduces the risk of postoperative infection 5-fold
- Efficacy is dependent on adequate drug tissue levels before microbial exposure
- Cefazolin and cefuroxime are currently the agents of choice
- These agents have short half-lives (cefazolin 1.4 hours, cefuroxime 1.3 hours) and should be readministered every 3 hours during surgery for optimal benefit
- Vancomycin 500mg should be given at 3 hours and as needed based on patient's renal function
- A one-day course of intravenous antimicrobials is as effective at 48 hours or more

Plan

- Ensure redosing of antibiotic after 3 hours during surgery

Do

- Encourage increased utilization of intraoperative antibiotics 3 hours after pre-operative dose and every 3 hours during surgery (cephalosporins)
- Pharmacy to place label on plastic bag containing antibiotics so that physician can be reminded Q3 hours of antibiotic dose
- Remind physician to document antibiotic administration in the antibiotic portion on the surgery notes

Study

- Sternal wound infection rates decreased

Act

- Data shared with the CV Surgery and Anesthesiology departments, and CV Core Workgroup
- Data monitored to hold the gains
- Improved glucose control and nasal bactroban improvement cycles implemented near the same time frame

tices. We revamped all of our protocols to tighten glucose control post-op.”

Another area that the CV Surgery Core Workgroup researched was the dosing of antibiotics—when the appropriate dose should be administered both inter-op and post-op. “We looked at surgeries over six hours long, and found that the evidence shows that if you give an antibiotic at the start of the case it does not provide enough coverage until the end. So we started re-dosing after three hours, which has been shown in the literature to decrease infection. Once we implemented this change, we actually cut our post-op sternal wound infection in half. For us this was a major improvement,” say Mia.

Average Door-to-Balloon Time Improved by 43%

On March 15, 2004, St. Luke's became the first hospital in the country to have a cardiologist and cath lab team in house, 24 hours a day, 7 days a week. Since implementation, St. Luke's has improved their average door-to-balloon time to 68 minutes—a 43% improvement and well below the national average. “We are very excited by these outcomes,” says Mia. St. Luke's has tracked their outstanding results through the Apollo Advance ACC Module. According to Data Management Coordinator of Cardiac Services Kristen Dwyer, RN, BSN, “Every time we add a new technique, such as the 24/7 cardiology team, we watch our data very carefully to see the impact.”

Blood Utilization Reduced by Almost Half with No Increase in Complications

Using the STS registry, Aurora found that they were using blood at a much higher rate than the national average. According to Mia, “The literature supports that patients who get a lot of blood have higher complications. Patients with a hematocrit of 25 do fine, and can be discharged home, without additional blood. Yet our blood utilization rate was higher than the STS national average. To find

Improving Care & Outcomes in Cardiac Surgery

Aim: Reduce LOS and blood utilization post-CABG by 25%

Background

- Blood transfusion increases the risks of post-op complications
- Significant differences in blood utilization exist between surgeons and anesthesiologists
- Plavix is given routinely pre-PCI procedure
- Baseline standard of practice is for transfusion trigger to be at 30

Plan

- Instituted Blood Order Sheet
- Transfusion trigger changed to 25
- Blood conservation education
- Collaborative work with department of cardiology on timing of Plavix loading before angioplasty
- Collaborative work with department of cardiology on admitting more patients elective for CABG

Do

- Blood order sheet with indications implemented by October 2003
- Physician education was provided by speakers from blood conservation programs nationwide
- Discharge criteria for elective CABG is a work in progress.

Study

- From October to June 2004, blood utilization was decreased by 50%

Act

- Data shared with CV Surgery and Anesthesiology departments, Blood Center, and CV Core Workgroup. Blood Order Sheet under evaluation for all surgeries.

out why we were giving so much blood, we looked at our current practices and found that our trigger to give blood was much higher than what was occurring nationally. So we created a Blood Order Sheet that requires physicians to document not only what type of blood product is given, but also the reason for giving it. And that in and of itself caused physicians to sit back and think, 'Why am I giving this?' We have decreased our blood utilization—practically cut it in half—as a result. We have had no increase in complications, length of stay, or readmission.”

Complications & Costs Reduced by Documenting True Outcomes of Sheath Removal Patch

While Kristen was working with the quality management nurse and physicians for cardiac services, she was asked, “Are we having more problems with groin complications when sheaths are removed?” Kristen was able to pull the data to see the trends in complications. She noticed that in less than a quarter cath lab complications had spiked up. While the staff had noticed something was going on when they entered the data, it wasn't apparent until the trends and a large enough sample size were analyzed. “We were able to identify the patients with complications and did a medical record review. We narrowed the cause down to a closure patch that was not being used correctly on our post-angioplasty patients. In the process of the investigation we found that this patch wasn't appropriate for our interventional patients based on trends in outcomes, complications, and costs. We discontinued the patch, and now our complication rate is back down to where it was.”

In addition to increasing complications, the patch was also a significant cost to the heart center. Aurora had originally budgeted \$30,000 per month so each patient could receive a patch. In cases where the first patch didn't work, patients would be given more patches, resulting in lost charges on the

Improving Care & Outcomes in Cardiac Surgery

Aim: Reduce neurological complications and decrease length of stay for CV surgery patients by 25%

Background

- Neurological changes and permanent stroke after open-heart surgery remain one of the most devastating and exhaustive complications that burden the recovery of the CV surgery patients
- Transient stroke defined by STS as RIND present for 72 hours or TIA for 24 hours. This includes patients with encephalopathy
- One strategy to decrease neurological complications is to increase the utilization of cerebral oximetry during surgery so that the OR heart team may intervene for optimal brain oxygenation

Plan

- Increase availability of intraoperative cerebral oximetry during heart cases
- Define interventions for occurrence of low cerebral oximeter readings
- Define outcomes assessed to evaluate cerebral oximeter

Do

- Compare concurrent group of patients using cerebral oximetry with previous group of patients not on cerebral oximetry
- Compare the following data points: LOS and Neurological complications related to CABG

Study

- Data showed a reduction in TIA and RIND following implementation of cerebral oximetry

Act Barriers:

- Anesthesia department has not embraced technology
- Go back to department and share positive information with next cycle focus on anesthesia and interventions
- Data shared with Anesthesiology and CV Surgery departments

floor. Then when patients had complications from the patch, their length of stay increased. All told, by quickly identifying and knowing the true outcomes of the patch, Aurora saved a minimum of \$360,000 that year.

Monitoring Renal Dye Reactions & Implementing Best Practices

Once Aurora implements a change, they believe follow up is vital to ensure that change has in fact had the desired outcome. One example is dye reactions and subsequent renal failure post cath lab procedure. Literature suggested that using bi-carb reduces renal complications from dye, so according to Mia, “We immediately got on board with bi-carb therapy and tracking the difference in outcomes. It was easy enough to track; all we did was add a new field to Apollo which asks, 'Is the patient on bi-carb protocol or not?' We look at patients as we enter them into Apollo, and once we have a big enough denominator—10 to 15 patients—we report the information to the quality physician for review. Having this structure in place, with a group who uses the data to come up with improvement plans, is vital. Without a structure in place, and without a group of people eagerly looking for that opportunity to create improvement, why even collect the data? Searching the literature, looking for best practices, implementing, and tracking results make Apollo so much more than a traditional documentation system.”

IIB/IIIA Targeted by Patient Population for Optimal Outcomes

The ACC tracks only whether IIB/IIIA medication was given, not its type. Aurora wanted to track the specific medications so they could make more informed decisions to improve care and control costs. “We added additional fields in Apollo to track what kind of IIB/IIIA is given for elective procedures, acute coronary syndrome, and ST elevation MI. We can view the trends to answer specific questions like, Are we using more Reopro or Integrilin? Which physicians use which medication? Once we had the data, we worked with physicians to target the optimal medications for each patient population and set up protocols.” Mia adds, “We want to know what kind of IIB/IIIA we are giving because of the huge difference in cost. We want to know the outcomes of patients receiving the different medications to see if it’s actually worth the cost.” Aurora has added similar fields to track the outcomes of Taxus and Cypher drug-eluting stents.

Implementing Clinical Trial Results in Days, Not Years

“At ACC this year we looked at the results of the PROVE-IT trial,” says Mia. “The outcomes of the trial showed that Lipitor was more effective at reducing the relative risk. So we automatically changed all of our order sets to include Lipitor as a choice. And that is just one example. When the Women's Initiative information was released we immediately put an order on our acute MI order sheets to stop all hormone replacement therapy. Those are just simple changes to implement evidence immediately into practice.”

Mia is a great proponent of using data management and evidenced-base medicine to improve outcomes. She also stresses the structure that needs to be in place in order to best affect change, “There are a lot of studies coming out, and we are constantly trying to find the best practice. It's vital to have the IT support and core group structure in place to be able to effectively use the data. Otherwise, you may as well just have a real nice documentation system, but to me that is not enough. It is not enough to just do things; you really have to look at the outcomes of what you are doing and see whether it is the right thing to do.”

Multi-City, Multi-Hospital Data Integration

With hospitals, clinics, and physicians spread across the state, integrating data is a challenge not only in data collection and standardization, but also in data analysis and implementation of quality improvement programs and software solutions. As the Cardiac Program Manager, Mia is uniquely experienced in dealing with these challenges. “Being able to look at outcomes data throughout the metro region—looking at similar problems, unique problems, and drilling down to improvements that we can do at each and every site—is very, very valuable to us. Our physicians can look up cath lab procedural reports and other information available on our Cerner system. However, that information is stored in Word documents and cannot be queried. For performance improvement we query data using our Apollo database. That’s why it is so important for use to implement Apollo at as many sites as possible, so we can look at opportunities to improve our Cardiac Program. For example, there may be renal problems at one site that do not exist at other sites. So that site would target to improve those complications. Looking at the whole and pulling it apart is really important to process improvement.”

Integrating Apollo with Cerner & Multiple Medical Devices

Aurora has worked to integrate key systems with their Apollo database: Cerner and HBOC ADT front ends, GE Prucka Cath Labs, GE Prucka EP CardioLabs, Echo, Nuclear, Congestive Heart Failure, ACC, STS, Perfusion Pumps, and Report Results to Cerner back ends. Aurora’s wide area network connects the metro hospitals, as well as interfaces to their systems. So on the front end, demographics and patient information is pulled from Cerner into Apollo through the ADT interface. Then they use interfaces from the GE Prucka Cath Labs, to bring in study information. From EP, the CardioLabs information is interfaced in. They also link to nuclear studies, echo, CHF, and perfusion. According to Susan McIntosh, IS Project Manager, “Integrated data is now available in a centralized database. When we want to do outcomes analysis, we can complete it all at one system. Before, we had silos of information—one database with our history in it, another with catherizations, another with echos, and on, and on. So there were many different flavors of databases, and my team had to learn and support many different technologies to get numbers for people. With Apollo, we have been able to consolidate those databases to become more efficient and productive, and have opened the door for super-user clinical users to query their own data. We just don’t have to switch hats as often.”

At the back end of Apollo, Word reports are sent back out to the Cerner patient record system to come full circle. Every clinic in Wisconsin and all 14 hospitals have access to Cerner. So any referring physician, or physician in the system can access the results in the format that he or she is used to.

Workflow-Focused Deployment Plans

Aurora carefully plans and rolls out the installation of each of their Apollo modules. Since they must plan, customize, and train staff with each rollout, they need to be flexible and highly coordinated. Susan McIntosh, IS Project Manager, explains, “The most important thing is to have a plan and understand how the pieces fit together. Know what to deploy and your priorities for deployment, because a lot of it is building blocks. When we get the product out of the box, we sit down with the lead person from the clinical side and just go over it. We ask, How does this fit your life? How can we change it to fit better? We change validation rules, add fields, and customize forms to suit workflow. It is a huge commitment for clinical users and IS. Typically, we will deploy to one hospital, get the kinks out, and then deploy to the others, avoiding the big bang effect. Where possible, we recommend module and report standardization across similar departments at multiple hospitals. Standardization helps keep operational and support costs down.”

Standardizing Definitions & Understanding Terms

“The biggest challenge was getting doctors to understand the data that I needed to collect from them,” says Kristen. “For example, they needed to learn the ACC definitions so we could collect the data accurately. We go through definitions and also send letters to the physician extenders, so then they know when they say that a patient had an exertional angina, they also have to tell me what caused the angina so we can classify it. To this end, I also developed a post-procedure progress note, which requires all of the ACC, STS, and JACHO criteria to be collected. After the procedure physicians can write everything on the form. If three months from now, I have to ask, ‘Remember that patient that you forgot to put this information, do you really think he had a heart attack?’ The physician is not going to remember. So we are trying to get documentation at the point of care to ensure accuracy.”

Physician Documentation with Wacom Touchscreen Tablets

“Our ultimate goal is to get physicians reporting on the computer, eliminating transcription,” says Mia. “We believe the touchscreen technology on the Wacom tablet is going to be a major advance to get

Standardizing Documentation of Hematoma Assessment

by Kristen Dwyer, RN, Angie Schlemm, RN
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Background

Accurate data collection is the first step in providing reliable information for improving the quality and outcomes of cardiovascular care. The ACC data definition for reporting a Vascular Complication—bleeding (element # 127) includes a requirement for a local hematoma to measure > 10cm in diameter. Review of nursing documentation in our institution revealed that there is a lack of standardized language used when documenting a vascular site hematoma in the patient record. Examples range from no actual measurement of the hematoma, to the use of comparison language (*i.e.*, size of a grapefruit, golf ball, or quarter). Documentation also frequently includes the use of words such as small, moderate, or large, which are a subjective interpretation.

It became increasingly clear that a consistent method of documentation of vascular site hematomas did not exist at our institution. The result is an under or over reporting of site hematomas to the Cardiology Section, as well as to ACC-NCDR.

Our main objectives were to 1) ensure consistent assessment of hematomas among health care providers, 2) standardize the language used in the documentation of hematomas, and 3) allow for accurate ACC data collection as to the occurrence of hematomas in our PCI population.

Method

Investigation on the units who care for PCI patients revealed that an actual measuring tool did not exist, or if it did—the staff wasn't utilizing it. Efforts were made to provide an inexpensive, disposable and convenient measurement tool to the staff to ensure compliance.

Once a tool was found, staff was educated as to how to use it when assessing a hematoma. Education was also provided regarding documentation of the assessment. Special attention was placed on the use of consistent language and the location of documentation in the patient record.

Conclusion

Providing a measurement tool along with education has allowed for more objective assessment and documentation of hematoma occurrence in our PCI population. This ensures more accurate data collection for our institution and ACC-NCDR. Due to the success of this quality improvement initiative, we will expand this practice enhancement to all areas that provide care to patients undergoing any invasive vascular procedure.

physicians entering patient data and completing reports. It's so much easier to use the touchscreen than to type. And, the reason that we liked LUMEDX from the beginning, is that it is a complex information system implemented in a clinical environment. Clinical users are not IT experts, so we needed to have something that was easy to use, easy to put data in, and easy to get information out. We have found LUMEDX to be our best solution for people working with the database day in and day out."

Kristen underscored the reason for building the database in blocks, expanding to a completely integrated CVIS, "I think going up slowly first shows the physicians what they can get out of the database. Then they start asking for more and more data because they understand the value of the information. Then they are more willing to learn and participate in planning new systems."

Adding EP & Other Modules in the Future

"Right now we are talking with our electrophysiologists about how we can use the EP Module and LUMEDX to design an outcomes database including EP and additional procedures. We want to answer questions like, How many times do we perform cardiac ablation? How often is this procedure successful? Research may say that the success rate is 90%, but we don't have proof that our internal outcomes are the same because we don't have that module, so the data isn't collected. But we have plans to change that. We will monitor the outcomes of many of our EP procedures. For example, for patients who have Bi-V pacers implanted, what are their outcomes? What is their readmission rate? How did they do after we put the devices in? Because you can't just put an implantable device in; you have to look at whether it made a difference in their life. Tracking the therapy delivered and whether it makes a difference is critical. Same with ablation, I just pulled an article today out of the ACC, *Catheter Ablation of Atrial Fibrillation Techniques for Achieving a High Cure Rate with Acceptable Risks*. The only way you can get that information is to track it."

We welcome your questions and comments. E-mails sent to greatapplications@lumedx.com will be forwarded to Aurora Health Care. Every effort will be made to respond.

About LUMEDX: With over 500 heart center clients worldwide, LUMEDX is the market leader in fully integrated cardiovascular information systems and the No. 1 independent integrator of cardiology information solutions. LUMEDX offers the most proven, comprehensive package of clinical information tools, cardiovascular products, and services to help medical institutions enhance quality of patient care, reduce costs, streamline workflow, increase patient volume, and grow revenue.

LUMEDX SOLUTIONS & TECHNOLOGIES AT AURORA

Solution

This Great Applications article describes how Aurora has implemented LUMEDX's integrated software solutions and customization services over a multi-city, multi-hospital CITRIX environment. The solutions they utilize are:

Software

- Apollo Advance
- CardioChart
- CardioDoc
- Echo Module
- Nuclear Module
- Congestive Heart Failure Module
- Perfusion Module
- Implantable Devices Module
- ACC Registry Reporting
- STS Registry Reporting
- Report Results to Cerner
- Prucka Cath MacLab Interface
- Prucka EP Cardiolab Interface
- ADT Interface
- Perfusion Terumo Pump Interface
- PaceArt Import
- GE Marquette Muse Integration
- Custom Non-Standard Database Conversion

Services

- CardioDoc Implementation and Training
- Customization Service
- Interface Implementation — Complex
- LUMEDX Deluxe Extended Support Package
- Advance Purchase Option