

# great applications

BUILDING CARDIOLOGY CENTERS OF EXCELLENCE



## Elimination of Transcription Results in Lower Costs, Fewer Delays & Greater Access to Patient Reports



Evanston Northwestern Healthcare

**“Greater access to information leads to better care throughout the health system, whether it is in the emergency room, cardiology department, or at the referring physician’s office.”**

Meredith Hammer  
Cardiology Systems Administrator  
Evanston Northwestern Healthcare

### Evanston Northwestern Healthcare Highlights

**Transcription eliminated:** Physicians, nurses, and technicians complete patient reports directly in Apollo Advance—ending the cost, delay, and errors associated with transcription

**Reporting integrated into workflow:** Data entry follows the unique workflow of each department—data can be interfaced in from the hospital information system, entered by technicians while the patient is prepped and during procedures, and then completed by the physician at case end.

**24/7 access to patient information:** Patient history, procedures performed anywhere in the healthcare system, and current patient reports can be accessed through Apollo, Epic, or CardioChart. This accessibility enables physicians and other caregivers to provide the highest quality care, based on up-to-the-minute patient information.

**Strengthened relationships with referring physicians & increased patient satisfaction:** By completing reports right after the case, referring physicians receive the report quickly, before the patient is back in their office. Patients have peace of mind knowing their reports are complete and in the right hands.

**Clinical and technical experience critical during implementation:** By understanding both the clinical needs and technology, Evanston built a system that balanced quick, easy data input with robust data collection

Like many hospitals, Evanston Northwestern Healthcare relied on transcription to produce patient reports. And like many hospitals, they wanted an end to the cost, delays, and limitations caused by transcription and paper-based patient reports. Their solution: have physicians, nurses, and technicians enter data directly into their **Apollo Advance** cardiovascular database. While Evanston had been using the database for several years to collect data, physicians typically never used the system directly. Instead, staff, technicians, and nurses entered the data after transcription—a retro-



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spective, lengthy process. By having physicians enter the information themselves, they could eliminate transcription entirely and enjoy the benefits of electronic medical records linked to a real-time clinical database.

Evanston chose to have the clinical teams enter their patients' data for several reasons:

	<b>Transcription</b>	<b>vs.</b>	<b>Electronic Documentation</b>
<b>Cost</b>	Expensive & requires hiring a FTE to enter data from chart to database		Builds on existing Apollo Advance database; no additional cost
<b>Efficiency &amp; Speed</b>	24 to 72 hours; delays if errors on the report		Depending on the department, some data is entered before, during, or up to 24 hours after the case
<b>Accuracy</b>	Errors may be introduced during transcription and again if data is typed into a database		Physicians enter data; field validation rules proof whether data is within valid parameters; physicians review and sign off in minutes
<b>Accessibility</b>	All information on one chart. Chart must be faxed, called in, or transferred if patient is seen by other departments		24/7 access: all departments, physicians, referring physicians, nurses, and staff can pull up the record at the same time, from wherever they are in the system

## Physician Champion & System Administrator Work Together

Evanston found that it was critical for staff implementing Apollo to understand both technology and the healthcare setting. Thomas Frohlich, MD, was chosen as their physician champion, because of his computer savvy and interest in the role data-integration technology plays in improving care. Dr. Frohlich learned how to administrate Apollo, so he could provide input on how to build the system most effectively for use by physicians and how to best capture data used for reports and data analysis.

Meredith Hammer, Cardiology Systems Administrator for Apollo, acquired her medical knowledge on the job, and at her Apollo training at LUMEDX headquarters in Seattle. By being an adept communicator and working with Dr. Frohlich, she is able to bridge the gap between clinical and technical. According to Meredith, "As many systems administrators are learning, it is critical to understand both the technology and the health care setting, to gain maximum benefit. As an administrator, Apollo is easy to customize by adding fields, drop downs, and modifying views. With Apollo, physicians can collect whatever data they want, and then share that data in custom patient reports. Of course, it is critical to find a balance between ease of entering data into Apollo and the ability to query information. For example, it takes more time to enter data into drop down boxes than other types of fields, but we are better able to query that information. The physician champion many times helps find that balance, determining what is important, and what is not; especially if he is willing to put the time in to help build the system properly. Apollo is a customizable, efficient system."

# great applications

## BUILDING CARDIOLOGY CENTERS OF EXCELLENCE

Evanston implemented Apollo in different modules; first catheterization, then surgery, followed by stress, echo, and PVI. Evanston spent about a month installing each module, using **Apollo Toolkit** to customize standard modules to match department workflow and data collection needs. The ease of implementation depended largely on the cooperation and input received from the physicians. If administrators didn't receive instructions on fields—where the fields fit into workflow, their range, type, and use—then they couldn't customize the module properly.

According to Meredith, “I worked with the techs, nurses, and physicians to get information to then build a piece that works with their workflow and information needs. From there, I built the reports that they need, both from the front end design that they see each month, and then the back end, which makes the reports run. As an administrator, Apollo Toolkit is really easy to customize and work with. The capabilities of the system are excellent. You can pull up a form, or create a form from scratch, and add any field with any amount of drop downs and choices. By having a dedicated systems administrator for Apollo, I have been able to learn the details of the system, and take advantage of its great capabilities.”

### Customized Pages Match Workflow

Evanston uses the Apollo database at three hospitals—Evanston, Glenbrook, and Highland Park—as well as three offsites with over 30 physicians entering data. Case volume is approximately 45 vascular cases a day, 10 to 15 cath lab cases, and 60 stress cases a day. All Evanston facilities use the Epic patient reporting system. An ADT interface transfers information from Apollo to Epic, eliminating duplicate data entry.

The degree to which the physicians feel comfortable using Apollo largely depends on their previous computer experience—a big adjustment for some, no problem for many. “We try to standardize reports as much as possible, both for querying purposes and to reduce the amount of typing,” says Meredith. “We have a lot of picklists, which are drop down boxes that make data entry easier for physicians, nurses, and techs.

### VOLUME OF TESTS AT ENH'S SITES

Location	Test Type	Count
<b>Evanston Hospital</b>	Adenosine Nuclear Test	34
	Dobutamine Echo Test	29
	Dobutamine Nuclear Test	15
	Stress Echo Test	103
	Stress Nuclear Test	85
	Stress Test	36
<b>Glenbrook Hospital</b>	Adenosine Nuclear Test	29
	Dobutamine Echo Test	22
	Dobutamine Nuclear Test	20
	Stress Echo Test	109
	Stress Nuclear Test	94
	Stress Test	40
<b>Glenbrook MOB Cardiology</b>	Stress Echo Test	5
	Stress Test	6
<b>Highland Park Hospital</b>	Adenosine Nuclear Test	37
	Dobutamine Echo Test	16
	Persantine Nuclear Test	5
	Stress Echo Test	67
	Stress Nuclear Test	64
	Stress Test	26
<b>Old Orchard Cardiology</b>	Stress Echo Test	28
	Stress Test	5
<b>Vernon Hills Cardiology</b>	Dobutamine Echo Test	3
	Stress Echo Test	33
	Stress Test	13


"To match workflow, we have customized the pages and forms. For example in our **stress module**, we have five pages (views) to fill out. The first page has information the technicians can enter the day before: like date of birth, referring physician, physician performing the procedure, etc. The next two pages are history and test information. Those two pages are completed by the techs as they are getting the patient ready. As they talk to the patient they enter the type of the test and patient history. The next two pages are for the physician to enter. Mobile carts are linked to Apollo, so while the patient is on the treadmill, the physician enters the information into the database. The flow of the data entry matches the procedure: first the fields for baseline information, next for the exercise, and then the conclusion. By the time the patient is off the treadmill the report is almost complete. After the report is run, the physician reviews it in Microsoft Word, signs off, and sends the report from there. Because Apollo reports interface to Epic, referring physicians are able to look up the report before the patient is back in their office. For referring physicians who do not use Epic, the report is printed out and faxed to their office."

Physicians enter data differently in the different departments. In the **cath lab**, the CathCor hemodynamic system transfers some of the information over to Apollo. Then when the physicians complete their cases, they sit down and enter the data. Physicians typically take 15 minutes to enter the data for cath cases (diagnostic or interventional).

In the **vascular lab** technicians enter all of the preliminary data, and then the surgeon will come at the end of the day or the next day and complete the reports—typically 20 or 30 at once. According to Meredith, "Previously with dictation, producing a final written report would take about a week. And when a problem occurred, it would be difficult to get a hold of the surgeons to find out what was wrong and correct it. Now, there are no problems entering it into Apollo; however, if the report does not show up in Epic, then I can go right into Apollo and fix it from there. So report turnaround is just a question of how fast the physician can get the report in the system. Our goal time is 24 hours, as the physician's schedule permits."

## Accessibility Improves Patient Care

"While typing can, at times, take longer than dictating, it does improve patient care. By using a system with a defined outline, it increases database searchability and forces the doctor to be inclusive such as providing pertinent negatives," says Dr. Alan Zunamon. "One recent benefit I came across was when a did a TEE on a patient that had already had two previous TEE's read by different doctors. The system enabled me to locate the previous results for comparison to the current result due to the similarities of the report structure as well as the information filled out in



**Stress Nuclear Test Report**  
Evanston Hospital

12/29/2004

Procedure Date: 12/29/2004 Order #: E3605414  
 SSN: Age: 71 DOB: 8/31/1933 Gender: Male  
 Weight: 84 kg Height: 170 cm BSA: 1.96 m<sup>2</sup>  
 Medications: HYTRIN, ZOCOR, HYZAAR, COUMADIN  
 Patient Activity Level: Active

**Performing MD:**  
**Interpreting MD:**  
 Stress Technician: Fawehudin, Riaz  
 Referring MD:

**Past Medical History**  
 Hypercholesterolemia.

Abnormal ECG (794.11)
Atrial flutter (427.23)
(427.20)
(427.2)

**Procedures (CPT):**  
 Phys supervision only, Phys interp and Report only, Stress Test (93016, 93018)

**Stress Procedural Note:**  
 Written and informed consent was obtained. Continuous 12 lead ECG monitoring was performed prior to administration of a radiotracer.


**Nuclear Procedural Note:**  
 Rest myocardial perfusion images were begun after 3.3 mCi of 201 TlCl<sub>2</sub> was administered IV. Stress images were begun 15 minutes following administration of 22.1 mCi of 99mTc-Tetrofosmin at 4 minutes, 50 seconds of stress, with 6 minutes, 0 seconds of post injection stress.  
 Completion was made with the prior study of 12/24/2002

**Stress ECG**  
 Baseline ECG: Atrial flutter, 2:1 AV conduction, RBBB-ST-T abnormality Abnormal ECG depression at  
 Protocol: Rest  
 Total exercise time: 6 min, 0 sec  
 Test terminated due to: reached target HR  
 Estimated MET Level: 7  
 Heart Rate: Resting 78, Peak 139, %Target Reached 93  
 Blood pressure: Resting 138/86, Peak 174/72  
 Blood Pressure Response: normal  
 Arrhythmias during exercise: atrial flutter with variable A-V conduction, during recovery: atrial flutter  
 Pretestament symptoms: none  
 ST depression at rest progressing to 3mm with put exercise.

**ECG Stress Summary**  
 Moderate exercise intolerance. Inconclusive for ECG evidence of ischemia. Inadequate heart rate response. Negative for chest pain. Positive for arrhythmias.

Cardiology  
 Created on 1/4/2005 11:50 AM  
 Last printed 1/4/2005 11:27 AM Page 1 of 2

Example of Stress Nuclear Test Report  
(click to view full report)



**CARDIAC CATHETERIZATION**  
**FINAL REPORT**  
Evanston Hospital

11/16/2004

Cath Number: 2034534 SSN: AGE: 61 Referring MD:  
 Date of Procedure: 11/16/2004 DOB: 7/28/1943

**Indications (ICD-9)**  
 Abnormal cardiac stress test (794.30)  
 Coronary atherosclerosis, native vessel (414.01)

**Notes:** active 61-year-old man with no cardiac symptoms, but with hypercholesterolemia and a strong family history of premature coronary artery disease. A second thallium stress test showed a moderate sized fixed defect of moderate intensity in the inferior region.

**Procedures**  
 Left heart catheterization (93510-26)  
 Left ventriculography (93543, 93555-26)  
 Coronary angiography (93543, 93556-26)

After informed consent, needle entry of the right femoral artery with a 5F introducer was accomplished without difficulty. Left heart pressures were recorded, left ventriculography and selective coronary angiography were performed. The sheath was removed and the artery was closed with a 6F Perclose device. There were no complications.

**Hemodynamic Data**  
 Height: cm: 188 Weight: kg: 86.1 BSA: 2.13 m<sup>2</sup>

State: 1: Rest			
Pressures	Site	Pressures, mm Hg	HR
	LV	123/81/17	75
	AO	127/82/101	75

Mean Grad, mm Hg 0 Aortic Valve Mitral valve

State: 2: Post Angio			
Pressures	Site	Pressures, mm Hg	HR
	LV	119/6/22	83

**Left ventriculography**  
 The apical septal wall is moderately hypokinetic  
 Estimated left ventricular ejection fraction: 60%.  
 Mitral valve: no regurgitation

**Coronary Arteriography**  
 Coronary dominance is Right

**Right Coronary:**  
 20% proximal stenosis with mild distal disease. PDA is large with minimal irregularities.

**Left Main:**  
 20% stenosis.

**Left Anterior Descending:**  
 Diffuse 50-60% proximal and mid disease with diffuse mild to moderate distal disease.

**Circumflex:**  
 Eccentric 60% proximal stenosis with diffuse mild distal disease.

**Summary**  
 1. Mildly elevated left ventricular end-diastolic pressure  
 2. Moderate apical septal hypokinesis with normal ejection fraction  
 3. Diffuse moderate coronary artery disease as described above.

**Plan**  
 1. Aggressive coronary risk factor reduction, with an LDL goal of < 70  
 2. Repeat stress test in one year

Final report electronically signed by

CARDIAC CATHETERIZATION LABORATORY  
 847-570-2216 Created on 1/4/2005 11:53 AM  
 847-570-1854 (FAX) Last printed 1/4/2005 11:25 AM Page 1 of 1

Example of Cardiac Catheterization Final Report  
(click to view full report)

the forms.” The electronic medical records in Apollo and Epic are accessible from any of the system's facilities, greatly improving communication.

For example, many times a patient will have an angiogram at Glenbrook Hospital, and then needs to be transferred to have angioplasty at Evanston. The technician at Evanston can pull up the patient record and the report, and review it before the patient even arrives. “Before Apollo, when we had a team involved in the patient's treatment, only one person could have the chart. So up-to-the minute information wasn't communicated. Now, if five different people want to look at the report at the same time, they have their choice to access it through Apollo, Epic, or over the Web through CardioChart [LUMEDX's solution for Web-enabled access to the patient record],” says Meredith. “Another big enhancement for us is with ER patients. When they send someone up from the ER, we are able to send them back downstairs with the report in their hand. That has been a big plus for us, cutting down on wait times, and eliminating phone calls to get results from the reports. Greater access to information leads to better care throughout the health system, whether it is in the emergency room, cardiology department, or at the referring physician's office.”

### Improved Patient Satisfaction & Peace of Mind

Many patients are concerned that their primary care physician or referring physician won't receive a copy of their report. According to Dr. Andrew Hamilton, “The Apollo system allows us to generate a report quickly and without transcription. We are able to have the report available to the referring physician and the patient before the patient leaves the department. It interfaces seamlessly with the electronic medical record and improves work flow efficiency.” Patient satisfaction improves when the patient can see their report is complete before they go home; likewise patient care improves through better accessibility of the patient report.

### Greater Responsiveness

Responding to complaints from referring physicians who were tired of receiving two separate reports for a patient's stress and nuclear stress test, Evanston added nuclear fields to the stress test module so the information is stored together. Reports are then produced, including both test results, eliminating complaints.

### Lessons Learned

At first, Apollo was a big adjustment for Evanston. “The initial setup, interfacing systems, and learning about inputting information was a challenge. Obviously nothing is going to be perfect right when you turn it on, so you learn from your mistakes and fix them,” says Meredith. “While it takes physicians longer to type orders, than to dictate them, in the last few months, we have started to depend on the system. Now that the doctors pull up the information themselves, they are able to see the benefit firsthand: Apollo saves them trips down to the lab, and time waiting for results.”

### LUMEDX SOLUTIONS AT EVANSTON

This Great Applications article describes how Evanston has implemented LUMEDX's integrated software solutions. The software solutions they utilize are:

#### Software

- Apollo Advance
- Apollo Toolkit
- CardioChart
- Echo Module
- Stress ECG Module
- Surgery Module
- Cath Module
- PV Module

#### Registry

- STS Registry

#### Interfaces

- CathCor import
- CathCor DRE
- HL7 ADT inbound to EPIC
- Orders inbound
- Muse
- Results outbound to EPIC

### Reports Support Clinical Analysis & Shorter Billing Cycle

In addition to patient reports, Evanston produces analytic reports to track patient volume, complications, and care, as well as operational reports to support billing, and referrals. According to Meredith, “Our head surgeon requested a complications analysis for the department. The report includes complications per month, types of complications, and complications per physician. That information can then be used to track changes over time, quickly correct unexpected rises in complications, and continue high-quality care. Our head physicians also like to see referrals for use in outreach. If there is a drop in referrals from a particular physician, they can talk to them, find out if there is anything wrong, and find a solution.”

Since billing reports are run out of Apollo, staff no longer manually fill out billing sheets. CPT and ICD codes are entered directly into the system, and then a report is produced combining patient information with CPT and ICD codes. The hospital billers pull up the report through data analysis in Apollo. The result has been fewer lost charges and fewer errors. In addition, Evanston has shortened their billing cycle. Billers can now look up Apollo billing reports at the end of the day if they want. Previously they would have to wait days for paper reports. Now, if billers look in Apollo and see that a patient was done, but there is no report, they can call up the department and have the billing report completed—no more lost charges.

### Future of Information Management at Evanston

In the future, as Evanston grows their cardiovascular information system, they plan to collect data for patient follow-up, and will submit data to the ACC Registry. Evanston is also considering adding **CardioWellness** to track gender specific patient information—particularly for their women's health program. By expanding data collection and analysis, Evanston hopes to promote greater accessibility, patient satisfaction, efficiency, and return on investment.

**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.

# Stress Nuclear Test Report

## Evanston Hospital

12/29/2004

Procedure Date: 12/29/2004 Order #:E36605414  
SSN: Age: 71 DOB: 8/31/1933 Gender: Male  
Weight: 84 kg Height: 170 cm BSA: 1.96 m<sup>2</sup>  
Medications: HYTRIN, ZOCOR, HYZAAR, COUMADIN  
Patient Activity Level: Active

**Performing MD:**

**Interpreting MD:**

Stress Technician: Faseehudin, Riaz

Referring MD:

**Past Medical History**

Hypercholesterolemia.

Indications (ICD9):

Abnormal ECG (794.31)
Atrial flutter (427.32)
(402.10)
(272)

Procedures (CPT):

Phys supervision only, Phys interp and Report only, Stress Test (93016, 93018)
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**Stress Procedural Note:**

Written and informed consent was obtained. Continuous 12 lead ECG monitoring was performed prior to administration of a radioisotope.

**Nuclear Procedural Note:**

Rest myocardial perfusion images were begun after 3.3 mCi of 201 TlCl was administered IV.

Stress images were begun 15 minutes following administration of 22.1 mCi of 99 mTc Tetrofosmin at 4 minutes, 50 seconds of stress, with 6 minutes, 0 seconds of post injection stress.

Comparison was made with the prior study of 12/4/2002

**Stress ECG**

Baseline ECG: Atrial flutter, 2:1 AV conduction, RBBB-ST-T abnormality Abnormal ECGdepression at

Protocol: Bruce

Total exercise time: 6 min 0 sec

Test terminated due to: reached target HR

Estimated MET Level: 7

Heart Rate: Resting 78, Peak 139, %Target Reached 93

Blood pressure: Resting 138/86, Peak 174/72

Blood Pressure Response: normal

Arrhythmias:during exercise: atrial flutter with variable A-V conduction, during recovery: atrial flutter

Predominant symptom(s): none

ST depression at rest progressing to 3mm with put exercise.

**ECG Stress**

**Summary**

**Moderate exercise intolerance. Inconclusive for ECG evidence of ischemia. Inadequate heart rate response. Negative for chest pain, Positive for arrhythmias.**

# Stress Nuclear Test Report

## Evanston Hospital

12/29/2004

### Nuclear Perfusion Study Findings

Technical quality of the images is good

Perfusion: Normal myocardial perfusion study, no perfusion defects are identified. (SSS/SDS=0/0).

Gated resting E.F. = 69%; E.D.V. = 80ml.

Gated resting wall motion: No abnormalities noted.

Compared to the previous study, the current study is unchanged.

### Nuclear Perfusion Study

#### Impression

Myocardial perfusion imaging is normal.

Final report electronically signed by



**CARDIAC CATHETERIZATION  
FINAL REPORT  
Evanston Hospital**

11/16/2004

**Cath Number:** 2E04534  
**Date of Procedure:** 11/16/2004

**SSN:**  
**AGE:** 61  
**DOB:** 7/28/1943

**Attending MD:**  
Referring MDs:

**Indications (ICD-9)**

Abnormal cardiac stress test (794.30)  
Coronary atherosclerosis, native vessel (414.01)

**Notes:** active 61-year-old man with no cardiac symptoms, but with hypercholesterolemia and a strong family history of premature coronary artery disease. A recent thallium stress test showed a moderate sized fixed defect of moderate intensity in the inferior region.

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**Hemodynamic Data**

Height, cm: 188 Weight, kg: 86.1 BSA: 2.13 m<sup>2</sup>

**State: 1: Rest**

**Pressures**

Site	Pressures, mm Hg	HR
LV	123/8/17	73
AO	127/82/101	73

	<b>Aortic Valve</b>	<b>Mitral valve</b>
Mean Grad, mm Hg	0	

**State: 2: Post Angio**

**Pressures**

Site	Pressures, mm Hg	HR
LV	119/6/22	83

**Left ventriculography**

The apical septal wall is moderately hypokinetic  
Estimated left ventricular ejection fraction: 60%.  
Mitral valve: no regurgitation

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Coronary dominance is Right

**Right Coronary:**

35% proximal stenosis with mild distal disease. PDA is large with minimal irregularities.

**Left Main:**

20% stenosis.

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Diffuse 50-60% proximal and mid disease with diffuse mild to moderate distal disease.

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**Summary**

- Mildly elevated left ventricular end-diastolic pressure
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**Plan**

- Aggressive coronary risk factor reduction, with an LDL goal of < 70
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