Chest Pain in children: Can we standardize our practice?

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Future of Pediatrics 2014
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Nothing to disclose

Aims

Appreciate the need for Standardized Clinical Assessment and Management Plans (SCAMPs).

Analyze the difference between pediatric chest pain presenting to the emergency room versus outpatient cardiology clinic.

Analyze key concepts of Quality improvement

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Case

15-1/2-year-old boy started complaining of chest pain 8 months ago on daily basis

Left-sided in location most of the time, sometimes it is right-sided or retrosternal

It lasts few seconds up to 5 minutes and one day it lasted the whole day.

sharp, not related to activities, certain positions or breathing.

No cyanosis, no diaphoresis, no dyspnea, no fatigue, no fainting, no dizziness.

Family history: heart attack in a maternal grandmother who died at age of 59.

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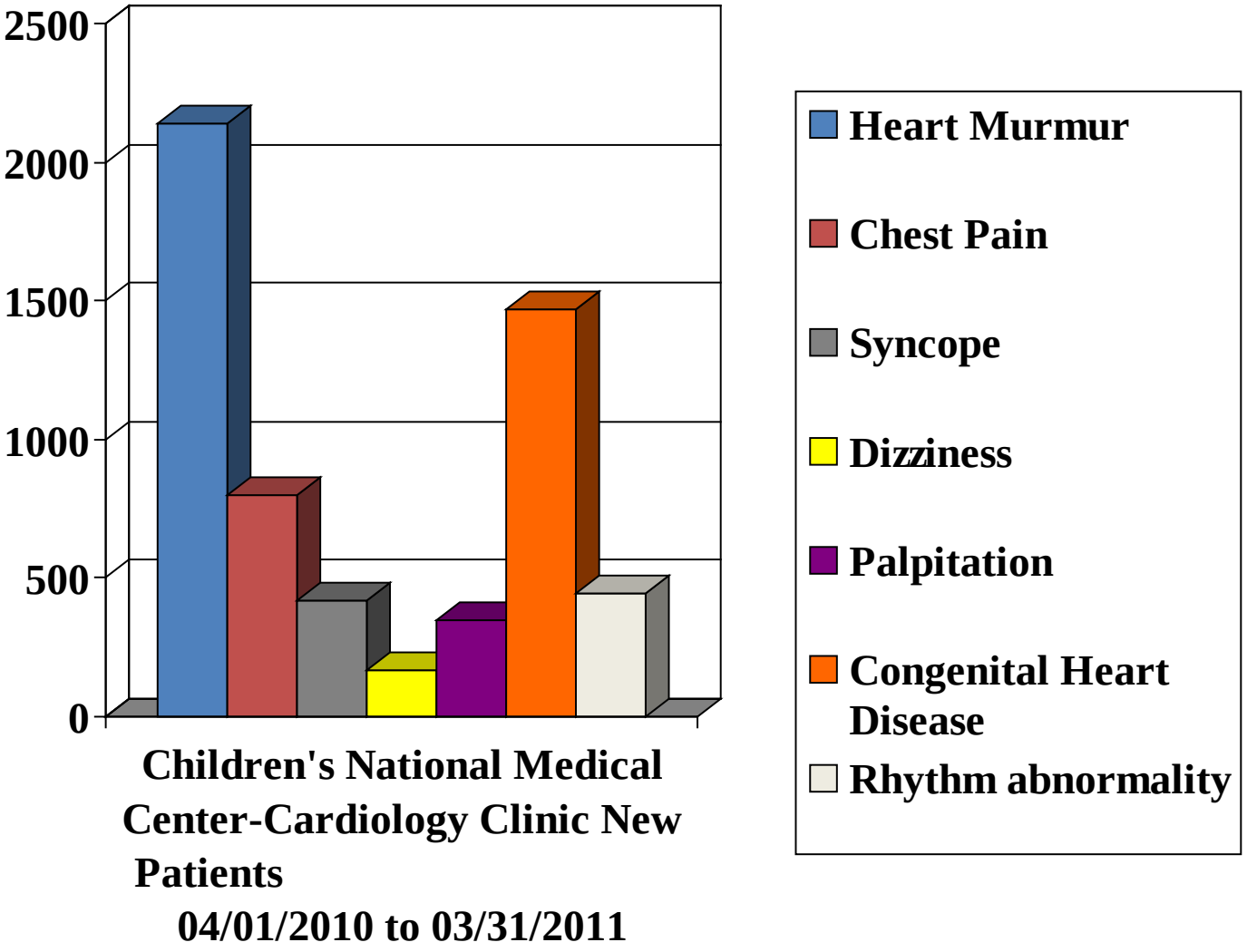
Outpatient ICD codes

New Patients' Encounter (n= 7935)



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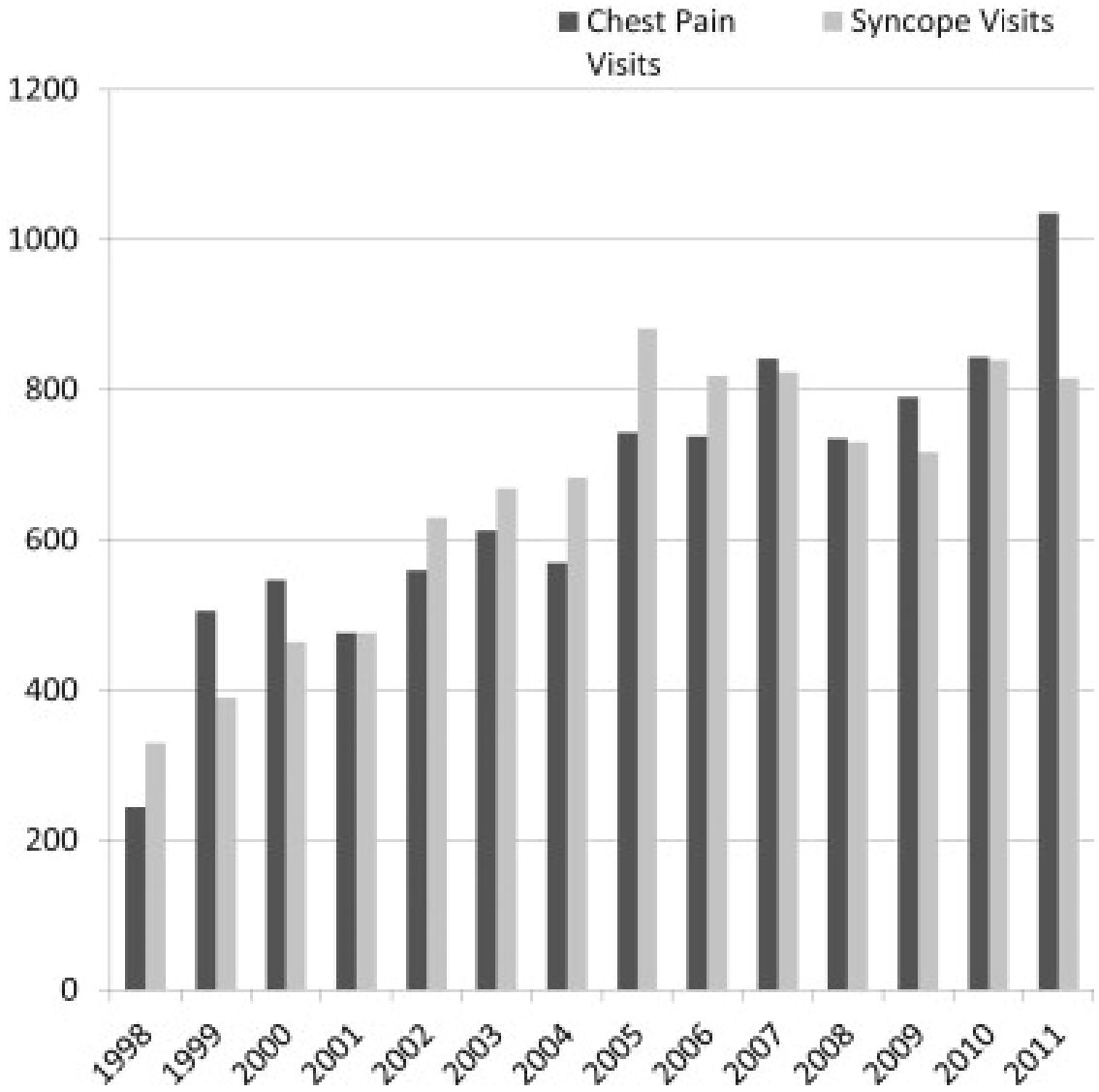

Friedman et al. The Journal of Pediatrics, Volume 163, Issue 3, 2013, 896 - 901.e3

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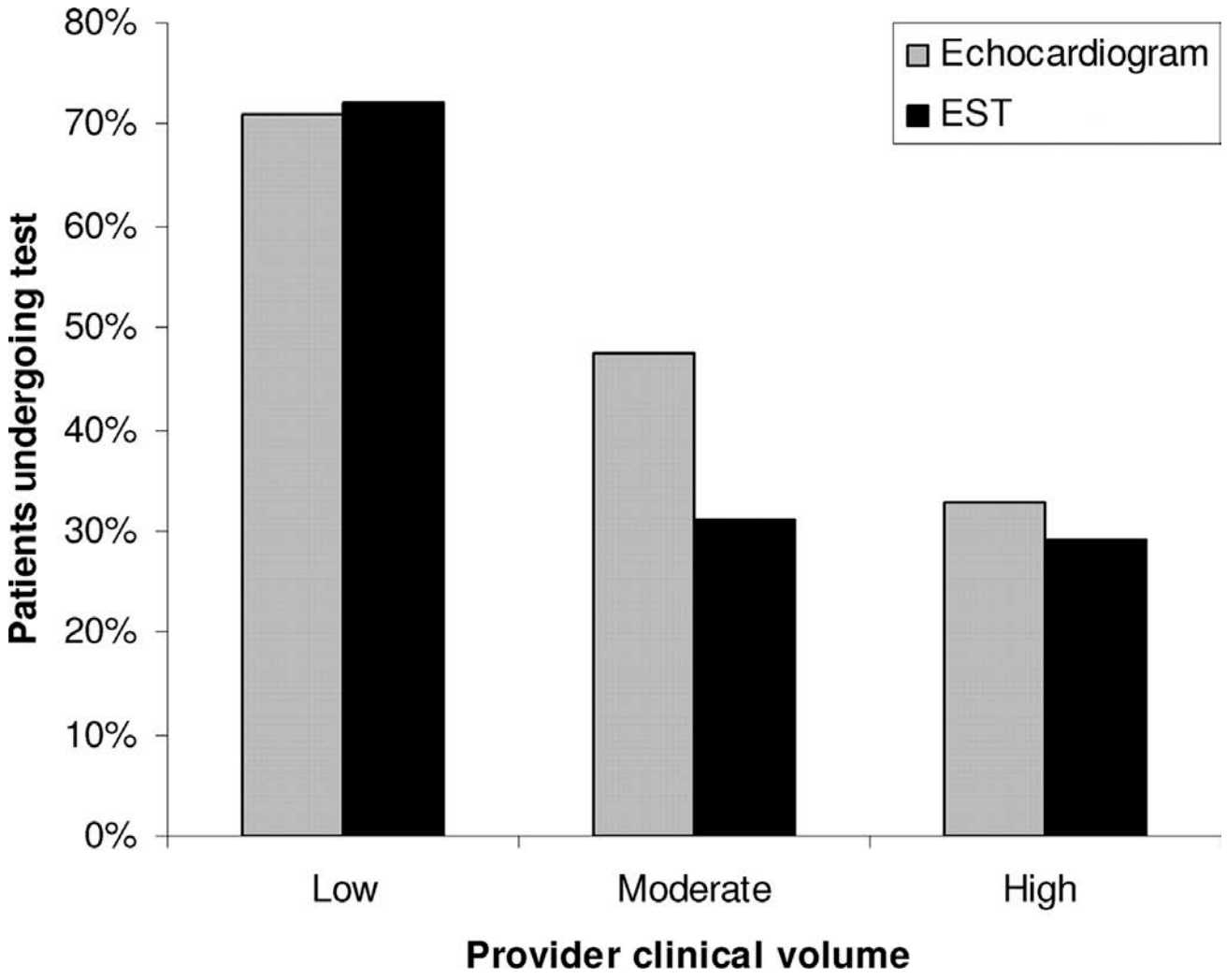
Variation in Practice

Cardiac testing according to clinical volume.



Friedman K G et al. Pediatrics 2011;128:239-245

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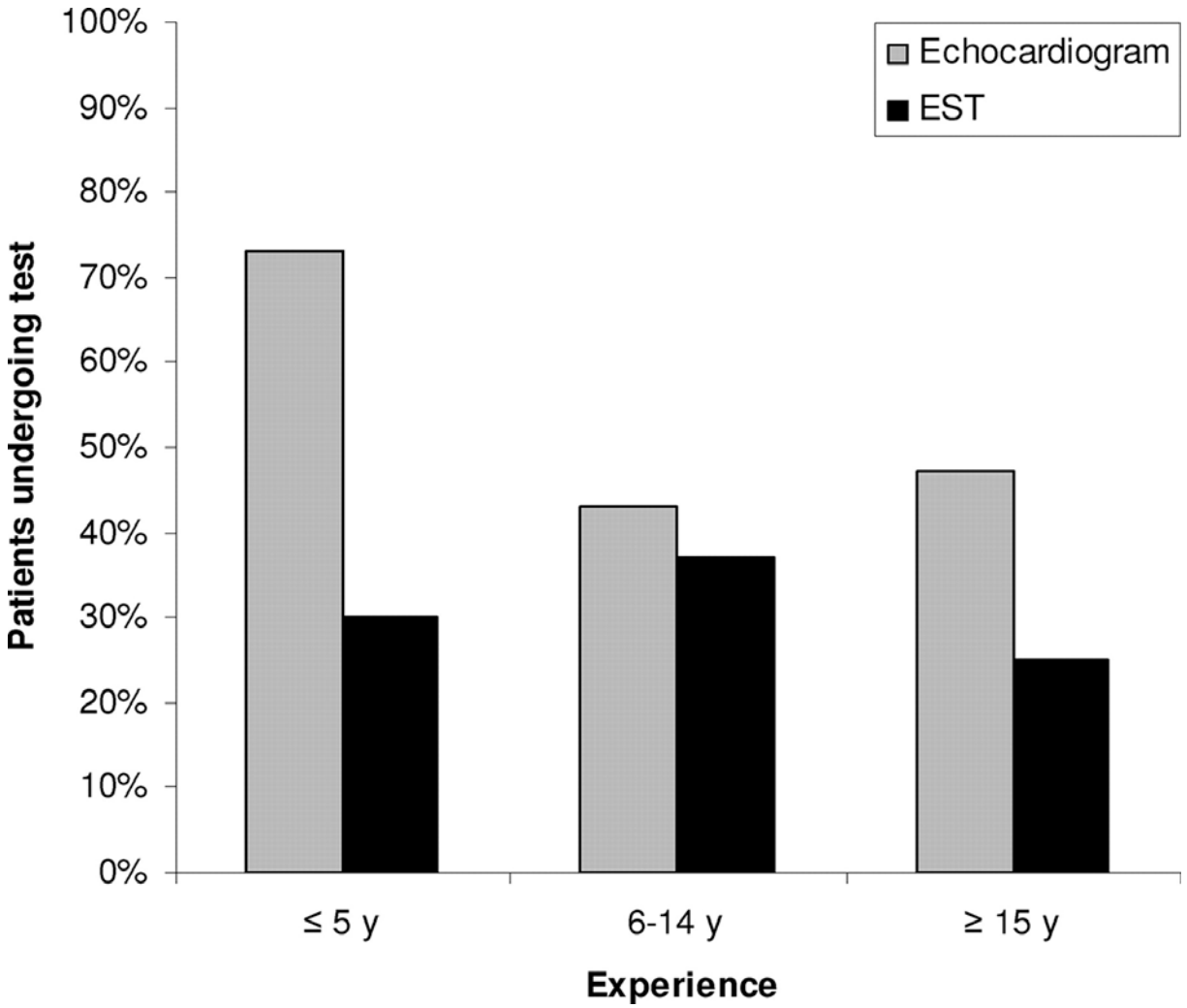
Cardiac testing according to provider experience.



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Quality Improvement

Standardized Clinical Assessment and Management Plans
What are SCAMPs?

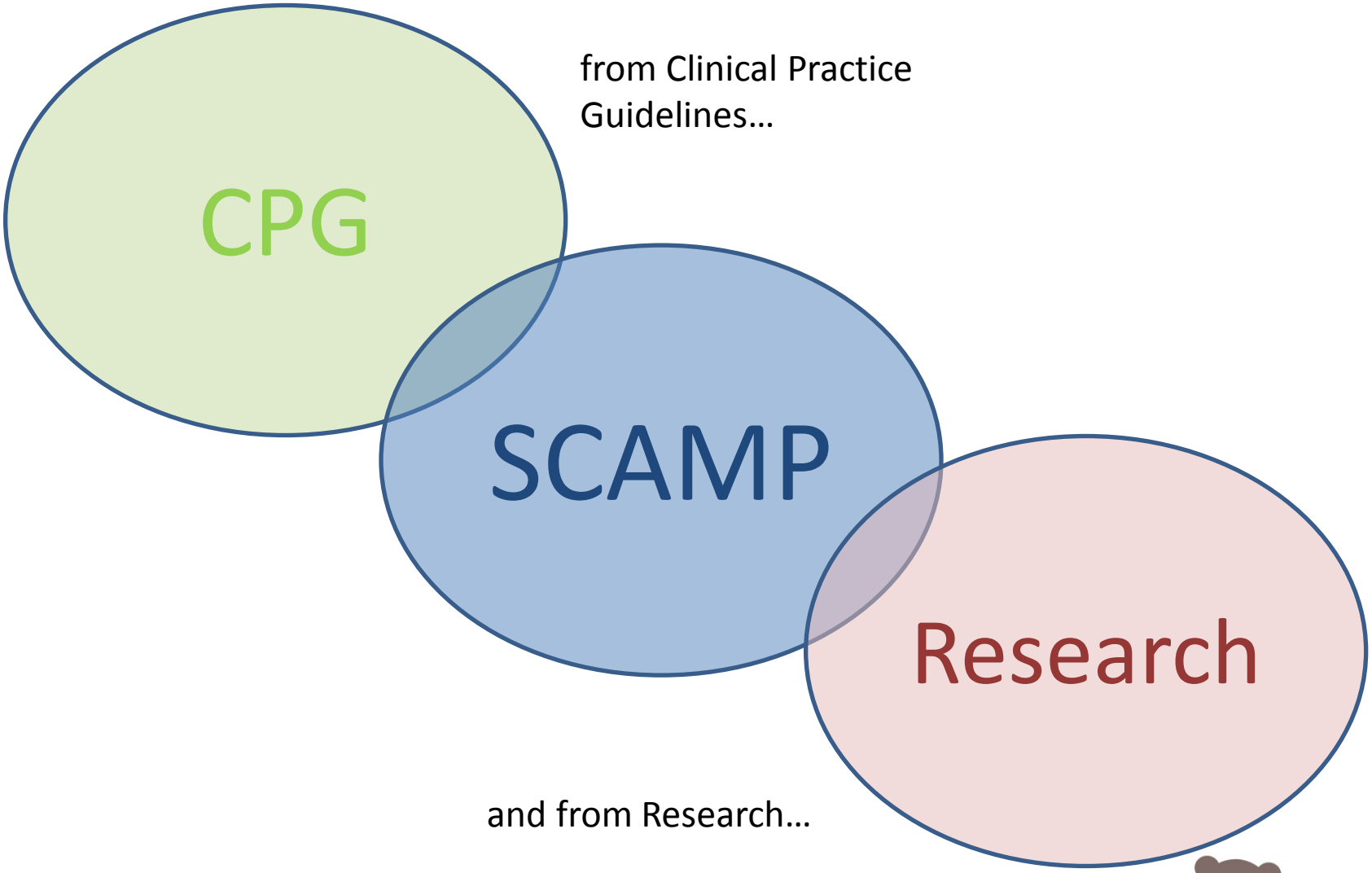
A consensus based standardized pathway with a dynamic information feedback system.

Progressive modification of the pathway occurs based on real-time acquisition of patient data focused on clinical questions.

SCAMPs Goals:

1. **Reduce practice variation**
2. **Improve patient care**
3. **Decrease ineffective or unnecessary resource utilization**

How are SCAMPs different?



from Clinical Practice Guidelines…

and from Research…

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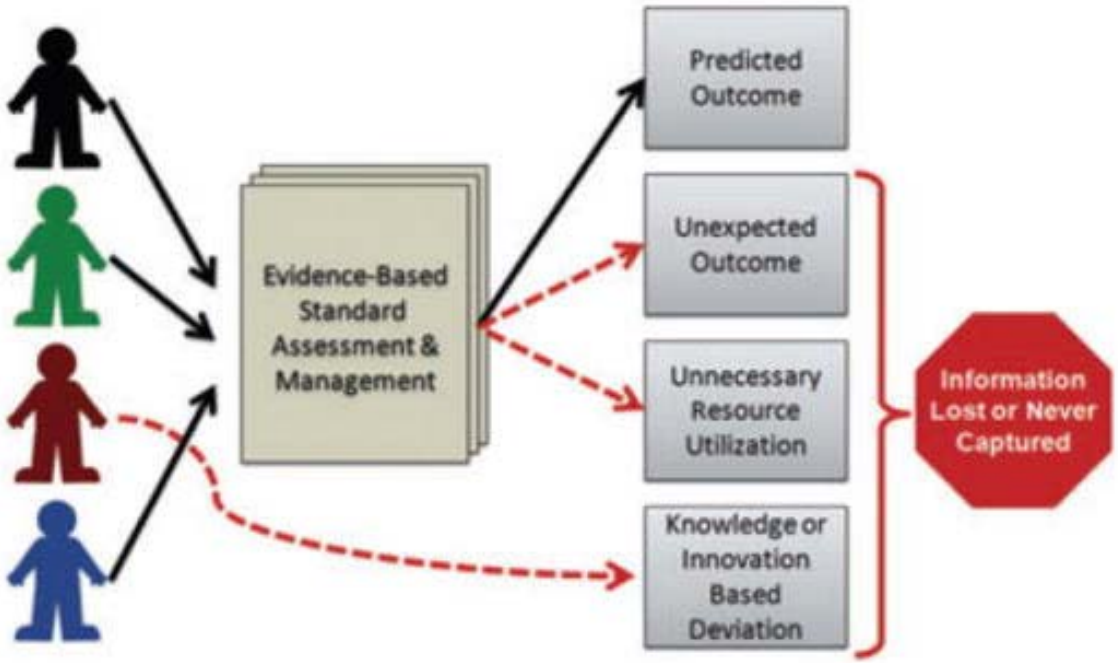
Clinical Practice Guidelines



Congenital Heart Dis. 2010 Jul-Aug; 5 (4): 343 - 353

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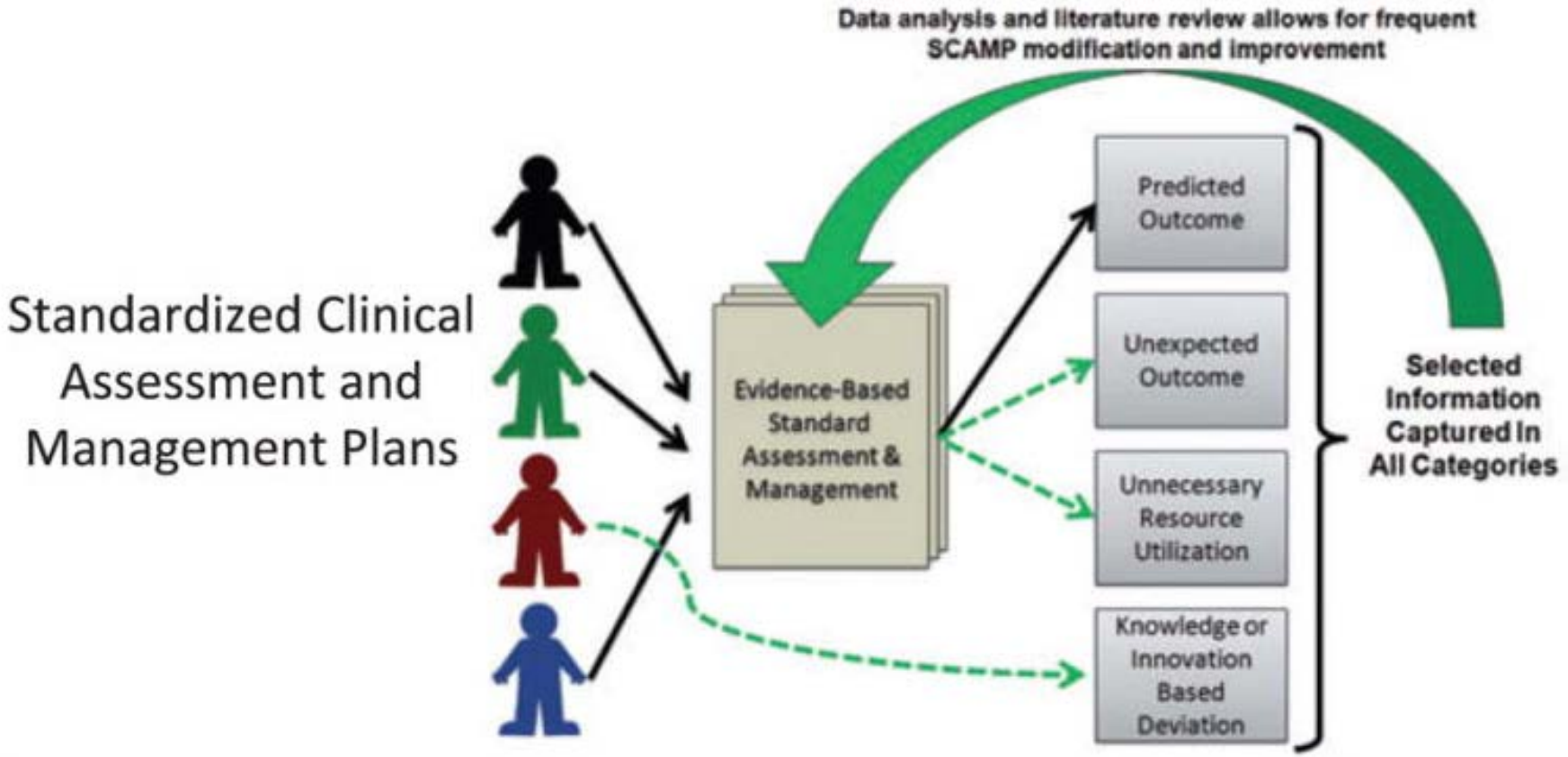

Congenital Heart Dis. 2010 Jul-Aug; 5 (4): 343 - 353

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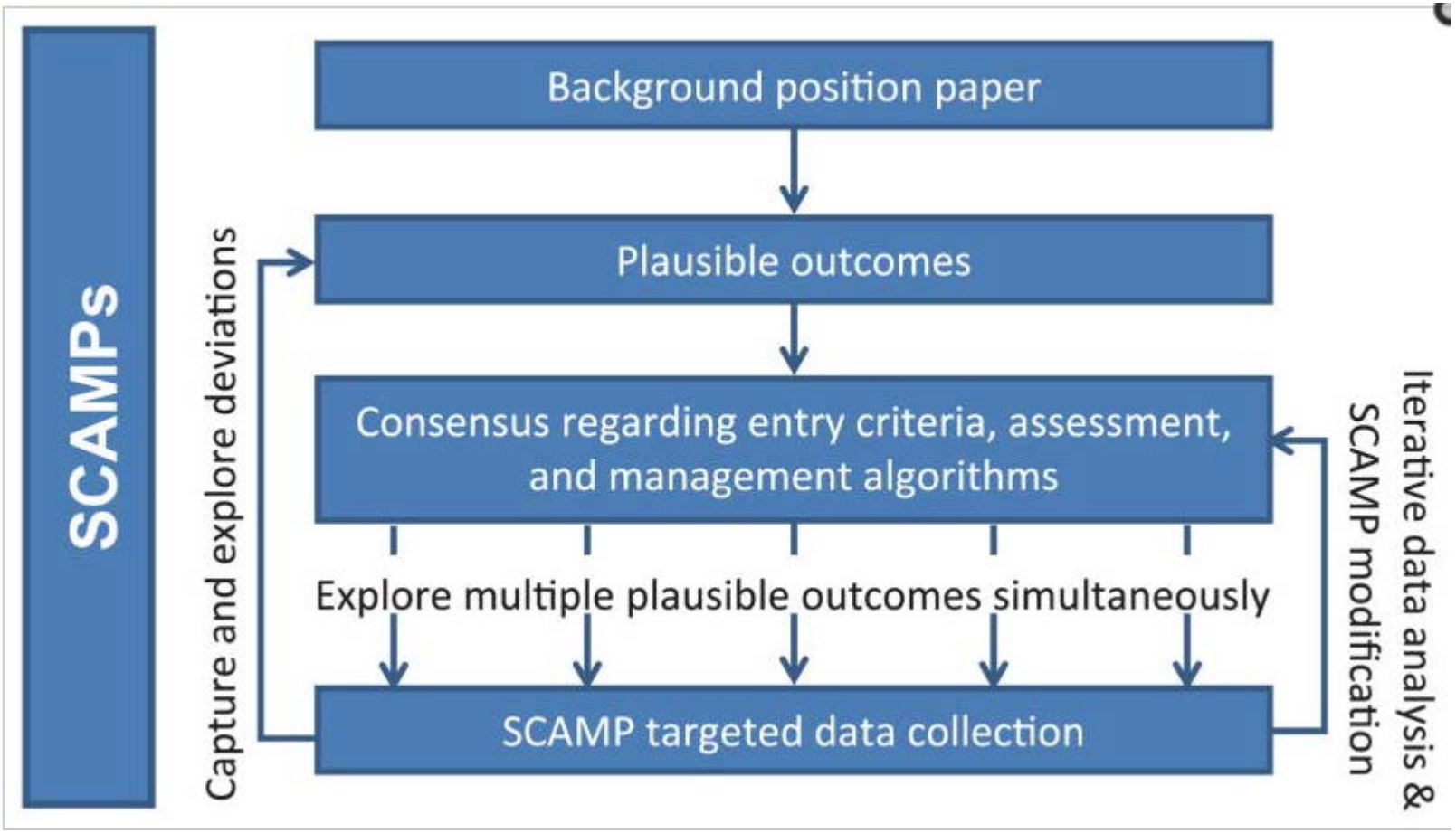

Congenital Heart Dis. 2010 Jul-Aug; 5 (4): 343 - 353

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How do SCAMPs Try to Achieve These Goals?

1. Identify known or suspected gaps in our knowledge about an episode of care, but create a care standard in the face of uncertainty.
2. Use those gaps to target prospective collection of relevant data.
3. Collect data on when and why professionals deviate from the care plan.
4. Use the data collected to improve the care plan prospectively and frequently. The data need not be "conclusive" just persuasive, since all changes will be revisited and revised by subsequent data.

Lock. SCAMPs conference June - 2012

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Integrating quality improvement methodology

"Science tells us what we can do;

Guidelines what we should do; &

Registries what we are actually doing."

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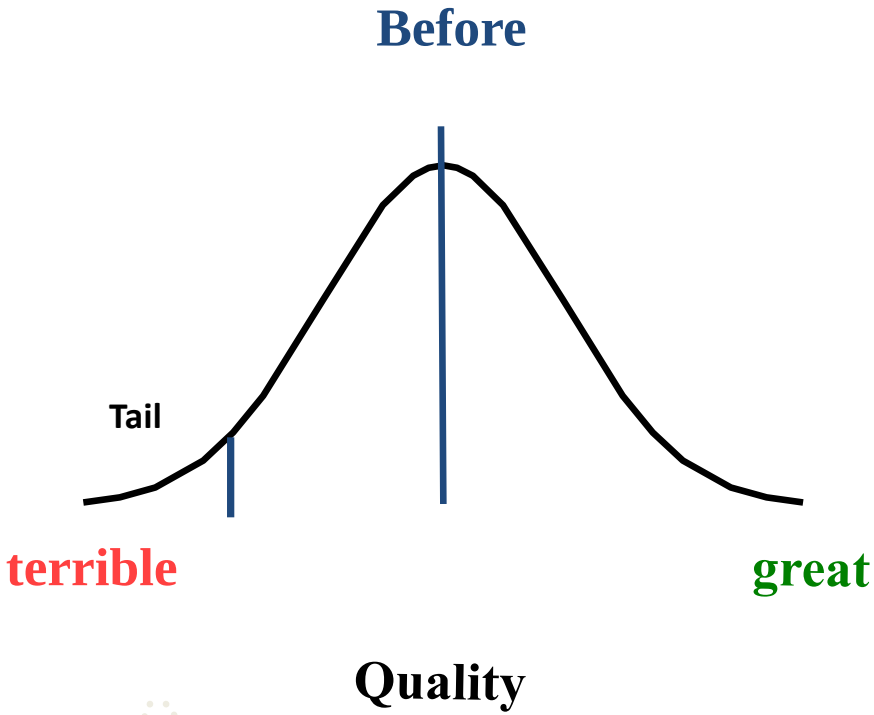
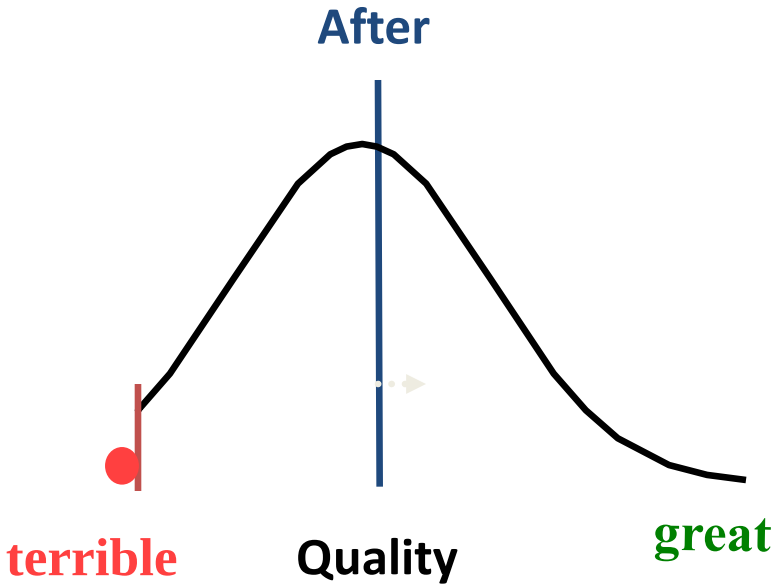
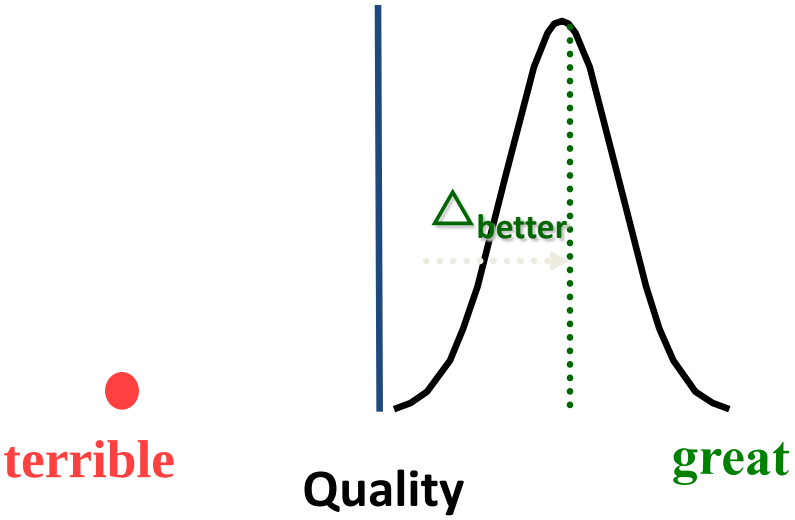
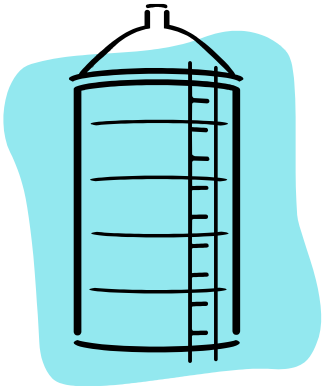
Improving Overall Quality, does not mean cutting off your tail…



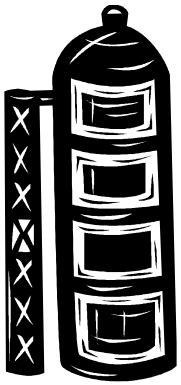




Eliminating Silos



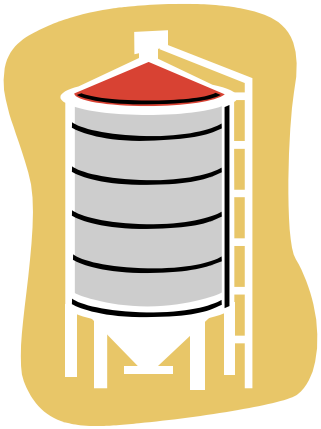
Medical



Research

Finance

Finance



Nursing

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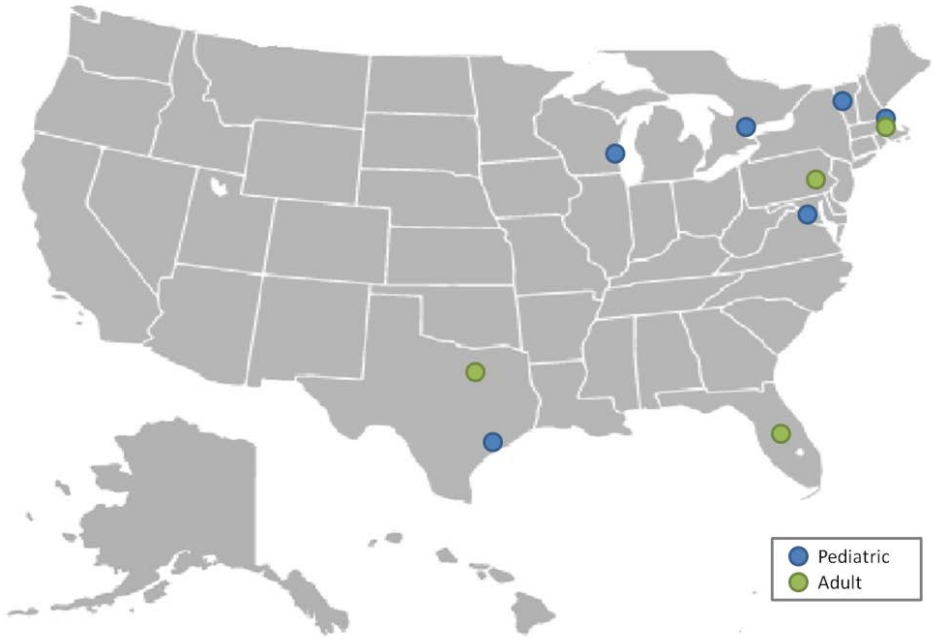
Institute for Relevant Clinical Data Analysis: Official Members

- Founders
  - Boston Children's Hospital
  - Brigham and Women's Hospital
  - Florida Hospital

- Contributors
  - Lancaster General Hospital
  - Baylor Healthcare System
  - Children's Hospital of Wisconsin
  - Children's National Health system
  - The Hospital for Sick Children - Toronto
  - New England Congenital Cardiology Association (NECCA)
  - Pediatric Endocrine Society (PES)



*Sahlgrenska Hospital, Gothenberg Sweden (pending)

SCAMPs
STANDARDIZED CLINICAL ASSESSMENT & MANAGEMENT PLANS

IRCDA
INSTITUTE FOR RELEVANT CLINICAL DATA ANALYTICS

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SCAMPs in Production

Pediatric SCAMPs: 39

- Airway Disorders
- Aortic Regurgitation
- Aortic Stenosis
- AS for Cath Lab
- ASO
- Aspiration Pneumonia
- Blood Ordering/Cell Salvage
- Chest Pain
- Coarctation
- Cognitive and Headache Management
- Critical Asthma
- Cytomegalovirus Prevention
- Dilated Aorta
- Distal Radius Fracture
- ECMO Anticoagulation
- Food Challenge
- HCM
- Hyperparathyroidism
- Immune Thrombocytopenia
- Interstage SV
- Lipid
- Lipid PCP
- Lymphatic Malformations
- Myocarditis
- Neonatal PDA
- Nutrition
- Operative Management of TOF/PS
- Orthodontic Retention
- Papilledema
- PICC
- Polycystic Ovarian Syndrome
- PPHN
- Sedation and Analgesia for Mechanical Ventilation
- Skin Abscess
- Small PDA
- Somatoform disorders
- Syncope
- Ureterocele
- WPW

Adult SCAMPs: 9

- Distal Radius Fracture
- Inpatient Chest Pain
- Immediate, Implant-based Breast Reconstruction
- Acute Kidney Injury
- ED Chest Pain
- Lumbar Spine Fusion
- Hypertrophic Cardiomyopathy
- Congestive Heart Failure
- In Vitro Fertilization

Chest Pain SCAMP

SCAMP PURPOSE:

With 95% of pediatric chest pain being non-cardiac in nature and clinicians over testing to come to the non-cardiac chest pain conclusion, this SCAMPs aims to standardize what testing is needed (if any) based on patient presentation.

INCLUSION CRITERIA:

All new patients between 7 and 21 years of age with chest pain, where chest pain is the primary or significant part of presenting features

EXCLUSION CRITERIA:

Patients with known heart disease

Background paper

Management of Pediatric Chest Pain Using a Standardized Assessment and Management Plan

AUTHORS: Kevin G. Friedman, MD,[a] David A. Kane, MD,[a] Rahul H. Rathod, MD,[a] Ashley Renaud, RN,[a] Michael Farias, MD,[a] Robert Geggel, MD,[a] David R. Fulton, MD,[a] James E. Lock, MD,[a] and Susan F. Saleeb, MD[a]

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KEY WORDS
chest pain, congenital heart disease, resource utilization, SCAMP

ABBREVIATIONS
SCAMP—Standardized Clinical Assessment and Management Plans
ECG—electrocardiogram
EST—exercise stress test

Dr Friedman contributed to the study design, data collection, data analysis, manuscript preparation, and approval of the final version; Dr Kane contributed to the study design, data analysis, manuscript preparation, and approval of the final version; Dr

WHAT'S KNOWN ON THIS SUBJECT: Chest pain is common in children and is a frequent reason for referral to pediatric cardiologists. Despite the benign nature of the vast majority of pediatric chest pain, extensive and costly cardiac evaluation is common in these patients.

WHAT THIS STUDY ADDS: Described here is an approach to pediatric chest pain that will reduce unnecessary resource use while maintaining high-quality care.

abstract

OBJECTIVES: Chest pain is a common reason for referral to pediatric cardiologists and often leads to an extensive cardiac evaluation. The

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Causes of pediatric chest pain: family's concerns versus medical diagnosis

Cause	Family's estimate of prevalence (%) (ref 4,5)	Medical diagnosis-prevalence (%) (ref 1,2,4-12)
Cardiac	52-56	1-6
Musculoskeletal	13	15-31
Respiratory tract	10	2-11
Skin infection	3	0
Breast related	3	1-5
Cancer	0-12	0
Unsure/idiopathic	10-19	21-45
Psychiatric	0	0-30
Gastrointestinal	0	2-8
Miscellaneous	--	9*

Chest Pain SCAMP Main Document

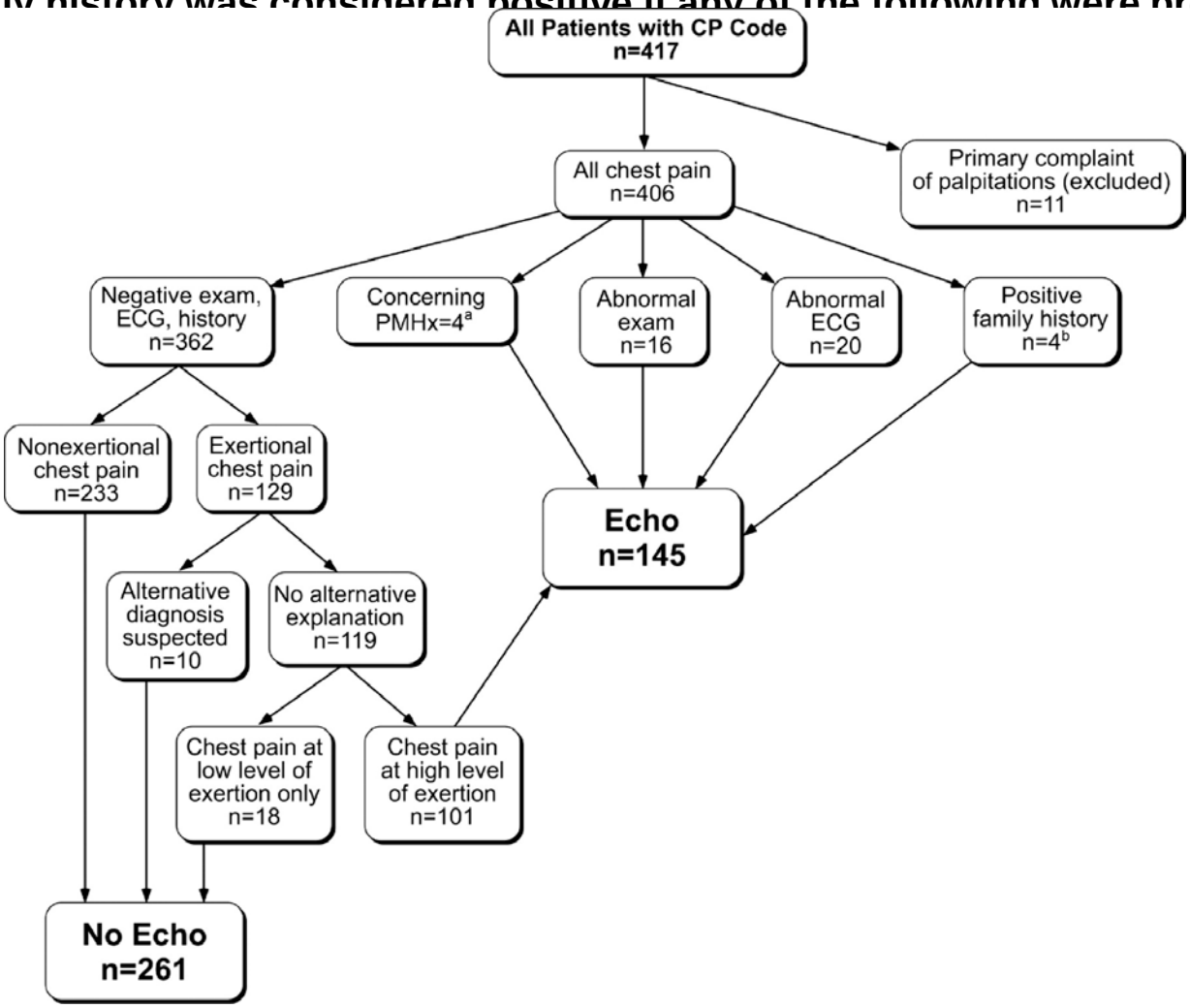
Diagnosis	Included Patients	Patients with Chest Pain
Aortic dissection	1	0 (0%)
Coronary anomalies	131	34 (26%)
Dilated cardiomyopathy	61	5 (8%)
Hypertrophic cardiomyopathy	100	5 (5%)
Myocarditis	62	**46 (74%)**
Pericarditis	65	**62 (95%)**
Pulmonary embolus	19	**13 (68%)**
Pulmonary hypertension	37	6 (16%)
Takayasu arteritis	8	0 (0%)
Total number of patients	**484**	**171 (35%)**

Kane et al. Congenit Heart Dis.2010 Jul-Aug;5(4):366-73

Diagnosis	Outpatient Department, n (%)	Emergency Department/ Inpatient Ward, n (%)
Aortic Dissection	0	0
Coronary Anomalies	32 (78)	2 (1)
LCA from right sinus	4	1
RCA from left sinus	12	0
Coronary artery disease	1	1
ALCAPA	1	0
High take-off of RCA	7*	0
Coronary artery fistula	3*	0
Dilated coronary artery	3	0
Narrowed LCA	1	0
Dilated Cardiomyopathy	0	5 (4)
Hypertrophic Cardiomyopathy	3 (7)	2 (1)
Myocarditis	1 (2)	45 (35)
Pericarditis	4 (10)	58 (45)
Pulmonary Embolus	0	13
Pulmonary Hypertension	1 (2)	5
Takayasu Arteritis	0	0
Total Patients	41	130

Kane et al. Congenit Heart Dis.2010 Jul-Aug;5(4):366-73

SCAMP algorithm to guide testing in patients with chest pain. a Diagnoses that lead to increased risk of cardiac chest pain (ie, inflammatory disorders, malignancy, thrombophilia). b Family history was considered positive if any of the following were presen...



Friedman K G et al. Pediatrics 2011;128:239-245

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PLAUSIBLE OUTCOMES

Included Patients: All new patients between 7 and 21 years of age with chest pain
Excluded Patients: Patients with known heart disease

1. Chest pain in children that occurs only at rest, with a normal ECG and cardiac examination, and without known risk factors (recent fever [PO temperature >38.5 C], family history of cardiomyopathy or hypercoagulable state) do not have a cardiac basis for the symptom of chest pain.
2. Chest pain that increases when the patient is supine or that radiates to the left shoulder has a high sensitivity and specificity for pericarditis.
3. The presence of resting sinus tachycardia in the absence of fever in a patient referred for chest pain will be associated with a higher incidence of cardiac disease compared with patients with a normal heart rate.
4. The assessment of chest pain in children presenting in the outpatient Cardiology clinic can be managed by a single visit. With proper patient and family education, the frequency of a repeat visit for patients diagnosed with non-cardiac chest pain will be less than 5%.
5. Exertional chest pain in patients with body mass index >25 or in patients involved in <3 hours/week of aerobic exercise is less likely to have a cardiac basis than chest pain that occurs in patients with body mass index 20-25 or those involved with more frequent aerobic exercise.

INITIAL EVALUATION OF PATIENT WITH CHEST PAIN

(See SDF 1)

COMPONENT	PARAMETER	COURSE OF ACTION
1. **History** →	Chest pain (CP) with exertion at peak exercise? Syncope with exercise? Anginal quality CP? CP radiates to back, jaw, left arm, or left shoulder or increases with supine position? CP temporally associated with fever (>38.4° C)? Syncope? Palpitations? CP primarily or exclusively at rest? Dyspnea on exertion? CP worse with inspiration or pleuritc in nature? Average > 3 hrs exercise/week? CP intensity, location, frequency, duration Dizziness or Lighteadedness?	If any RED items positive: → order ECHO If CP associated with fever: → order CXR Otherwise Best Clinical Judgment
2. **Past Medical History** →	Hypercoagulable state? Arthritis/Vasculitis? Immobilization? Asthma? Lens dislocation? GERD? Scoliosis? Joint mobility/dislocation?	If any RED items positive: → order ECHO Otherwise Best Clinical Judgment
3. **Family History** → (in first degree relatives)	Sudden Unexplained Death? Cardiomyopathy? Congenital Heart Disease? Aortic Aneurysm? Hypercoagulable state? Recent coronary event/MI Connective Tissue Disease? Arrhythmia/Pacemaker/ICD?	If any RED items positive: → order ECHO Otherwise Best Clinical Judgment
4. **Social History** →	Illicit Drug Use (cocaine, marijuana, amphetamines)	If positive: → order Urine/Serum Tox Screen
5. **Physical Exam** →	Ht, Wt, HR, BP, RR, Temp Ill-appearing? Painful/swollen extrm Non-innocent murmur Distant Heart Sounds Gallop ↑ Pulmonic Component Pericardial Friction Rub Peripheral edema Hepatomegaly Marfanoid Appearance Reproducible on palp Pulsus paradoxus Peripheral pulses	If any RED (non-VS) items positive: → order ECHO If RR > 40 or Temp > 38.4 → order CXR Otherwise Best Clinical Judgment
6. **EKG** →	RVH LVH ST-T segment change > 2 mm Low QRS voltage PR segment depression S1,Q3,inverted T3 QTc > 470 ms RAE, LAE Borderline LVH, RVH	If any RED items positive: → order ECHO Otherwise Best Clinical Judgment
7. **Anxiety Score** →	Patient/Family Score at beginning of visit Provider Score at end of visit	Best Clinical Judgment

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SCAMPs® Program

CNMC SDF 1: Initial Evaluation of Patient with Chest Pain

Stamp with addressograph, place sticker, or fill out the following:

CNMC MRN: _____

Pt name: _____

Eligibility:

Inclusion: All new patients between 7 and 21 years of age with chest pain, where chest pain is the primary or significant part of presenting features

Exclusion: Patients < 7 years of age or patients with known heart disease

Recommended SCAMP Testing:

- Height, Weight, Blood Pressure, Respiratory Rate, EKG

Visit date: _____ **Location** _____

Attending physician name (Please print): _____

Fellow physician / NP name (Please print): _____

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SCAMPs® Program

Chest Pain CHB SDF 1: Initial Evaluation of Patient with CP

Patient History

	Yes	No	Unk
5. CP with exertion?	☐	☐	☐
a. If **YES**, how often? ☐ Always ☐ Sometimes ☐ Rarely			
b. If **YES**, does CP prevent the patient from continuing with activity?	☐	☐	☐
c. If **YES**, can the patient resume activity after a break?	☐	☐	☐
6. Exertional syncope?	☐	☐	☐
7. CP radiates to back, jaw, left arm, or left shoulder or increases with supine position?	☐	☐	☐
8. CP temporally associated with fever (>38.4°C)?	☐	☐	☐

	Yes	No	Unk
9. Palpitations?	☐	☐	☐
10. Dizziness or lightheadedness?	☐	☐	☐
11. Syncope?	☐	☐	☐
12. CP Primarily or exclusively at rest?	☐	☐	☐
13. Is the quality of the CP the same at rest as with exertion?	☐	☐	☐
14. Does the patient also experience fatigue with CP?	☐	☐	☐
15. Dyspnea on exertion?	☐	☐	☐
16. CP worse with inspiration or pleuritic in nature?	☐	☐	☐
17. Average > 3 hrs exercise/week?	☐	☐	☐

- If **answered Yes** to questions **5-8, Echocardiogram Recommended**
- If **answered Yes** to question **8, CXR Recommended**

Comments: _____

Past Medical History

	Yes	No	Unk
18. Hypercoagulable state?	☐	☐	☐
19. Arthritis/Vasculitis?	☐	☐	☐
20. Immobilization?	☐	☐	☐

	Yes	No	Unk
21. Asthma?	☐	☐	☐
22. Lens dislocation or other features of CTD?	☐	☐	☐

- If **answered Yes to any** questions **18-20, Echocardiogram Recommended**

Comments: _____

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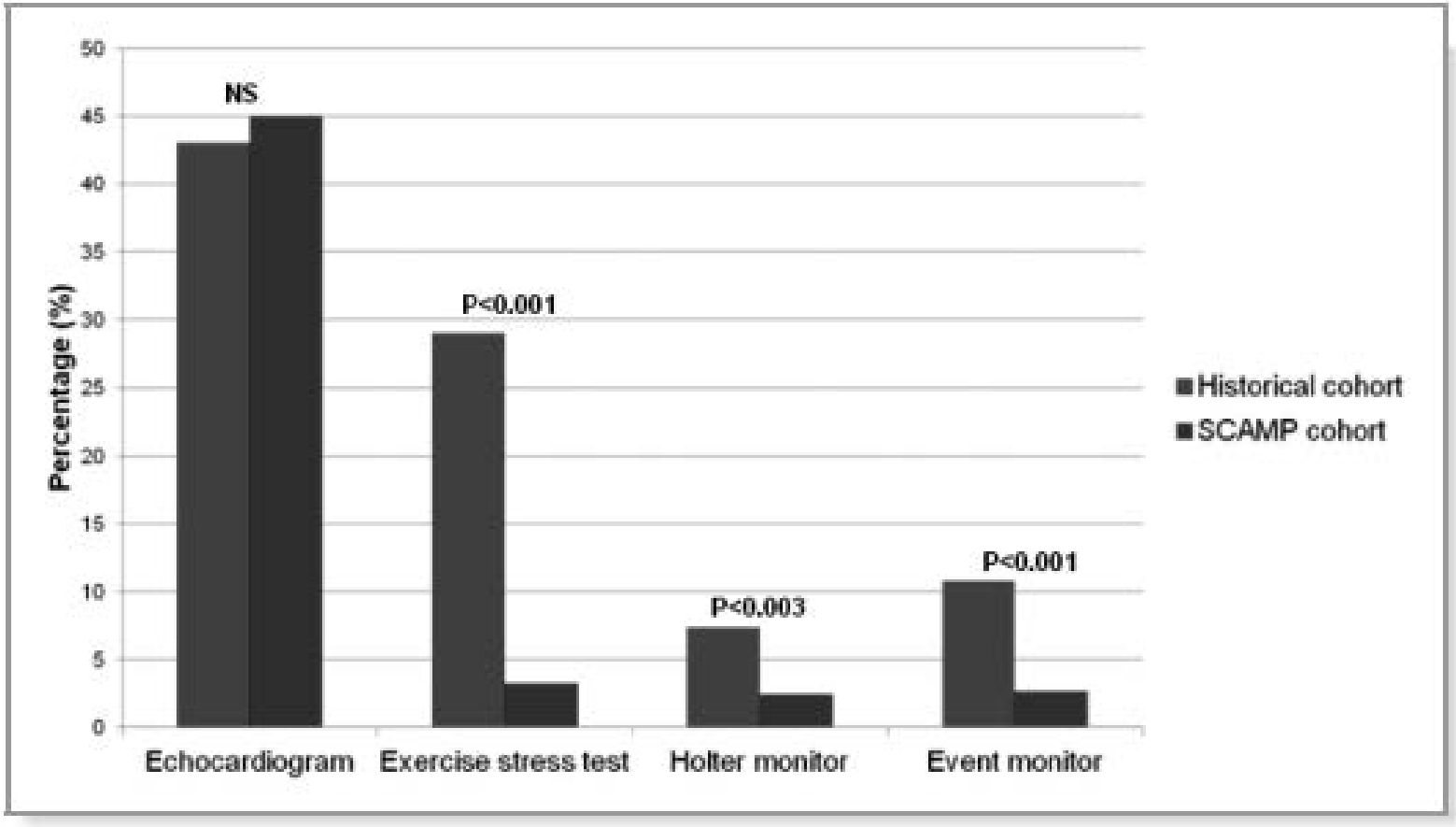
Lessons Learned



Friedman et al. Congenit Heart Dis. 2010 Jul-Aug;5(4):374-81

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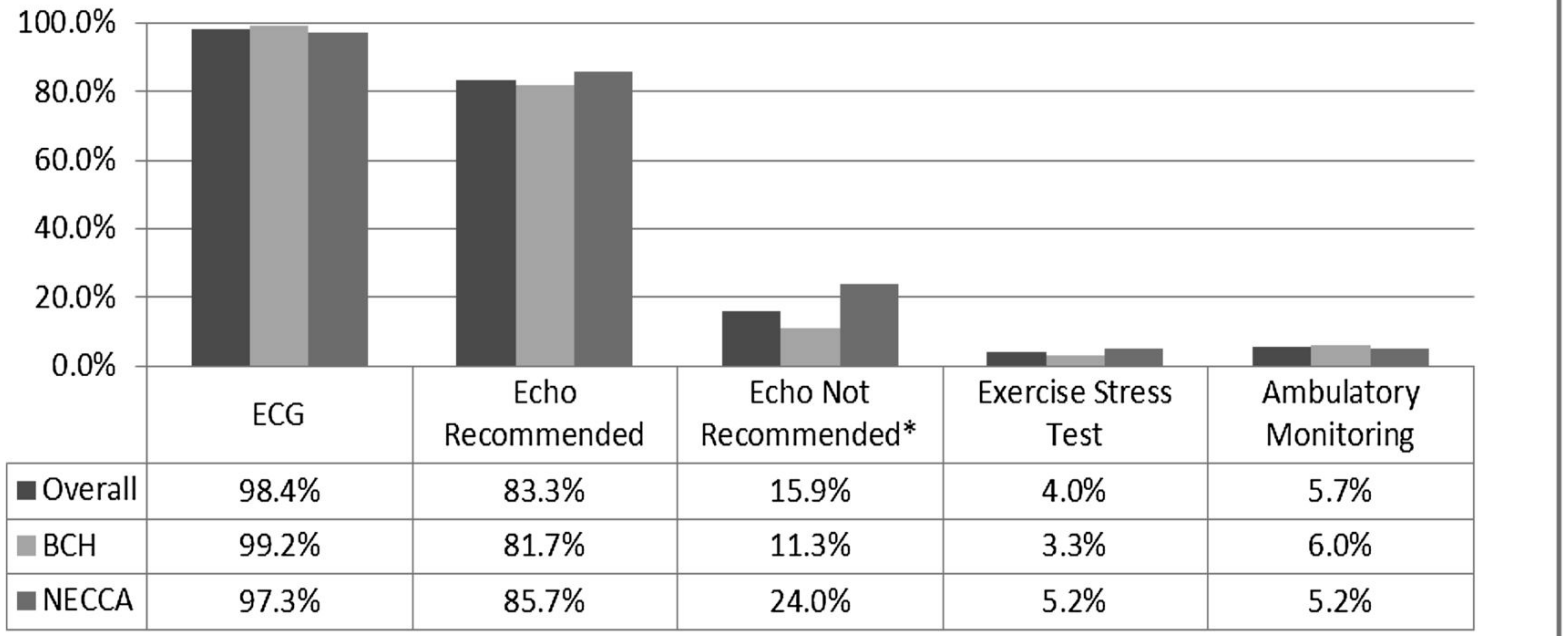
Variation analysis. *BCH versus NECCA (11.3% vs 24.0%), P < .001.



	ECG	Echo Recommended	Echo Not Recommended*	Exercise Stress Test	Ambulatory Monitoring
Overall	98.4%	83.3%	15.9%	4.0%	5.7%
BCH	99.2%	81.7%	11.3%	3.3%	6.0%
NECCA	97.3%	85.7%	24.0%	5.2%	5.2%

Angoff G H et al. Pediatrics 2013;132:e1010-e1017

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Improving quality using SCAMPs at Children's National

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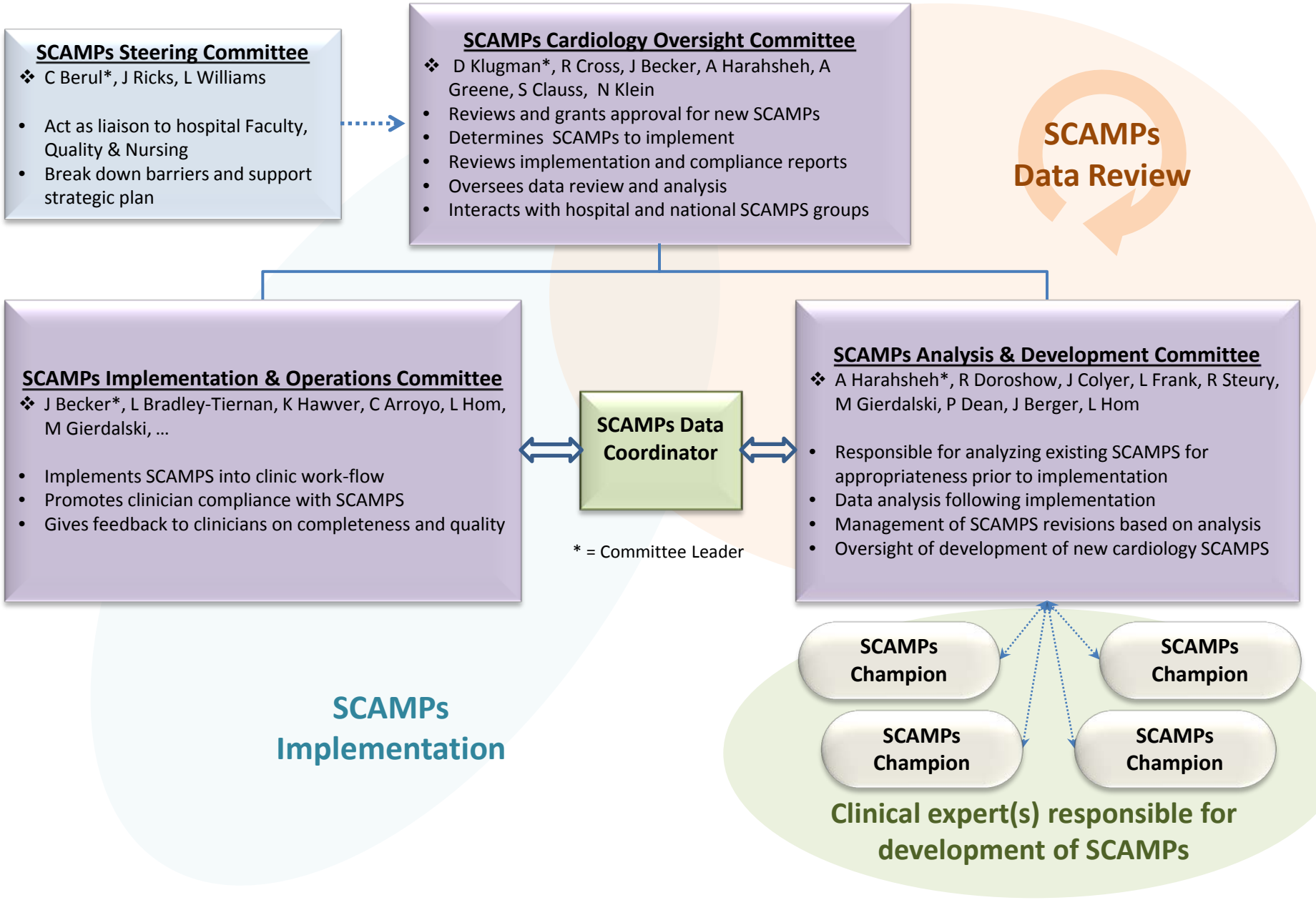
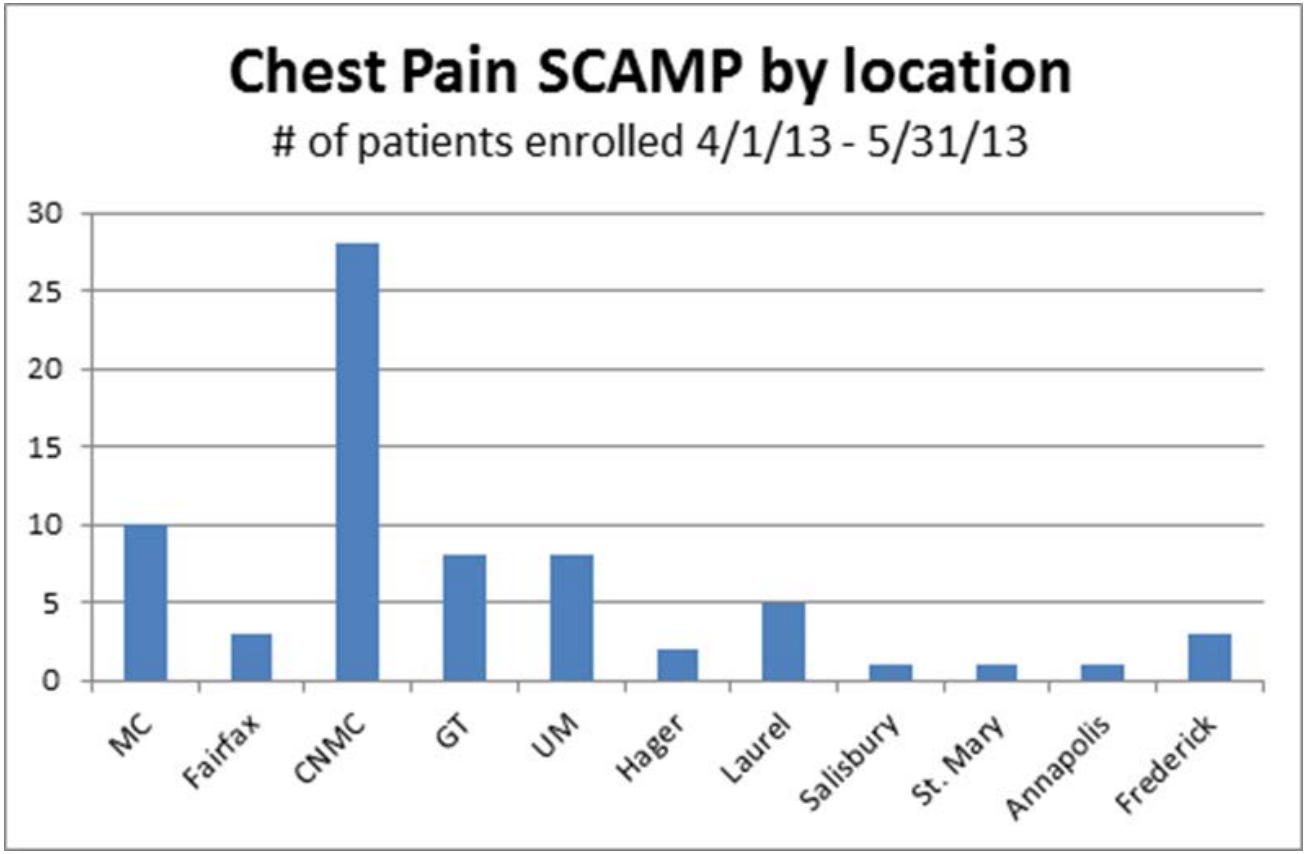
CNHI SCAMPs Organizational Chart



Implementation – make it easy to do the right thing.



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Why deviate?

TABLE 4 Testing Deviation

Stated Reasons for Deviation from Echo Recommendations (a)			
Echo Done When Not Recommended	*n* = 81 (%)	Echo Not Done When Recommended	*n* = 85 (%)
Parental anxiety or preference	2 (2.5%)	Provider felt chest pain was noncardiac	43 (50.6%)
Abnormal ECG	5 (6.2%)	Only 1 episode during exertion	6 (7.1%)
Other symptoms with chest pain	9 (11.1%)	Chest pain at rest	15 (17.6%)
Family history prompted echo	8 (9.9%)	Chest pain brief	3 (3.5%)
Exam or history finding for cardiac disease unrelated to chest pain	21 (25.9%)	Patient deconditioned	8 (9.4%)
Done before visit	7 (8.6%)	Chest pain after trauma	3 (3.5%)
No clear explanation given	12 (14.8%)	Reproducible on examination	3 (3.5%)
Missing	17 (21.0%)	Done previously and found to be normal	2 (2.4%)
		Testing not available	2 (2.4%)

Pediatrics 2013;132:e1–e8

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Iterative analysis - Chest Pain report preliminary findings

- **EKG testing recommendation followed**
  - **CNHS 247/256 (96.5%)**
- **ECHO testing recommendation followed**
  - **CNHS 154/168 (91.7%)**
- **CXR testing recommendation followed**
  - **CNHS 17/253 (6.7%)**

Algorithm development and analysis committee will meet next week to answer the question of why are we seeing variation and how can we use this data to improve evaluation and outcomes…

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Understanding EGC and Echo variation

ECG Testing by CNHS Location

	N=256	Adherence to ECG Testing N (%)
Main	115	113 (98.3%)
ROC	121	119 (98.3%)
Pebbles	18	15 (83.3%)
Not Recorded	2	0 (0.0%)

ECHO Testing by CNHS Location

	N=168	Recommended N (%)	N=88	Test Not Recommend N (%)
Main	71	64 (90.0%)	44	20 (45.5%)
ROC	84	79 (94.0%)	37	11 (29.7%)
Pebbles	13	11 (84.6%)	5	1 (20.0%)
Not Recorded	0	-	2	1 (50.0%)

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Added Cardiac Tests (Not Recommended by SCAMP)

	CNHS N=256 (%)
02 sat (oxygen Saturation)	1 (0.4%)
Blood Test (CBC, Liver fn, etc)	
CRP (C-Reactive Protein)	
Cardiac MRI	1 (0.4%)
Electrolytes	
Event Monitor	4 (1.6%)
Exercise Stress Test	10 (3.9%)
Fasting Lipid Profile	
Holter Monitor	21 (8.2%)
Loop Monitor	
Non-fasting Total Cholesterol & HDL	
Other	6 (2.3%)
Stress Echocardiogram	1 (0.4%)
TSH (Tyroid Stimulating Hormone)	1 (0.4%)
Urinalysis	

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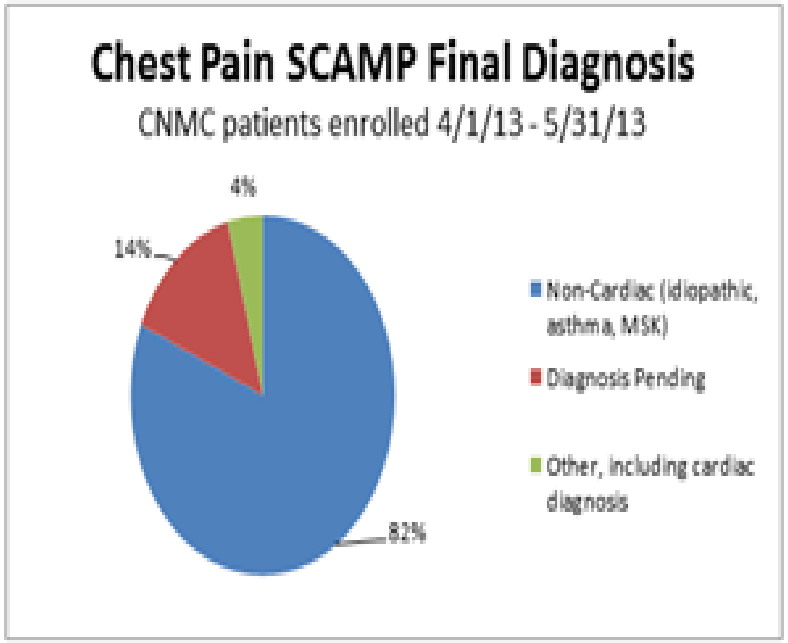
Chest Pain Final Diagnosis



	N=3,096 (%)
Non-cardiac Chest Pain	2,918 (94.3%)
Musculoskeletal	*1,303 (44.7%)*
Psychological	*75 (2.6%)*
Gastrointestinal	*106 (3.6%)*
Neurological	*6 (0.2%)*
Pulmonary	*160 (5.5%)*
Pre-Cordial Catch Syndrome	*52 (1.8%)*
Syncope	*3 (0.1%)*
Palpitations / Arrhythmia	*6 (0.2%)*
Deconditioning	*24 (0.8%)*
Other	*159 (5.4%)*
Not Recorded	*1,024 (35.1%)*
Myocarditis	2 (0.1%)
Pericarditis	5 (0.2%)
Anomalous Coronary Artery	3 (0.1%)
Other Cardiac Diagnosis	13 (0.4%)
Diagnosis Pending	112 (3.6%)
Not Recorded	43 (1.4%)

What makes a good SCAMP?

- **Provides insight into key areas of uncertainty, or an area of disagreement among physicians**
- **Identifies unnecessary utilization of resources**
- **Address variation in outcomes**
- **Identifiable patient population with clear entry and exit criteria**

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Thank You

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