

# An Application to Provide Views of the EHR to Cardiology Patients

Lauren Wilcox, MS

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David Vawdrey, PhD

Collaborators:

Dan Morris, PhD, Desney Tan, PhD

Justin Gatewood, MD , Eric Horvitz, MD, PhD



# Patient Care

Vitals


Medical History

Consultations

Procedures

Laboratory Tests

Medications

A person is sitting on a dark-colored couch, with their hands resting on their knees. They appear to be in a state of deep thought or listening intently. The background is slightly blurred, showing a light-colored wall and a blue cushion. The overall mood is contemplative and focused.

**Hospital  
patients and  
their loved  
ones are  
starving for  
information.**

# Information delivery to patients

ED patients disoriented, anxious

[Byrne 97] [Dahlen, Janson 02]

Anxiety correlated to negative outcomes

[Moser 07, Huffman et al. 07, Bruggemann, Nixon, Cavenett 07,  
Austin, Tully & Parker 07, Jones et al 07]

Increasing amount of information a patient  
receives in the clinical setting can help

[Björvell, Stieg 91]



## Welcome to Springfield Hospital

Room 7

### Your Profile

#### Reason For Your Visit

Chest Pain

#### Your Health Profile

We've reviewed your medical history.

We've reviewed the 3 medications you take at home.

You're allergic to ACE inhibitors.

#### Vitals at Triage (2:20 PM)

Heart rate: 72

Blood pressure: 172/108

Temperature: 98.0

Respiratory Rate: 18.0

### Your Visit

#### Current Status

Dr. Morris is waiting for your EKG results.

#### What's Next

Dr. Morris will call Dr. Tan to discuss next steps.

#### We've Completed

##### Physical Exam

Dr. Collins

##### Bloodwork

Hematocrit is normal

#### Pending

EKG (Approx. 1.5 hours)

Chest X-Ray Review (Radiologist reviewed, consulting with Dr. Morris)

CT Scan Review (Approx. 2.5 hours)

Additional Labs (Approx. 4 hours)

D-Dimer

Cardiac Enzymes

#### Your Medications

Nitroglycerin (to improve delivery of oxygen to the heart)

### Your Care Team

Attending Physician



John Smith, MD

Registered Nurse



Sarah Stein, RN

Senior ED Resident



Stephanie Gates, MD

myNYP.org

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Welcome back, CARMEN  
Sign out

MY HOSPITAL VISIT

MY HEALTH EXPLAINED

MY HEALTH TOOLS

MY DOCTORS

## My Care Team

Today, Thursday April 7th - Morning

Attending Physician



Susan Restaino, MD

Senior Resident



Tracy Andrews, MD

Nurse



Erica Simonich, RN

Clinic Fellow



Nasif Tamim, MD

Consulting Physician



David Vawdrey, MD

Resident



Cathy Lambert, MD

## My Health Information

Hospital Medications

Allergies

Home Medications

My Notes

Yesterday, Wednesday April 6th

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Wilcox, Morris, Tan, Gatewood, Horvitz  
CHI '10, CHI '11

Wilcox, Liu, Collins, Feiner, Restaino, Vawdrey  
(Forthcoming)

Vawdrey, Wilcox, Collins, Bakken,  
Feiner, Boyer, Restaino (Forthcoming)

# Patient-Facing Views of the EHR

Do patients benefit from electronic displays of health info in the clinical setting?

How should we structure information for a patient-centric information display?

What technological problems do we need to solve?

# Preliminary Studies

Emergency Department

Cardiology Step-Down



# Preliminary Studies: Emergency Department



18 Patients (11 female, 7 male)

11 Visitors (8 female, 3 male)

(age range 29–84, mean = 54)

Large Display Prototypes

Some 8.5 x 11 Handouts



# Preliminary Studies: Emergency Department - Results



## Benefits:

- Communication
- Archive
- Summarization
- Calming Effect
- Needed memory aids in the ED

# Preliminary Studies: Emergency Department



18 Patients (11 female, 7 male)  
22 Attending Physicians

11 Visitors (8 female, 3 male)  
(follow up survey)

(Age Range 29–84, mean = 54)

Large Display Prototypes

Some 8.5 x 11 Handouts

# Preliminary Studies: Cardiology Step-Down



11 Patients (2 female, 9 male)  
(age range 23– 79, mean = 53)

6 Nurses

(2 – 12 yrs experience)

Semi-Structured Interviews:

Medication Info Needs  
Explanation Strategies

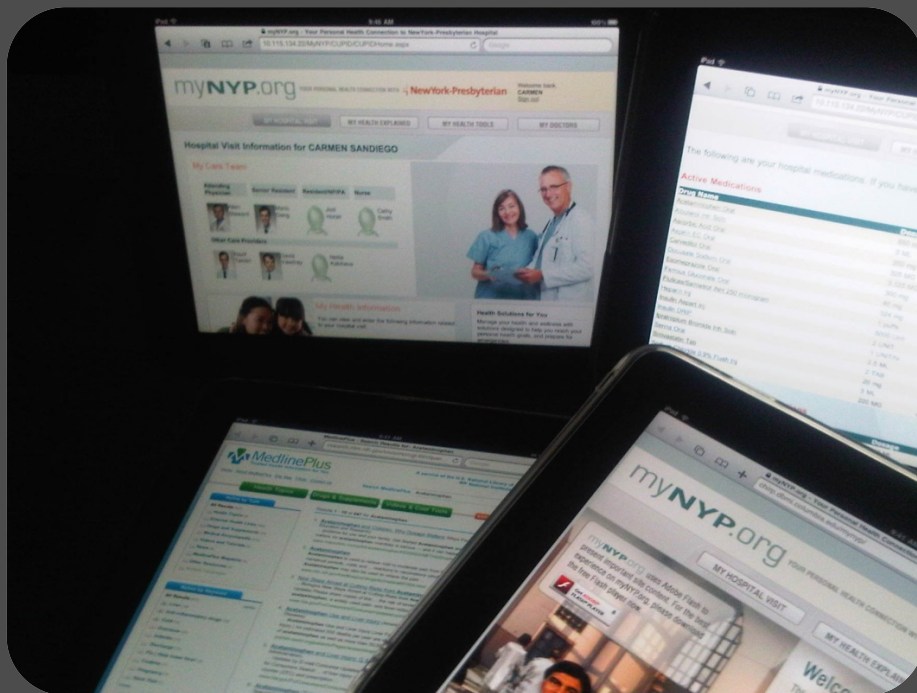


# Preliminary Studies: Cardiology Step-Down - Results

(Results in forthcoming paper)



# Patient Application: Cardiology Step-Down



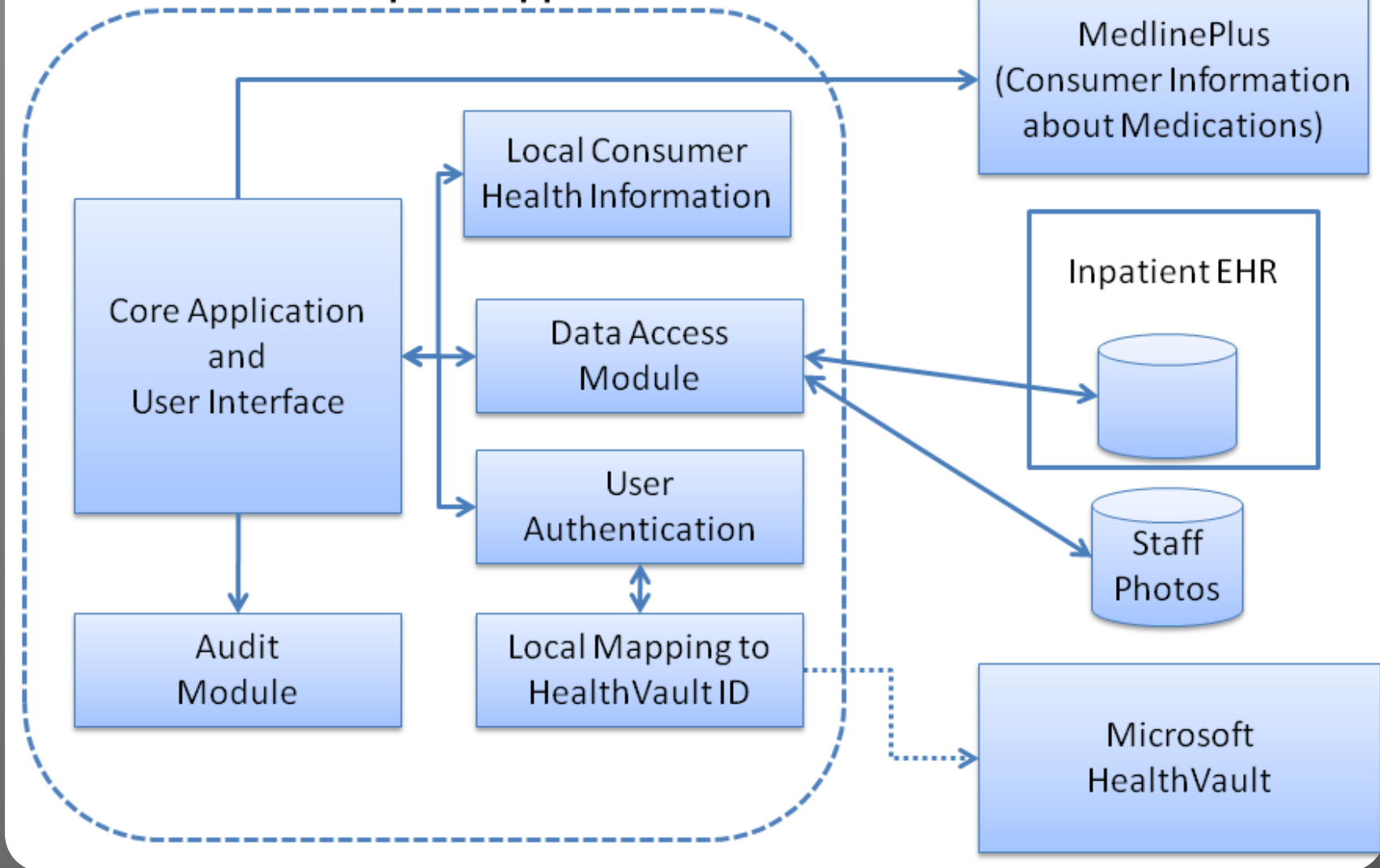
Usage Sessions

5 Patients (5 male)

Mean age= 55.4

Avg hospital stay = 5.4 days

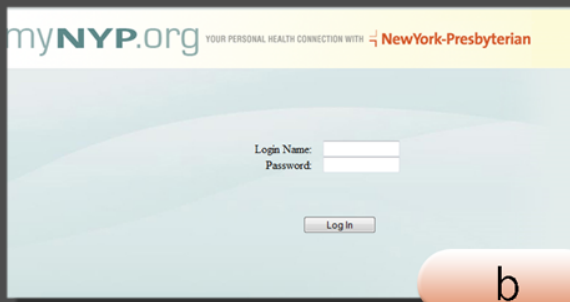
## Tablet Computer Application



# Usage Session Flow: Cardiology Step-Down



a



b



c

# Usage Session Flow: Cardiology Step-Down

**My Health Information**

You can view and enter the following information related to your hospital visit:

- Allergies
- Hospital Medications
- Home Medications
- Record Pain
- Record Activity
- My Notes/Questions

a

## Completed or Discontinued Medications

Drug Name	Dosage	Frequency	Last Given Time
Acetaminophen Rectal	650 MG	Once	2/4/2011 3:00:00 PM
Alprazolam Oral	0.25 MG	bedtime	3/2/2011 9:00:00 PM
Alteplase +R+ Inj	2 MG	Once	3/7/2011 10:03:00 AM
Amiodarone +R+ DRIP	0.5 mg/min	<Continuous>	2/12/2011 1:09:00 PM
Amiodarone +R+ Inj	150 MG	Once	2/6/2011 1:30:00 PM
Amiodarone +R+ Oral	200 MG	daily 9am	2/22/2011 9:00:00 AM
aml.ODIPine Oral	10 MG	Daily	3/11/2011 9:00:00 AM
Aripiprazole Inj	5 mg	Once	2/9/2011 5:40:00 PM
Ascorbic Acid Oral	500 mg	q24h	2/18/2011 9:00:00 AM
Aspinn Oral	81 MG	q24h	3/11/2011 9:00:00 AM
Atovaquone Oral Susp	1500 MG	daily 9am	2/22/2011 9:00:00 AM
Azathioprine Oral	300 MG	Once	2/3/2011 8:30:00 AM
Baclofen Oral	10 MG	q12hr	3/15/2011 6:00:00 AM
Barium Sulfate 2.1% Oral Susp	900 ml	Once	
Bisacodyl Rectal	10 MG	Once	2/17/2011 4:00:00 PM
Bumetanide Inj	4 mg	bid-(9,17)	3/9/2011 10:00:00 AM
Calcium Citrate + Vit D Oral	1 TAB	daily 9am	3/7/2011 9:00:00 AM
Calcium Gluconate DRIP	120 mg/hr	Once	2/14/2011 7:00:00 PM
Calcium Gluconate Inj	2 G	q1h	2/10/2011 3:30:00 AM
Cefepime +R+ Inj	2 G	q12hr	2/18/2011 12:00:00 PM
Chlorothiazide Inj	500 mg	q12hr	2/16/2011 4:00:00 AM
	250 MG	bid-(9,17)	3/9/2011 9:30:00 AM
	0.8 microgram/kg/hr	<Continuous>	2/10/2011 7:00:00 AM
	25 G	q15 min	2/17/2011 7:00:00 PM
	50 mg	Once	2/4/2011 3:00:00 PM
	25 MG	q6hr	2/27/2011 3:00:00 PM
	1 microgram/kg/min	<Continuous>	2/10/2011 5:34:00 AM
	100 mg	tid-(9,13,17)	2/18/2011 1:00:00 PM
	100 MG	tid-(9,13,17)	2/11/2011 9:00:00 AM
	2 MG	q12hr	3/10/2011 11:01:00 AM
	3 microgram/min	<Continuous>	2/6/2011 6:00:00 AM
	40 mg	q24h	2/6/2011 2:00:00 PM
	40 mg	daily 9am	2/18/2011 9:00:00 AM
	40 mg	q24h	2/16/2011 2:00:00 PM
	0.4 microgram/kg/min	<Continuous>	2/14/2011 7:00:00 PM
	50 MCG	Once	2/14/2011 2:00:00 PM
	200 microgram/hr	<Continuous>	2/13/2011 7:00:00 PM
	5 mg/hr	<Continuous>	2/15/2011 7:00:00 PM
	120 mg	bid-(9,17)	3/5/2011 9:00:00 PM
	135 MG	q24h	2/17/2011 4:00:00 AM

c

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The following are your hospital medications. If you have questions about a medication, please contact your care team.

**Active Medications**

Drug Name	Dosage	Frequency	Last Given Time
Acetaminophen Oral	650 mg	q4h	3/15/2011 10:00:00 PM
Ascorbic Acid Oral	500 mg	daily 9am	3/17/2011 9:00:00 AM
Bumetanide Inj	4 mg	q12h-(9,21)	3/17/2011 9:00:00 AM
Calcium Citrate + Vit D Oral	2 TAB	q12h-(9,21)	3/17/2011 9:00:00 AM
Cefepime +R+ Inj	2 G	q12hr	3/17/2011 9:00:00 AM
Chlorothiazide Oral Susp	250 MG	q12hr	3/17/2011 8:30:00 AM
Citalopram Oral	10 MG	q24h	3/16/2011 6:00:00 PM

b



# Usage Session: Cardiology Step-Down - Results

(Results in forthcoming paper)

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MY HOSPITAL VISIT MY HEALTH EXPLAINED MY HEALTH TOOLS MY DOCTORS

### My Care Team

Today, Thursday April 7th - Morning

Attending Physician	Senior Resident	Nurse
 Susan Restaino, MD	 Tracy Andrews, MD	 Erica Simonich, RN
Clinic Fellow	Consulting Physician	Resident
 Nasif Tamim, MD	 David Vawdrey, MD	 Cathy Lambert, MD

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- Hospital Medications
- Allergies
- Home Medications
- My Notes

◀ Yesterday, Wednesday April 6th

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### Current Status

Dr. Morris is

### What's Next

Dr. Morris will

### We've Completed

#### Physical Exam

Dr. Collins

#### Bloodwork

Hematocrit

### Pending

EKG (Approx. 1

Chest X-Ray Re

consulting w

CT Scan Review

Additional Lab

D-Dimer

Cardiac En

### Your Medications

Nitroglycerin (to improve delivery of oxygen to the heart)

## Your Medications

Nitroglycerin (to improve delivery of oxygen to the heart)

## Your Care Team

Attending  
Physician



John Smith, MD

Registered  
Nurse



Sarah Stein, RN

Senior ED  
Resident



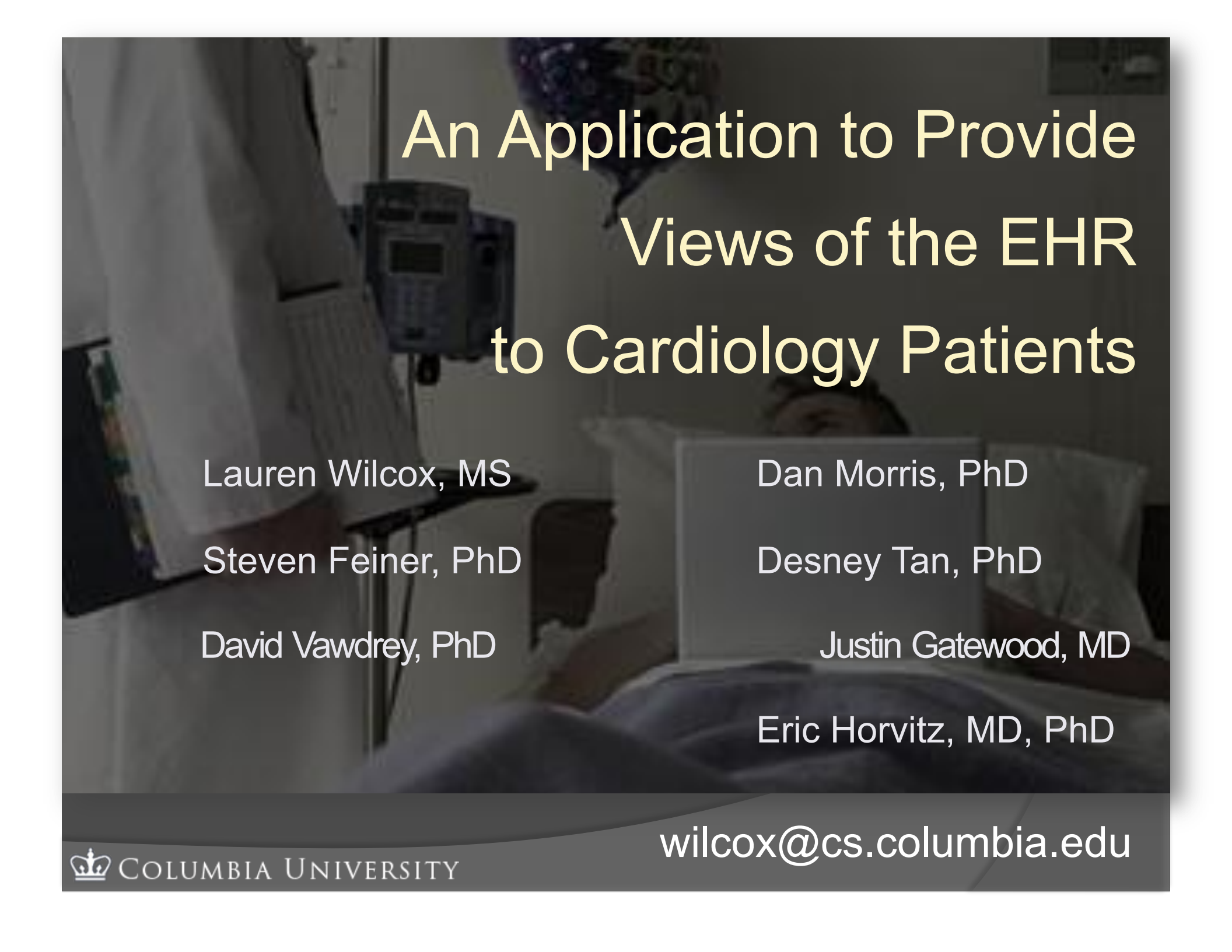
Stephanie Gates, MD





# Next Steps – Data Browsing

1. Associate multiple attributes of data in representations of the data  
Bade et al. '04, Plaisant et al. '96, Wang et al. '08
2. Browse several levels of detail  
Bade et al. '04, Chen et al. '04, Lam et al. '06, Pieczkiewicz et al. '07, Plaisant et al. '96, Powsner & Tufte '94, Wang et al. '08
3. Show qualitative scales  
Bade et al. '04, Powsner & Tufte '94
4. Show relationships to other data over time  
Bade et al. '04, Plaisant et al. '96, Wang et al. '08
5. Allow browsing on small screens (mobile views)  
Chen et al. '04, Lam et al. '06



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