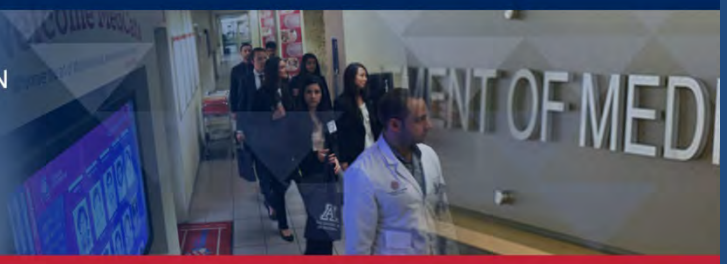
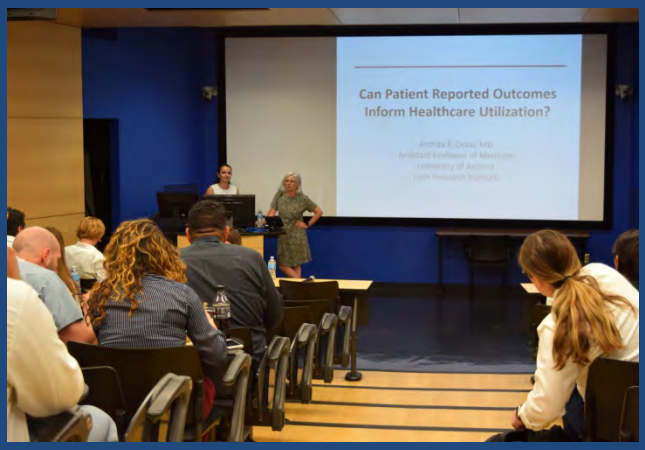
THE UNIVERSITY OF ARIZONA HEALTH SCIENCES

COLLEGE OF MEDICINE TUCSON

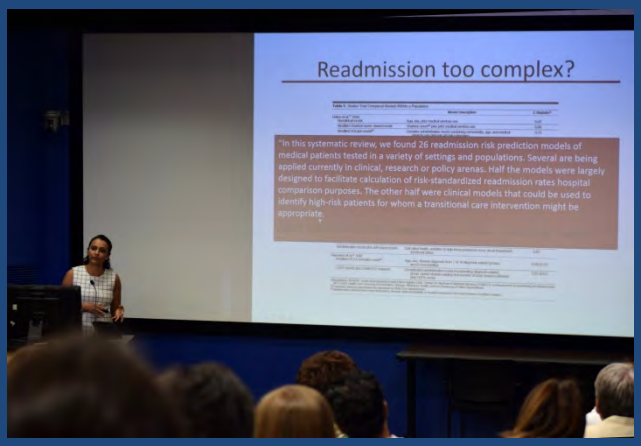
Department of Medicine

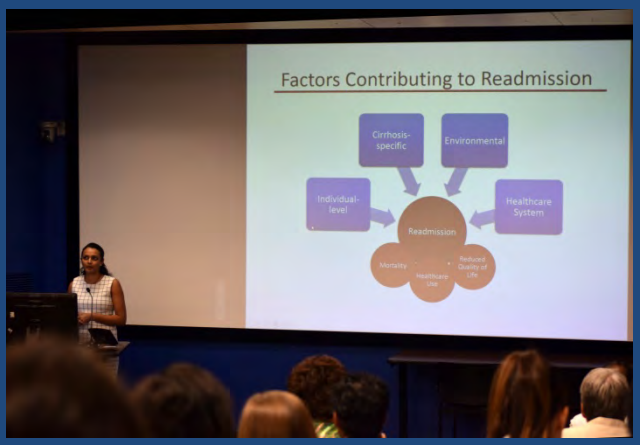


DOM Research Seminar with Drs. Archita Desai and Bhaskar Banerjee – May 11, 2017

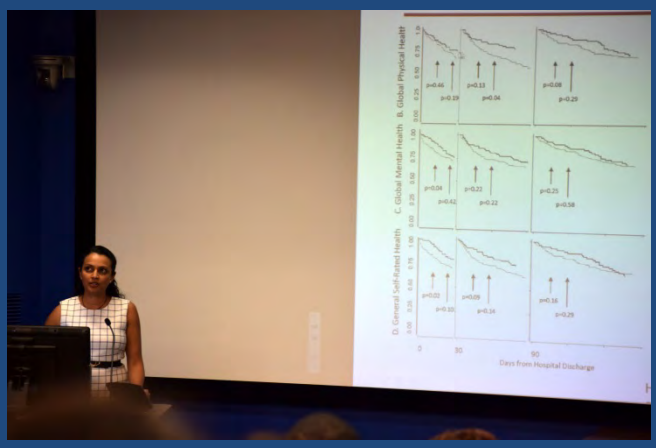


The Division of Gastroenterology's Archita Desai, MD (of the Liver Research Institute), and Bhaskar Banerjee, MD, PhD, presented on respectively "Can Patient Reported Outcomes Inform Healthcare Utilization?" and "Optical and Engineering Solutions for Clinical Needs in Gastroenterology." Archived video of their lectures can be viewed **here**.

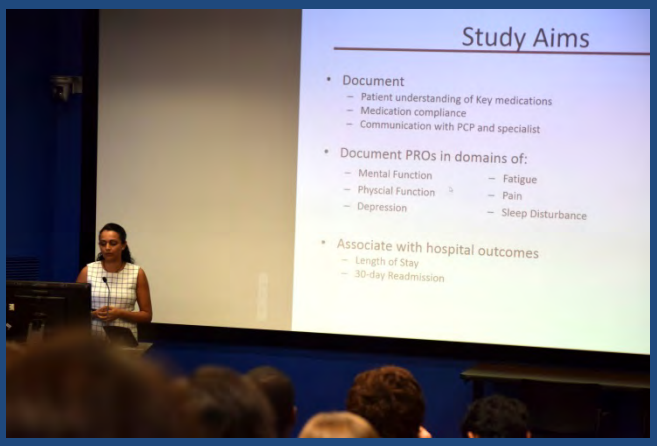

Readmission too complex?
"In this systematic review, we found 26 readmission risk prediction models of medical patients tested in a variety of settings and populations. Several are being applied currently in clinical, research or policy arenas. Half the models were largely designed to facilitate calculation of risk-standardized readmission rates hospital comparison purposes. The other half were clinical models that could be used to identify high-risk patients for whom a transitional care intervention might be appropriate."

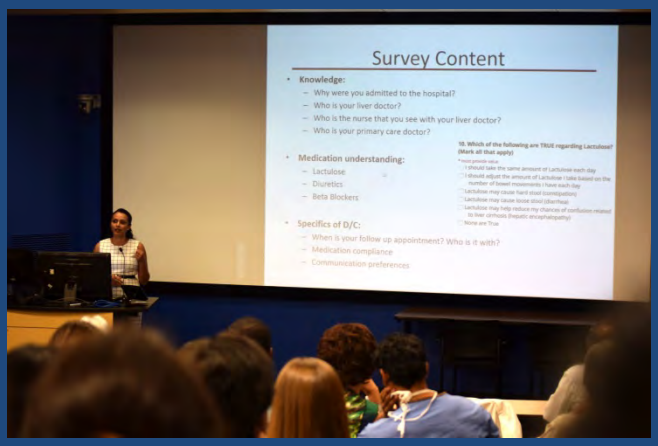

Factors Contributing to Readmission
Cirrhosis-specific
Environmental
Individual-level
Healthcare System
Readmission
Mortality
Healthcare Use
Reduced Quality of Life


Role of Patient Reported Outcomes
Kaplan-Meier plots of time to first hospital-based utilization by the better (dark line) versus poorer (faint line) median quantiles of each patient-reported Outcomes obtained at hospital discharge and around 30, 90, and 180 days thereafter.


B. Global Physical Health
C. Global Mental Health
D. General Self-Rated Health
Days from Hospital Discharge


Role of Patient Reported Outcomes
Post-SVR12 improvements in PRO scores. All P<0.0001, except for WPAI: absenteeism.
SF-36
FACIT-F
CLDQ-HCV
WPAI
MCID: 8%


Study Aims
Document
Patient understanding of Key medications
Medication compliance
Communication with PCP and specialist
Document PROs in domains of:
Mental Function
Physical Function
Depression
Fatigue
Pain
Sleep Disturbance
Associate with hospital outcomes
Length of Stay
30-day Readmission


Survey Content
Knowledge:
Why were you admitted to the hospital?
Who is your liver doctor?
Who is the nurse that you see with your liver doctor?
Who is your primary care doctor?
Medication understanding:
Lactulose
Diuretics
Beta Blockers
Specifics of D/C:
When is your follow up appointment? Who is it with?
Medication compliance
Communication preferences


Survey Content
PROMIS® Adult Self-Reported Health
Physical Health
Mental Health
Social Health
PROMIS® developed self-report measures for adults for the functions, symptoms, behaviors, and feelings shown here. Measures are applicable to the general population and to those with chronic conditions.


Results – Patient Charatercistics

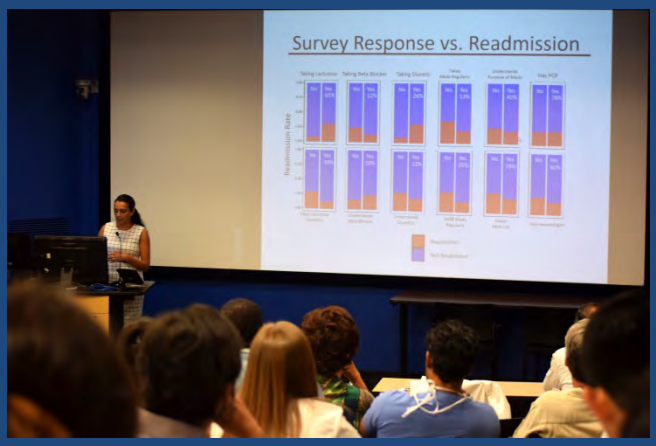

Results – Hospitalization Charateristics

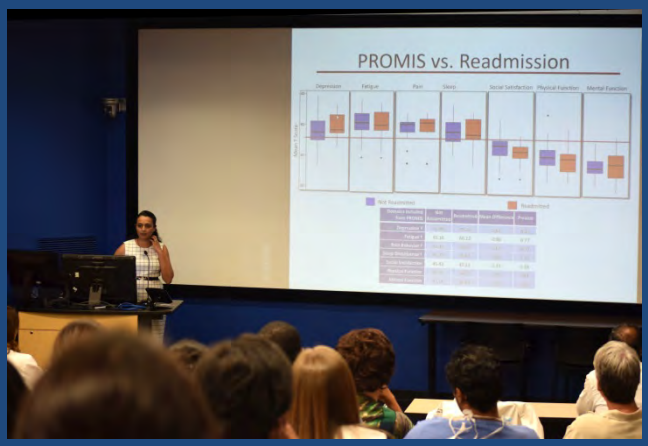

Association with 30-day Readmission

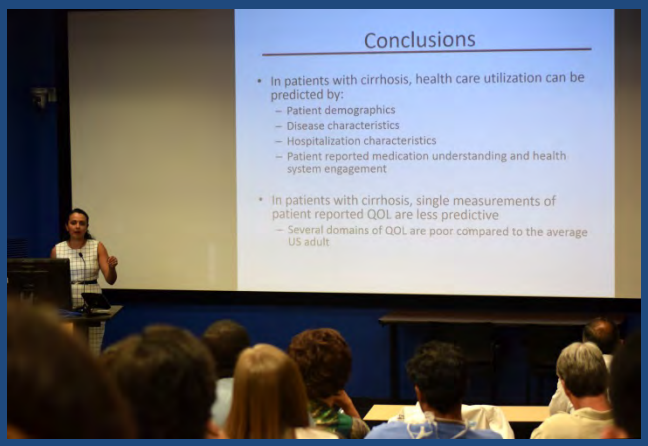

Survey Response vs. Length of Stay

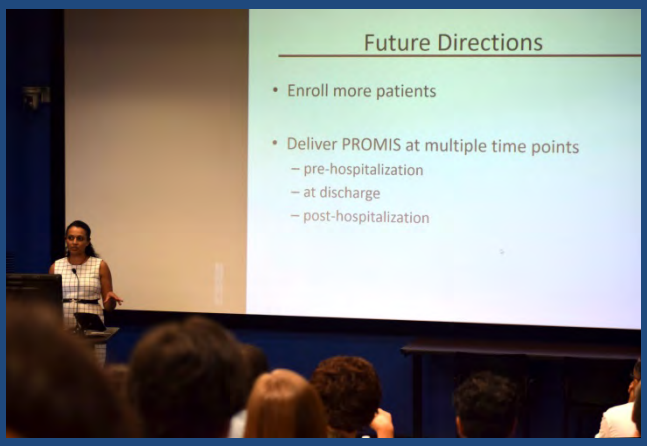

Survey Response vs. Length of Stay


PROMIS vs. Length of Stay


Survey Response vs. Readmission


PROMIS vs. Readmission


Conclusions
In patients with cirrhosis, health care utilization can be predicted by:
Patient demographics
Disease characteristics
Hospitalization characteristics
Patient reported medication understanding and health system engagement
In patients with cirrhosis, single measurements of patient reported QOL are less predictive
Several domains of QOL are poor compared to the average US adult


Future Directions
• Enroll more patients
• Deliver PROMIS at multiple time points
– pre-hospitalization
– at discharge
– post-hospitalization


Future Directions
SA #2
"Liver30-PRO"
• Validate LACE Index in Cirrhosis
• Expand LACE with comprehensive EHR data
•Further Refine
• Socioeconomic
• Environmental
• Healthcare System
• Patient Reported Outcomes
• Calibrate in subgroups:
• Race
• Ethnicity
• Socioeconomic position
• Access to Care
Performance Calibration
SA #3
SA #1

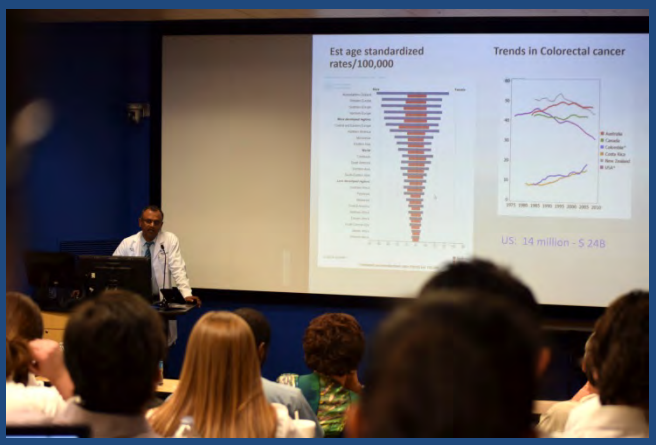

Acknowledgements
• Mentors
– Elizabeth Calhoun, PhD, Med
– Thomas Boyer, MD
– Michael Fallon, MD
– Steve Goldschmid, MD
• Arizona Health Sciences & 2015 CDA Award Committee
• Liver Research Institute
– Skye King, MD; Azadeh Fotouhie, MD; Samah Alshehri PharmD
– Jo McClain, RN; Laurie Judge, RN
– Jason Gass
– Shannon Knapp, PhD (Bio5 Institute)
– Lisa Laughlin
• Clinical Staff
– Mirna Cano, MA; Janet Serrano, MA
– Kane Gronback, NP; Carol Peters, NP


The University of Arizona
Health Sciences

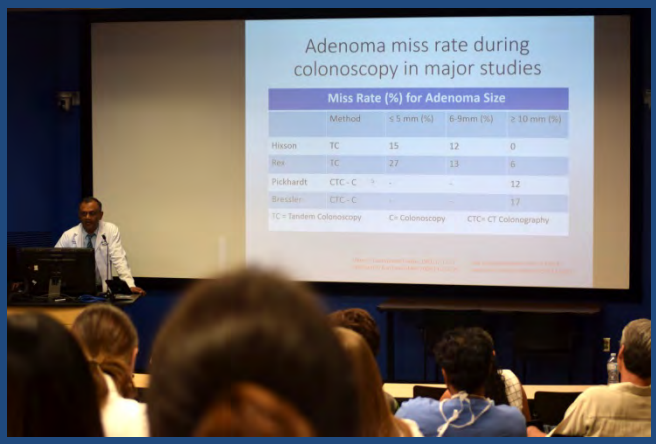

Optical and engineering solutions for clinical needs in Gastroenterology
Bhaskar Banerjee, MD
Professor of Medicine, Optical Sciences and Biomedical Engineering


Disclosure
Funding:
NIH
Tech Launch AZ
Barrett Cancer Imaging Fund
Intellectual Property:
Formulaic Imaging
US 61630,303
Dual-view multi-modal probe
US 61831438, PCT/US14/39619
Europe, Japan, 4 others
Co-founder: Omniscient LLC

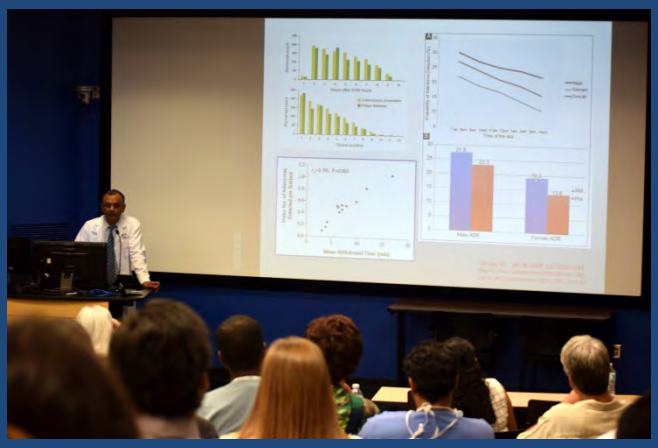

Incidence of colorectal cancer


Est age standardized rates/100,000
Trends in Colorectal cancer
US: 14 million - $ 24B


Proximal and distal colon
Odds Ratio for Association between Colonoscopy & Colorectal Cancer Death
All Cancer
R - sided
L - sided
Undefined
0.63
0.99
0.33
0.90
INTERVAL CANCER
Unexpected cancer found between index and subsequent colonoscopy (5% of all cancers at colonoscopy)


Adenoma miss rate during colonoscopy in major studies
Miss Rate (%) for Adenoma Size
Method
≤ 5 mm (%)
6-9mm (%)
≥ 10 mm (%)
Hixson
TC
15
12
0
Rex
TC
27
13
6
Pickhardt
CTC - C
12
Bressler
CTC - C
17
TC = Tandem Colonoscopy
C= Colonoscopy
CTC= CT Colonography


How do we determine quality?
Adenoma Detection Rate (ADR):
% screening patients with ≥ 1 adenoma
Target threshold
Mean ADR
Top detectors
Men
25%
20-37%
40-45%
Women
15%
18-20%
(range 7-52%)
Cannot be measured electronically – linked to histology report
'Gaming' – once a likely 'adenoma' is found, rapid completion of procedure
Centers for Medicare & Medicaid – proposed ADR reportable quality measure
GIQuIC – National database 4,000+ endoscopists

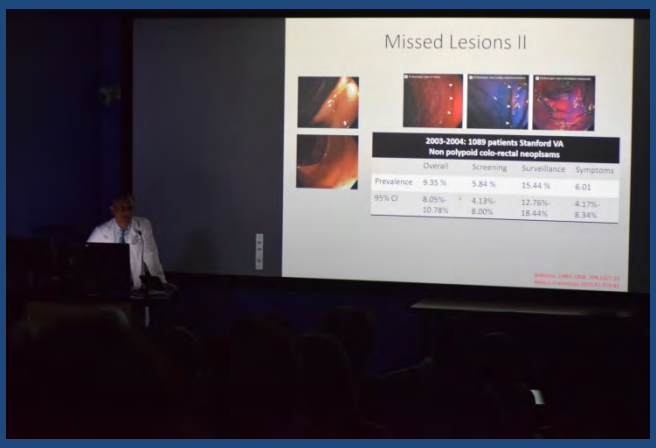



186 endoscopists; 45,026 pts.; 188,788 pt. years; 5 yr. follow up; 42 interval cancers
Interval Cancers
0
1
2
3
Endoscopists
154
25
3
1
Procedures
25,874
10,658
5189
3035

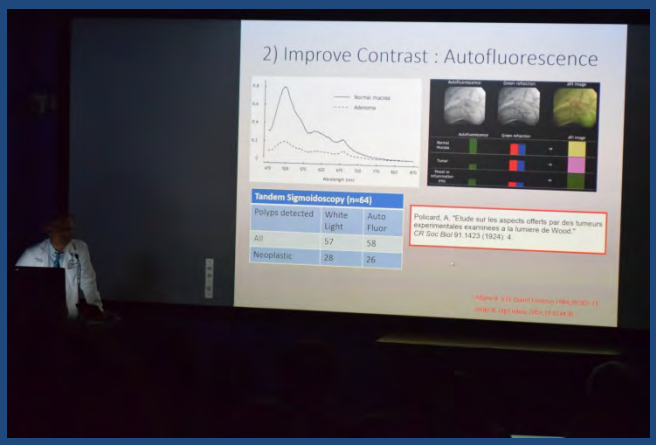

Is it all due to human error?
Poor preparation
Incomplete polypectomy
Poor technique
Insufficient time
Fatigue
(rapid growth)

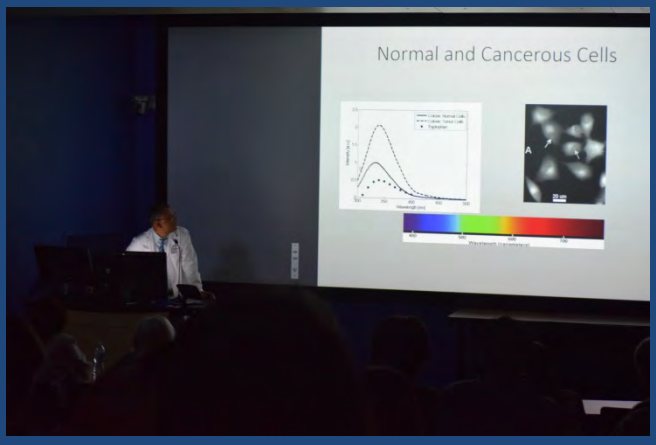

Missed lesions I: hidden behind folds
Virtual Colonoscopy
Optical Colonoscopy Blinded to VC
After each segment seen, VC results for previous segment un-blinded
n=1,233
71% of missed neoplasms BEHIND a fold
Antegrade endoluminal view of 'flight' through the colon (looking distally towards rectum).
Green: areas visualized during retrograde fly through.
Unpainted areas: not seen during 'flight'.

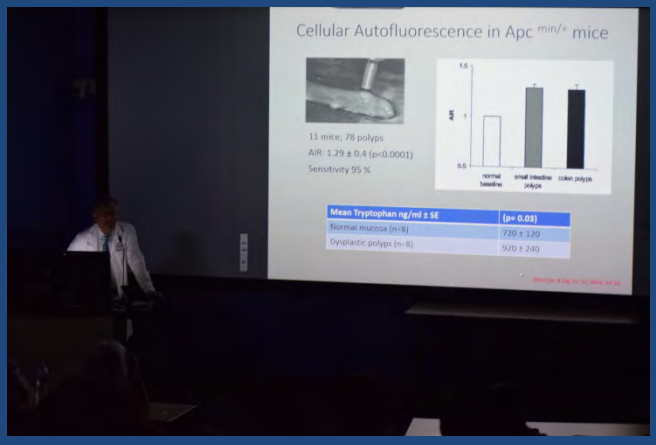

Missed Lesions II

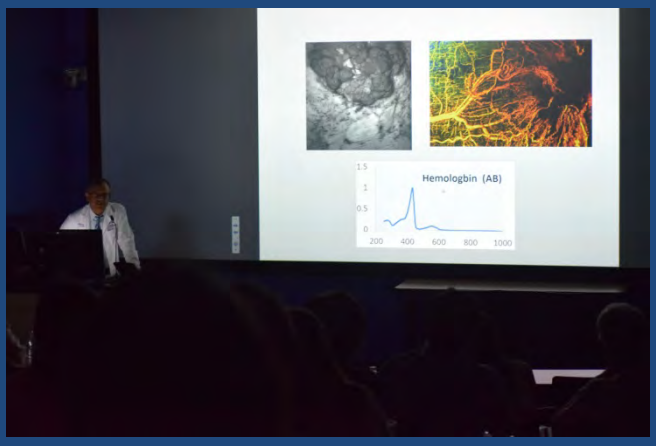

Missed Lesions II
2003-2004: 1089 patients Stanford VA
Non polypoid colo-rectal neoplasms
Overall
Screening
Surveillance
Symptoms
Prevalence
9.35 %
5.84 %
15.44 %
6.01
95% CI
8.05%-10.78%
4.13%-8.00%
12.76%-18.44%
4.17%-8.34%

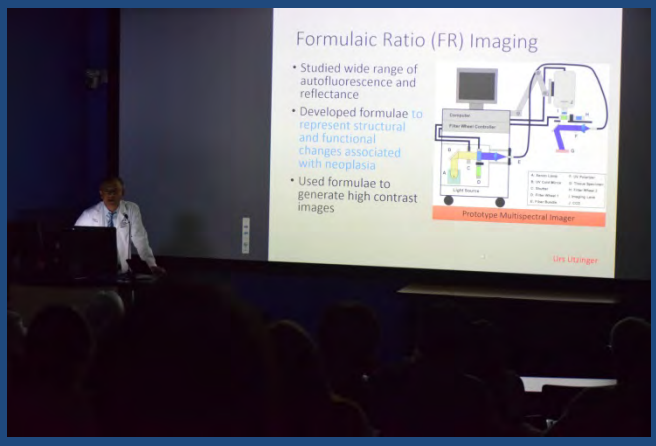

Ask clear & detailed questions
We don't see all of the colon
LIMITED FIELD OF VIEW
Some polyps have
POOR COLOR CONTRAST
1. Can we increase the Field of View?


2) Improve Contrast : Autofluorescence
Tandem Sigmoidoscopy (n=64)
Polyps detected
White Light
Auto Fluor
All
57
58
Neoplastic
28
26
Polycard, A. "Etude sur les aspects offerts par des tumeurs expérimentales examinees a la lumiere de Wood."
CR Soc Biol 91.1423 (1924): 4.


Normal and Cancerous Cells

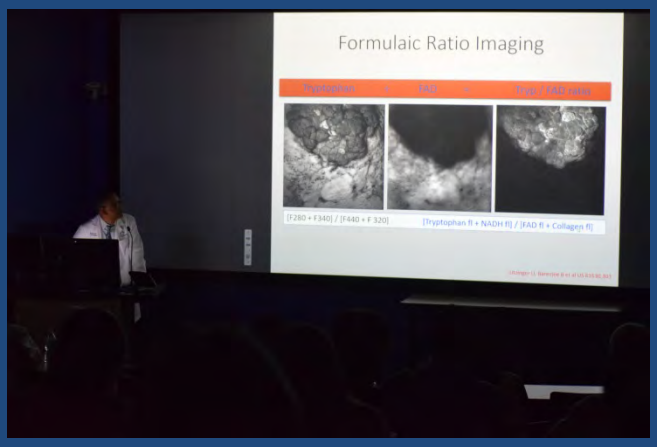

Cellular Autofluorescence in Apc min/+ mice
11 mice; 78 polyps
AIR: 1.29 ± 0.4 (p<0.0001)
Sensitivity 95 %
normal baseline
small intestine polyps
colon polyps
Mean Tryptophan ng/ml ± SE
(p= 0.03)
Normal mucosa (n=8)
720 ± 120
Dysplastic polyps (n=8)
920 ± 240

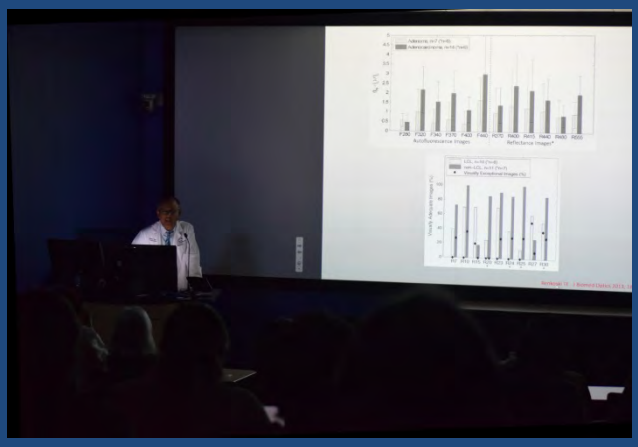

Hemologbin (AB)


Formulaic Ratio (FR) Imaging
• Studied wide range of autofluorescence and reflectance
• Developed formulae to represent structural and functional changes associated with neoplasia
• Used formulae to generate high contrast images
Prototype Multispectral Imager
Lisa Litzinger

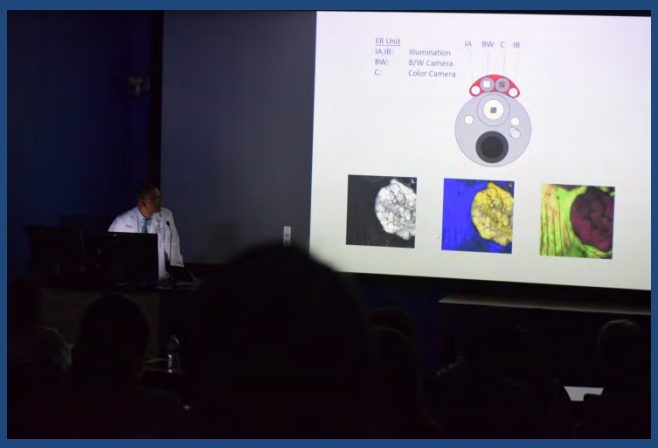

Images Captured
• Auto-fluorescence
Name | Emission (nm) | Target Fluorophore | (Other)
F280 | 345-410 | Tryptophan | (Pyridoxine)
F320 | 375-410 | Collagen | (Pyridoxine)
F340 | 410-500 | NADH | (Collagen, Elastin)
F370 | 410-500 | Collagen | (NADH, Elastin)
F400 | 600-655 | Porphyrins
F440 | 500-600 | FAD | (Collagen)
• Crossed Polarization Reflectance (Narrowband)
Name | Color
R370 | UV-A
R400 | Violet
R415 | Violet
R440 | Blue
R480 | Blue-Green
R555 | Green
Hemoglobin Absorption


F280 / R555
Tryptophan fl / Hemoglobin reflectance
0.97+/-0.12
3.0+/-0.6

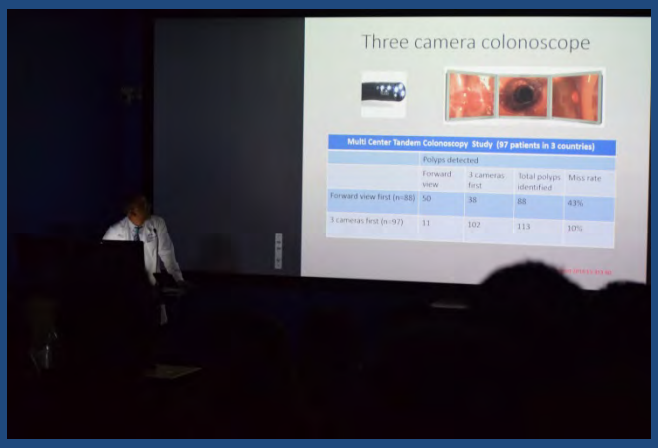

Formulaic Ratio Imaging
Pyridoxine
FAD
Tryp. / FAD ratio
[F280 + F340] / [F440 + F 320]
[Tryptophan fl + NADH fl] / [FAD fl + Collagen fl]



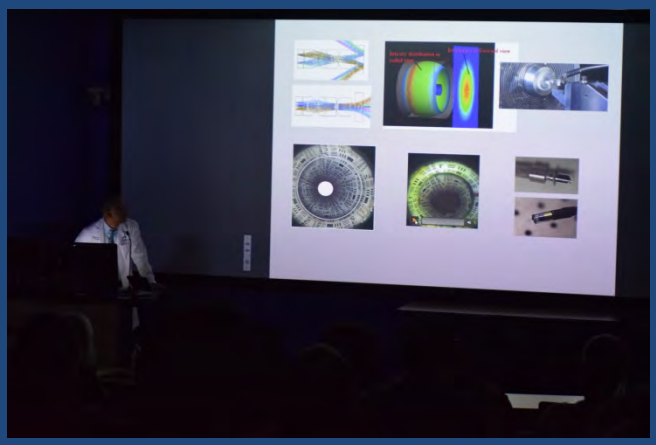

FR Unit
IA,IB: Illumination
BW: B/W Camera
C: Color Camera
IA BW C IB

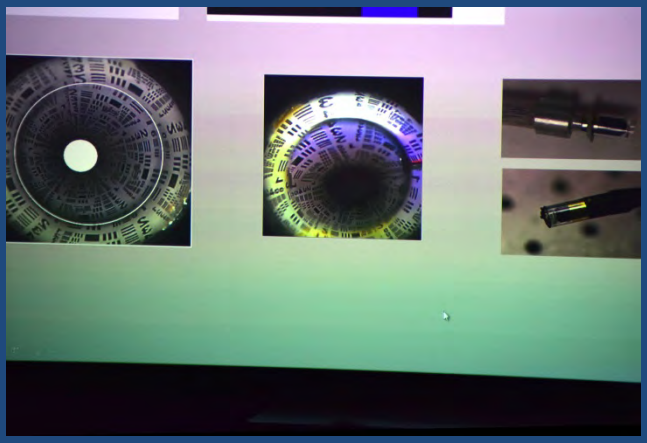

FR Unit
IA,IB: Illumination
BW: B/W Camera
C: Color Camera
IA BW C IB

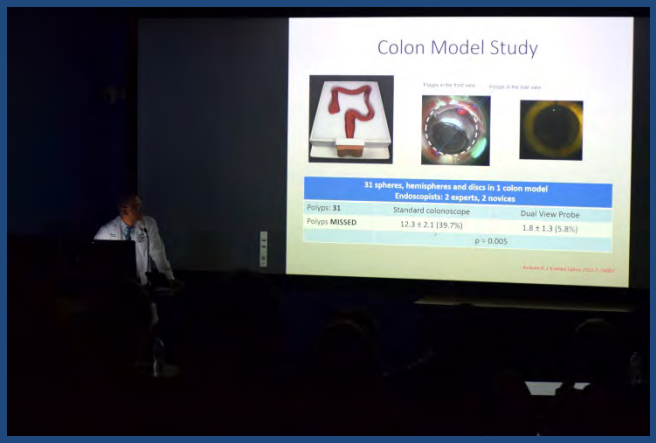

1) Improve Field of View
• A 140 degree colonoscope fails to image 20 % of the surface of the colon
• >70 % of missed polyps are behind folds
• Colon: ~ 1.6m long, 50 haustral folds

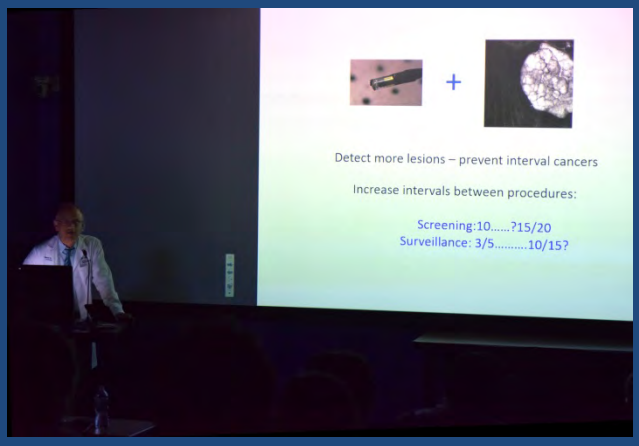

Three camera colonoscope
Multi Center Tandem Colonoscopy Study (97 patients in 3 countries)
Polyps detected
Forward view
3 cameras first
Total polyps identified
Miss rate
Forward view first (n=88)
50
38
88
43%
3 cameras first (n=97)
11
102
113
10%


Proposed Solution
fuse






Colon Model Study
31 spheres, hemispheres and discs in 1 colon model
Endoscopists: 2 experts, 2 novices
Polyps: 31
Standard colonoscope
Dual View Probe
Polyps MISSED
12.3 ± 2.1 (39.7%)
1.8 ± 1.3 (5.8%)
p = 0.005


+
Detect more lesions – prevent interval cancers
Increase intervals between procedures:
Screening:10.....?15/20
Surveillance: 3/5.....10/15?


DUAL VIEW IMAGING
Ron Liang, PhD (Opt Sci.)
Rajendar Katkam*
Xiaoyin Zhu*
Nam Zhu
Basel Salahieh
Jerri-Lynn Kincade
Luis Ocampo
FUNDING:
TECH LAUNCH ARIZONA
Barrett Cancer Imaging Fund
FORMULAIC IMAGING
Urs Utzinger, PhD (Bio Med Eng.)
Tim Renkoski**
Logan Graves
Nathaniel Rial
RECEPTOR TARGETED MICROBUBBLE DETECTION OF CANCER WITH MULTI PHOTON MICROSCOPY
Terry Matsunaga Pharm D, PhD, (Med Imaging)
Josef Vagner PhD (BIOS)
Khanh Kiew PhD (Opt Sci)
Ashley McDaniel*
Kaitlin Harper*
Robert Dawson Baker
Babak Amirsolaimani*
Soroush Mehrevar*
(Grad students * MS; ** PhD)

Photos courtesy of David Mogollón, Communications Coordinator, UA Department of Medicine, (520) 626-1137 or **dmogollon@deptofmed.arizona.edu**