Imaging in Population Health Management

James Brink, MD

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HARVARD MEDICAL SCHOOL

MASSACHUSETTS GENERAL HOSPITAL

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- MGH Radiology Consulting Group provides consulting services to Nuance, Inc., regarding CDS for Reporting
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  - Tim Ferris
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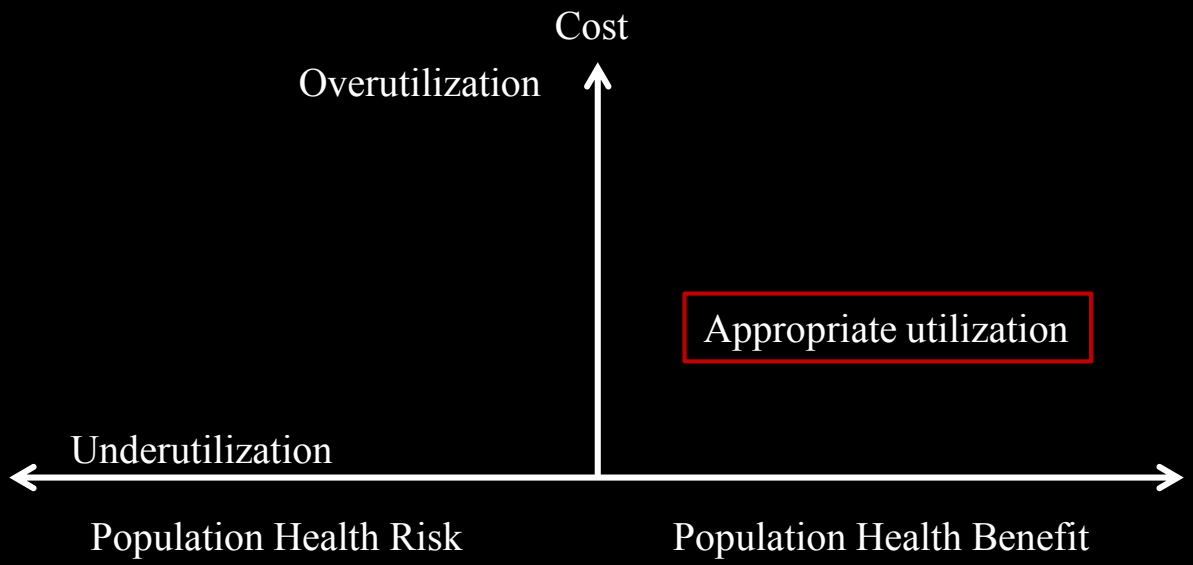
  - Jeff Weilburg
  - McKinley Glover
  - Pari Pandharipande
  - MT Shore

Population Health Management

The goal is to keep a patient population as healthy as possible, minimizing the need for expensive interventions such as emergency visits, hospitalizations, imaging tests, procedures

Automation makes population health management feasible, scalable and sustainable

Population Health Management: Variation Control



The goal is to ensure *consistent and appropriate resource utilization*, thereby optimizing health benefits while reducing healthcare costs.

Courtesy of Pari Pandharipande, MGH

Reducing Variation

- Clinical Decision Support
  - Before imaging – to guide practitioners to the most appropriate imaging exam for their patients
  - Before interventional procedures – shared decision-making tool for reviewing the benefits and risks
  - After imaging – to guide radiologists to the appropriate recommendations consequent to findings


ACRselect
NATIONAL
DECISION SUPPORT
COMPANY


ESR iGUIDE
EUROPEAN SOCIETY OF RADIOLOGY

Impact of a Commercially Available Clinical Decision Support Program on Provider Ordering Habits

Journal of the American College of Radiology
Volume 15 ■ Number 7 ■ July 2018

Timothy C. Huber, MD, Arun Krishnaraj, MD, MPH, James Patrie, MS, Cree M. Gaskin, MD

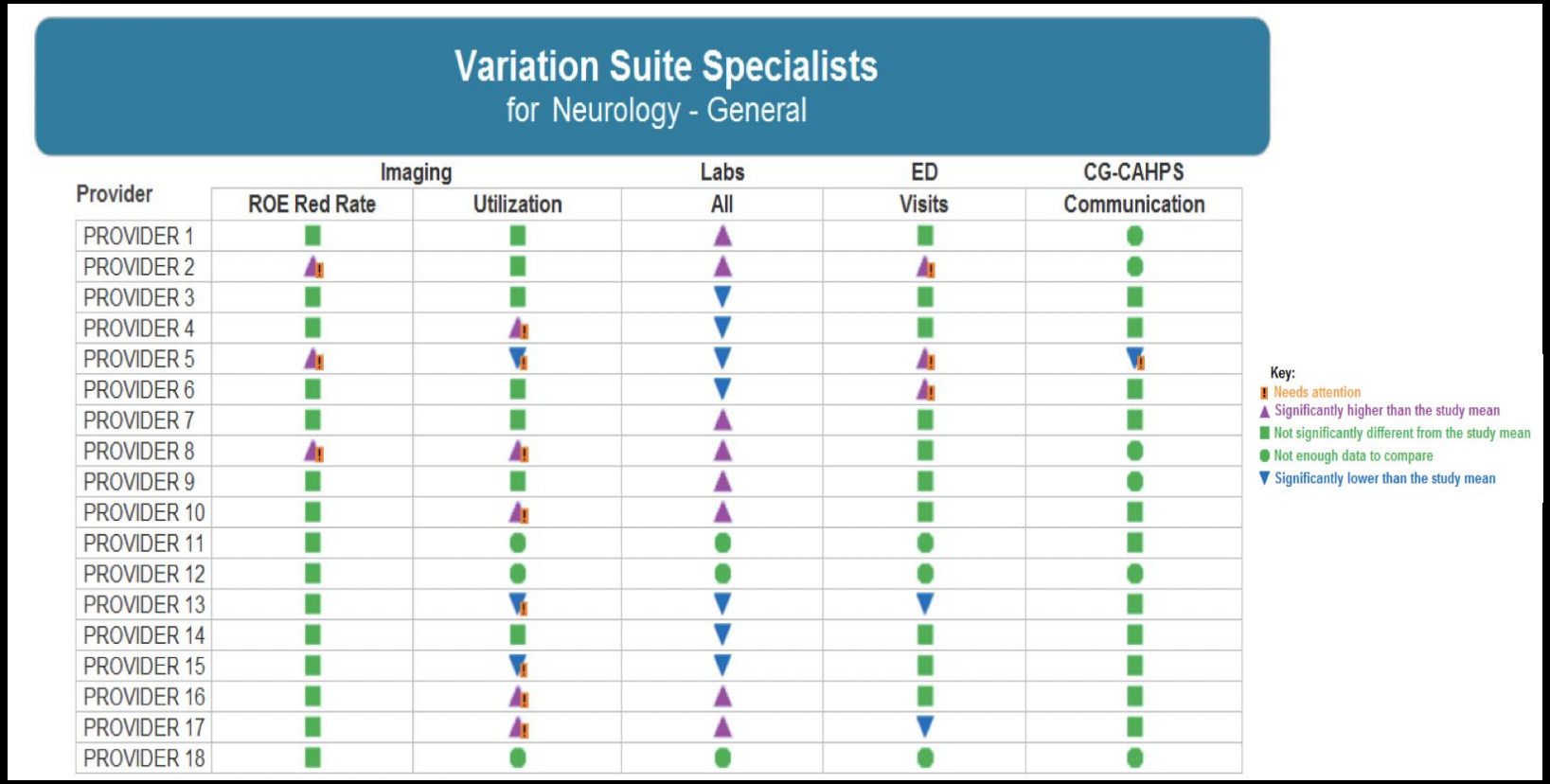
Appropriateness Score Categorization	Study Period			
	Pre-Intervention	%	Intervention	%
Low utility	746	11.0	918	5.4
Marginal	1655	24.5	2134	12.6
Indicated	4353	64.5	13857	82.0
Total	6754	100.0	16909	100.0

6 months

24 months

ER and Inpatients

MGH - Variation by Specialist



Drill Down into Imaging CDS Red Rate

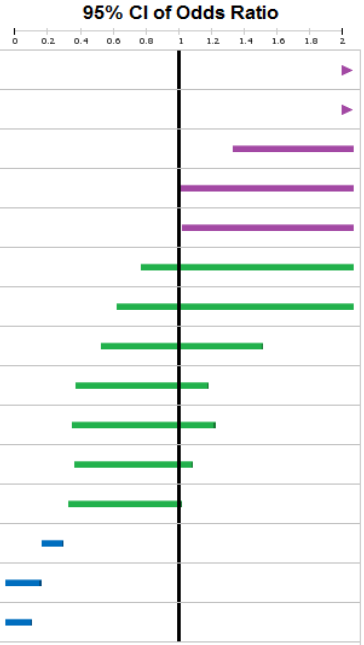
Provider	Orders in Model	Observed	Red Rate	Odds of Red
PROVIDER 1	21	4	19.05	14.42
PROVIDER 2	111	14	12.61	9.61
PROVIDER 3	30	3	10.00	5.32
PROVIDER 4	69	3	4.35	2.43
PROVIDER 5	29	1	3.45	2.30
PROVIDER 6	41	1	2.44	1.99
PROVIDER 7	87	2	2.30	1.45
PROVIDER 8	18	0	0.00	0.79
PROVIDER 9	28	0	0.00	0.75
PROVIDER 10	13	0	0.00	0.75
PROVIDER 11	24	0	0.00	0.66
PROVIDER 12	25	0	0.00	0.65
PROVIDER 13	46	0	0.00	0.64
PROVIDER 14	43	0	0.00	0.55
PROVIDER 15	112	0	0.00	0.33
PROVIDER 16	258	0	0.00	0.27
PROVIDER 17	183	0	0.00	0.26
PROVIDER 18	136	0	0.00	0.24

Key:

- Significantly higher than the study mean
- Not significantly different from the study mean
- Significantly lower than the study mean

Drill Down into Imaging Utilization Rate

Provider	Pts in Model	Observed	Expected*	Odds
PROVIDER 1	414	195	47.41	5.17
PROVIDER 2	288	142	46.07	4.43
PROVIDER 3	91	30	11.85	2.48
PROVIDER 4	197	47	22.06	1.79
PROVIDER 5	444	108	56.69	1.72
PROVIDER 6	61	14	7.39	1.59
PROVIDER 7	70	13	7.74	1.30
PROVIDER 8	776	113	98.67	0.90
PROVIDER 9	398	47	54.02	0.67
PROVIDER 10	267	27	28.53	0.66
PROVIDER 11	701	76	88.46	0.63
PROVIDER 12	601	60	74.96	0.59
PROVIDER 13	772	70	98.95	0.52
PROVIDER 14	326	19	44.76	0.32
PROVIDER 15	696	22	72.22	0.21
PROVIDER 16	0	0	0.00	Not enough data
PROVIDER 17	2	1	0.00	Not enough data
PROVIDER 18	8	3	0.00	Not enough data



Key:
- Significantly higher than the study mean
- Not significantly different from the study mean
- Significantly lower than the study mean

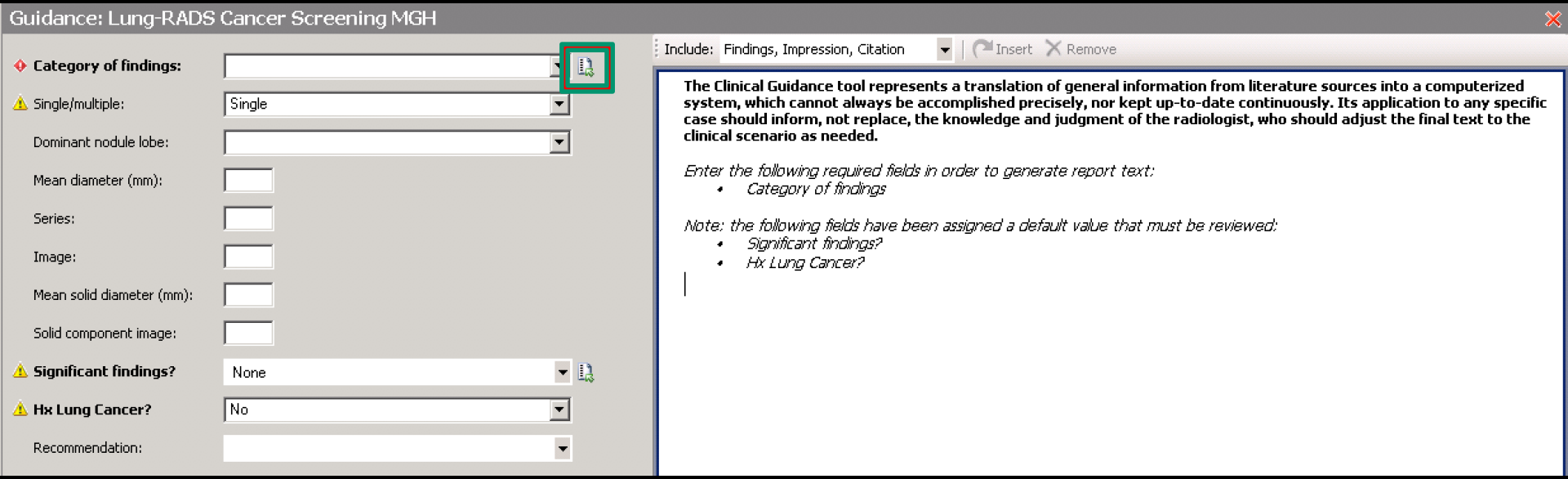
*health status adjusted

Reducing Variation

- Clinical Decision Support
  - Before imaging – to guide practitioners to the most appropriate imaging exam for their patients
  - Before interventional procedures – shared decision-making tool for reviewing the benefits and risks
  - After imaging – to guide radiologists to the appropriate recommendations consequent to findings

Lung RADS – Clinical Decision Support

Structured reporting for lung cancer CT screening programs



Report - UNKNOWN, - 43434

0 default

Guidance: Lung-RADS Cance

- Category of findings:
- Single/multiple: Single
- Dominant nodule lobe:
- Mean diameter (mm):
- Series:
- Image:
- Mean solid diameter (mm):
- Solid component image:
- Significant findings? None
- Hx Lung Cancer? No
- Recommendation:

Clinical Guidance

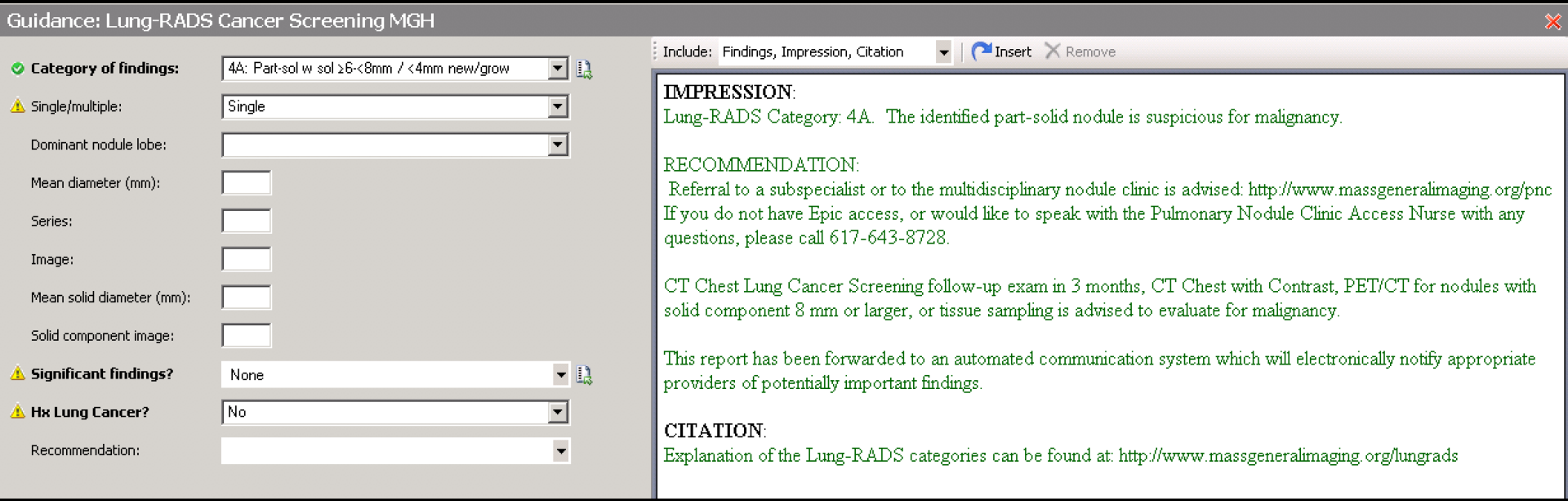
Category	Category Descriptor	Category	Findings
Incomplete	-	0	prior chest CT examination(s) being located for comparison part or all of lungs cannot be evaluated
Negative	No nodules and definitely benign nodules	1	no lung nodules nodule(s) with specific calcifications: complete, central, popcorn, concentric rings and fat containing nodules
Benign Appearance or Behavior	Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth	2	solid nodule(s): < 6 mm new < 4 mm part solid nodule(s): < 6 mm total diameter on baseline screening non solid nodule(s) (GGN): < 20 mm OR ≥ 20 mm and unchanged or slowly growing category 3 or 4 nodules unchanged for ≥ 3 months
Probably Benign	Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer	3	solid nodule(s): ≥ 6 to < 8 mm at baseline OR new 4 mm to < 6 mm part solid nodule(s) ≥ 6 mm total diameter with solid component < 6 mm OR new < 6 mm total diameter non solid nodule(s) (GGN) ≥ 20 mm on baseline CT or new
Suspicious	Findings for which additional diagnostic testing and/or tissue sampling is recommended	4A	solid nodule(s): ≥ 8 to < 15 mm at baseline OR growing < 8 mm OR part solid nodule(s: ≥ 6 mm with solid component ≥ 6 mm to < 8 mm OR with a new or growing < 4 mm solid component
		4B	solid nodule(s) ≥ 15 mm OR new or growing, and ≥ 8 mm part solid nodule(s) with: a solid component ≥ 8 mm OR a new or growing ≥ 4 mm solid component
		4X	Category 3 or 4 nodules with additional features or imaging findings that increases the suspicion of malignancy

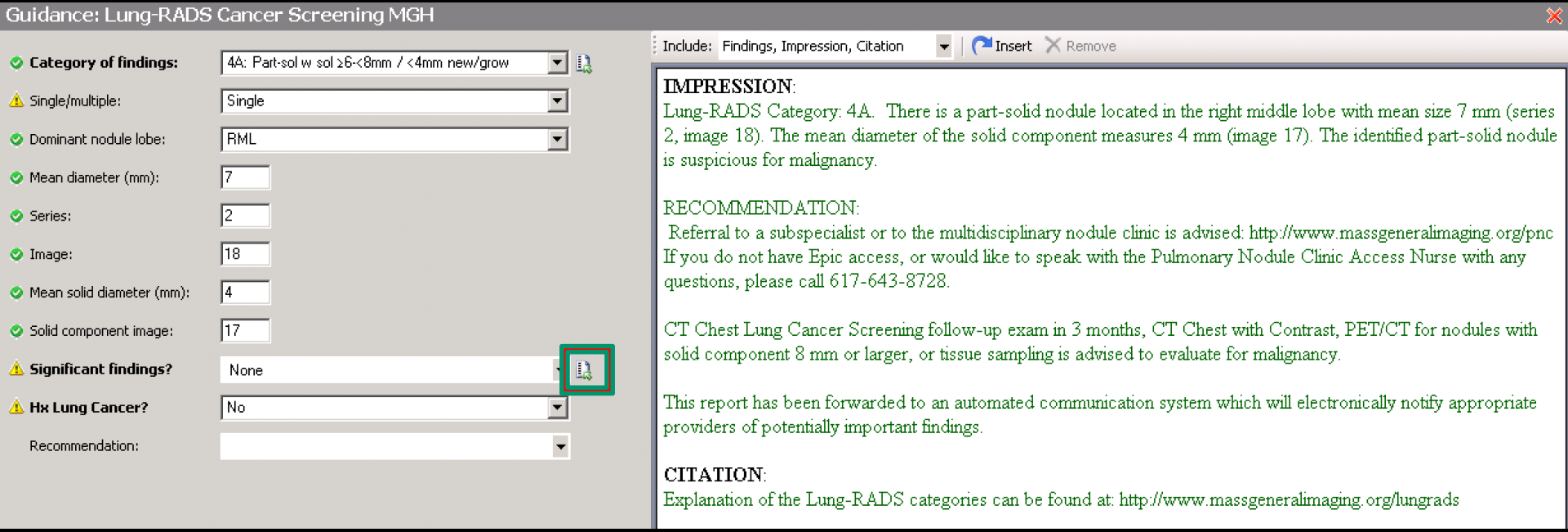
OK Cancel

...eral information from literature sources into a computerized ...hor kept up-to-date continuously. Its application to any specific ...ment of the radiologist, who should adjust the final text to the

...ort text:

...ue that must be reviewed:


Guidance: Lung-RADS Cancer Screening MGH
Category of findings:
4A: Part-sol w sol ≥6-<8mm / <4mm new/grow
Single/multiple:
Single
Dominant nodule lobe:
Mean diameter (mm):
Series:
Image:
Mean solid diameter (mm):
Solid component image:
Significant findings?
None
Hx Lung Cancer?
No
Recommendation:
Include:
Findings, Impression, Citation
Insert
Remove
IMPRESSION:
Lung-RADS Category: 4A. The identified part-solid nodule is suspicious for malignancy.
RECOMMENDATION:
Referral to a subspecialist or to the multidisciplinary nodule clinic is advised: http://www.massgeneralimaging.org/pnc
If you do not have Epic access, or would like to speak with the Pulmonary Nodule Clinic Access Nurse with any questions, please call 617-643-8728.
CT Chest Lung Cancer Screening follow-up exam in 3 months, CT Chest with Contrast, PET/CT for nodules with solid component 8 mm or larger, or tissue sampling is advised to evaluate for malignancy.
This report has been forwarded to an automated communication system which will electronically notify appropriate providers of potentially important findings.
CITATION:
Explanation of the Lung-RADS categories can be found at: http://www.massgeneralimaging.org/lungrads


Guidance: Lung-RADS Cancer Screening MGH
Category of findings:
4A: Part-sol w sol ≥6-<8mm / <4mm new/grow
Single/multiple:
Single
Dominant nodule lobe:
RML
Mean diameter (mm):
7
Series:
2
Image:
18
Mean solid diameter (mm):
4
Solid component image:
17
Significant findings?
None
Hx Lung Cancer?
No
Recommendation:
Include:
Findings, Impression, Citation
Insert
Remove
IMPRESSION:
Lung-RADS Category: 4A. There is a part-solid nodule located in the right middle lobe with mean size 7 mm (series 2, image 18). The mean diameter of the solid component measures 4 mm (image 17). The identified part-solid nodule is suspicious for malignancy.
RECOMMENDATION:
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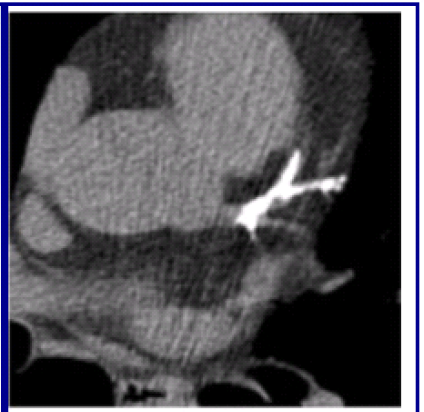
Clinical Guidance

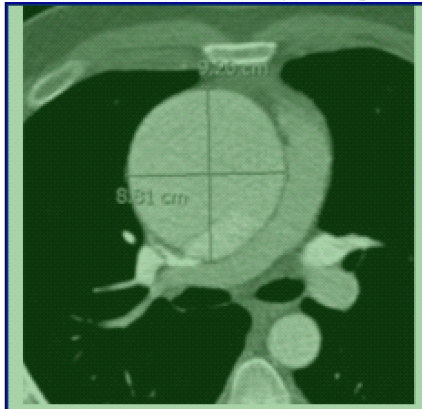
Mild CAC

Moderate CAC



Severe CAC

*Mild CAC is not considered to be a reportable significant finding.



Aortic aneurysm

Other lung disease:

- Fibrosis
- Interstitial lung disease

Mass:

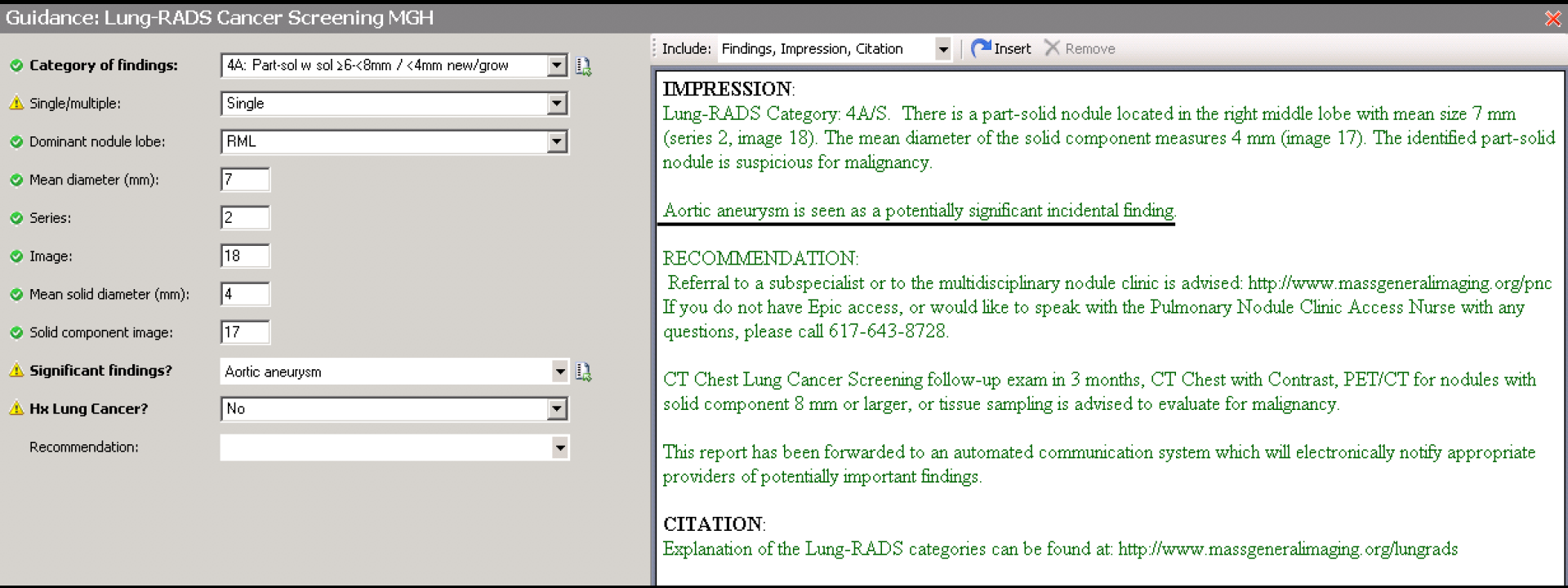
- Thyroid
- Thymus
- Breast
- Liver
- Spleen
- Pancreas
- Kidney
- Adrenal gland
- Intramuscular
- Intra-abdominal
- Bone
- Lymph nodes

Other

None

OK

Cancel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Dominant nodule lobe:
RML
Mean diameter (mm):
7
Series:
2
Image:
18
Mean solid diameter (mm):
4
Solid component image:
17
Significant findings?
Aortic aneurysm
Hx Lung Cancer?
No
Recommendation:
Include:
Findings, Impression, Citation
Insert
Remove
IMPRESSION:
Lung-RADS Category: 4A/S. There is a part-solid nodule located in the right middle lobe with mean size 7 mm (series 2, image 18). The mean diameter of the solid component measures 4 mm (image 17). The identified part-solid nodule is suspicious for malignancy.
Aortic aneurysm is seen as a potentially significant incidental finding.
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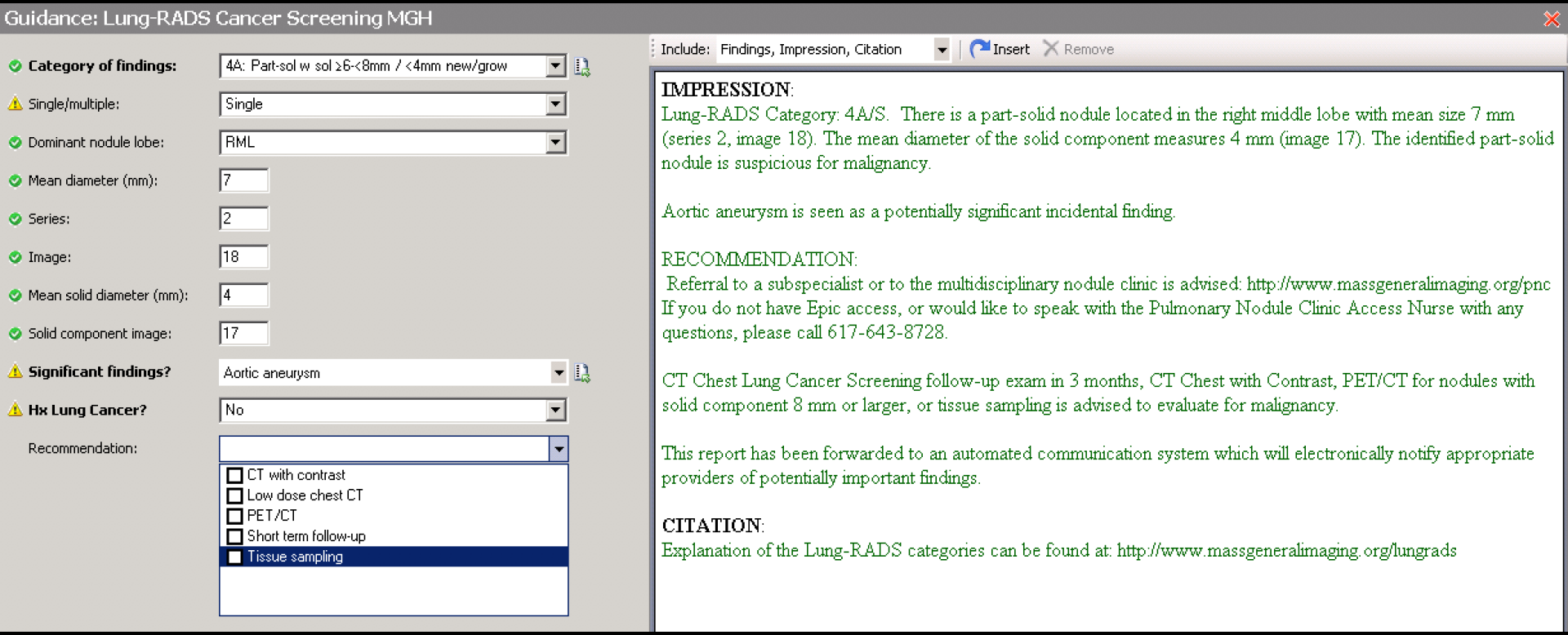
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Dominant nodule lobe:
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Mean diameter (mm):
7
Series:
2
Image:
18
Mean solid diameter (mm):
4
Solid component image:
17
Significant findings?
Aortic aneurysm
Hx Lung Cancer?
No
Recommendation:
CT with contrast
Low dose chest CT
PET/CT
Short term follow-up
Tissue sampling
Include:
Findings, Impression, Citation
Insert
Remove
IMPRESSION:
Lung-RADS Category: 4A/S. There is a part-solid nodule located in the right middle lobe with mean size 7 mm (series 2, image 18). The mean diameter of the solid component measures 4 mm (image 17). The identified part-solid nodule is suspicious for malignancy.
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Series:	2
Image:	18
Mean solid diameter (mm):	4
Solid component image:	17
Significant findings?	Aortic aneurysm
Hx Lung Cancer?	No
Recommendation:	Tissue sampling

Include: Findings, Impression, Citation | Insert | Remove

IMPRESSION:
Lung-RADS Category: 4A/S. There is a part-solid nodule located in the right middle lobe with mean size 7 mm (series 2, image 18). The mean diameter of the solid component measures 4 mm (image 17). The identified part-solid nodule is suspicious for malignancy.

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Tissue sampling is advised to evaluate for malignancy.

Recommendation for significant incidental finding: further evaluation as needed.

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February 02, 2018

FDA-Funded NEST Program Names ACR Data Science Institute AI Use Case as Demonstration Project

Designation Boosts National Efforts to Improve Medical Imaging Care Using Artificial Intelligence

A U.S. Food and Drug Administration (FDA) -funded program to speed safe and effective medical device technologies to market has chosen an ACR Data Science Institute™ (DSI) use case among its first demonstration projects. The National Evaluation System for Health Technology Coordinating Center (NESTcc) selected the "Lung-RADS® Assist: Advanced Radiology Guidance, Reporting and Monitoring" use case. The center supports timely, reliable and cost-effective evidence development regarding FDA medical device pre- and post-market requirements.

Lung-RADS Assist: Advanced Radiology Guidance, Reporting and Monitoring will determine the end-to-end workflow from deployment of an AI algorithm in a radiology reporting system through capture of performance metrics within a national registry. It will:

- Utilize existing ACR technology to demonstrate the ability to collect validation data and perform local algorithm testing prior to market approval
- Utilize existing ACR technology to facilitate interoperability between reporting and AI vendors to generate standardized data in a real-world setting
- Capture validation data and real-world events in a national registry to enable both facility-level and cross-facility reporting

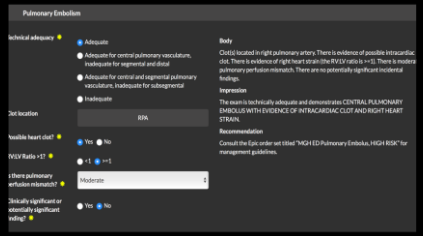
Quality & Efficiency Strategies

- Improve Ambulatory Access
  - Streamlined workflows to improve throughput
- Increase Patient Engagement
  - Efforts to reduce missed imaging care opportunities
  - Efforts to improve cancer screening compliance
- Increase Virtual Care
  - Virtual radiology consults

Streamlined Care Pathways for ED Reporting and Notification

Jul, 2017

PE Impression Reporting Guidance Tool Implemented

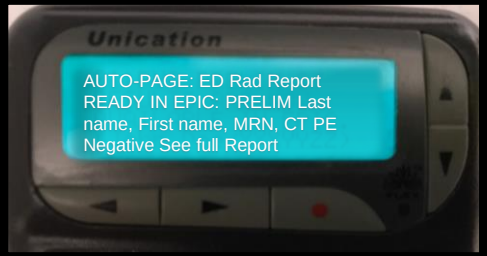


Sep, 2017

Notifying ED medicine "CT results are available in EPIC" via paging alert *All CT Protocols*

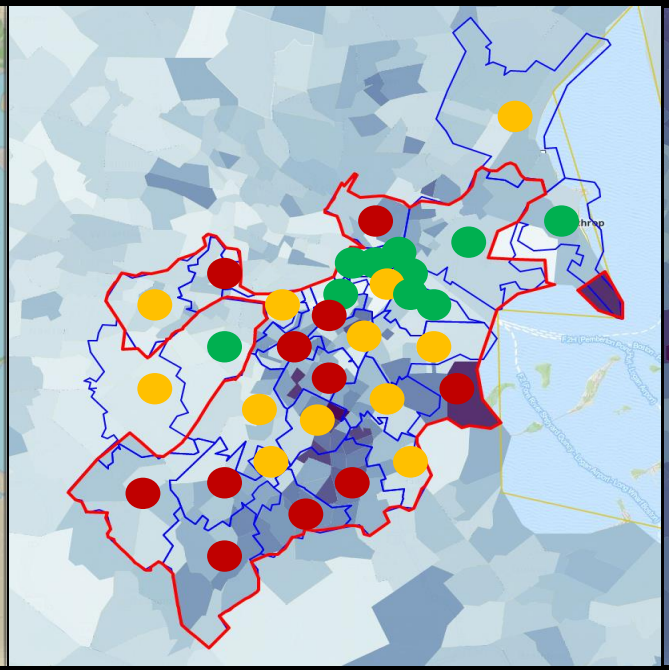
Jul, 2018

CTPE to ED Physician Alert including reporting guidance tool content: "Positive" *vs.* "Negative"

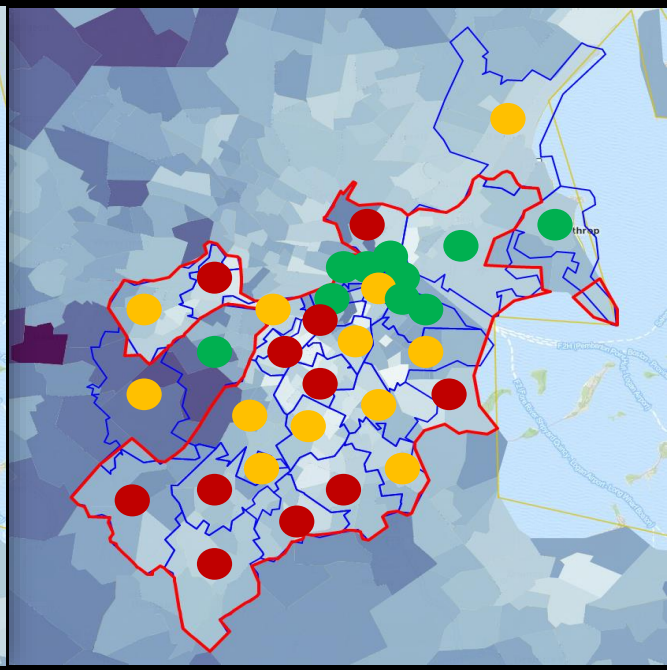


Boston -Imaging Missed Care Opportunities Rate

Unemployment data



Median Household Income



Top 33%ile
Mid 33%ile
Bottom 33%ile

High Unemployment
Low Unemployment

High income
Low income

http://www.city-data.com/income/income-Boston-Massachusetts.html

Flores, EJ. Radiology Rounds. July 2016; 14 (7). @EJFLORESMD

Transportation Assistance

CT Lung Cancer Screening Initiatives

Same day Lung Cancer Screening for vulnerable patients

SAME-DAY LUNG CANCER SCREENING
CT PILOT PROGRAM FOR VULNERABLE PATIENTS

Stop.

Screen.

Breathe.

The pilot program goal is to decrease barriers to lung cancer screening in vulnerable patients seen by Boston Health Care for the Homeless Program at MGH and by the MGH Chelsea Community HealthCare Center.

Eligible patients will be offered the option to undergo Lung cancer screening CT on the same day as their clinic visit, without the need for a prior radiology appointment. This may help increase the likelihood that these patients undergo screening.

Details for patients to undergo same-day screening:

- Currently only available for the MGH Healthcare for Homeless Program and the MGH Chelsea Community HealthCare Center.

Lung Cancer Screening Campaign for Hispanic Community

English

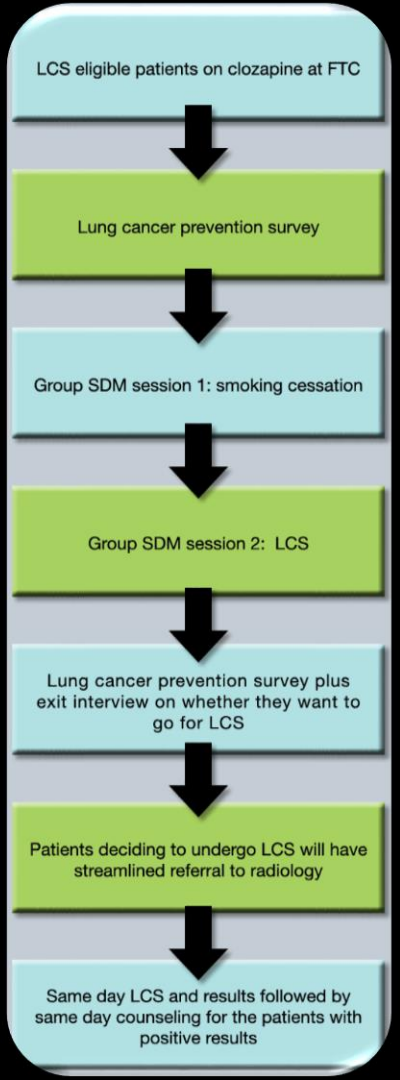
Spanish

@EJFLORESMD

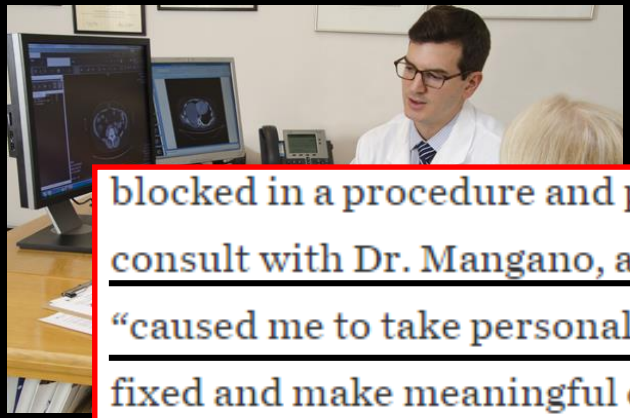
The Largest Health Disparity We Don't Talk About

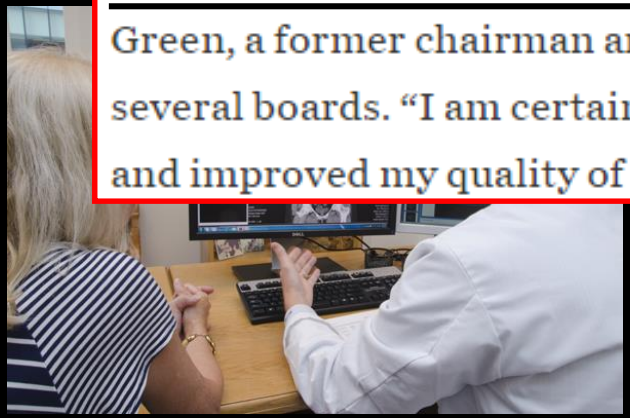
Americans with serious mental illnesses die 15 to 30 years earlier than those without.

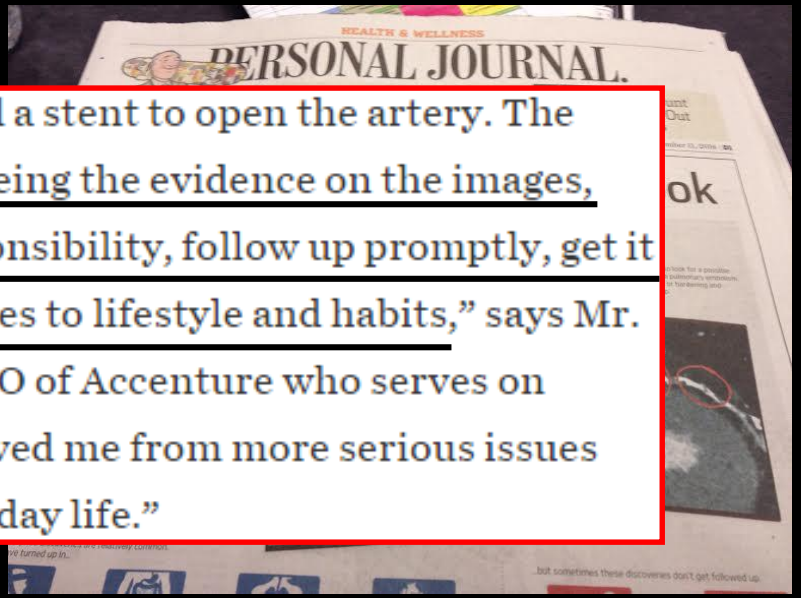
- To assess if a **novel integrated care** pathway tailored for individuals with Serious Mental Illness will increase LCS participation:
  - **Targeted shared decision making**
  - Performed in a **group setting** at the community mental health clinic
  - **Streamlined radiology referrals**



Radiology Consultation Clinic





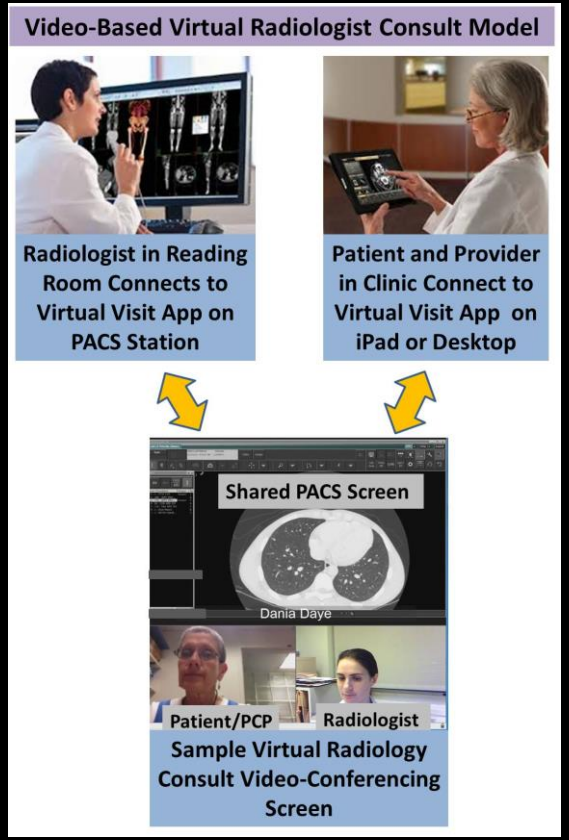


blocked in a procedure and placed a stent to open the artery. The consult with Dr. Mangano, and seeing the evidence on the images, "caused me to take personal responsibility, follow up promptly, get it fixed and make meaningful changes to lifestyle and habits," says Mr. Green, a former chairman and CEO of Accenture who serves on several boards. "I am certain it saved me from more serious issues and improved my quality of everyday life."

Wall Street Journal, 11/11/14

Courtesy, Mark Magnano, MD

Virtual Radiology Consults



- Point-of-care virtual consultations in radiology, through the implementation of **synchronous video-based virtual consultations**
- **<u>Consult Model:</u>** Referring primary care physicians consult with a radiologist virtually and review studies in real-time while seeing a patient.

Courtesy, Dania Daye, MD, PhD


LUNDER BUILDING
LUNDER BUILDING
MASSACHUSETTS GENERAL HOSPITAL
ENTRANCE