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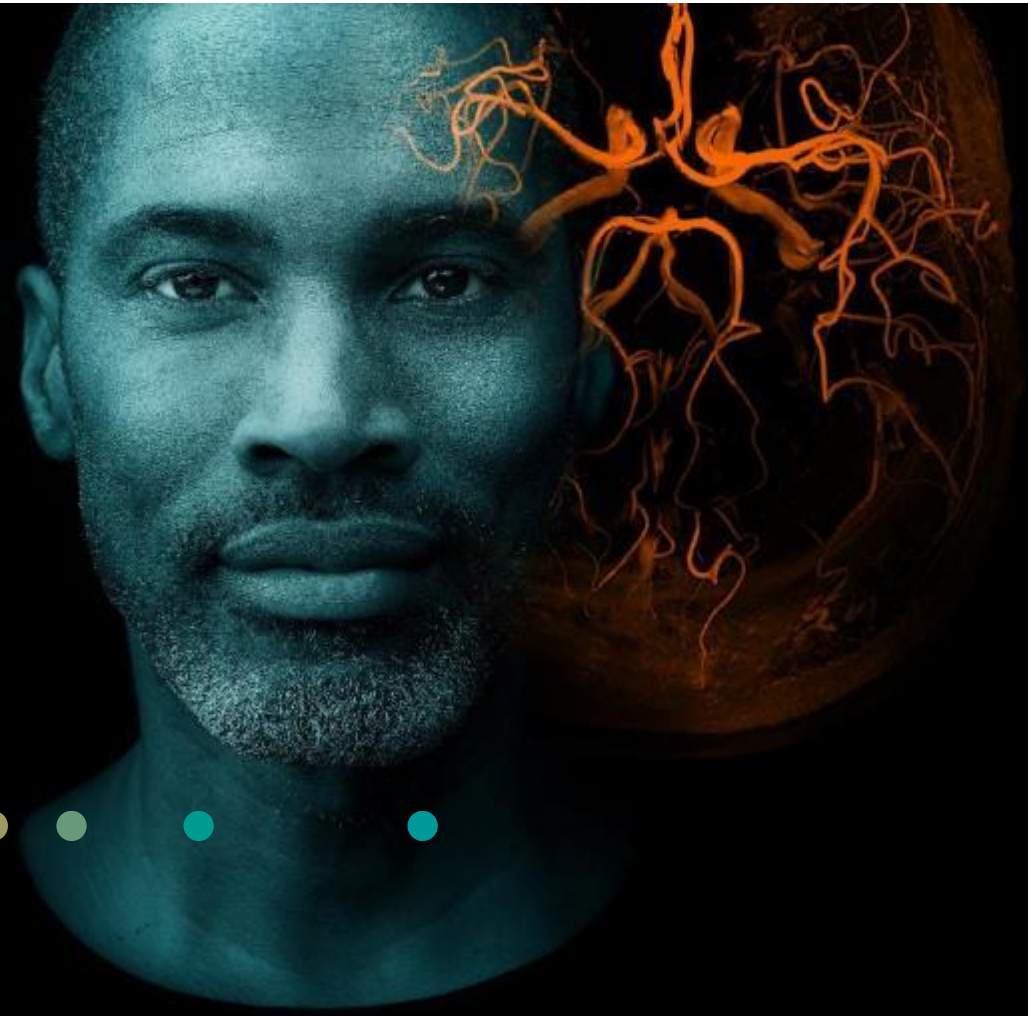
Man-Machine Interaction in the Era of AI - Artificial Intelligence for an Efficient Workflow



Arthur Kaindl

INTERNATIONAL SOCIETY FOR STRATEGIC STUDIES IN RADIOLOGY
November, 10 2018

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Radiologists using AI will replace those who don't

Dr. Bertalan Meskó, PhD
The Medical Futurist
Director of The Medical Futurist Institute, Semmelweis Medical School, Budapest, Hungary

On average, a radiologist interprets one image every 3–4 seconds, 8 hours a day.

McDonald RJ, Schwartz KM, Eckel LJ, Diehn FE, Hunt CH, Bartholmai BJ, et al. (2018): The effects of changes in utilization and technological advancements of cross-sectional imaging on radiologist workload.

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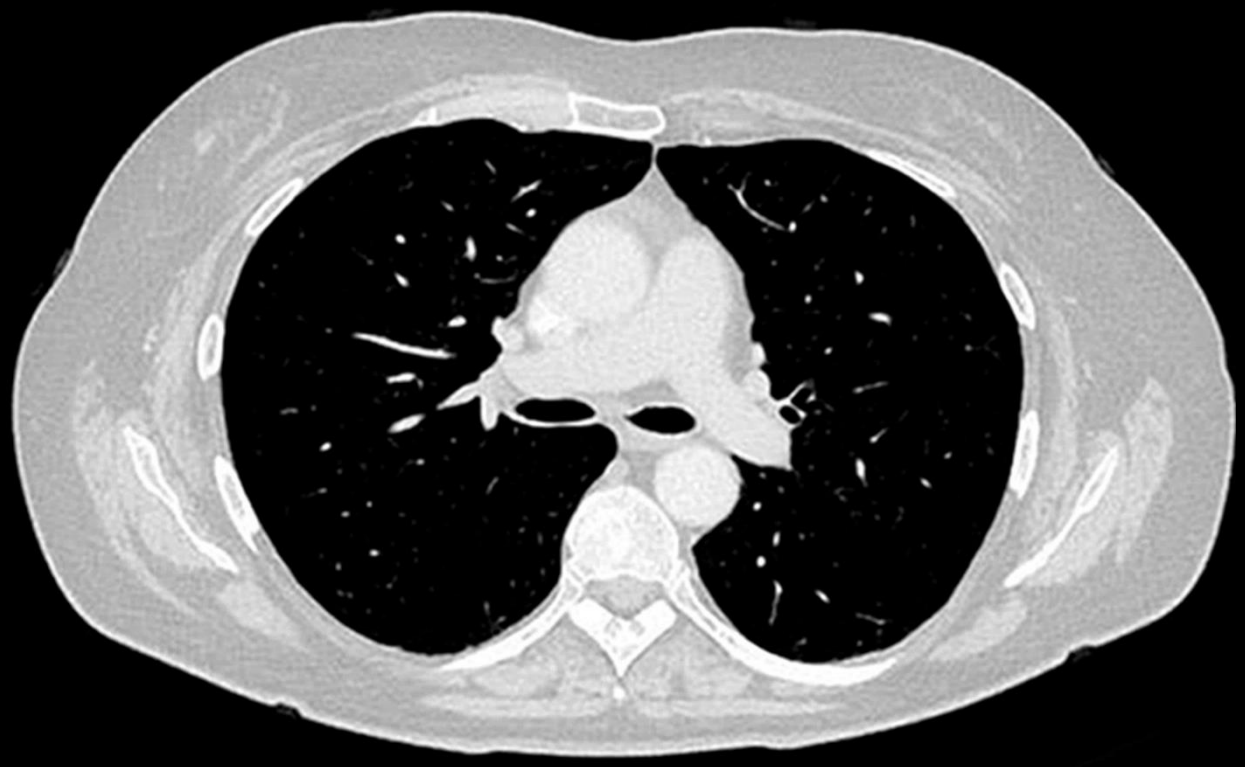

*A study found that 19% of lung cancers with nodules of 16 mm in size **were missed** on chest radiographs.*

Lee CS, Nagy PG, Weaver SJ, Newman-Toker DE (2013): Cognitive and system factors contributing to diagnostic errors in radiology.

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Less interpretation time means higher error rates

1) Berlin L: Faster Reporting Speed and Interpretation Errors: Conjecture, Evidence, and Malpractice Implications.

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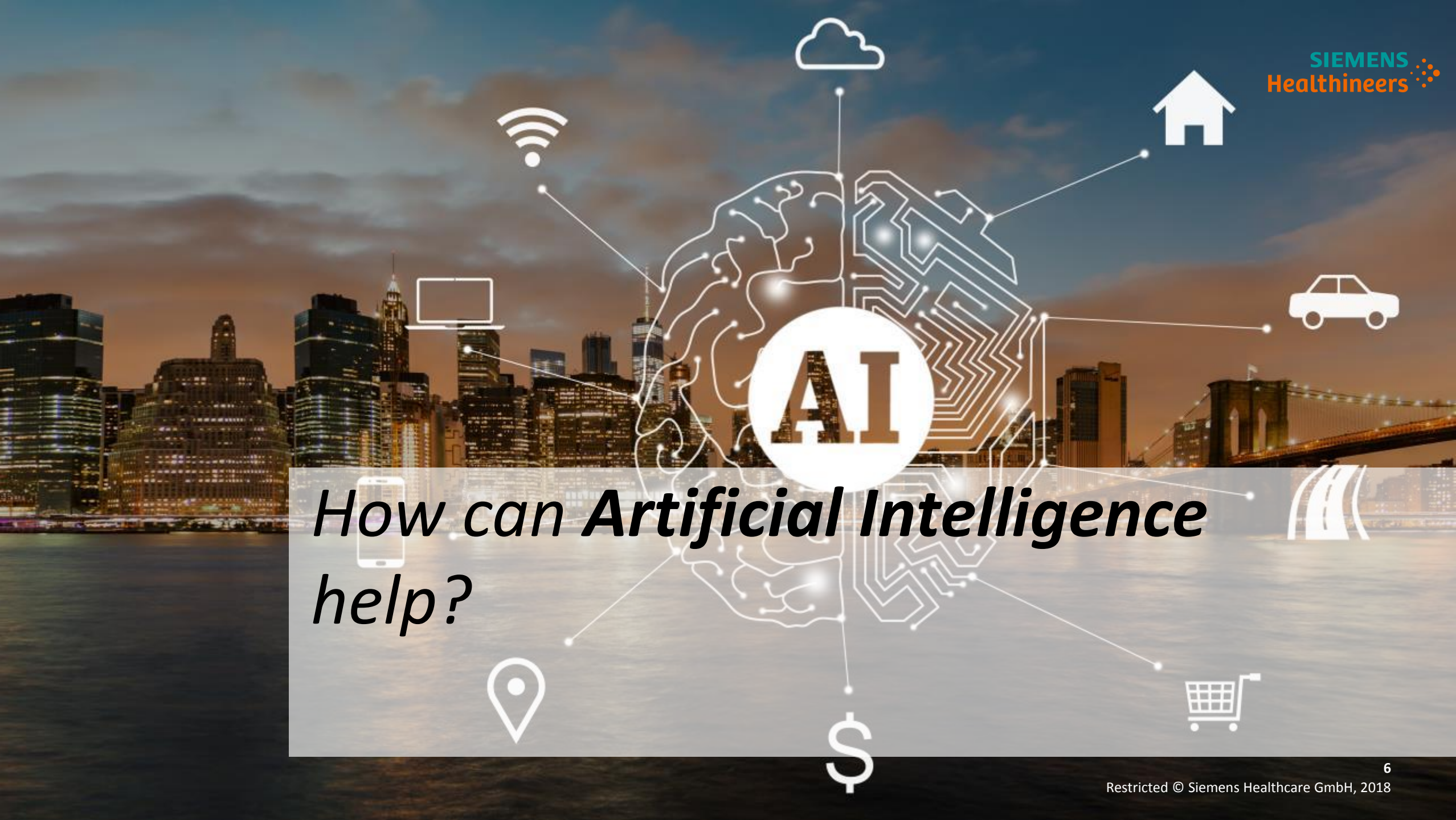

*How can **Artificial Intelligence** help?*

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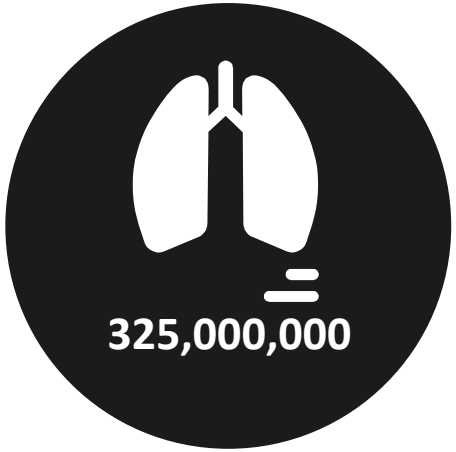
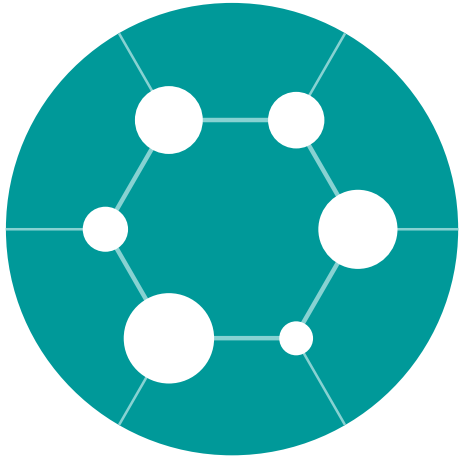
AI can help radiologists - with a powerful AI infrastructure as a basis



More than 325 million curated images and data together with clinical collaborations



Worldwide supercomputing infrastructure in US, EU and Asia

More than 600 patents in the field of machine learning and **125 patent applications** in deep learning

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Applying traditional machine learning and deep learning to help along the entire imaging chain

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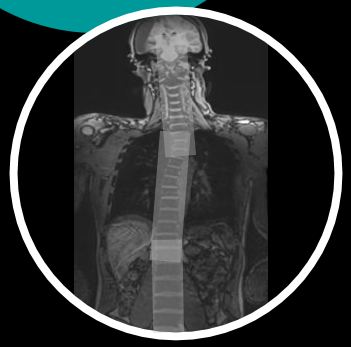
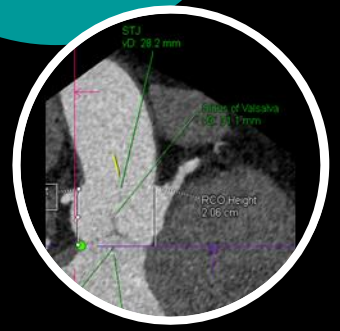
AI powered
Acquisition & Examination



AI powered
Processing & Interpretation

AI powered
Guidance & Workflow



AI powered
Decision support

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Deep learning algorithms help to care for patients more individually

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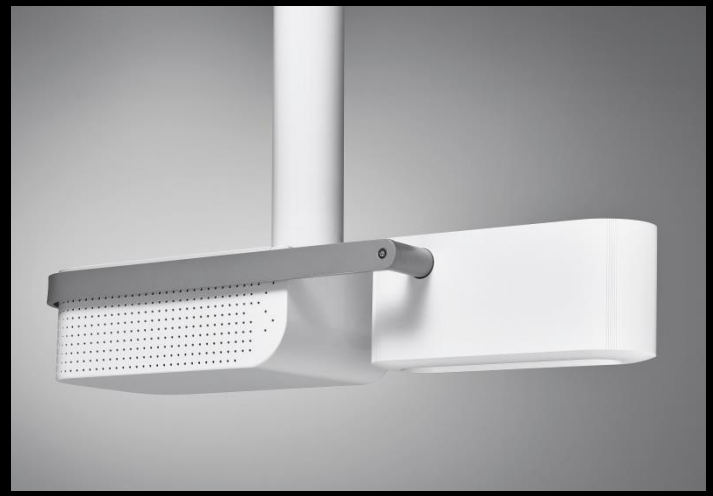
Input

Color Image Data
3D Depth Image Data
Infrared Image Data



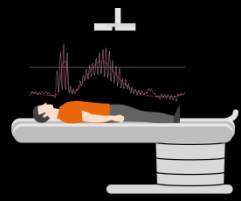
FAST Integrated Workflow incl. unique FAST 3D Camera

AI

Based on deep learning algorithms the following are possible:

- Landmark detection
- Range detection based on protocol input
- Range adaption to user changes over time
- Isocenter positioning
- Patient direction analysis

Output



Right dose modulation with **FAST Isocentering**

Right scan direction with **FAST Direction**

Correct and complete body region with **FAST Range**

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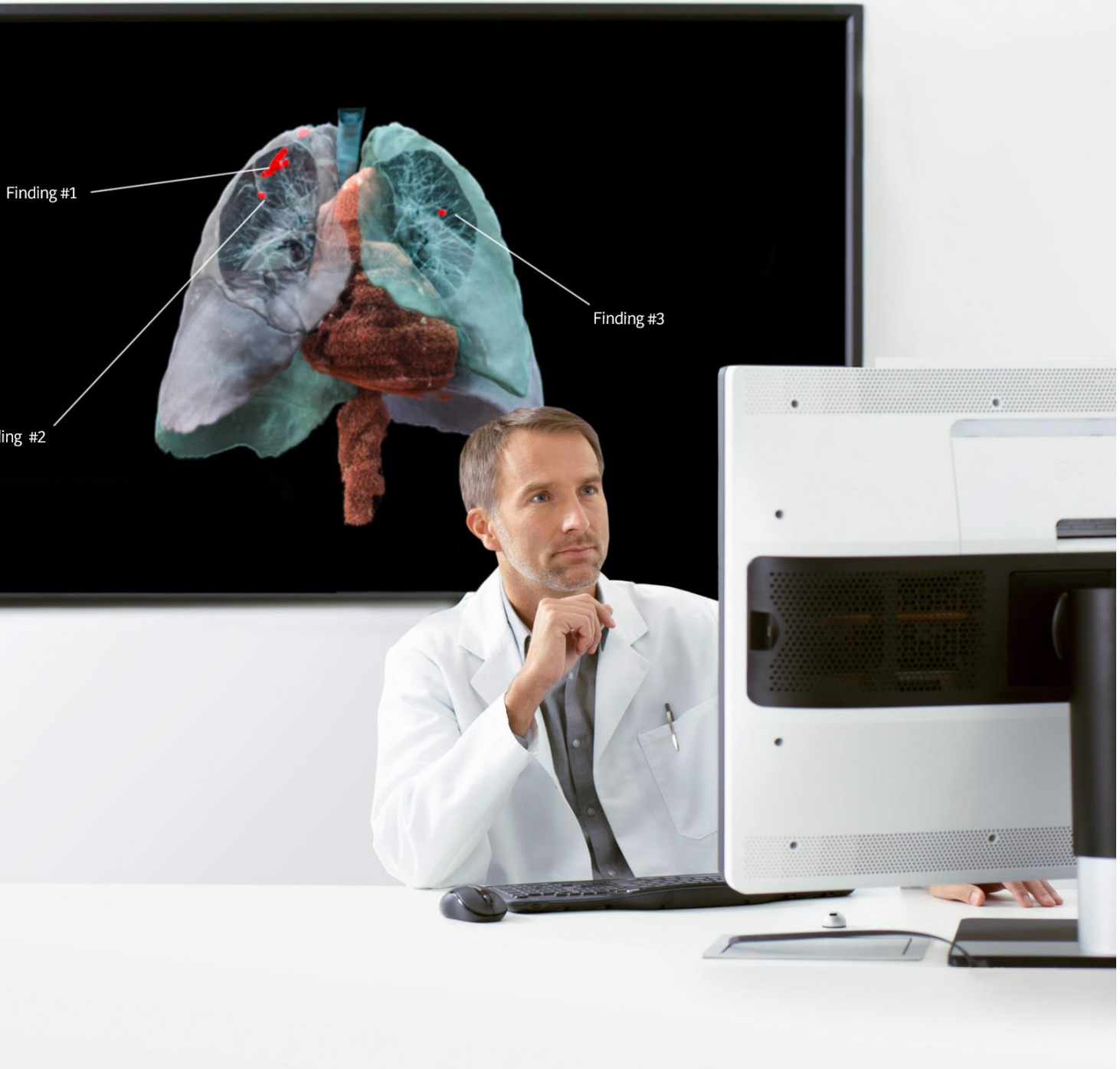

AI-Rad Companion Chest CT

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Reduce the time of interpretation and reporting

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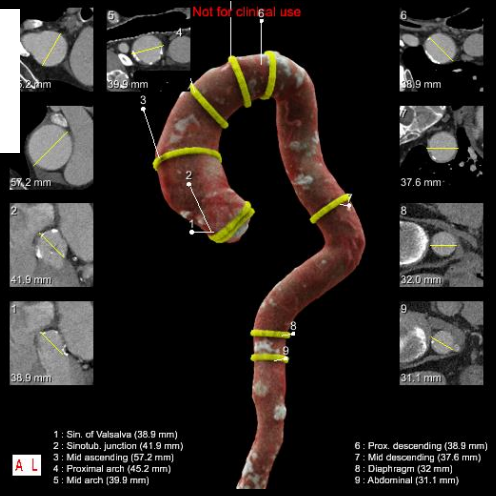
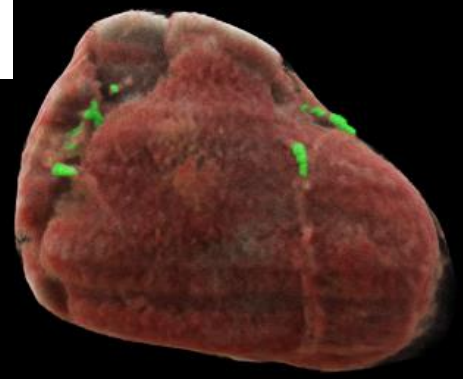
Measuring

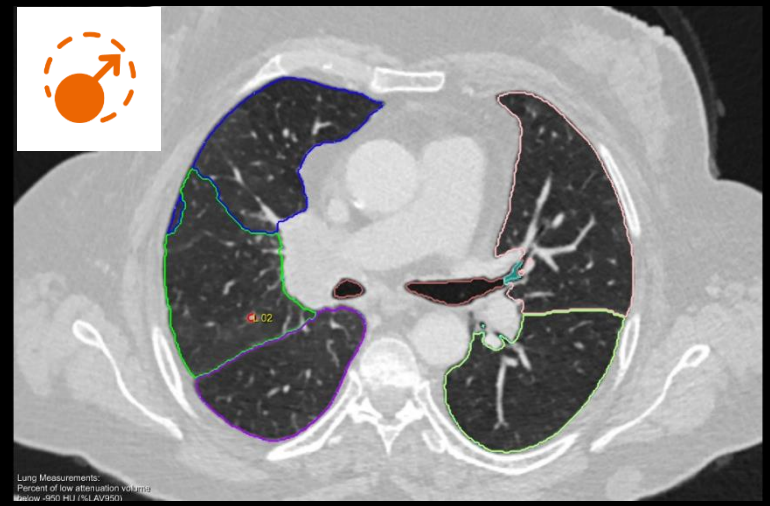


Referencing

3/5



Comparing



Courtesy of Klinikum Nürnberg, Nürnberg, Germany

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Increase accuracy in interpretation and reporting

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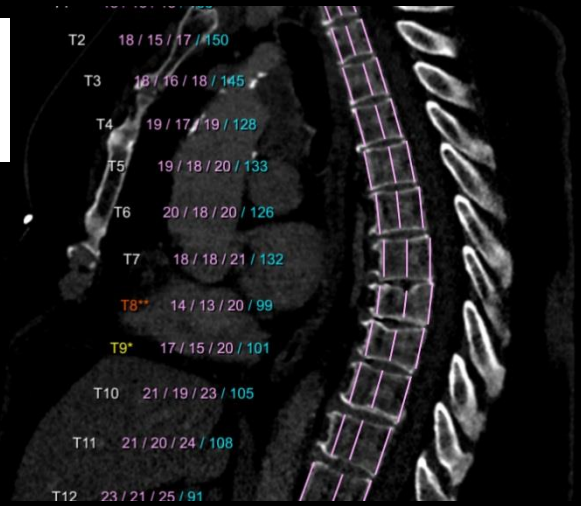
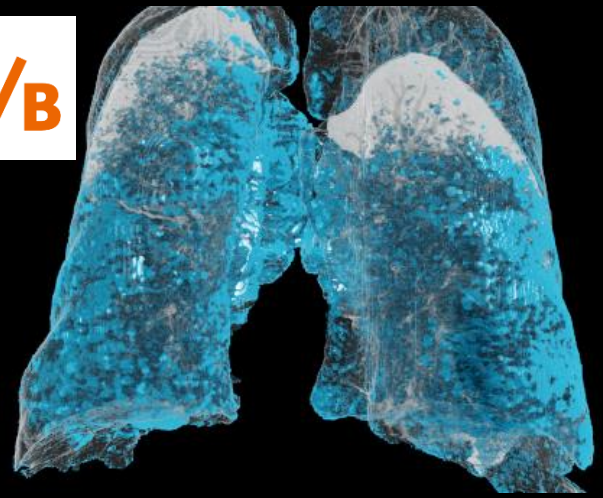
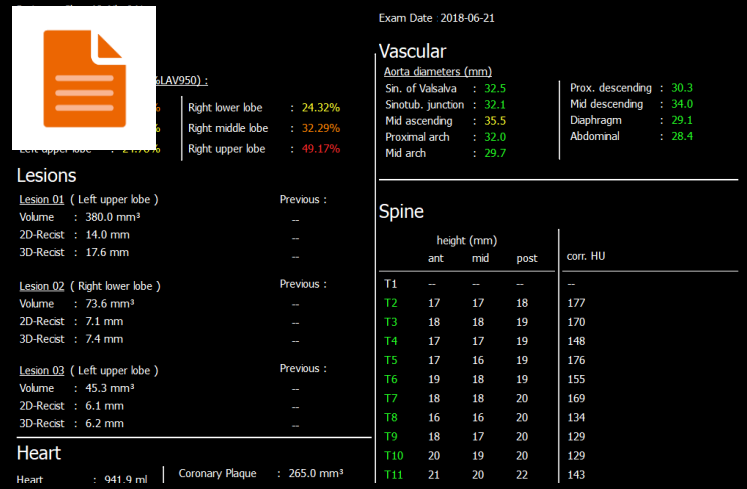
Highlighting



Characterizing



Reporting



Exam Date : 2018-06-21

Right lower lobe : 24.32%
Right middle lobe : 32.29%
Right upper lobe : 49.17%

Lesions

Lesion 01 (Left upper lobe) Previous :
Volume : 380.0 mm³ --
2D-Recist : 14.0 mm --
3D-Recist : 17.6 mm --

Lesion 02 (Right lower lobe) Previous :
Volume : 73.6 mm³ --
2D-Recist : 7.1 mm --
3D-Recist : 7.4 mm --

Lesion 03 (Left upper lobe) Previous :
Volume : 45.3 mm³ --
2D-Recist : 6.1 mm --
3D-Recist : 6.2 mm --

Heart

Heart : 941.9 ml | Coronary Plaque : 265.0 mm³

Vascular

Aorta diameters (mm)

Sin. of Valsalva	32.5	Prox. descending	30.3
Sinotub. junction	32.1	Mid descending	34.0
Mid ascending	35.5	Diaphragm	29.1
Proximal arch	32.0	Abdominal	28.4
Mid arch	29.7		

Spine

	height (mm) ant	mid	post	corr. HU
T1	--	--	--	--
T2	17	17	18	177
T3	18	18	19	170
T4	17	17	19	148
T5	17	16	19	176
T6	19	18	19	155
T7	18	18	20	169
T8	16	16	20	134
T9	18	17	20	129
T10	20	19	20	129
T11	21	20	22	143

Courtesy of Klinikum Nürnberg, Nürnberg, Germany

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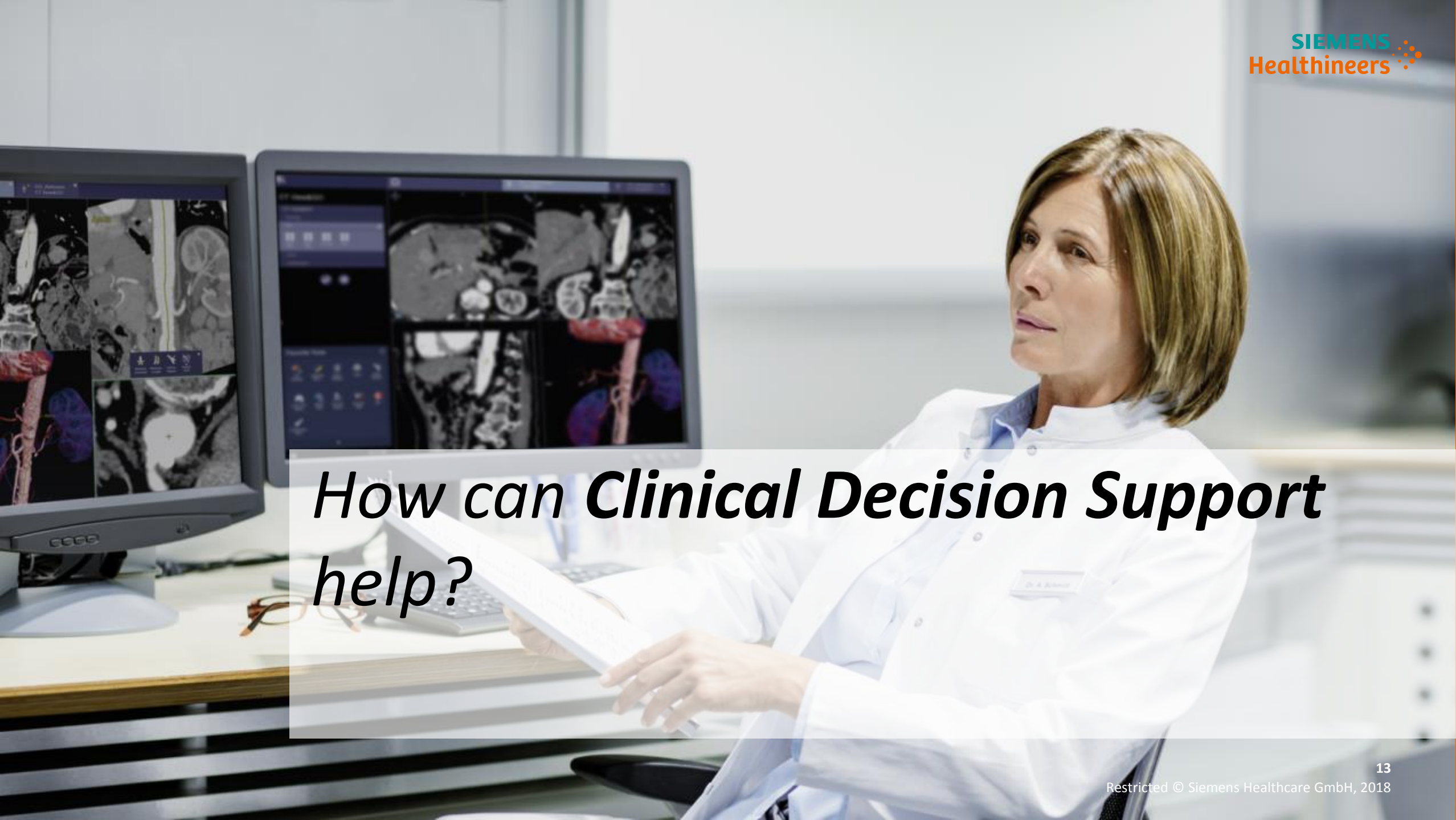

*How can **Clinical Decision Support** help?*

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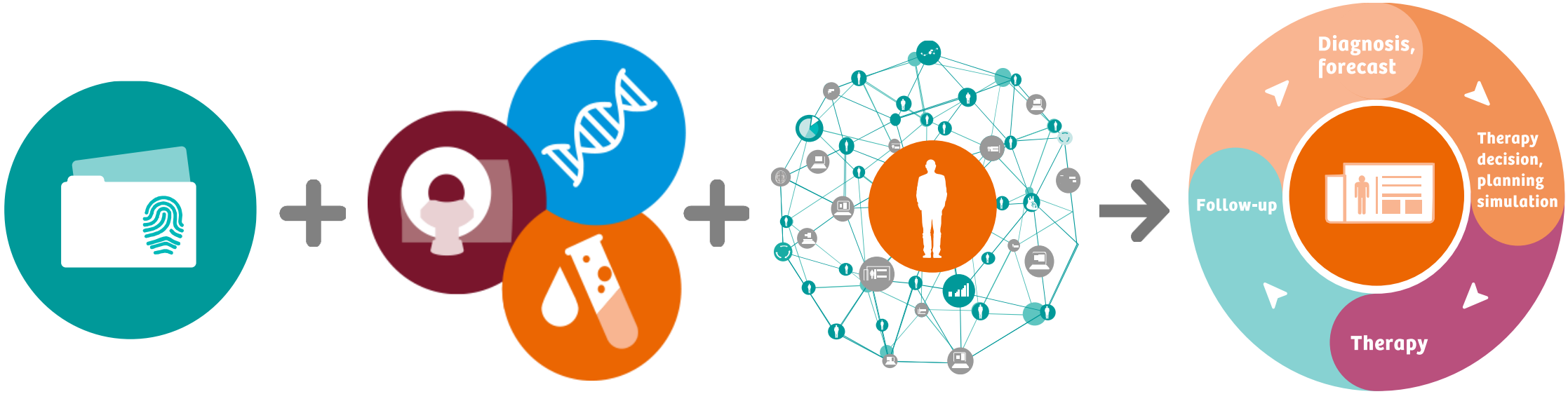
Right decision-making along a clinical pathway using relevant data-driven insights



Historical patient data from EMR

Current **in-vivo** and **in-vitro** biomarkers including genomics and other **omics** data

Real-time **correlation** to reference data and **population cohorts**

Personalized diagnostics and treatment decision

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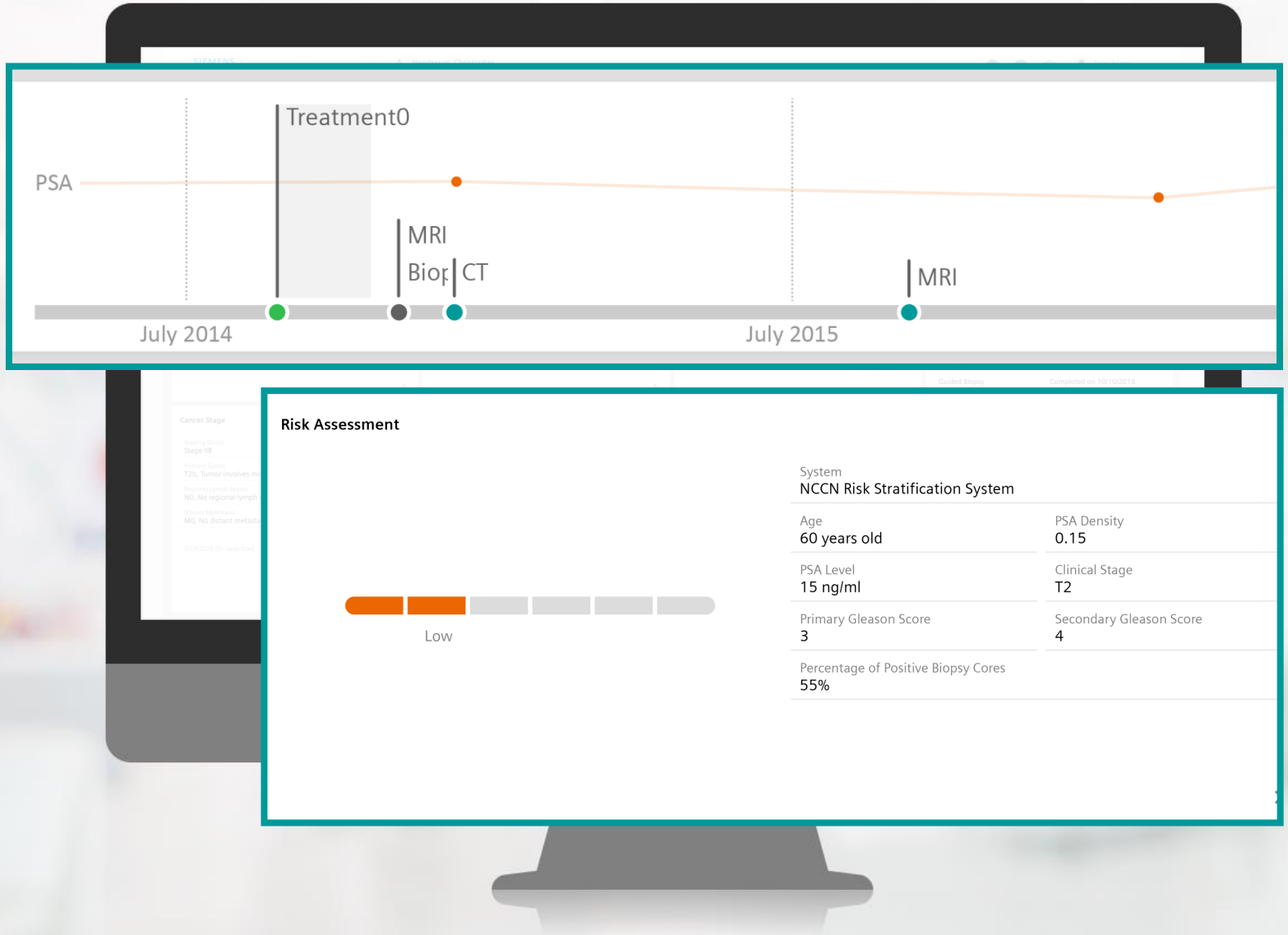
Pathway Companion

Helping to make the right decisions along clinical pathways



Timeline

Risk assessment

Pathway Companion

Helping to make the right decisions along clinical pathways

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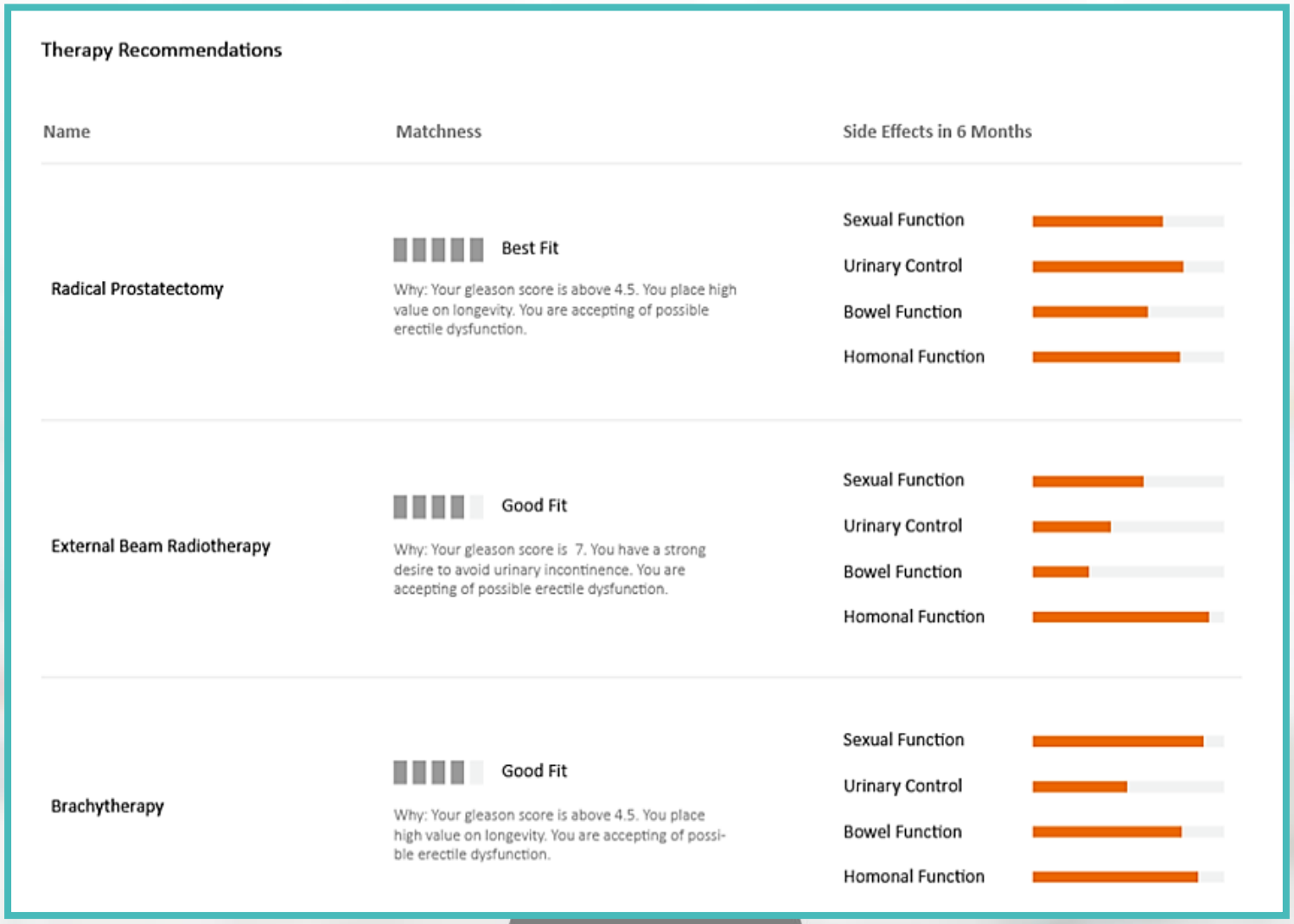

Therapy Recommendation

https://panoramafarmaceutico.com.br/2018/07/06/brasil-tem-um-grande-desafio-a-frente-envelhecer-com-saude-2/

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Data makes staff become experts

Experts will be available virtually everywhere

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Companies using AI will replace those who don't

Dr. Bertalan Meskó, PhD
The Medical Futurist
Director of The Medical Futurist Institute, Semmelweis Medical School, Budapest, Hungary

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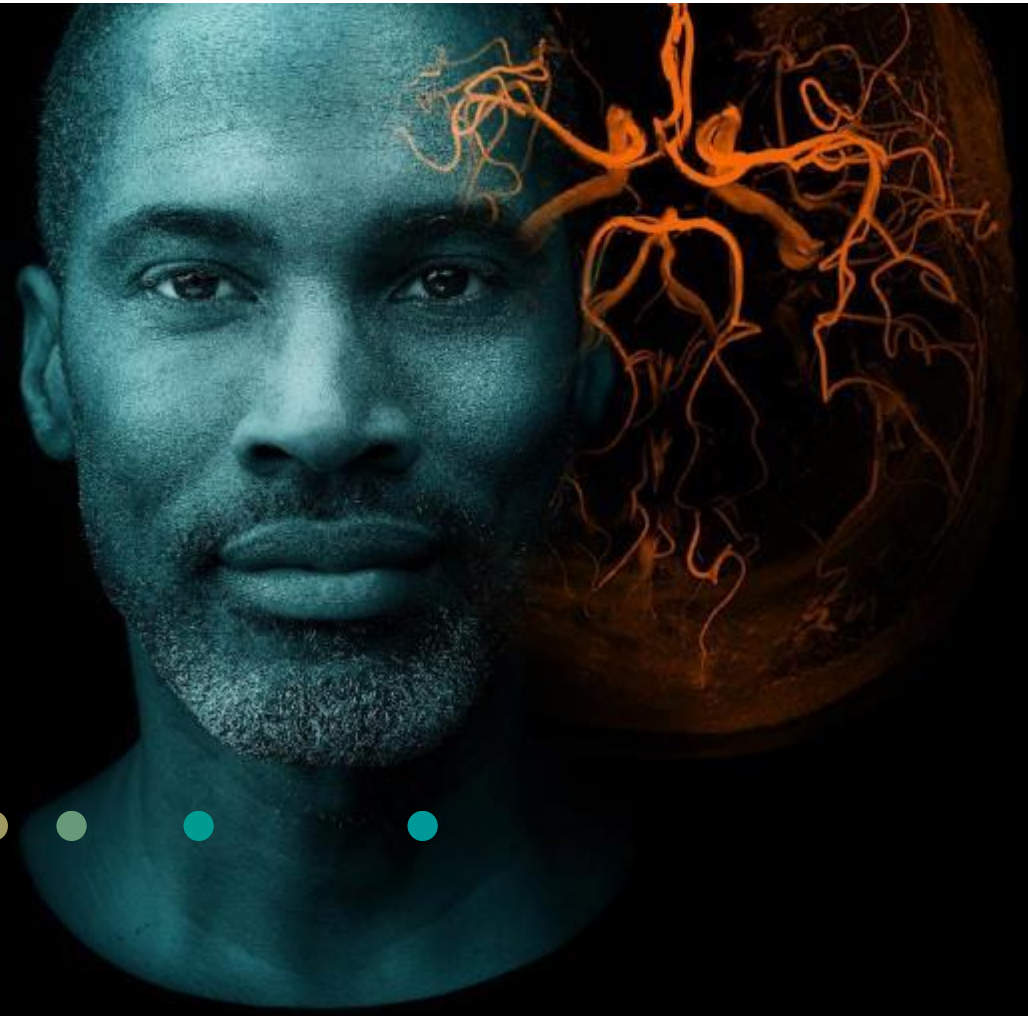
Thank you.



Arthur Kaindl
November, 2018

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