

# The Power of Triage (CADt) in Breast Imaging

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Artificial intelligence (AI) has already made—and continues to make—significant impacts on radiology.

One area of clinical practice, in particular, is in triage, also known as CADt. Indeed, CAD triage already is playing an active role in some clinical practices, where a deep learning-based algorithm acts as the “first reader” of medical images and highlights cases based on suspicion level of pathology, thus providing a prioritized worklist to the radiologist as the “second reader.”

Longstanding research on error-reduction practices in aviation and surgery underscores the usefulness of prioritization to minimize human error and improve efficiencies. One study found that prioritizing urgent exams in a worklist helped improve reporting turnaround times.<sup>1</sup> Radiologists typically read exams either in a random fashion or on a sequential “first in, first out” basis. This means suspicious cases may not be interpreted promptly, depending on practice backlogs. This inefficiency can impact practices, outcomes, and patient care.

Triage software for worklist prioritization or physician notification has been successfully deployed for medical imaging studies such as stroke imaging and other emergency indications.

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Patient name and ID	Procedure name	Study Date	Accession number	CureMetrix
Q METRIX, NINA	MAMMOGRAPH	16/07/19, 11:21	CMA000008	cmTriage: Suspicious
Q METRIX, ANDREA	MAMMOGRAPH	19/07/19, 10:32	CMA000013	cmTriage: Suspicious
Q METRIX, WENDY	MAMMOGRAPH	17/07/19, 09:02	CMA000002	cmTriage: Suspicious
Q METRIX, MARY	MAMMOGRAPH	16/07/19, 12:30	CMA000022	cmTriage: Suspicious
Q METRIX, GENEVIEVE	MAMMOGRAPH	16/07/19, 09:28	CMA000023	cmTriage: Suspicious
Q METRIX, JESSICA	MAMMOGRAPH	15/07/19, 16:05	CMA000017	cmTriage: Suspicious
Q METRIX, JOEY	MG_LINKNOWN	18/07/19, 15:14	CMA000014	cmTriage: Suspicious
Q METRIX, VIVIAN	MAMMOGRAPH	19/07/19, 13:55	CMA000003	cmTriage: Suspicious
Q METRIX, SANDY	MAMMOGRAPH	15/07/19, 12:09	CMA000018	cmTriage:
Q METRIX, JOAN	MAMMOGRAPH	17/07/19, 14:36	CMA000027	cmTriage:
Q METRIX, SALLY	MAMMOGRAPH	17/07/19, 11:07	CMA000024	cmTriage:
Q METRIX, JENNIFER	MAMMOGRAPH	16/07/19, 08:12	CMA000004	cmTriage:
Q METRIX, ERIKA	MAMMOGRAPH	19/07/19, 13:42	CMA000007	cmTriage:
Q METRIX, JOANNA	MAMMOGRAPH	15/07/19, 11:22	CMA000015	cmTriage:
Q METRIX, MIRANDA	MAMMOGRAPH	19/07/19, 09:17	CMA000016	cmTriage:
Q METRIX, SANDRA	MAMMOGRAPH	17/07/19, 13:33	CMA000029	cmTriage:
Q METRIX, JEANETTE	MAMMOGRAPH	16/07/19, 14:01	CMA000016	cmTriage:
Q METRIX, FELICIA	MAMMOGRAPH	16/07/19, 12:52	CMA000025	cmTriage:
Q METRIX, ALEX	MAMMOGRAPH	18/07/19, 11:41	CMA000001	cmTriage:
Q METRIX, ANALYNN	MAMMOGRAPH	18/07/19, 14:25	CMA000031	cmTriage:

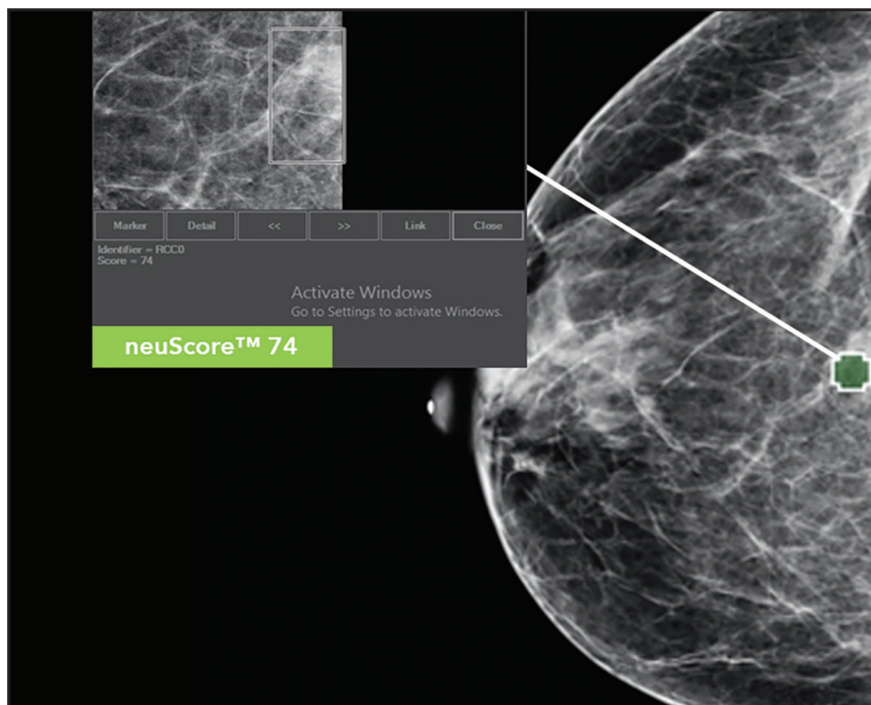
**FIGURE 1.** CureMetrix cmTriage on an anonymized PACS Worklist. Triage functions as the first reader and sorts mammograms based on case-based scoring. cmTriage can also be displayed on a RIS worklist such as Nuance.

FDA-cleared software for stroke triage includes solutions from Avicenna, RapidAI, and Viz.ai. The benefits of these programs include direct notification of stroke teams to expedite decision making and treatment. Vendors like Aidoc also offer software that prioritizes such critical cases as intracranial hemorrhage, pneumothorax, cervical spine fracture, and pulmonary embolus.

CAD triage also holds significant benefits for mammography, where it has been shown to outperform traditional CAD. As stated in an editorial recently appearing in *Radiology*, “Ultimately, this innovative application [CADt] of artificial intelligence may prove more effective and reliable than conventional computer aided detection in advancing a so-called lean approach to mammographic screening.”<sup>2</sup>

CureMetrix brought the first FDA-cleared AI-based triage product for mammography to market. The company’s cmTriage automatically moves suspicious studies to the top of a worklist and expedites recall of suspicious mammogram cases. Triage can also be used to strategically distribute mammograms to multiple readers in a large practice. In addition, triage sensitivity can be set high to facilitate segregation of most-likely normal mammograms for reading.

The positive reader bias from triage can result in up to 30% faster reading times. A study presented at the Society of Breast Imaging’s 2020 annual meeting showed that an academic practice could realize up to a 55% reduction in false-positive recalls, a 12% reduction in benign biopsies, and a 17% improvement in cancer detection rates using triage



**FIGURE 2.** In this case, a clinically missed cancer was sorted as suspicious through cmTriage and the lesion was flagged by cmAssist with a high neuScore = 74.

workflow as compared to clinical workflows without triage.<sup>3</sup>

Case-based triage software works hand in hand with lesion-based CAD. Once a suspicious case is opened for viewing, lesion-based CAD flags areas of concern. Traditional CAD (CADE) was intended to be used as a second reader. While initial publications suggested improved reader accuracy with CADE, subsequent research in a large, multi-reader study showed an overall decrease in radiologist performance in the clinical setting, dampening enthusiasm for CADE.<sup>4</sup> AI-based quantitative CAD, based on deep learning, is also known as CADx. CADx tools such as CureMetrix's cmAssist can enhance sensitivity and specificity.

A recently published MD Anderson Cancer Center study demonstrated a 69% reduction in false-positive markings per image with cmAssist AI-based CAD.<sup>5</sup> Multiple-reader studies have shown that AI-based CAD improves cancer detection rates in mammography. In one published study, cancer detection

rates averaged a 27% improvement for readers of varying experience and training levels using AI-based CAD, without an increase in recall rates.<sup>5</sup>

Hologic and iCAD offer AI-based solutions designed to increase reader efficiency for 3D mammography, or digital breast tomosynthesis (DBT). Hologic's 3DQuorum technology reconstructs 3D imaging data from the company's DBT solution into 6mm slices that identify clinically relevant features and regions of interest. According to Hologic, 3DQuorum can reduce tomosynthesis image volume by up to 66%, or an average of 1 hour per 8 hours of image interpretation without compromising image quality, sensitivity, or reader accuracy.<sup>6</sup>

iCAD's ProFound AI analyzes DBT images to provide information on the Certainty of Finding lesion and Case Scores to assist reader efficiency. A recent study reported the solution reduced radiologist reading times by 52.7%, reduced unnecessary patient recall rates by 7.2%, and improved

radiologist sensitivity by 8%.<sup>7</sup> ICAD also reports its solution reduces reading times by up to 57.4% in women with dense breasts.<sup>8</sup>

In summary, applications of AI, particularly in triage, have become a clinical reality and are well suited to mammography, offering numerous benefits that include cost savings<sup>9</sup> and increased efficiency, accuracy, overall practice value, and job satisfaction. It behooves all breast imagers to investigate and consider implementing AI solutions in clinical practice.

## REFERENCES

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