| Standard Setting Report: Mammography - Effective July 2019 |

Background

The mission of the American Registry of Radiologic Technologists (ARRT) is to "promote high standards of patient care by recognizing qualified individuals in medical imaging, interventional procedures, and radiation therapy." The ARRT's equation for excellence states that excellence equals education plus ethics plus examination; standard setting is one of many processes within the examination component that ensure it is an accurate reflection of the knowledge, skills, and abilities required of entry level technologists.

This report details a standard setting conducted in April 2019 for Mammography, including committee composition, methods, results, recommendations, and any changes to the exam cut score. It is ARRT's primary goal for the exam to reflect the current state of practice and expectations for entry-level mammographers. Therefore, this meeting served to update those expectations from the previous standard setting in 2001.

ARRT utilizes experts in standard setting, called psychometricians, to train and facilitate a committee of subject matter experts from the field to define expectations, collect data, and make recommendations before presenting the results to the ARRT Board of Trustees. These facilitators provided training throughout the meeting to ensure that the committee was prepared to hold productive discussions, make well-reasoned judgments, and provide suitable recommendations at the meeting's conclusion.

Facilitators:

- Ben Babcock, Ph.D., Supervising Senior Psychometrician at ARRT
- Tim Walker, Ph.D., Psychometrician at ARRT

The ARRT Board of Trustees reviewed the results of the standard setting meeting and committee recommendations before approving the final standard. ARRT psychometrics staff will ensure the passing threshold for all exams administered on or after the effective date reflect that prescribed level of performance.

Committee Composition

ARRT staff selected individuals from the volunteer database with the goal of maximizing diversity in role, geography, and experience in mammography. When possible, ARRT will bias the volunteer pool towards individuals early in their career as the exam is designed to assess candidates at entry level. In addition, the radiologist assigned to the exam committee by the American College of Radiology is invited to attend. In total, 19 subject matter experts participated in the standard setting meeting. Please refer to the following table for specific demographics of this group.

Table 1. Committee Demographics

Rater	Role	Location	Credentials
A	Technologist	SD	R.T.(R)(M)(QM)(ARRT)
B	Radiologist	MT	M.D.
C	Technologist	IL	R.T.(R)(M)(ARRT)
D	Radiologist	TX	M.D., FACR
E	Technologist	CA	R.T.(R)(M)(ARRT)
F	Technologist	IN	R.T.(R)(M)(ARRT)
G	Technologist	TN	R.T.(R)(M)(CT)(QM)(BD)(ARRT)
H	Technologist	SD	R.T.(R)(M)(CT)(ARRT)
I	Technologist	AR	R.T.(R)(M)(CT)(ARRT)
J	Technologist	IN	R.T.(R)(M)(BD)(ARRT)
K	Technologist	ND	R.T.(R)(M)(BD)(ARRT)
L	Physicist	CO	M.S., FACR, FAAPM
M	Technologist	AZ	R.T.()(M)(BS)(ARRT)
N	Technologist	NY	R.T.(R)(M)(QM)(ARRT)
O	Technologist	WA	R.T.(R)(M)(BS)(ARRT)
P	Technologist	TN	R.T.(R)(M)(ARRT)
Q	Technologist	MS	R.T.(R)(M)
R	Technologist	KS	R.T.(R)(M)(BD)
S	Trustee	WI	M.D., FACR

Minimally Qualified Candidate

After training regarding the purpose and implications of standard setting, the committee discussed the knowledge, skills, and abilities expected of an entry level mammographer with primary focus on the minimum qualifications that should be demonstrated to earn an ARRT credential. This discussion of the "minimally qualified candidate," who possesses only the knowledge, skills, and abilities required for certification, is important because it allows the committee to come to a common understanding of what is required for the role prior to any data collection activities. Note that "entry level" and "minimally qualified" are not interchangeable terms. Entry level individuals are early in their career with limited clinical experience irrespective of their level of qualification.

Through their discussion, the committee created a list of generic and discipline-specific examples of knowledge, skills, and abilities that are representative of well qualified, minimally qualified, and not yet qualified candidates.

Modified Angoff

The committee performed a modified Angoff activity (Angoff, 1971) using a recently retired exam form. The facilitator provided training to explain the function and intent of the Angoff to the committee and the committee performed a practice activity with a few items to familiarize themselves with the software. The committee was split into two groups for the procedure, but summary statistics were presented in aggregate, as below.

In the first round of the full activity, committee members read each item on the form and provided their judgment for the percentage of minimally qualified candidates that should answer the item correctly. No additional information was provided during this round.

After the first round, committee members were each provided with feedback regarding their own ratings. Specifically, the facilitator determined each individual's cut score based on the first round before comparing each judgment to the expected percent correct for the individual's cut. The

facilitator then provided each committee member with a personalized mix of approximately twenty items that were either rated too high, too low, or close to the expected percent correct for their personal cut score.

The facilitator then provided training for the committee regarding the next round of ratings. Namely, that committee would be able to review the items again with their individual feedback as well as the overall proportion correct for first-time candidates. This training also included a discussion of first-time candidate score distribution and the differing implications of common academic scores (e.g., A, B, C, D, F) and binary pass/fail certification exam results.

Finally, the committee performed a second round of the activity with their first-round judgements provided for them in the response window. Committee members could keep or modify any judgements they desired during this round.

Table 2. Modified Angoff Results

Percent Correct Cut	Round 1	Round 2
Mean	66.5	66.9
Minimum	55.5	58.6
Maximum	66.5	66.9
Standard Deviation	6.3	6.0

Item Plat

Prior to the meeting, ARRT psychometric staff grouped similarly difficult items from different sections of the exam and placed those groups (plats) into a binder in difficulty order. Seventeen plats of six items were necessary to cover the difficulty range likely to be deemed acceptable by the ARRT Board of Trustees. During the meeting, the facilitator provided each committee member with a copy of the plat binder as well as instruction regarding the goals and methods of the activity.

Committee members individually reviewed the plats and selected two; the first being the plat where they believed that 50% of minimally qualified candidates would answer the items correctly and the second was to be the point where they believed that 66% of minimally qualified candidates would answer correctly. The facilitator used the flag (50% or 66%) and plat difficulty to determine two potential cut scores per individual. The following table states the activity results as a percent correct cut for the form used in the Angoff activity to allow comparisons between activities.

Table 3. Item Plat Activity Results

Percent Correct Cut	50% Flag	66% Flag
Mean	59.2	62.6
Minimum	20.0	23.3
Maximum	95.0	95.4

Final Discussion

After all data collection was complete, the standard setting committee reviewed the activity results along with an estimated pass rate for potential cut scores within that range. The committee discussed the results, their impressions of the activities, and the cut score they wished to submit to the ARRT Board of Trustees for review. After the discussion, each committee member submitted their final recommended cut score, and the mean of those recommendations was submitted as the overall committee recommendation.

Table 4. Final Recommended Cut Score

Median	66.0
Minimum	65.0
Maximum	69.6

New Standard and Implementation

The ARRT Board of Trustees reviewed the results and discussed the impact of potential new standards before approving a final standard for the Mammography exam.

The board elected to renew the current standard (equivalent to 76 out of 115 items on the exam form used for this meeting). This standard will remain in place until at least 2025, when the next standard setting is scheduled to take place.

References

Angoff, W.H. (1971). Scales, norms, and equivalent scores. In R.L. Thorndike (Ed.), *Educational Measurement* (2nd ed., pp. 508-600). American Council on Education.