Purpose:

Signal-difference-to-noise ratio (SDNR) can be served as an indicator representing the sensitivity of an x-ray system. This study aimed to evaluate the automatic exposure control (AEC) performance using the SDNR based on the national survey data in Taiwan.

Methods:

Measurements were made on all the 113 flat-panel digital mammography units in Taiwan during our 2010 national survey. They included GE Senographe 2000D (38), DS (15) and Essential (3), Hologic Selenia with Mo (20) and W (24) targets, Siemens Mammomat NovationDR(8) and Inspiration (4), and IMS Giotto Image3D (1). A disk was placed on top of the 2, 4 and 6-cm thick acrylic blocks to simulate the contrast. Clinical AEC modes were selected to acquire images and SDNR were then measured as the mean pixel value differences between the disk and the background divided by the noise using the equation defined in ACRIN DMIST recommendations.

Results:

AEC systems of different manufacturers/models, or even different units with the same models resulted in different target/filter combinations and techniques when performing the thickness tracking. For example, 6-cm thickness led to 40% Mo/Mo and 60% Mo/Rh in Hologic Selenia systems with Mo target and 4-cm thickness led to 26% for Mo/Mo and 74% for Mo/Rh in GE 2000D systems. Decreasing SDNRs were observed when thickness increased in all the eight digital models. When normalized the mean SDNR of each model to their 4-cm-thickness data, large deviations between 2 cm and 6 cm were observed in the GE systems (94.7%, 87.1% and 63.0% for DS, Essential and 2000D, respectively). Deviations of the other five models ranged from 36.9% to 59.6%.

Conclusions:

Evaluating AEC performance using SDNR showed the decreasing trend with increasing thickness in all the eight digital models. Considering the average glandular dose together, Figure of Merit will be further investigated in the future.