AbstractID: 5822 Title: Variation in Dual-Energy Chest Radiography Among Systems Using Identical Digital Flat Panel Detectors

Purpose:
To study the variation of dual-energy chest radiography systems by measuring Spectral Quality Factor (SQF) and subtracted-image Noise Quality Factor (NQF) defined by Alvarez, Seibert, and Thompson (2004) [1]. SQF depends on the x-ray energy spectrum and detector DQE. NQF is a measure of noise in the subtracted image, which depends on SQF and detected signal levels.

Method and Materials:
Stepwedges of aluminum and polycarbonate duplicating the original work and a 4.8 mm thick acrylic slab were radiographed in dual energy chest mode at 120 and 60 kVp using 15 systems (XQ/i, XR/d, and XR/dII; GE Medical Systems; Milwaukee, WI). Exposure levels of approximately 16, 24, 47, and 57 mR were measured free-in-air, corrected to the surface of the acrylic slab. SQF was calculated from effective linear attenuation coefficients, slopes of logarithm of pixel values behind each step relative to an uncovered area versus step thickness from raw images of each stepwedge at low and high energy. NQF was the slope of SNR^2 in the soft-tissue image of the smallest step of the polycarbonate stepwedge versus entrance exposure.

Results:
Alvarez, et al. compared three dual-energy detector technologies, reporting results in relative terms, including variation of ±5% in SQF for an individual unit like ours. Our SQF was approximately 1.2×10^{-8} mm^{-2} ±14%. They reported NQF of 0.18 mR^{-1} estimated from Fig.10 using images subtracted by their own algorithm. Our NQF was approximately 0.16 mR^{-1} ±9% using images subtracted by the clinical system.

Conclusions:
SQF and NQF are useful indicators of dual energy system performance that can be determined in a practical setting with clinical systems. Values for our flat panel systems are in general agreement with previous reports.