

## ASSESSING BREAST DENSITY CHANGE OVER TIME

Ralph Highnam; Bruce Schroeder

*Matakina International Limited*; The Brody School of Medicine, East Carolina University

Most analysis of breast density to date has been at a single time point, and yet there's been widespread discussion of how important breast density change over time might be. For example, there's been discussion of the significance of a woman's breast density if it doesn't change over menopause, the significance of how a woman's breast density changes with drugs, and there's the concept of detecting early breast cancer by determining breast density increases (both local and global) over time.

Volpara<sup>®</sup> is an FDA cleared software product to estimate volumetric breast density from raw, "For Processing", digital mammograms. It automatically and objectively estimates volume of fibroglandular tissue, volume of breast tissue and their ratio, the volumetric breast density:

$$\text{Volumetric Breast Density} = \text{Volume of Fibroglandular Tissue} / \text{Volume of Breast}$$

Volpara has been validated by comparing to phantom data, breast density assessed from breast MRI's, breast density assessed by eye (BI-RADS ACR) and breast density assessed using Cumulus. Volpara assesses Volumetric Breast Density for each image; the average of those results for both breasts gives the breast density for the woman. Using BI-RADS ACR data we have mapped the breast density for the woman to what we've termed the Volpara Density Grade as an aid to radiologists assessing BI-RADS ACR:

Volpara Density Grade (VDG)	Volumetric Breast Density Range
1	0-4.8%
2	4.8-8.0%
3	8.0-15.1%
4	15.1% and up

We collected data from 296 women who all had at least two episodes of screening and we analyzed their breast density for change using VDG, and the BI-RADS ACR data. The women were sequentially selected from screening data and the age range was from 40 up to 70. We do, of course, expect to see some natural reduction in density over time.

The BI-RADS ACR data suggested that 29.7% of the woman changed in breast density over the screening data that we have, whilst VDG suggested change in 28.7% of the cases. On analysis, however, it became very clear that the BI-RADS ACR data was extremely unpredictable due to the different observers used and the inherent subjectivity of visual assessment.

For the VDG changes, 12.7% of the cases were what we've dubbed "border changes", in these cases the volumetric density moved from, for example, 4.75% to 4.9%, which was enough to change the VDG grade from 1 to 2. If we exclude border changes, then it appears 16% of the women have a significant change in density over the screening episodes. Of those 16%, we found a number of the changes were due to pacemakers appearing in the left image causing issues; poor compression in some images; positioning changes and many apparently genuine changes.

16% of women changing breast density over a year appears more reasonable than 28.7% and is the same percentage as the percentage of women that exhibited a change in volumetric breast density of over 2%.

Assessing temporal change on a whole breast basis is possible but we firmly believe it should be on a continue measure as to avoid border issues. In all cases, however, you still need to beware of variations between the imaging procedures such as positioning, pacemakers and compression. Regional comparison of density would help overcome these issues.

ABSTRACTS