Table. Clinical guidelines for staging bone scans

Clinical Guidelines		Recommend bone scan if any of these:
EAU	European Association of Urology	- GS ≥8 - cT3/T4 disease - PSA >10 ng/ml - Symptomatic
AUA	American Urological Association	- GS ≥8 - PSA >20 ng/ml - Symptomatic
NCCN	National Comprehensive Cancer Network	- cT1 disease & PSA >20 ng/ml - cT2 disease & PSA >10 ng/ml - Gleason sum ≥8 - cT3/T4 disease - Symptomatic
Briganti's CART	Briganti's Classification and Regression Tree	- GS ≥8 - ≥cT2 disease & PSA >10 ng/ml - Symptomatic

Estimating Sensitivity and Specificity of the Clinical Guidelines

We used the method outlined by Begg and Greenes[1] to estimate the sensitivity and specificity of the published recommendations regarding the need for staging bone scan (BS) in newly-diagnosed prostate cancer patients. We define the "test" to be the outcome of applying some guideline (G), such as the AUA guideline, where "+" and "-", denote whether a patient is recommended to receive a BS or not, respectively. The sensitivity and specificity are defined as:

$$Sensitivity = P(G+|Disease\ Present)$$

$$Specificity = P(G-|Disease\ Not\ Present)$$

Following the approach described in Begg and Greenes[1] if we assume that the factors considered by the guideline (e.g. PSA, Gleason Score) are the only factors that influence selection of patients recommended for staging BS, then using *Bayes Rule* we can write:

$$Sensitivity = P(G+|Disease\ Present) = \frac{P(Disease\ Present\ |G+)P(G+)}{P(Disease\ Present)}$$

$$Specificity = P(G-|Disease\ Not\ Present) = \frac{P(Disease\ Not\ Present\ |G-)P(G-)}{P(Disease\ Not\ Present)}$$

The probabilities above were estimated as follows:

1) To estimate $P(Disease\ Present\ |G+)$ and $P(Disease\ Not\ Present\ |G-)$, separate the entire population (with and without bone scan) into G- and G+ and apply the logistic regression model to get an estimate of the mean probability for each group of patients.
2) Estimate P(G+) and P(G-) as the proportion of the population with G+ and G-.
3) Estimate $P(Disease\ Present)$ and $P(Disease\ Not\ Present)$ based on the following:

$$P(Disease\ Present) = P(Disease\ Present\ |G+)P(G+) + P(Disease\ Present|G-)P(G-)$$

$$P(Disease\ Not\ Present) = P(Disease\ Not\ Present\ |G+)P(G+) + P(Disease\ Not\ Present|G-)P(G-)$$

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1. Begg, C. B., Greenes, R. A.: Assessment of diagnostic tests when disease verification is subject to selection bias. Biometrics, **39:** 207, 1983