Calculated Prevalence of Gout in the U.S. OSA Population

This calculation uses Bayes's rule from the probability theory branch of mathematics, written as

$P(G \mid O) = P(O \mid G) \times P(G) / P(O)$

This is a straightforward algebraic equation with four variables, expressing the desired result in the form R = X multiplied by Y divided by Z. Instead of the single letters R, X, Y, Z to symbolize each variable, Bayes's rule uses the more intricate symbols $P(G \mid O)$, $P(O \mid G)$, P(G), P(O) which are better mnemonics of the meaning of each variable.

The four variables in Bayses's rule are all probabilities. In order to use prevalence data to quantify a variable, we postulate that prevalence in a population is equal to the probability of occurrence in any randomly selected individual in that population.

Thus, we define the meanings of the four Bayes's rule variables with referenced quantifications as:

$P(G \mid O)$ = probability (prevalence) of gout given that OSA is present

$P(O \mid G)$ = probability (prevalence) of OSA given that gout is present = 0.89 [17]

P(G) = probability (prevalence) of gout in U.S.= 0.052 in men, 0.027 in women [A]

P(O) = probability (prevalence) of OSA in U.S. = 0.34 in men, 0.17 in women [40]

Therefore, using the Bayes's rule equation with the quantifications given above, the U.S. prevalence (probability) of gout in those with OSA is calculated to be:

$P(G \mid O) = 0.89 \times 0.052 / 0.34 = 14\%$ in men

$P(G \mid O) = 0.89 \times 0.027 / 0.17 = 14\%$ in women

[A]. Chen-Xu M, Yokose C, Rai SK, Pillinger MH, Choi HK. Contemporary prevalence of gout and hyperuricemia in the United States and decadal trends: the national health and nutrition examination survey, 2007-2016. Arthritis Rheumatol. 2019;71:991–9.