Diagnostic Uncertainty: A Software Tool for Calculating the Uncertainty of Diagnostic Accuracy Measures

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1. Purpose/Problem

Although diagnostic accuracy measures are used to evaluate the correctness of classification in clinical research and practice, there has been limited research on their uncertainty.

2. Description of the Program

For this reason, the freely available interactive program *Diagnostic Uncertainty* was developed for calculating the uncertainty of diagnostic accuracy measures of diagnostic or screening tests, measuring a normally distributed measurand, applied at a single point in time in samples of non-diseased and diseased populations [1].

3. Outcomes

The program calculates and plots the standard combined, measurement and sampling uncertainty and the resultant confidence intervals of various diagnostic accuracy measures of screening or diagnostic tests, for differing sample sizes, mean and standard deviation of the measurand, diagnostic threshold and standard measurement uncertainty of the test (see Fig. 1-3).

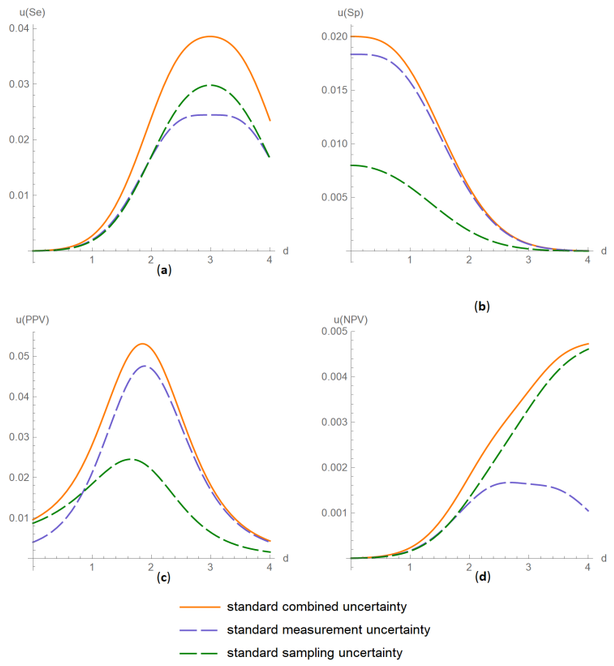
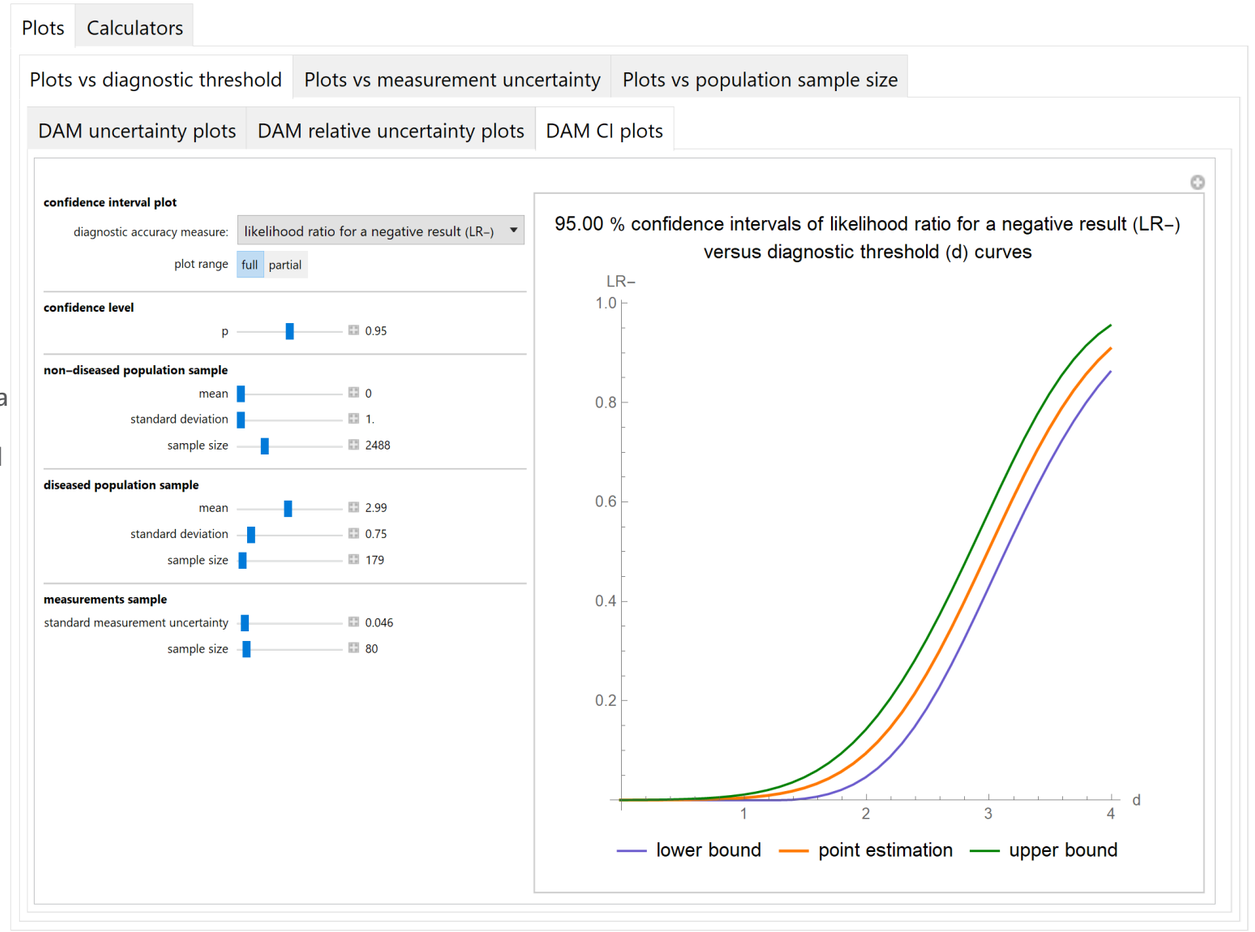
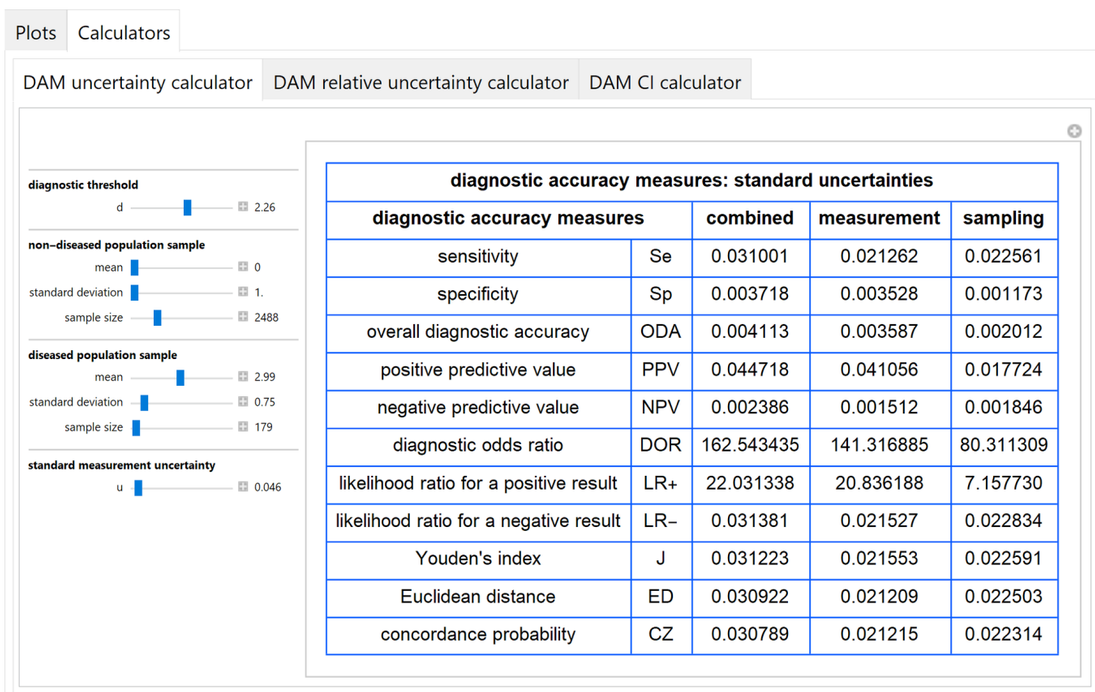


Figure 1. *Plots of standard uncertainties of Sensitivity (Se), Specificity (Sp), Positive and Negative Predictive Value (PPV) and NPV) vs diagnostic threshold (d).*





diagnostic accuracy measures: standard uncertainties				
diagnostic accuracy measures		**combined**	**measurement**	**sampling**
sensitivity	Se	0.031001	0.021262	0.022561
specificity	Sp	0.003718	0.003528	0.001173
overall diagnostic accuracy	ODA	0.004113	0.003587	0.002012
positive predictive value	PPV	0.044718	0.041056	0.017724
negative predictive value	NPV	0.002386	0.001512	0.001846
diagnostic odds ratio	DOR	162.543435	141.316885	80.311309
likelihood ratio for a positive result	LR+	22.031338	20.836188	7.157730
likelihood ratio for a negative result	LR−	0.031381	0.021527	0.022834
Youden's index	J	0.031223	0.021553	0.022591
Euclidean distance	ED	0.030922	0.021209	0.022503
concordance probability	CZ	0.030789	0.021215	0.022314

4. Discussion

This program calculates the standard and expanded combined, measurement and sampling uncertainty and the resultant confidence intervals of diagnostic accuracy measures of diagnostic tests, applied to samples of populations, providing 99 different types of plots and three different types of comprehensive tables, many of which are novel. To the best of our knowledge, no software, including all major general or medical statistical and uncertainty related software packages provides this range of plots and tables without advanced programming.

Figure 2. *Snapshot of the program: Confidence intervals of likelihood ratio for a negative test result (LR -) versus diagnostic threshold (d) curves plot, with the settings shown at the left.*

5. Significance

The program "Diagnostic Uncertainty" can be used as a flexible, user-friendly, interactive educational or research tool in medical decision-making, to calculate the uncertainty of diagnostic accuracy measures.

6. References

1. Chatzimichail T, Hatjimihail AT. A Software Tool for Calculating the Uncertainty of Diagnostic Accuracy Measures. Diagnostics. 2021; 11(3):406. DOI: 10.3390/diagnostics11030406.

6. Supplementary Materials

The program *Diagnostic Uncertainty* is freely available at:

https://www.hcsl.com/Tools/Uncertainty/

Figure 3. *Snapshot of the program: Calculated standard combined, measurement, and sampling uncertainty of diagnostic accuracy measures, with the settings shown at the left.*

Contact

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