

**Evidence-Based Medicine
Journal Club:
How to Use an Article about a
Diagnostic Test**

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**Peds EBM teaching slides credits--
materials developed with help from:**

- User's Guide to EBM (reproduced with permission of JAMA): <http://www.cche.net/usersguides/main.asp>
- Dr. Susan Guralnick of Stony Brook (SUNY)
- EBM Pediatric Program Directors and Educators Workshop at University of Illinois at Chicago
- Epidemiology and Preventive Medicine Dept. at Univ. of MD (Masters Program)

**How to Use an Article about a
Diagnostic Test**

- Are the results likely to be valid?
- Are the results clinically significant?
- Are the results applicable to my patient?
- Will the results change my management

**How to Use an Article about a
Diagnostic Test**

- **Are the results likely to be VALID?**
- Was there an independent, blind comparison with a reference "Gold" Standard?
- Was the diagnostic test evaluated in an appropriate spectrum of patients (like those in whom we would use it in practice)?
- Was the reference "Gold" standard applied regardless of the diagnostic test result?

If NO, Stop here!

**How to Use an Article about a
Diagnostic Test**

Are the results Clinically Significant?

	Disease Present	Disease Absent	Totals
Test Result Positive	a	b	a + b
Test Result Negative	c	d	c+d
	a + c	b + d	a+b+c+d

Are the results Clinically Significant?

	Disease Present	Disease Absent	Totals
Test Result (+)	a	b	a + b
Test Result (-)	c	d	c+d
	a + c	b + d	a+b+c+d

Sensitivity = a / a+c

Specificity = d / b + d

Positive Predictive Value = a / a + b

Negative Predictive Value = d / c + d

LR(+)= [a / (a+c)] / [b / (b + d)]

LR (-)= [c / (a + c)] / [d / (b+d)]

How to Use an Article about a Diagnostic Test

- **Sensitivity:** The ability of the test to detect diseased people from a diseased population
- **Specificity:** The ability of a test to detect healthy people from a healthy population

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- **Positive Predictive Value:** The probability that a given test result is a true positive, given a specific disease prevalence ($a / a + b$)
- **Negative Predictive Value:** The probability that a given test result is a true negative, given a specific disease prevalence ($d / c + d$)

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- **Likelihood Ratio:** For a given test result, the probability that our patient comes from the diseased versus the non-diseased population
- **LR (+):** The probability that the patient has a true positive test, rather than a false positive
- **LR (-):** The probability that the patient has a true negative test and not a false negative

How to Use an Article about a Diagnostic Test

- *Likelihood Ratios* indicate by how much a given diagnostic test result will raise or lower the pretest probability of the target disorder
- LR = 1 means the post-test probability is exactly the same as the pre-test probability
- LR > 1 increases the probability that the target disorder is present
- LR < 1 decreases the probability that the target disorder is present

How to Use an Article about a Diagnostic Test

- A Rough Guide to LR significance
- LR > 10 or < 0.1 generate large and often conclusive changes from pre-test to post-test probability
- LR = 5 - 10 or 0.1 - 0.2 generate moderate shifts pre-test to post-test
- LR = 2 - 5 or 0.5 - 0.2 generate small, but sometimes important changes in probability
- LR = 1 - 2 or 0.5 - 1 are rarely important shifts

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- How do we use the Likelihood Ratios?

How to Use an Article about a Diagnostic Test

- **Post-Test Probability**

Calculated from the Likelihood Ratio and the patient's Pre-Test Probability (Prevalence) of having the disease

Calculation:

Prevalence Ratio (PR) = prevalence / (1 - Prevalence)

Post-Test Odds of Disease = PR x LR

Probability of Disease = Post-Test Odds/(1+Post-Test Odds)

How to Use an Article about a Diagnostic Test

- **Post-Test Probability** is calculated from the Likelihood Ratio and the patient's Pre-Test Probability (Prevalence) of having the disease

Calculation:

- Prevalence Ratio (PR) = prevalence / (1 - Prevalence)

- Post-Test Odds of Disease = PR x LR

- Probability of Disease = Post-Test Odds/(1+Post-Test Odds)

- Nomogram

- LR Calculator:

<http://araw.mede.uic.edu/cgi-alansz/testcalc.pl>

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- LR = 8 means that it is 8 times more likely that a positive test is a true positive than a false positive.
- **Prevalence** = all study pts with disease / all pts in study
- **Likelihood Ratio** is prevalence-independent
- **Predictive Value** is wholly prevalence-dependent
- Prevalence is often higher in studies compared to routine practice due to selection bias.

How to Use an Article about a Diagnostic Test

- Will the results help me in caring for my patient?
- Will the reproducibility of the test result and its interpretation be satisfactory in my setting?

How to Use an Article about a Diagnostic Test

- Are the results applicable to my patient?
 - Test Properties may change with a different mix of disease severity or a different distribution of competing conditions
 - When patients with the target disorder all have severe disease, the LR's will move away from a value of 1 (sensitivity increases)
 - When patients without the target disorder have competing conditions that mimic the test results of patients who do have the target disorder, the LRs move toward one, and the test appear less useful

How to Use an Article about a Diagnostic Test

- Will the results change my management?
 - **Test Threshold** – probabilities below which a clinician would dismiss a diagnosis and order no further tests
 - **Treatment Threshold** – probabilities above which a clinician would consider the diagnosis confirmed, and would stop testing

How to Use an Article about a Diagnostic Test

- When the probability of the target disorder falls between the test and treatment thresholds, further testing is mandated
- Once test and treatment thresholds are determined, the post-test probabilities have direct treatment implications