3.7 Platelet Count as test for Invasive Bacterial Infection [10 points]

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Cruz et al did a cross-sectional study to investigate using the platelet count to identify febrile infants < 60 days old with invasive bacterial infections (IBI) and reported these results.

Table 4. Test Characteristics of CBC Parameters for Identifying Infants With Invasive Bacterial Infections

Parameter	Threshold	% (95% CI) Sensitivity	Specificity	PV+	PV−	LR+ (95% CI)	LR− (95% CI)
Platelets, $\times 10^3$ cells/μL	<100	7 (2-12)	100 (99-100)	26 (9-42)	98 (97-98)	15.1 (6.6-34.9)	0.9 (0.9-1)
	<150	9 (4-15)	99 (99-99)	16 (6-25)	98 (97-98)	7.9 (4.0-15.7)	0.9 (0.9-1)
	<150 or ≥450	31 (22-40)	69 (68-71)	2 (1-3)	98 (97-98)	1.0 (0.8-1.4)	1.1 (1.0-1.2)
	≥450	22 (13-30)	71 (69-72)	2 (1-2)	97 (97-98)	0.7 (0.5-1.1)	1.1 (1.0-1.2)
	≤362[a]	61 (51-71)	56 (55-58)	3 (2-4)	98 (98-99)	1.4 (1.2-1.7)	0.7 (0.5-0.9)

Here is the data table that gave rise to the above:

Platelet Count $\times 10^3$ cells/μL	IBI+	IBI-	**Total**
<100	7	16	23
100-<150	2	26	28
150-<450	67	2909	2976
450+	21	1265	1286
	97	4216	4313

a) Admittedly some of the numbers are small, but what is the point estimate for the interval likelihood ratio for a platelet count of 100 - < 150 $\times 10^3$? (Show calculation.) [2]

(2/97)/(26/4216) = 3.3

b) You are working with a population of patients whose prior probability of IBI you believe is very similar to the prevalence reported in this study. Your current patient is a febrile infant < 60 days old with a platelet count of 125 × 10^3 cells/μL. Based on this study and the platelet count, what is your best estimate for the probability of IBI? Explain and show calculations.[2]

2/28 = 0.071 (You can do the whole calculation of pre-test prob → odds → etc., but all of the other numbers will cancel out and you will get the same answer.)

c) Of the 4 platelet count intervals in the table above, which is the most concerning for IBI? [1]
As in part b, because this study used cross-sectional sampling, you can look across rows to see

which one has the highest risk of IBI. It's clearly the first row, with a risk of 7/23. So the most worrisome platelet count is < 100 × 10^3 cells/μL.

d) What is the LR for a platelet count in that interval?[1]

The LR =(7/97)/(16/4216) = 19.0

e) If your treatment threshold probability for IBI is 1% and the only test you were considering was the platelet count, what pre-test probability would allow you to skip the test and forgo treatment. [2]

It would be a pretest probability such that even if you got the most worrisome result (<100) the LR would not be sufficient to move you past the treatment threshold. So we can divide the treatment threshold by the LR. You don't have to convert to odds because all of the probabilities for this problem are so small: 0.01/19 = 0.00053. (if you convert to odds and back you get 0.00052.)

f) In Table 4 from the paper, the authors report an LR of 1.0 for platelets < 150 or ≥ 450. What is the LR for a platelet count 150 - < 450 ? [2]

If you trusted the authors (which would probably be a mistake, given their failure to use interval LRs in the table above, you could skip the calculation by realizing that if the LR for one of two complementary intervals is 1.0, then the LR for the other interval must also be 1.0. To do the calculation, it's easiest to just do (67/97)/(2909/4216) = 1.00.