

The Effectiveness of Current Urinalysis Reflex Criteria on Urine Cultures



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Introduction

Urinalysis is a common laboratory screening test for the detection of such conditions as urinary tract infections, kidney disorders, liver conditions, and diabetes. A urinalysis consists of visual, chemical, and microscopic examination to detect cells, bacteria, as well as other structures and substances. Urinalysis is used as a screening test for urine cultures by determining which samples are likely to show microbial growth based on predetermined reflex criteria. The current reflex criteria for Bridgeport Hospital consists of reflexing samples to microbiology for culture if any one of the following criteria are met:

- Esterase- trace or greater
- Nitrite- positive
- WBC > 5
- Bacteria- moderate to marked

Methods of Analysis

- Data analysis was conducted on a total of 300 randomly selected urinalysis samples from Bridgeport Hospital that were reflexed to culture since 12/6/2016 using statistical software (JMP) to determine the most effective criteria for reflex.
- The types of analysis used include P value, Contingency Tables, and an Excel pivot table was also used to construct the reflex criteria.
- The criteria analyzed include Color, Clarity, Protein, Leukocyte Esterase, Ketones, Red Blood Cells, Bilirubin, Urobilinogen, Specific Gravity, Nitrite, pH, and Glucose as the independent variables and culture growth as the dependent variable.

Results

The Current State:

- Out of 300 patient samples that were reflexed to microbiology for culture:
 - 116 showed growth
 - 184 showed no growth
- This translates to 61% unnecessary tests.
- My hypothesis was that current urinalysis reflex criteria creates a statistically significant number ($\geq 20\%$) of unnecessary specimens for microbiology testing.
 - This is found to be true, therefore the reflex criteria must be revised.

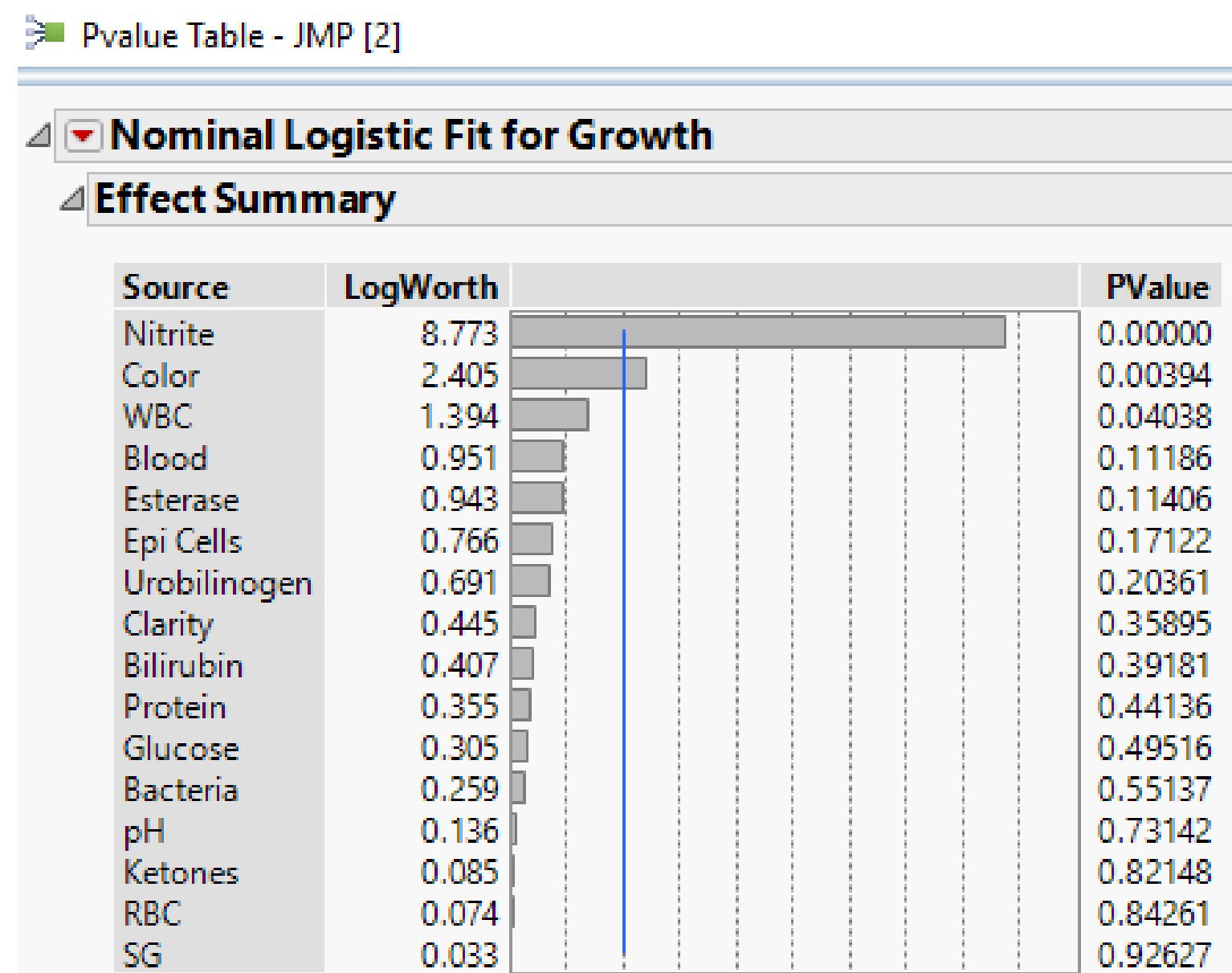


Figure 1. This table shows the reflex criteria that have the most effect on growth. From the table, the criteria that have the most effect on culture growth are:

1. Nitrite
 2. Color
 3. WBC
 4. Blood
- These criteria were used to construct appropriate reflex criteria.
 - These criteria were included in the reflex criteria because they had a P value of 0.05 or less, except blood, whose P value was higher.
 - Blood was included in order to lower the number of false negatives.

Contingency tables were constructed for the top four criteria to determine how they should be used in the construction of the new reflex criteria.

Figure 2. Contingency Table
Nitrite By Growth

Count	No	Yes	Total	Percent
Negative	173	72	245	29.4%
Positive	11	44	55	80.0%
Total	184	116	300	

Figure 3. Contingency Table
Color By Growth

Count	No	Yes	Total	Percent
Amber	35	28	63	44.4%
Orange	3	5	8	62.5%
Red	11	3	14	21.4%
Yellow	135	80	215	37.2%
Total	184	116	300	

Figure 4. Contingency Table
WBC By Growth

Count	No	Yes	Total	Percent
0	7	1	8	12.5%
<5	71	18	89	20.2%
5-20	73	36	109	33.0%
20-50	21	18	39	46.2%
50-100	6	18	24	75%
>100	6	25	31	80.6%
Total	184	116	300	

Figure 5. Contingency Table
Blood By Growth

Count	No	Yes	Total	Percent
Negative	80	43	123	35.0%
Trace	23	10	33	30.3%
Small	17	17	34	50.0%
Moderate	17	17	34	50.0%
Large	47	29	76	38.2%
Total	184	116	300	

The reflex criteria highlighted in yellow indicate those that are most indicative of culture growth and, therefore, are included in the proposed reflex criteria.

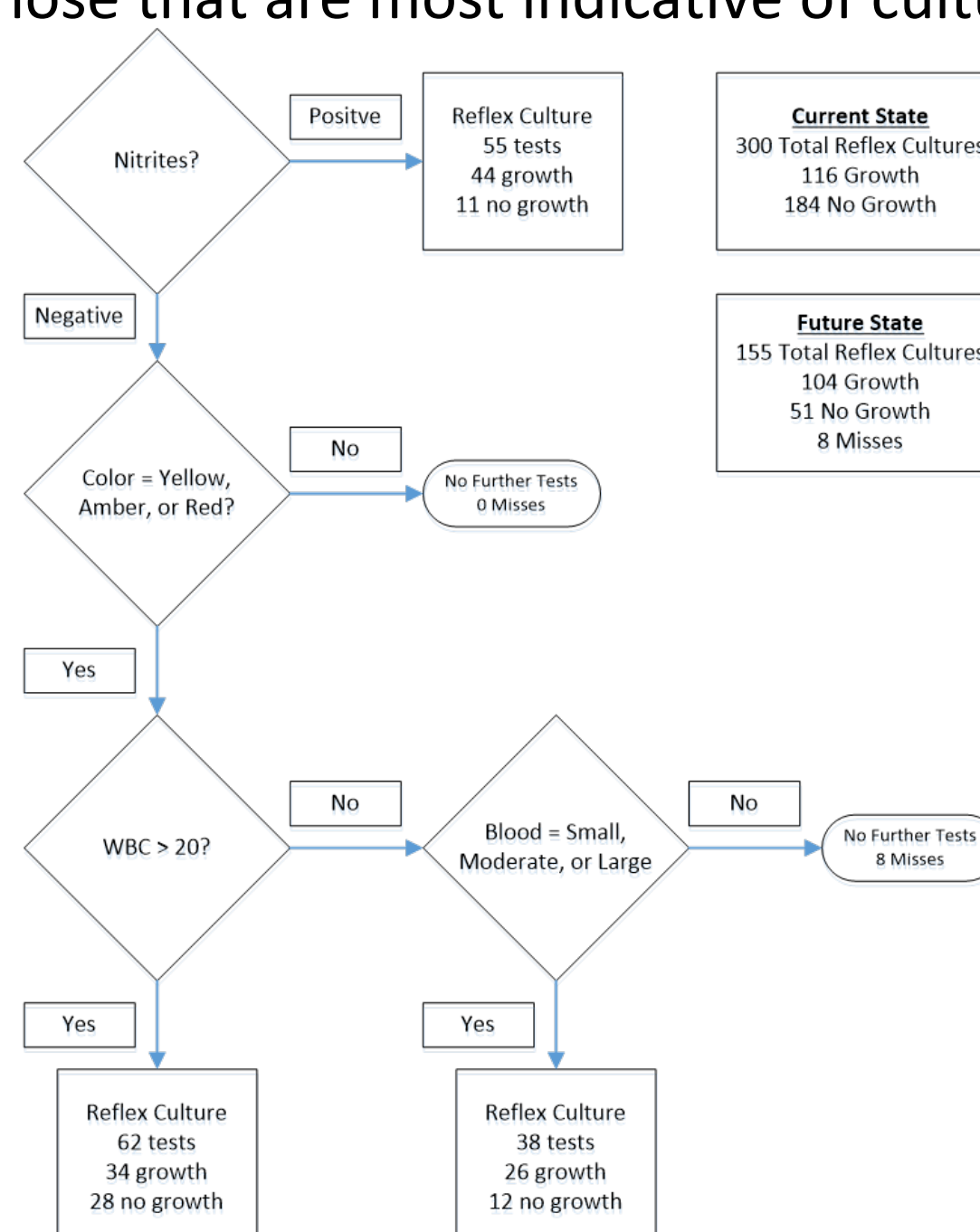


Figure 6. This figure depicts the proposed reflex criteria as constructed using the contingency tables and an Excel pivot table.

- The four criteria were used as filters
- The filters were used to find the best combination of reflex criteria to provide the least amount of unnecessary tests, while also providing the lowest amount of false negatives.
- The filters were used to include and exclude samples based on changes in the reflex criteria so that the optimal set of criteria could be constructed.

Conclusion and Benefits

- This reflex criteria cuts the number of reflex tests from 300 to 155.
 - This is a 48.3% reduction in the number of tests.
- Out of the 155 reflex tests still performed, 51 are unnecessary and showed no growth.
 - This means that 33% of the reflex cultures performed will still show no growth.
- However, this is only 17% out of the original 300 people that walked in the door, while only performing nearly half as many tests.
 - This saves both bench time and costs.
- In addition, out of the original 116 samples that showed growth, the revised reflex criteria would produce only 8 false negatives.
 - This translates to 6.9% false negatives. However, these are not true false negatives since they were never tested, so they are better described as "misses".

Acknowledgements

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References

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- ² *Urinalysis: The Test*. (2016, May 25). Retrieved February 12, 2017, from <https://labtestsonline.org/understanding/analytes/urinalysis/tab/test>