

Development of a Clinical Research Project Comparing Infection Risk Assessment Scores in Oncology

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Problem

- Sepsis is the leading cause of nonmalignant death in oncology patients^{1,2}. Approximately 14% of oncology patients develop sepsis. Sepsis-related mortality rate in this patient population is estimated to be 30-40%^{1,3}.
- Early sepsis detection results in better patient outcomes. Multiple sepsis screening tools exist, but none are validated specifically for oncology patients. Hospital-wide sepsis screening methods over diagnose sepsis, and research suggests that the universal screening criteria should be updated⁴.
- The MASCC score is recommended to predict sepsis in oncology patients. It is only validated in febrile neutropenic patients and not all oncological populations^{1,5}.

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Long Term Objectives:

- Primary Aim:** Evaluate MASCC's sensitivity and specificity to predict severe sepsis or septic shock in ambulatory oncology patients who screen positive for sepsis.
- Secondary Aim:** Analyze subpopulations for which the MASCC Risk score has not been validated to evaluate potential application.

Short Term Objective:

- Conduct review of current evidence to determine which variables and screening tools should be studied. Findings were utilized to draft and submit an IRB proposal to compare and correlate variables and tools supporting prediction of sepsis outcomes in patients with cancer.

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Literature Review

A review of current literature was done to update a previous review from 2013⁴. PubMed, EMBASE, Cochrane, CINAHL, and Guidelines.gov were used to search for qSOFA, SOFA, MASCC, and Sepsis screening related articles published since March 2014 to determine appropriate variables. Based on the review and current JHH practices it was concluded that three scoring systems should be compared with MASCC results:

- JHH Oncology Current Sepsis Score** Not validated in powered study⁶
- qSOFA** Low sensitivity, high specificity⁷
- Surviving Sepsis** Poor sensitivity & specificity⁴

Table 1. Sepsis screening score criteria.

Parameter	Surviving Sepsis ⁴	JHH ⁶	qSOFA ⁷
Temperature	T < 36.0°C or > 38.3°C	T < 35.5 °C (with out symptoms) or > 38.0 °C	----
Heart Rate	HR > 90 bpm	HR > 100 bpm	----
Respiratory Rate	RR > 20/min	RR> 20/min	RR > 21/min
Blood Pressure	SBP < 90 mmHg or > 40 mmHg drop from baseline, or MAP < 65 mmHg	SBP < 90 mmHg or > 40 mmHg drop from baseline, or MAP < 65 mmHg	Systolic BP < 100 mmHg
WBC	< 4000 mm ³ or > 12,000mm ³ or >10% bands	< 4000 mm ³ or > 12,000mm ³ or >10% bands, neutropenia	----
Other	None	Glucose > 140 mg/dL in absence of diabetes	Mental status changes
Positive Screen	Any two of the above parameters plus risk of infection		

Variable Selection: based on the sepsis screening tools, MASCC screening tool, and data indicating patients' infection status and oncology treatment.

Table 2. Variable selection rationale

Variable	Rationale	Literature
Oncology diagnosis and treatment type	No currently validated sepsis screening tools for general oncology patient populations.	Shelton, 2016 ⁴
Sepsis screen data: JHH, qSOFA, Surviving Sepsis score	All three scores needed to determine which was most efficient when compared to the MASCC risk score.	
MASCC Screening Data: illness burden, hypotension, COPD, malignancy without prior fungal infection, dehydration, outpatient status, and age.	Necessary to calculate MASCC scores for each participant. These are independent factors that predict level of risk in febrile neutropenic oncology patients.	Klastersky et al., 2000 ¹²
Patient outcome data: Severe Sepsis, Septic Shock, and Survival Status	These data will support or contradict the predictive screening tests. Similar methods were used when validating MASCC scores.	Klastersky, 2000; Shelton, 2016; Ahn et al., 2012; Baskaran et al., 2008; Feld et al., 2002; Klastersky & Paesmans, 2013 ^{5,4,9,10,11,12}
Laboratory values: serum lactate, serum creatinine, bilirubin	Strong predictors of sepsis severity and mortality. Indicates accuracy of the screening tools.	Dellinger et al., 2013 ⁶
Infection Variables: source, positive culture, antibiotics	Provide evidence of true infection. Utilized in similar studies.	Kim et al., 2017 ⁷

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Methods: Prospective chart review of all patients seen in the ambulatory Hematology-Oncology Clinic or the Weinberg Urgent Care Clinic.

- Numerator data: 3660 patient encounters during which patients display signs of sepsis
- Denominator data: all clinic visits.

Table 3. Study question and associated tests

Question	Test
How do sepsis screen positivity and MASCC risk scores compare to incidence of severe sepsis or septic shock?	Correlational statistics to validate MASCC score's prediction of severe sepsis
How does the MASCC risk score compare to the three sepsis screen positive scores for predictive value?	<ul style="list-style-type: none"> Sensitivity Specificity Positive predictive value/negative predictive value
Specific focus: appropriateness for use of the MASCC score to predict outcomes for ambulatory oncology patients regardless of febrile neutropenia	<ul style="list-style-type: none"> Receiver Operating Characteristic (ROC) curves ANOVA and Multiple Regression compare MASCC score with other sepsis positive criteria

ROC Curve: The ROC statistic allows for comparison of different tools' sensitivity and specificity. The area under ROC curves indicates the accuracy of MASCC⁸. These AUC statistics will be compared between tools to determine relative accuracy as is seen in other literature⁷.

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Timeline

- Literature review; consult with experts in oncology, infectious disease and statistics
- Observed current practices in the ambulatory clinics and discussed with unit leadership
- Submitted application to the Oncology Nursing Research Committee. After revisions, received final approval
- Submitted and received Shirley Sohmer Research Grant
- Drafted outcomes assessment and data collection tools
- Submitted project to Hospital Nursing Research Committee
- Completed IRB required modules, drafted IRB application and submitted project

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Lessons Learned

- Additional research was needed to determine the best way to record lab culture data that was drawn at the initial screen and what to use as time zero.
- Approval was required by the Oncology Nursing Research Committee, Hospital Nursing Research Committee, and the IRB prior to beginning the research
 - Provided multiple sources of input
 - Delayed data collection.

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