

# *Paramedic – Evidence Based Medicine (P-EBP) Program*

## Paramedic CAT (Critically Appraised Topic) Worksheet

**Title:** Use of Beta-2 agonists in Acute Decompensated Heart Failure with Pulmonary Edema.

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### **Clinical Scenario:**

*You arrive to on scene to a patient in respiratory distress, the patient is in the tripod position, with an obvious increase in work of breathing, appearing pale, with central and peripheral cyanosis, your patient is speaking in 2-3 word dyspneic sentences, and claims to have awoken suddenly from sleep, feeling extremely short of breath, coughing up frothy, pink tinged sputum, having never experienced an event like this before.*

### **PICO (Population – Intervention – Comparison – Outcome) Question:**

*Among patients with acute decompensated heart failure with pulmonary edema, does the addition of a beta-2 agonist to standard clinical interventions, correlate with a reduction in hospital stay duration, compared to standard interventions without beta 2 agonists?*



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## Search Strategy:

("ventolin"[Title/Abstract] OR "salbutamol"[Title/Abstract] OR "puffer\*"[Title/Abstract] OR "bronchodilat\*"[Title/Abstract] OR "albuterol"[Title/Abstract]) AND ("CHF"[Title/Abstract] OR "congestive heart failure"[Title/Abstract] OR "ADHF"[Title/Abstract] OR "acute decompensated heart failure"[Title/Abstract] OR "heart failure"[Title/Abstract])) AND (2008:2023[pdat])

## Search Outcome:

159

## Relevant Papers:

AUTHOR, DATE	POPULATION: SAMPLE CHARACTERISTICS	DESIGN (LOE)	OUTCOMES	RESULTS	STRENGTHS/ WEAKNESSES
<p>First author's last name and date of publication <b>MAAK, 2007</b></p> <p>Hypothetical Example: Jensen J. 2013</p>	<p>Who did they study and how many? <b>Patients experiencing dyspnea secondary to Acute Decompensated Heart Failure.</b></p>	<p>What study design was used? <b>Randomized, double-blind, placebo-controlled, 14-day crossover.</b> <b>Randomized, double-blind, placebo-controlled, 3-day crossover.</b> <b>Randomized, double-blind, placebo-controlled, crossover.</b></p>	<p>This is what the author was looking for.</p> <ol style="list-style-type: none"> <li><b>Pulmonary Function</b></li> <li><b>Hemodynamic stability</b></li> <li><b>Adverse effects in ADHF</b></li> </ol> <p>Ex: conversion rate Ex: mortality Ex: patient satisfaction</p>	<p>These are the <u>actual numbers</u> they found. Include p-value or confidence interval if provided.</p> <p>Ex:78% conversion rate in electrical cardioversion group vs. 76% in adenosine group (p=0.8) Ex: 3.2% mortality with adenosine Ex:98% satisfaction with electrical cardioversion vs. 28% in chemical conversion group. (p=0.001)</p>	<p>Were there flaws?</p> <p>Small sample size?</p> <p>Generalizable to the EMS setting?</p> <p>Good randomization?</p> <p>...Basically tell me if you trust this study and why.</p> <p><b>A strength of this study would include the amount of</b></p>



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		<p>Prospective. Prospective, single-blind. Prospective, randomized, placebo-controlled, crossover. Prospective, randomized, double-blind.</p> <p>Ex: controlled trial?</p> <p>What level of evidence is this? <b>Level II Evidence.</b></p>		<p>1. Previous evidence shows patients with heart failure have some degree of airway hyperresponsiveness, there is no direct evidence to address function of beta 2 agonists in ADHF, However, indirect evidence from 4 studies, show impact of inhaled beta 2 agonists in patients with chronic heart failure to have improved pulmonary function, examples including a 6% improvement in forced expiratory volume within the first second, peak expiratory flow from 410LPM to 450LPM, and improved airway resistance from 0.53 to 0.38 as measured by impulse oscillometry, no p-value is given, stated to have a wide confidence interval, with no percentage.</p>	<p>prospective research used, in combination with other study designs, for potential future study of beta 2 agonists in combination with normal standard clinical treatment for ADHF.</p> <p>Some weaknesses include the lack of RCTs' used in this research, with lots of prospective observational studies. Alongside insufficient study on the effect of beta 2 agonists in ADHF, and indirect supporting evidence solely from chronic heart failure.</p>
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				<p>2. No direct evidence addressing the effects of beta-2 agonist administration on cardiovascular hemodynamics in patients with ADHF. Indirect evidence comes from studies of inhaled, oral, subcutaneous, and intravenous agents in patients with chronic heart failure. 20 studies measuring hemodynamic variables (ranging from 8 to 59 subjects), noted significant increases in cardiac output or cardiac index after the administration of beta 2 agonists, from initial values of 1.3-3.5 L/min/m<sup>2</sup> to 1.8 - 4.8 L/min/m<sup>2</sup> after administration of beta-2 agonist therapy (increases of 15- 80%), significant increase in left- and right-sided ventricular</p>	
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				<p>ejection fractions (0.24 – 0.38 and 0.36 – 0.51, respectively, both p 0.01) with the administration of nebulized terbutaline, consistently, demonstrated a decrease in systemic vascular resistance after administration of beta 2 agonists ranging from 13% to 51%.</p> <p>3. No direct evidence examining the association between beta 2 agonist administration and incidence of dysrhythmias in patients with ADHF. Indirect evidence from chronic heart failure patients did not reveal a clear association between acute beta-agonist administration and the occurrence of significant dysrhythmias. 15 studies with 230 patients reported on the occurrence of</p>	
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				<p>dysrhythmias. 6 of these studies reported an increase in ventricular ectopy, with one reported episode of supraventricular tachycardia, and 4 patients with treatment-induced non-sustained ventricular tachycardia. No patient required treatment to terminate the dysrhythmia and all resolved with discontinuation of albuterol. The increase in non-sustained ventricular tachycardia was observed by Mettauer et al. in patients who had severe left ventricular dysfunction and frequent baseline ectopy, with an increase from two episodes in 2 patients before treatment, to 27 episodes in 6 patients during treatment. None of the studies using inhaled beta-2 agonist treatment observed an increase in dysrhythmias.</p>	
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<p><i>Singer, 2008</i></p>	<p>Adult patients, treated in the emergency departments for acute decompensated heart failure or chronic heart failure with decompensation.</p>	<p>Retrospective Level II Evidence</p>	<p>1. ED IV Vasodilator Use COPD vs non COPD 2. In-Patient Mechanical Ventilation Use 3. Hospital Mortality</p>	<p>1. During the ED stay, intravenous vasodilator use was more common among heart failure patients without chronic obstructive pulmonary disease who received bronchodilators compared with those who did not (28.4% versus 16.9%; propensity-adjusted OR 1.40  2. Patients without chronic obstructive pulmonary disease who received a bronchodilator were more likely to require inpatient mechanical ventilation (6.0% versus 2.4%; propensity-adjusted OR 1.69 [95% CI 1.21 to 2.37]).  3. Mortality was not different in either patients with or without chronic obstructive pulmonary disease who received a bronchodilator or those who did not (OR 1.02; 95% CI 0.67 to 1.56).</p>	<p>This was not an analysis of RTCs but was taking data from an observational source. As this was retrospective and had no randomization, the more severely ill patients may have received bronchodilators which may skew results.</p>
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Supples, 2022	159 included adult patients who were transported by EMS to hospital who were complaining of shortness of breath. Patients with a discharge diagnosis of etiology aside from cardiac or pulmonary origin.	Retrospective  Level II Evidence	1. The accuracy of prehospital diagnosis of AHF in patients with acute dyspnea.	1. Of 199 included patients, 50 (25%) had a final diagnosis of AHF. Of the 50 patients with a final diagnosis of AHF, seven were correctly identified by EMS, indicating a sensitivity of 14% (CI 0.06-0.26). The specificity and diagnostic accuracy of EMS for AHF were 98% (CI 0.94-0.99) and 77% (CI 0.70-0.82), respectively.	This was a small study that was conducted retrospectively with one single EMS agency and one single hospital system. Of which their current practice standards are unknown to us. Some of the references used in this study are also over twenty years old, making it unreliable for practice standards today.
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**Comments:** *Any additional information about your search results.*

Our focus for a PICO question was to determine the treatment standards of acute decompensated heart failure in the prehospital environment. Our search strategy did not yield any results that focused solely on prehospital care and many studies we observed took place in the emergency room. This provided good information that can be applied to practice but does not follow exactly what we were searching for.

**Consider:** *Why would you NOT change practice, based on these articles?*

When we consider the differences between the prehospital environment and care within the emergency department, there are several differences. Since the results of our studies, we must weigh the risks with the



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benefits of introducing a new standard of practice into a new environment without any substantial data on the prehospital environment specifically.

**Clinical Bottom Line:** *Give me a one-two liner on the answer you found.*

Overall, AHF is extremely difficult to diagnosis in the prehospital setting and therefore beta-2 agonists will still be given for the acute dyspnea patient as standards dictate.

## References:

1)

Maak, C. A., Tabas, J. A., & McClintock, D. E. (2011). Should acute treatment with inhaled beta agonists be withheld from patients with dyspnea who may have heart failure? *The Journal of emergency medicine*, 40(2), 135-145.

2)

Singer, A. J., Emerman, C., Char, D. M., Heywood, J. T., Kirk, J. D., Hollander, J. E., Summers, R., Lee, C. C., Wynne, J., Kellerman, L., & Peacock, W. F. (2008). Bronchodilator therapy in acute decompensated heart failure patients without a history of chronic obstructive pulmonary disease. *Annals of emergency medicine*, 51(1), 25-34.

3)

Supples, M., Jelden, K., Pallansch, J., & Russell, F. M. (2022). Prehospital Diagnosis and Treatment of Patients With Acute Heart Failure. *Cureus*, 14(6), e25866.

