

# Effect of hyperdynamic LVEF on ICU outcomes

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## Abstract

**Objective** To study the effect of hyperdynamic left ventricular function on ICU outcomes.

**Keywords:** Intensive Care Unit, Hyperdynamic

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## 1. Background

In a recent meta-analysis review by Huang et al. (2013) [1] the authors attempted to answer the question whether ventricular depression or dilation is associated with lower mortality rates. A total of 62 studies were reviewed and 14 included in the analysis. The meta-analysis failed to find any evidence to support the view that the survivors from severe sepsis or septic shock had lower ejection fractions. This study aims to further explore this research question using the MIMIC-II clinical database from the Beth Israel Deaconess Medical Center in Boston, MA [2].

## 2. Methods

We conducted a retrospective cohort study using the Multiparameter Intelligent Monitoring in Intensive Care II (MIMIC II) database. MIMIC II is a large open-access database, which includes data from electronic medical records of patients admitted to the ICUs at Beth Israel Deaconess Medical Center since 2001. The creation and use of the MIMIC database was approved by the institutional review boards of both Beth Israel Deaconess Medical Center and Massachusetts Institute of Technology (IRB protocol 2001-P-001699/3).

All adult patient records who underwent an echocardiograph in the database were screened for purposes of inclusion. Patients were excluded if their left-ventricular function was suppressed. The cohort characteristics used in this study is shown in Figure 1. The study outcome was 28-day mortality among the entire patient cohort.

All statistical analysis was performed using R. Baseline comparisons were performed using Fisher tests for categorical variables with results reported as numbers and percentages. Continuously normally distributed variables were compared using *t*-tests and reported as median, while non-normally distributed

27 data were compared using Mann-Whitney tests and reported as medians and  
 28 interquartile range (IQR).

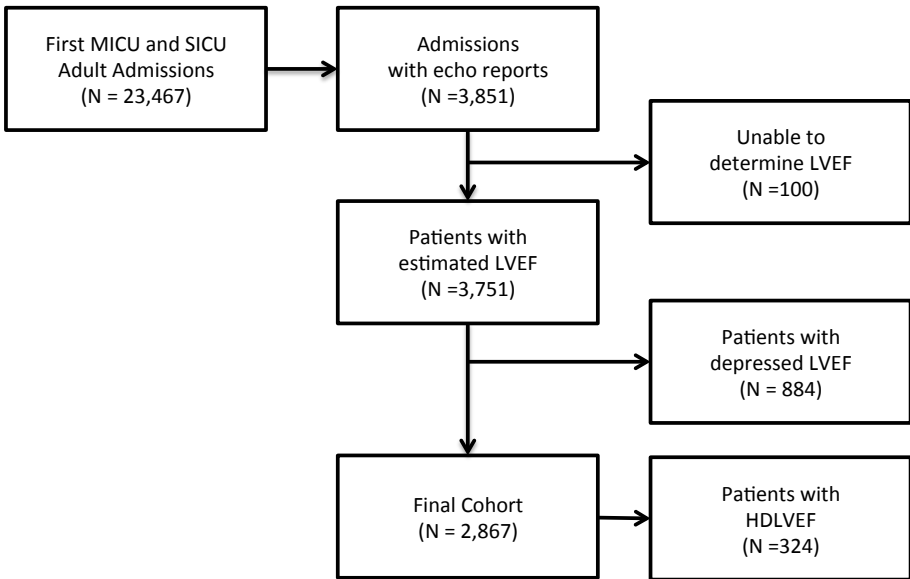


Figure 1: Patient record selection. Using the MIMIC II database we identified 2,481 patients that had a echo report.

### 29 3. Results

30 Table ?? highlights the results of the univariate analysis for all patients with  
 31 hyperdynamic EF. Table ?? highlights the results of the univariate analysis  
 32 for all patients with acute hyperdynamic EF. Significant values ( $P < 0.05$ ) are  
 33 shown in bold. Hyperdynamic patients are more likely to be female, be admitted  
 34 to MICU, SICU and ventilated. Hyperdynamic patients also have higher risk of  
 35 mortality, SOFA and SAPSI scores and stay longer in ICU. Table ?? looks at  
 36 potential confounders for the cohort: hyperdynamic patients are more likely to  
 37 have congestive heart failure, hypertension and cancer.

38 Table ?? highlights the results of the univariate analysis for all septic pa-  
 39 tients. Significant values ( $P < 0.05$ ) are shown in bold. Hyperdynamic septic  
 40 patients have a higher 28-day and ICU/hospital mortality are more likely to be  
 41 administered more fluids. The confounder analysis in Table ?? is inconclusive.

### 42 References

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|                                    | <b>NLVEF</b> (N=2543)<br>N (%) or median (IQR) | <b>HDLVEF</b> (N=324)<br>N (%) or median (IQR) | <i>P</i> -value |
|------------------------------------|--|--|-----------------|
| Age                                | 65 (51 - 78)                                   | 69 (56 - 78)                                   | <b>0.03</b>     |
| Gender (Male)                      | 1246 (49 %)                                    | 134 (41 %)                                     | < <b>0.01</b>   |
| Care Unit                          |  |  | 0.9             |
| MICU                               | 1720 (68 %)                                    | 221 (68 %)                                     |                 |
| SICU                               | 823 (32 %)                                     | 103 (32 %)                                     |                 |
| Time to echo (days)                | 1.1 (0.1 - 3.3)                                | 0.9 (0.0 - 4.2)                                | 0.4             |
| Co-morbidities by ICD9 & DRG Codes |  |  |                 |
| Diabetes                           | 590 (23 %)                                     | 89 (27 %)                                      | 0.1             |
| Alcohol abuse                      | 153 (6 %)                                      | 19 (6 %)                                       | 1.0             |
| Arrhythmias                        | 700 (28 %)                                     | 82 (25 %)                                      | 0.4             |
| Valvular disease                   | 255 (10 %)                                     | 38 (12 %)                                      | 0.3             |
| Hypertension                       | 852 (34 %)                                     | 134 (41 %)                                     | < <b>0.01</b>   |
| Renal failure                      | 213 (8 %)                                      | 29 (9 %)                                       | 0.7             |
| Chronic pulmonary                  | 536 (21 %)                                     | 68 (21 %)                                      | 1.0             |
| Liver disease                      | 199 (8 %)                                      | 32 (10 %)                                      | 0.2             |
| Cancer                             | 120 (5 %)                                      | 28 (9 %)                                       | < <b>0.01</b>   |
| Psychosis                          | 117 (5 %)                                      | 15 (5 %)                                       | 1.0             |
| Depression                         | 148 (6 %)                                      | 12 (4 %)                                       | 0.1             |
| CHF                                | 841 (33 %)                                     | 127 (39 %)                                     | <b>0.03</b>     |
| Illness                            |  |  |                 |
| SAPS-I                             | 14 (11 - 18)                                   | 16 (12 - 19)                                   | < <b>0.01</b>   |
| Septic                             | 1025 (40 %)                                    | 150 (46 %)                                     | <b>0.04</b>     |
| Labs                               |  |  |                 |
| Max WBC                            | 13.3 (9.4 - 18.3)                              | 14.60 (10.2 - 20.5)                            | < <b>0.01</b>   |
| Max lactate                        | 2.1 (1.4 - 3.7)                                | 2.60 (1.6 - 4.8)                               | < <b>0.01</b>   |
| Max creatinine                     | 1.1 (0.8 - 1.8)                                | 1.20 (0.8 - 2.0)                               | <b>0.04</b>     |
| Treatments                         |  |  |                 |
| RRT                                | 288 (11 %)                                     | 50 (15 %)                                      | <b>0.04</b>     |
| Vasopressor                        | 853 (34 %)                                     | 143 (44 %)                                     | < <b>0.01</b>   |
| Ventilated                         | 1347 (53 %)                                    | 202 (62 %)                                     | < <b>0.01</b>   |
| IVF first 24hr (ml)                | 2214.0 (674.5 - 5248.1)                        | 2500.0 (771.0 - 5701.8)                        | 0.2             |

Table 1: Characteristics of normal versus all HDLVEF patients

|                  | Odds-ratio (95% Confidence Interval) | <i>P</i> -value |
|------------------|--------------------------------------|-----------------|
| Age              | 1.006 (1.001,1.011)                  | <b>0.02</b>     |
| Gender (Male)    | 1.056 (0.859,1.298)                  | 0.6             |
| Elixhauser Score | 1.057 (1.040,1.074)                  | < <b>0.001</b>  |
| SAPS-I           | 1.086 (1.063,1.110)                  | < <b>0.001</b>  |
| Vasopressor      | 1.894 (1.523,2.356)                  | < <b>0.001</b>  |
| HDLVEF           | 1.380 (1.027,1.838)                  | <b>0.03</b>     |

Table 2: Multivariate logistic regression model predicting 28-day mortality for all patients

|                  | Odds-ratio (95% Confidence Interval) | <b>P-value</b>   |
|------------------|--------------------------------------|------------------|
| Age              | 1.005 (0.997,1.013)                  | 0.2              |
| Gender (Male)    | 1.202 (0.899,1.610)                  | 0.2              |
| Elixhauser Score | 1.053 (1.029,1.078)                  | <b>&lt;0.001</b> |
| SAPS-I           | 1.066 (1.035,1.098)                  | <b>&lt;0.001</b> |
| Vasopressor      | 1.861 (1.367,2.542)                  | <b>&lt;0.001</b> |
| HDLVEF           | 1.537 (1.028,2.273)                  | <b>0.03</b>      |

Table 3: Multivariate logistic regression model predicting 28-day mortality for septic patients

|                  | Hazard ratio (95% Confidence Interval) | <b>P-value</b>   |
|------------------|--|------------------|
| Age              | 1.0059 (1.0035,1.0083)                 | <b>&lt;0.001</b> |
| Gender (Male)    | 1.0639 (0.9775,1.1579)                 | 0.2              |
| Elixhauser Score | 1.0177 (1.0085,1.0270)                 | <b>&lt;0.001</b> |
| SAPS-I           | 1.0463 (0.9492,1.1533)                 | 0.4              |
| Vasopressor      | 1.0683 (0.9287,1.2288)                 | 0.4              |
| HDLVEF           | 1.0364 (1.0276,1.0453)                 | <b>&lt;0.001</b> |

Table 4: Multivariate Cox Hazard model predicting one-year mortality for all 28-day survivors