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### HEART FAILURE

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# N-Terminal Pro-B-Type Natriuretic Peptide Testing Improves the Management of Patients With Suspected Acute Heart Failure

Primary Results of the Canadian Prospective Randomized Multicenter IMPROVE-CHF Study

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**Abstract: Background** The diagnostic utility of N-terminal pro-B-type natriuretic peptide

ventricular dysfunction in 45 subjects (9%), and not acute HF in patients without prior HF in 225 subjects (45%). For all patients, the mean duration of stay in the ED was 7.2±5.4 hours (mean±SD). Two hundred eighty-five patients (57%) were subsequently admitted to hospital from the ED.

### Comparison of Strategies of Usual Care and NT-proBNP–Guided Care

The clinical outcome data for the 2 randomized groups in all 500 patients are shown in [Table 2](#). The median duration of the initial ED visit was 5.6 hours in the NT-proBNP group and 6.3 hours in the usual care group ( $P=0.0309$ ). The differences in initial hospitalizations, the hospital length of stay, the initial intensive care unit admissions and length of stay, and initial and 60-day mortality were not statistically significant. However, a significant reduction in the number of patients rehospitalized by 60 days (13% versus 20%;  $P=0.0463$ ) was observed. Direct medical costs over 60 days of follow-up are shown in [Table 3](#). The use of NT-proBNP tests reduced total direct medical costs to the healthcare system by 15% from \$6129 to \$5180 ( $P=0.0232$ ). To understand the contribution of outpatient use of diagnostic tests to the overall cost reduction, the proportion of patients who had undergone various advanced diagnostic tests related to the assessment of dyspnea are shown in [Figure 2](#). Overall, the frequency of outpatient use of these diagnostic tests was relatively low, but there was a tendency for less use of echocardiography, radionuclide ventriculography, and computed tomography scan of the chest in the NT-proBNP group. Finally, to understand whether the benefit of knowing NT-proBNP results was derived from patients with an intermediate likelihood of a diagnosis of HF as judged by the ED physicians, the data of clinical outcomes and direct medical costs of the 2





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proBNP was lacking. **Methods and Results**— We tested the hypothesis that NT-proBNP testing improves the management of patients presenting with dyspnea to emergency departments in Canada by prospectively comparing the clinical and economic impact of a randomized management strategy either guided by NT-proBNP results or without knowledge of NT-proBNP concentrations. Five hundred patients presenting with dyspnea to 7 emergency departments were studied. The median NT-proBNP level among the 230 subjects with a final diagnosis of heart failure was 3697 compared with 212 pg/mL in those without heart failure ( $P<0.00001$ ). Knowledge of NT-proBNP results reduced the duration of ED visit by 21% (6.3 to 5.6 hours;  $P=0.031$ ), the number of patients rehospitalized over 60 days by 35% (51 to 33;  $P=0.046$ ), and direct medical costs of all ED visits, hospitalizations, and subsequent outpatient services (US \$6129 to US \$5180 per patient;  $P=0.023$ ) over 60 days from enrollment. Adding NT-proBNP to clinical judgment enhanced the accuracy of a diagnosis; the area under the receiver-operating characteristic curve increased from 0.83 to 0.90 ( $P<0.00001$ ). **Conclusions** — In a universal health coverage system mandating judicious use of healthcare resources, inclusion of NT-proBNP testing improves the management of patients presenting to emergency departments with dyspnea through improved diagnosis, cost savings, and improvement in selected outcomes.

**Key Words:** costs and cost analysis ■ healthcare economics and organizations ■ heart failure ■ natriuretic peptides





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The clinical outcome data for the 2 randomized groups in all 500 patients are shown in Table 2. The median duration of the initial ED visit was 5.6 hours in the NT-proBNP group and 6.3 hours in the usual care group ( $P=0.0309$ ). The differences in initial hospitalizations, the hospital length of stay, the initial intensive care unit admissions and length of stay, and initial and 60-day mortality were not statistically significant. However, a significant reduction in the number of patients rehospitalized by 60 days (13% versus 20%;  $P=0.0463$ ) was observed. Direct medical costs over 60 days of follow-up are shown in Table 3. **The use of NT-proBNP tests reduced total direct medical costs to the healthcare system by 15% from \$6129 to \$5180 ( $P=0.0232$ ).** To understand the contribution of outpatient use of diagnostic tests to the overall cost reduction, the proportion of patients who had undergone various advanced diagnostic tests related to the assessment of dyspnea are shown in Figure 2. Overall, the frequency of outpatient use of these diagnostic tests was relatively low, but there was a tendency for less use of echocardiography, radionuclide ventriculography, and computed tomography scan of the chest in the NT-proBNP group. Finally, to understand whether the benefit of knowing NT-proBNP results was derived from patients with an intermediate likelihood of a diagnosis of HF as judged by the ED physicians, the data of clinical outcomes and direct medical costs of the 2 treatment groups were analyzed for the 219 patients with a 20% to 80% likelihood of HF. As shown in Tables 4 and 5, knowledge of NT-proBNP results appears to have a greater impact on the duration of ED visits and the costs of initial and subsequent ED visits in these patients compared with the entire study group.

TABLE 2. Clinical Outcomes in the NT-proBNP and Usual Care Groups (Table view)

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