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Economic Impact of Same-Day Home Discharge After Uncomplicated Transradial Percutaneous Coronary Intervention and Bolus-Only Abciximab Regimen

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Objectives This study sought to estimate the economic impact of same-day home discharge compared with overnight hospitalization after transradial percutaneous coronary intervention (PCI).

Background Same-day home discharge after transradial PCI and a bolus-only abciximab regimen was found to be clinically noninferior to the abciximab standard therapy and overnight hospitalization in patients with various forms of acute coronary syndromes.

Methods In the EASY (Early Discharge After Transradial Stenting of Coronary Arteries) trial, 1,005 patients were randomized after a bolus of abciximab and uncomplicated transradial coronary stenting, either to same-day home discharge and no infusion (outpatient group) or to overnight hospitalization and 12-h abciximab infusion (overnight-stay group). We estimated post-PCI health care cost (in Canadian dollars) of trial subjects and short-term economic impact of same-day home discharge. As randomization was done after the procedure, outcomes were similar, and PCI resource use showed minimal and nonsignificant differences, a post-PCI cost-minimization analysis was conducted. Detailed per-patient information of health care resources used immediately after PCI up to 30 days was collected.

Results Mean post-PCI hospital stay was 8.9 h for outpatients versus 26.5 h for overnight-stay patients ($p < 0.001$). At 30-day follow-up, the mean cumulative medical cost per outpatient was $1,117 \pm $1,554 versus $2,258 $\pm$ $1,328 for overnight-stay patients. The mean difference of $1,141 (95% confidence interval: $962 to $1,320) was mainly due to the extra night for overnight hospital stay.

Conclusions In a real-world setting, same-day home discharge after uncomplicated transradial PCI and a bolus-only abciximab regimen resulted in a 50% relative reduction in medical costs. Extension of this outpatient strategy would be welcomed by the hospitals and reimbursement systems in a context of increasing demand for health care cost reduction. (Early Discharge After Transradial Stenting of Coronary Arteries [EASY]; NCT00169819) (J Am Coll Cardiol Intv 2010;3:1011–9) © 2010 by the American College of Cardiology Foundation

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Inpatient treatment of cardiovascular disease remains a leading cause of increasing health care costs in the industrialized world (1). With an aging population, health care policy makers and managers are constantly struggling to cope with increasing demands for fewer hospital beds. Day surgery has become the standard of care for many procedures (e.g., cholecystectomy, transurethral prostatectomy) that only a few years ago required the patient to stay hospitalized overnight (2,3). Therefore, any intervention that will increase efficiency by reducing hospital length of stay, especially in cardiac patients, could have a major impact on maximizing limited resources. With the advent of coronary stents and potent antithrombotic drugs such as glycoprotein IIb/IIIa inhibitors, percutaneous coronary intervention (PCI) is now an extremely safe procedure. Nowadays, patients who do not experience periprocedural complications will usually have an uneventful in-hospital course (4). Even when a post-PCI myocardial infarction (MI) occurs in the absence of an overt angiographic complication, long-term mortality for those patients is not increased when compared with long-term mortality of patients without post-PCI MI (5). In addition, with the use of the transradial approach, catheter site bleeding complications are now extremely infrequent (6). Therefore, the need for the routine overnight hospital stay following PCI has been questioned. In the large single-center EASY (Early Discharge After Transradial Stenting of Coronary Arteries) trial, same-day home discharge after uncomplicated transradial PCI and a bolus-only abciximab regimen was found to be clinically noninferior to the abciximab bolus and 12-h infusion standard therapy and overnight hospitalization in patients with various forms of acute coronary syndromes (4). Same-day discharge after elective PCI via the femoral approach was also reported to be feasible and safe in the majority of patients selected for day-case PCI (7). Furthermore, a recent observational study also reported the safety and feasibility for a prospective evaluation of ambulatory transradial PCI in an American practice setting (8).

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Abbreviations and Acronyms

CHUM = Centre Hospitalier de l'Université de Montréal

DRG = diagnostic-related grouping

IUCPQ = Institut Universitaire de Cardiologie et de Pneumologie de Québec

MI = myocardial infarction

NIRRU = Niveau d'Intensité Relative des Ressources Utilisées

PCI = percutaneous coronary intervention

RAMQ = Régie de l'Assurance Maladie du Québec

Resources freed due to such an outpatient strategy could be redirected to more valuable and cost-effective purposes. Because in the EASY trial clinical outcomes (including death, MI, urgent revascularization, major bleeding, repeat hospitalization, access site complications, and severe thrombocytopenia) were similar at 30 days (4), the purpose of our study was to estimate the cost difference between the 2 treatment approaches (cost-minimization analysis) using microcosting and macrocosting analysis.

Methods

Clinical trial. The details of the EASY trial have been previously described (4). Briefly, patients referred for coronary angiography and possible PCI were enrolled from October 2003 to April 2005 at the Institut Universitaire de Cardiologie et de Pneumologie de Québec (IUCPQ), (formerly Laval Hospital). Patients were excluded if they presented with ST-segment elevation MI within 72 h or had previous left ventricular ejection fraction ≤30%. Except for a secondary branch in a bifurcation lesion or repeat dilation for in-stent restenosis, all severe lesions had to be stented. The protocol was approved by Health Canada and the IUCPQ Ethics Review Board. All patients signed informed consent forms for participation in the trial.

The study was a randomized, controlled, open-label study comparing same-day home discharge and abciximab bolus only (outpatient group, n = 504) to overnight hospitalization and bolus followed by 12 h of abciximab infusion (hospitalized group, n = 501) after uncomplicated transradial coronary stenting. In case of suboptimal results or clinical complications during the PCI procedure, patients were excluded from randomization and received abciximab bolus and infusion. Abciximab was administered as a 0.25-mg/kg bolus before first balloon angioplasty, and infusion was given for a total of 12 h at 0.125 μg/kg/min to a maximum of 10 μg/min. All patients received aspirin and clopidogrel before diagnostic angiography. After radial or ulnar sheath insertion, a bolus of 70 U/kg heparin was given intravenously. Vascular sheaths were removed at the end of the procedure, and a bracelet (Hemostop, Zoom, Inc., Piedmont, Quebec) remained in place until hemostasis was completed. Primary end point at 30 days was a composite of death, MI, urgent revascularization, major bleeding, repeat hospitalization, access site complication, and severe thrombocytopenia.

Summary of economic methods. Detailed per-patient resources used were collected prospectively in case-report forms as planned at the beginning of the study. Given that the IUCPQ billing services were not at the time of the study measuring per-patient costs in their different services and department, we relied on a similar Canadian hospital (Centre Hospitalier de l'Université de Montréal or CHUM) detailed costing system for the unit costs used in our microcosting approach. Finally, we assessed the impact of the costing strategy on our results by using other sources of

costs (macrocosting). We used a time horizon of 30 days after PCI, when the primary end point was measured.

Resources measurements. Detailed per-patient information was recorded in dedicated case-report forms with respect to the procedural resources used, procedural complications, and hospital admission and discharge dates for all patients in the trial. The exact moment of completion of the intervention and discharge after the PCI was recorded, and the duration of post-PCI hospitalization was calculated for all subjects. All patients were evaluated, either through direct patient contact or by telephone, within 4 to 6 h, 24 h, and 30 days of the procedure, and detailed information was recorded with respect to subsequent angiogram or PCI (inpatient or outpatient), related surgery, repeat and prolonged hospitalizations, prescription drugs used, tests performed, and unscheduled physician visits. When possible, the diagnostic-related grouping (DRG) assigned by the hospital archiving system was retrieved for both the initial hospitalization associated with the PCI and for repeat hospitalizations within 30 days.

Costs. As the subjects were randomized following PCI, the costs of resources used were estimated beginning immediately after the procedure. Therefore, costs following PCI, including costs during the index hospitalization and after discharge up to 30 days after PCI, were measured. Costs were calculated from the perspective of the institution using only hospital-based costs and also from the perspective of the health care system by adding the hospital-based costs, physician fees, and prescription drug costs for a modified medical system perspective.

Hospitalization costs were computed spanning the time from randomization up to 30 days after the procedure and included in-hospital drug use, any repeat cardiovascular procedures (angiogram or PCI), urgent revascularization, emergency department visits, nonscheduled outpatient clinic visits, and subsequent hospitalizations. Patients discharged home the same day were requested to complete an outpatient blood test and were called the following day by a nurse. These costs were included in the total cost calculation. The costs of inpatient resources used (e.g., nursing time, medication, procedures, and overhead) were based on a costing system developed at CHUM (9). Briefly, it identifies precisely the utilization of hospital-based services for any given patient, for any DRG, and at any given hospital visit (outpatient, emergency department, inpatient stay).

Hourly cost of post-PCI hospitalization was estimated at $65/h, based on the mean 2005 to 2006 cost for patients hospitalized with DRG 112 (levels 1 to 3) with angioplasty and stent ($5,716), subtracting the estimated cost of the PCI procedure itself ($3,078), and dividing the remaining costs by the mean length of stay of patients in the hospitalized group.

To estimate costs of rehospitalizations within 30 days, price per episode was approximated using the complexity-based DRG, a classification method that groups hospitalization episodes by center and type of expenses using collected and reported financial and statistical data for each event. It takes into account direct inpatient costs, allocated overhead, diagnostic and therapeutic services, and excludes physician compensation, capital costs for buildings and termination benefits or pre-retirement leave for personnel. Cases are classified according to diagnosis, procedures, age, and complexity. Within a group, typical cases are all assigned a same resource-intensity weight, whereas atypical cases (e.g., deaths, transfers) are assigned a unique and specific resource-intensity weight according to the length of stay. The DRG of each hospitalization at IUCPQ was retrieved as coded for the index hospitalization. When unavailable (generally for patients hospitalized in other centers), the most likely DRG for the hospitalization was selected based on the detailed information collected in the case-report forms. Similar methodology has been used in other studies (10).

Cost associated with glycoprotein IIb/IIIa inhibitor abciximab at index intervention included only the infusion cost as the bolus was mandatory in both treatment groups.

The cost of major follow-up outpatient procedures (coronary angiograms or PCI) were estimated according to a detailed, per-procedure microcosting evaluation of each procedure based on the CHUM catheterization laboratory system cost for the year 2002 to 2003 and revised using the consumer price index for health care from 2002 to 2006, to estimate the 2006 costs (11). This microcosting system includes staff costs, overhead costs for the laboratory, and basic material for coronary angiography and PCI.

In addition to the costs of hospitalizations and hospital-based procedures, our analysis also included costs for physician services (as normally billed to the provincial health program) and prescription drug use (net of beneficiary copayment). The usual number and type of in-hospital physician services were estimated for patients in the 2 groups. They included 2 visits by the interventional cardiologist for the overnight stay group versus 1 for outpatients. A similar approach was applied for subsequent procedures including repeat coronary angiography and PCI procedures. Costs of unscheduled outpatient visits related to cardiovascular care were also included in our analysis, with costs for each service based on the 2007 Régie de l'Assurance Maladie du Québec (RAMQ) fee schedule, the unique public payer in the province (Table 1) (12).

Outpatient prescription drugs use was recorded for 10 cardiac drug classes at each visit. For each medication class, we assigned an average 30-day cost based on data from the RAMQ drug reimbursement program. Specifically, we compared the average daily prescription drugs in these classes to a similar sample of beneficiaries of the RAMQ

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Table 1. Unit Costs per Patient for Economic Analysis

Resource	$CDN	Sensitivity Analyses	Source
In-patient resource use			
Post-procedure hospital hourly cost	$65	$10* $88† $167‡	CHUM 2005–2006
Abxicimab 10-mg vial	$111		2007 IMS Health Canada, Canadian drugstores, and hospital purchases audit
Subsequent procedures or visits (outpatient)			
Basic outpatient visit	$23		CHUM 2005–2006
Coronary angiography (uncomplicated)	$1,847	$473† to $2,048‡	CHUM 2002 detailed costing (increased by CPI of 7.3%)
PCI	$3,078		CHUM 2002 detailed costing (increased by CPI of 7.3%)
Emergency department visit	$224		CHUM 2005–2006
Repeat hospitalization DRG§	Per DRG§	$4,056†	CHUM 2005–2006
Prescribed outpatient drugs (per day cost)			Average daily cost to provincial program from 2004/2005 RAMQ drug program beneficiaries (increased by CPI of 3.4%)
Aspirin	$0.19		
Statins	$1.40		
Other lipid-lowering agents	$1.18		
ACE inhibitor	$0.79		
Beta-blocker	$0.34		
Calcium-channel blocker	$1.08		
Clopidogrel	$1.95		
Angiotensin II antagonists	$0.85		
Nitrates	$0.68		
Warfarin	$0.34		
Physician fees			2007 RAMQ manuals for specialists and for general practitioners
Total physician fees for outpatient angiogram	$655		
Total physician fees for PCI	$786		
Cardiologist office visit	$50		
Cardiologist inpatient control visit	$23		
Cardiologist outpatient control visit	$17		
Emergency department visit	$79		
Physician (general practitioner) office visit	$63		
Follow-up call for intervention subjects			
Nursing time for phone call (10 min)	$4.54		1/6 of average nursing visit cost of $26.34 (10) increased by 3.4%
Laboratory blood test (complete blood test and CK-MB)	$2.95		Laboratoire de biologie medicale, mesure de la production ed. 2006–2997, Sante et services sociaux Quebec

Amounts >$10 are rounded to nearest dollar. *Lower limit tested. †NIRRU Quebec 2002–2003 (increased by CPI of 7.3%). ‡Alberta 2004–2005. §DRG is classified according to complexity level for each hospitalization episode.

ACE = angiotensin-converting enzyme; CDN = Canadian; CHUM = Centre Hospitalier de l'Université de Montréal; CK-MB = creatine kinase-myocardial band; CPI = consumer price index; DRG = diagnostic-related group; IMS = Intercontinental Marketing Services; NIRRU = Niveau d'Intensité Relative des Ressources Utilisées; PCI = percutaneous coronary intervention; RAMQ = Régie de l'Assurance Maladie du Québec.

provincial drug program and were able to estimate the cost of prescription drug use per patient for the 30 days following the procedure, while excluding the drugs administered during hospitalization (12). Details of these costs are also found in Table 1.

Sensitivity analyses. Sensitivity analyses were conducted on key assumptions in order to consider alternative costs of key resources where alternative data were available. The 2002 to 2003 Niveau d'Intensité Relative des Ressources Utilisées (NIRRU) (the Quebec weighting factor derived for the case mix group) average cost of diagnostic-related groups 111 and 112 (PCI) levels 1 to 3 (weighted by the number of cases in each group) and inflated by the consumer price index of 7.3% was estimated to be $6,658. This figure was used to estimate an alternative hourly cost for post-PCI stay ($88). Additionally, the province of Alberta's 2004 to 2005 average cost of case mix groups 188 and 189 (PCI) levels 1 to 3 (weighted by the number of cases in each group) was estimated to be $9,820. We used this figure to estimate an alternative hourly cost for post-PCI stay ($167). A 2002 to 2003 NIRRU for outpatient angiogram and the average outpatient procedure cost (NIRRU = 1) of $441 (2002 to 2003) increased by the consumer price index of 7.3% ($473) and the Alberta 2004 to 2005 outpatient cost for angiogram of $2,048 were also used to test the impact of subsequent outpatient angiograms. To test the impact of

rehospitalization costs, we used the average short duration hospitalization cost of $3,780 in Quebec in 2002 to 2003 and adjusted it again for 2006 by 7.3% ($4,056). Finally, the impact of the abciximab infusion cost was assessed.

Data analyses. Data are presented as percentage, mean with standard deviation or 95% confidence intervals (CI) and medians with interquartile (25th to 75th percentile) range (IQR). Proportions were compared using chi-square test, and given the large sample size, continuous data were compared with 2-sample *t* test irrespective of the distribution of the data, unless specified (13). Average per-patient cost components and aggregated costs of health services use within 30 days after PCI were calculated by summing all available costs from all patients and dividing by the number of patients contributing for that component. Costs are expressed as 2006 Canadian dollars. Given the short-term perspective of the analysis, no discounting was performed. Analyses were performed with SPSS statistics software version 16.0.1 (SPSS, Inc., Chicago, Illinois).

Results

Per-procedure resource use. Resource utilization for the index PCI procedure is summarized in Table 2. There were no significant differences in the angiography or PCI equipment or number of stents used between outpatient group and overnight hospitalized group.

Table 2. Resource Use During the Index PCI Procedure (Prior to Randomization)

Resources Used	Same-Day Home Discharge (n = 504)	Overnight Stay (n = 501)	p Value
Number of stents implanted			0.16
0, %	0.2	1.2	
1, %	60.3	58.7	
2, %	30.0	27.9	
3, %	6.5	9.4	
4 or more, %	3	2.8	
Drug-eluting stents, %	18	18	0.89
Angiography and PCI equipment, n per case			
Diagnostic catheter(s)	1.7 ± 0.74 2 [1–2]	1.69 ± 0.78 2 [1–2]	0.77
Guiding catheter(s)	1.27 ± 0.69 1 [1–1]	1.27 ± 0.55 1 [1–1]	0.99
Guidewire(s)	1.45 ± 0.89 1 [1–2]	1.42 ± 0.83 1 [1–2]	0.64
Balloon(s)	1.99 ± 1.68 2 [1–3]	2.01 ± 1.63 2 [1–3]	0.86
Stent(s)	1.52 ± 0.78 1 [1–2]	1.54 ± 0.81 1 [1–2]	0.73
Contrast media, ml	201 ± 76 190 [150–230]	197 ± 72 190 [150–230]	0.46
Abciximab bolus, mg	20 ± 4 20 [18–22]	20 ± 4 20 [17–22]	0.69

Data are presented as mean ± SD and median [25th to 75th percentile], or percentage when indicated.

In-hospital resource use. As expected and per protocol, the mean post-PCI hospital length of stay was longer in patients hospitalized overnight (26.5 ± 14.3 h; median: 22.9 h, IQR: 20.8 to 24.9 h) than for outpatients (8.9 ± 7.5 h; median: 6.7 h, IQR: 5.8 to 8.4 h) ($p < 0.001$), for a mean difference of 17.7 h (95% CI: 16.3 h to 19.1 h).

Follow-up resource use. Fifty-one repeat hospitalizations for any cause, related or not to the index procedure, occurred within 30 days of the index PCI, in 29 outpatients and in 21 patients in the overnight stay group ($p = 0.26$). Mean and median length of stay for these rehospitalized subjects was 4.28 and 2 days in the early discharge group versus 3.81 and 2 days in the overnight stay group (Wilcoxon rank-sum $p = 0.51$). One outpatient was rehospitalized twice. Index procedure-related repeat hospitalizations were noted in 24 outpatients and 17 overnight stay patients ($p = 0.27$). Within the same period, subsequent angiograms were performed in 10 outpatients and in 7 overnight stay patients ($p = 0.47$), and repeat PCI was performed in 5 outpatients versus none in the overnight stay group ($p = 0.025$). There was no significant difference in the number of reported unscheduled physician visits between the 2 groups (0.11 per patient for both groups; $p = 0.89$).

Costs. At 30-day follow-up, and from the perspective of the institution, the total hospital-based costs incurred by an outpatient were estimated to be $891 ± $1,434 (median: $459, IQR: $391 to $611) compared with $2,018 ± $1,280 (median: $1,618, IQR: $1,492 to $1,788) per patient in the overnight stay group ($p < 0.001$) for a difference of $1,127 (95% CI: $959 to $1,296) (Figs. 1 and 2). The mean cumulative health care costs per patient were estimated to be $1,117 ± $1,554 (median: $667, IQR: $580 to $822) in the outpatient group compared with $2,258 ± $1,328 (median: $1,851, IQR: $1,709 to $2,015) in the overnight stay group ($p < 0.001$). The $1,141 per patient (95% CI: $962 to $1,320) difference in cost was due mainly to the reduction in cost related to the extra night for post-PCI overnight stay, as there were no significant differences in follow-up costs for procedures, physician services, or medications.

Sensitivity analyses. The base case analysis estimated a $1,127 difference in total hospital-based costs. Increasing the estimated hourly hospitalization cost only increased this difference between the groups. Reducing the cost decreased the difference, but the balance favored the outpatient group even when reducing the cost as low as $10 per hour. As archive-coded hospitalization types were available for only a subset (n = 21) of the subjects' rehospitalization episodes (mainly for those occurrences at the IUCPQ), we examined this subset of subjects by comparing their estimated rehospitalization costs to the subjects for whom a DRG had been

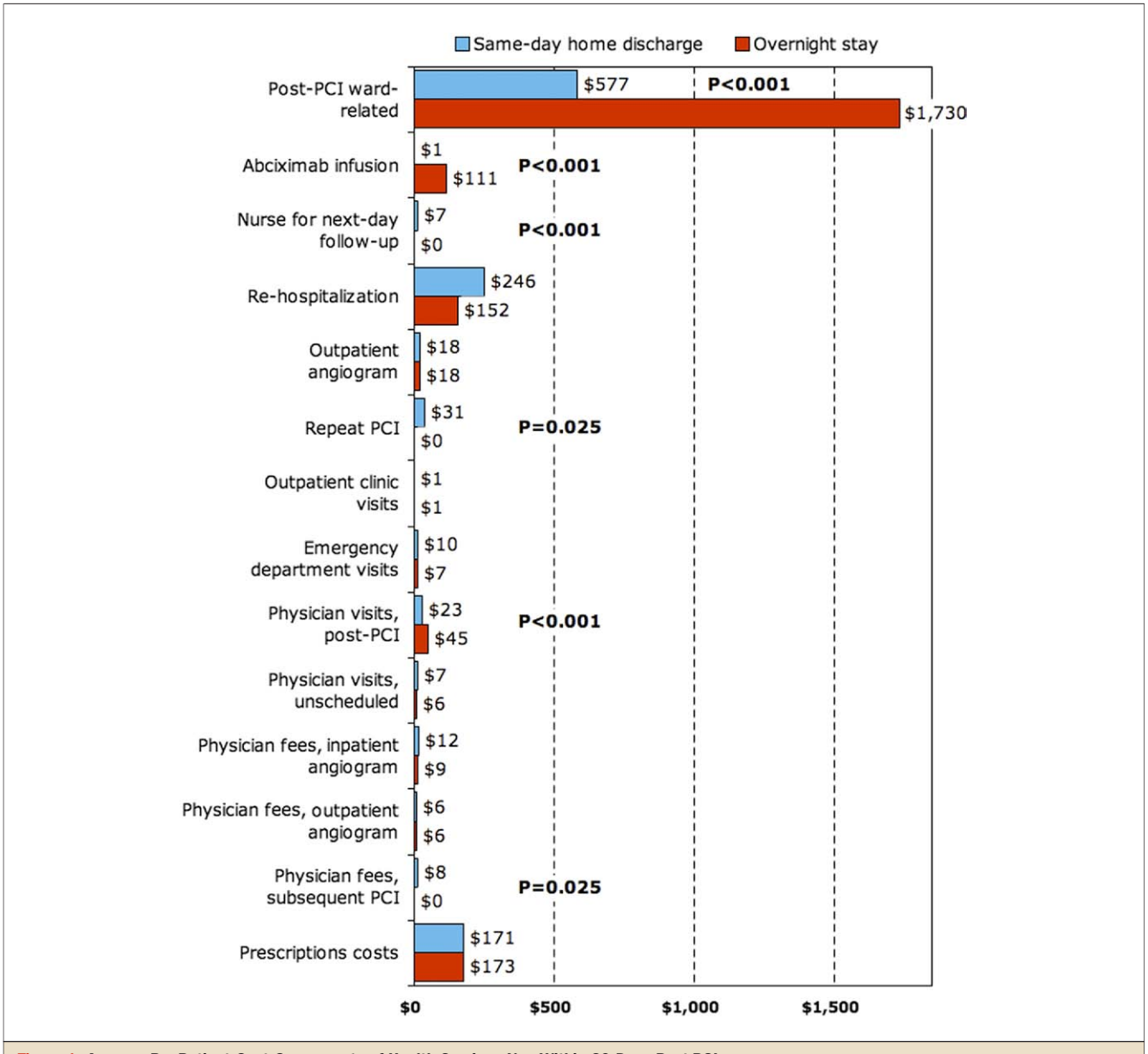

Figure 1. Average Per-Patient Cost Components of Health Services Use Within 30 Days Post-PCI

When no p value is indicated, $p > 0.05$. PCI = percutaneous coronary intervention.

assigned, and little difference was observed. Even if all subjects with created and assigned DRG were removed, the analyses yielded results similar to the base case analysis. Replacing the DRG-specific hospitalization costs with the average NIRRU-based cost had little impact on the results (Table 3).

Discussion

We found that a strategy of same-day home discharge following uncomplicated transradial PCI saved on average $1,141 per patient compared with the post-PCI overnight stay strategy, without any harm to the patients. Such an amount represents a 50% relative saving in post-PCI costs. For every 1,000 outpatients, such strategy could yield over $1 million in savings. Such savings were achieved with trivial system costs of implementing the early discharge program, essentially nursing time cost of $7 per patient. Finally, we found little evidence of increased resource utilization or cost during the 30-day follow-up period.

Few post-intervention strategies in health care actually save costs. Hence, our findings have important implications, both from the institution and the health care system

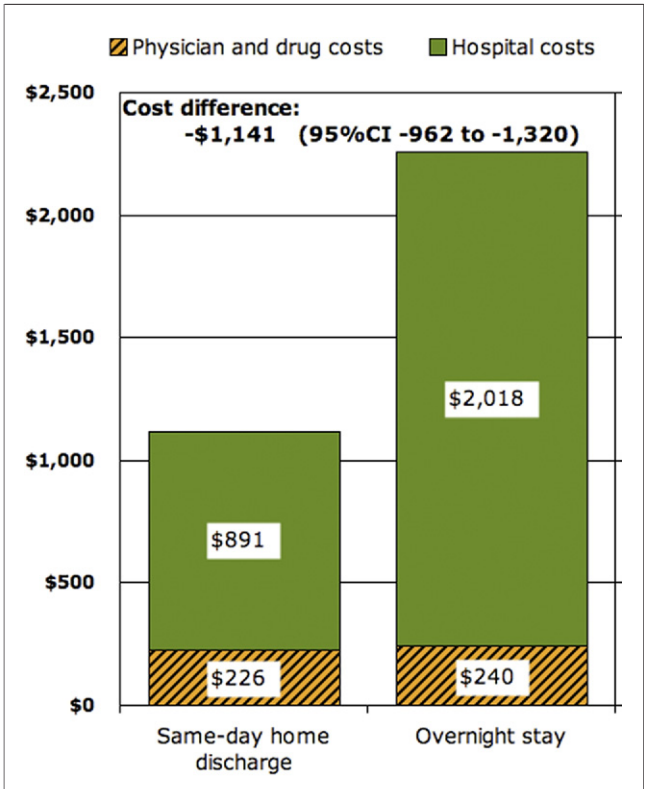

Figure 2. Cumulative Health Care Costs Within 30 Days Post-Percutaneous Coronary Intervention

CI = confidence interval.

perspective. In-patient treatment of cardiovascular disease still represents a substantial amount of all health care resources spent in the industrialized world. In 2006, $43.9 billion was spent in the U.S. on hospital admissions for heart ailments (1). As shown, most of the savings were derived by shortening of the hospital stay, and avoidance of the abciximab infusion, although savings would still be present even when ignoring abciximab infusion costs. Therefore, with other periprocedural antithrombotic strategies, such as with bivalirudin, which can be stopped immediately after the procedure (14,15), hospital savings of $1,127 per patient would be expected in cases of uncomplicated PCI. Moreover, from the health care system perspective, the fact that hospital savings were not offset by follow-up increase in health care resources consumption is reassuring.

It would be tempting to perceive this strategy as potentially unprofitable for U.S. hospitals; however, 62% of the patients were already hospitalized for an acute coronary syndrome. Given that reimbursement is not dependent on length of stay in U.S. hospitals but rather on assigned DRG by Medicare or private insurers, we believe that adopting a same-day discharge strategy for acute coronary patients could lead to profit for individual hospitals implementing it. Treatment of coronary artery diseases still represents a significant cost burden to U.S. society, with almost 1.2 million hospital discharges in the U.S. alone in 2006 (16). There is also a major move in the U.S. to pay hospitals outpatient rates for elective, uncomplicated PCI, and these payments are about 50% of those for inpatient PCI. Therefore, U.S. hospitals should have tremendous incentive to identify cost savings for the PCI programs. Recently, Jabara et al. (8) reported the safety and feasibility for a prospective evaluation of ambulatory transradial PCI in an American practice setting.

Table 3. Sensitivity Analyses: Results of Varying Significant Cost Items and Impact on Estimated Hospital-Based Costs

Cost Item Value Varied	Same-Day Home Discharge (n = 504) Mean ± SD Median [IQR]	Overnight Stay (n = 501) Mean ± SD Median [IQR]	Mean Difference (95% CI)	p Value
Post-stay hourly cost				
Base case, $65/h	$891 ± $1,434 $459 [$391–$611]	$2,018 ± $1,280 $1,618 [$1,492–$1,788]	–$1,127 (–$959 to –$1,296)	<0.001
Increase to $167/h	$1,792 ± $1,902 $1,154 [$986–$1,508]	$4,719 ± $2,554 $3,960 [$3,628–$4,405]	–$2,927 (–$2,649 to –$3,206)	<0.001
Increase to $88/h	$1,093 ± $1,518 $616 [$525–$807]	$2,623 ± $1,537 $2,141 [$1,973–$2,374]	–$1,556 (–$1,431 to –$1,680)	<0.001
Decrease to $10/h	$403 ± $1,305 $77 [$66–$103]	$554 ± $878 $344 [$323–$376]	–$152 (–$14 to –$289)	0.031
Rehospitalization cost				
Use NIRRU cost of $4,056	$886 ± $1,320 $459 [$391–$611]	$2,036 ± $1,325 $1,618 [$1,492–$1,788]	–$1,151 (–$987 to –$1,314)	<0.001
Remove cost of infusion	$890 ± $1,434 $459 [$391–$611]	$1,908 ± $1,280 $1,507 [$1,383–$1,677]	–$1,018 (–$849 to –$1,186)	<0.001
Remove subjects with DRG created for rehospitalization	$736 ± $1,177 $455 [$389–$583]	$1,917 ± $1,047 $1,614 [$1,491–$1,767]	–$1,180 (–1,041 to –$1,320)	<0.001

IQR = interquartile range (25th to 75th percentile); other abbreviations as in Table 1.

Early discharge after elective PCI via the femoral approach was also reported to be feasible and safe in a majority of patients selected for day-case PCI, despite a higher risk of bleeding related to the transfemoral procedure (6,7). However, cost savings related to such early discharge strategy were less than 10%. Only a minority of U.S. operators have adopted the transradial route for routine catheterization and PCI (16). The transradial route, although technically more demanding at beginning, can be used routinely by most operators within a very short learning period. Besides, the very low bleeding rates associated with the transradial approach allow operators to use whichever peri-PCI antithrombotic regimen, without increased risks (6). Recent large trials have tested new drugs to reduce the risk of bleeding after PCI (14,15), bleeding that in turn greatly increases the risk of long-term mortality, as much as an MI (17). However, the transradial route almost completely reduces site-related bleeding. Economic savings from same-day home discharge following transradial approach may encourage a larger uptake of this site access in the near future.

Study limitations. First, hospital payments in Canada are not based on individual charges but rather on fixed budgets. As few hospitals collect individual per-patient costs for management purposes, we based our post-PCI hourly unit costing, the major cost driver of our analysis, on costs derived from similar cases treated at CHUM. It is possible that some of the cost items included in the post-PCI hospital cost (e.g., nursing, meals) differ slightly at the IUCPQ where the study was performed. However, both institutions are large Canadian teaching hospitals, located in the same province, and have an overall similar administrative and clinical structure. Moreover, when using a coarser costing method such as the NIRRU method, estimates of savings remain substantial and for the most part unchanged. Second, we only used a case-mix–based costing model for follow-up hospitalizations. Because these costs represented <20% of the full 30-day costs, it is unlikely that a more precise estimate would have changed the magnitude of our findings. Furthermore, our analysis does not take into consideration the potential disutility or inconvenience associated with the outpatient blood sample performed in patients discharged the same day. Neither does it consider, on the other hand, the potential advantage and preference of being home the night after the PCI. It would be extremely unlikely that such short-term utility differences, if present, could offset the substantial savings observed. Given that major health care outcomes were similar, we felt that a cost-minimization approach was reasonable. Fourth, we did not measure individual patient medications by item but rather by class, but medication cost is not a major cost driver in our analysis. Fifth, we measured cost up to 30 days, when the primary end point was assessed. Given the lack of differences in clinical outcomes, it would seem unlikely that there would be systematic differences in health care resource utilization or attendant costs in a longer-term analysis. Sixth, as repeat PCI was performed in 5 outpatients versus none in the overnight stay group ($p = 0.025$), one could argue that a cost-minimization analysis was not justified. However, the study clearly reported similar primary outcomes rates at 30 days, so we felt justified to limit the analysis to costs. Moreover, the significant difference in repeat revascularization at 30 days is likely a chance effect. Despite including those repeat revascularization costs in the analysis, aggregated costs were still lower with early discharge. Seventh, repeat hospitalization and procedure-related hospitalization event rates are low in absolute numbers, resulting in low power for these comparisons. Eighth, the applicability of these findings from a public medical system to that of the U.S. needs to be confirmed. Finally, our result may only apply to patients treated from a transradial approach.

Conclusions

There is substantial economic incentive for same-day home discharge of patients following an uncomplicated transradial PCI, even in patients admitted for an acute coronary syndrome as in the EASY trial. Savings in health care spending may be turned into profit in specific situations, when in-patient treatment of acute coronary treatment can be safely abrogated.

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Key Words: cost ■ percutaneous coronary intervention ■ same-day discharge ■ transradial.