 Association of same-day discharge after elective percutaneous coronary intervention in the United States with costs and outcomes

THE HEALTH ECONOMICS QUESTION STUDIED
Same-day discharge (SDD) after elective percutaneous coronary intervention (PCI) is associated with lower costs and preferred by patients, although patterns of discharge in the US are unknown following the procedure. This study investigated the incidence and trends in SDD, hospital variations, the association between SDD and readmissions for bleeding, acute kidney injury (AKI), acute myocardial infarction (AMI), or mortality at 30, 90, and 365 days after PCI, and hospital costs of SDD and its drivers.

METHODOLOGY
Observational cross-sectional cohort study on 672,470 patients enrolled in a national administrative claims healthcare database (Premier Healthcare) who underwent elective PCI at 493 hospitals between Jan 2006 and Dec 2015 with 1-year follow-up. This database represents approximately 20% of all acute care hospitalizations in the US for more than 15 years.

RESULTS
The unadjusted, overall SDD rate of (9.1%) was corrected to an adjusted overall rate of 3.5% (95% CI, 3.0%-4.0%), which increased from 0.4% in 2006 to 6.3% in 2015. Thus, SDD after elective PCI was infrequent; substantial hospital variation for SDD was seen from 0% to 83%. 1 in 5 elective radial PCI patients underwent SDD. There was no higher risk of death, bleeding, AKI, or AMI at 30, 90, or 365 days for SDD vs non-SDD. SDD was associated with a cost savings of $5128 per procedure, driven mainly by reduced costs of room and boarding and central supplies. Changes in present SDD practices in the US could have saved $129 million annually in this population.

HEALTH ECONOMICS IMPLICATIONS
SDD was safe in the short and long term. Cost savings of more than $5000 per PCI are associated with SDD. Greater and more consistent use of SDD could save US hospitals about $577 million if adopted in the entire country. More consistent use of SDD could markedly increase the overall value of PCI care.
Reversing the “risk-treatment paradox” of bleeding in patients undergoing percutaneous coronary intervention: risk-concordant use of bleeding avoidance strategies is associated with reduced bleeding and lower costs


THE HEALTH ECONOMICS QUESTION STUDIED

Bleeding is a common, morbid, and costly complication of percutaneous coronary intervention, occurring in 2% to >10% of the more than 600,000 patients who undergo PCI each year. Bleeding event costs $8,000 to $12,000 per episode. This study examined the use of a patient-centric approach to specifically increase the risk-concordant use of BAS and investigated whether reversing the ‘risk-treatment paradox’ (a situation in which patients at high risk for adverse events receive less-intensive treatment than do patients at lower risk) is associated with reduced bleeding and associated costs.

METHODOLOGY

The investigators implemented intervention to reverse the bleeding risk-treatment paradox at Barnes-Jewish Hospital, St. Louis, MO (USA) and examined: (1) the temporal trends in BAS use and (2) the association of risk-concordant BAS use with bleeding and hospital costs of PCI intervention.

RESULTS

Among 3519 percutaneous coronary interventions, there was a significantly increasing trend (P=0.002) in risk-concordant use of BAS. The bleeding incidence was 2% in the risk-concordant group versus 9% in the risk-discordant group (absolute risk difference, 7%; number NNT, 14). Risk-concordant BAS use was associated with a 67% (95% confidence interval, 52–78%; P<0.001) reduction in the risk of bleeding and a $4738 (95% CI, 3353–6122; P<0.001) reduction in per-patient PCI hospitalization costs (21.6% cost-savings).

HEALTH ECONOMICS IMPLICATIONS

Patient-centric care based on the predicted risk of bleeding led to more risk-concordant use of BAS and reversal of the risk-treatment paradox. Such a personalized strategy was associated with a reduction in bleeding and costs of hospitalization. Both the patient and hospital (via substantial reduction in per-patient costs) are likely to benefit by a simple change of practice that encourages objectivity and minimizes variability in care.
Relation of length of stay to unplanned readmissions for patients who undergo elective percutaneous coronary intervention


THE HEALTH ECONOMICS QUESTION STUDIED
The cost of inpatient percutaneous coronary intervention (PCI) is related to length of stay (LOS). However, it is not known if LOS is associated with readmission rates and costs of index PCI plus readmissions in elective PCI. This study aims evaluated the rates, predictors, causes, and costs associated with 30-day unplanned readmissions according to LOS in patients who underwent elective PCI.

METHODOLOGY
The study included patients enrolled in the Nationwide Readmission Database (a nationally representative sample of all-age, all-payer discharges from US nonfederal hospitals), who were admitted to a hospital from 2010 to 2014, and who underwent uncomplicated elective PCI. LOS was defined as 0, 1, 2, and ≥3 days. A total of 324,345 patients were included in the analysis and the 30-day unplanned readmission was 4.75%, 4.67%, 6.44%, and 9.42% in the LOS groups 0, 1, 2, and ≥3 days, respectively.

RESULTS
Statistically significant SDD increase was observed with the proportion of cases in which the LOS was 1 day decreased over time.

Comorbidities and risk factors were strong predictors of LOS. Irrespective of the LOS, the most frequent cause of cardiac readmission was chest pain (lower post-procedural threshold) and 60% of all readmissions are for noncardiac causes. Prolonged LOS in hospital was associated with higher rates of readmission for heart failure (LOS 0 days 3.9%, 1 day 4.6%, 2 days 7.8%, and ≥3 days

Compared with 0 days, the odds of readmissions were greater for 2 days (OR 1.41, 95% CI 1.07 to 1.87, p = 0.016) and ≥3 days (OR 1.70, 95% CI 1.28 to 2.24, p <0.001). Prolonged LOS was associated with increased average total 30-day cost (index and readmission cost, 0 days $15,063, 1 day $14,693, 2 days $18,136, and ≥3 days $24,336).

HEALTH ECONOMICS IMPLICATIONS
This analysis suggests that same-day-discharge and shorter lengths of stay in elective patients are not associated with increased rates of unplanned readmission and that the savings achieved with shorter LOS are not offset by increased total healthcare cost for 30-days driven by unplanned readmissions. Longer LOS was associated with reduced incidence of readmissions for noncardiac causes such as noncardiac chest pain, but a greater rate of readmissions for heart failure.
Same versus next day discharge after elective transradial PCI: the RadialSame Day Discharge after PCI trial. (The RASADDa-PCI trial)


THE HEALTH ECONOMICS QUESTION STUDIED
Transradial percutaneous coronary intervention (TR-PCI) has been increasingly used during the last decade, with at least a 13-fold increase. (now 1 in 6 elective PCI). TR-PCI offers improved patient satisfaction and significant cost reductions for PCI procedures. Prior studies have shown that same-day discharge (SDD) after elective PCI is just as safe as overnight (ON) observation. This study assessed the clinical and financial impact of early discharge in patients undergoing TR-PCI (as a single center experience).

METHODOLOGY
This was a single center registry analysis of patients undergoing elective TR-PCI. Timing of discharge was determined by the treating physician. (Groups: Same Day Discharge –SD-; Overnight Stay –ON-). Outcomes included 30 day-MACE and procedure-related complications, as well as total operative costs. Propensity score matching for patient demographics, coronary symptoms and procedure indicators was used to compare both groups.

RESULTS
This was the largest single center registry data in USA that initially aimed to analyze data from 1000 patients and included 852 patients (429 in SD group and 423 in ON group) in interim analysis. After propensity scoring the analysis was performed on 245 patients in both groups. The groups were well-balanced in their demographic and clinical characteristics. The statistical power both for clinical outcome at 30 day and cost effectiveness endpoints were reached at that time, and the registry was prematurely stopped.

A) The clinical outcomes at 30 days did not show any difference between 2 groups.

B) Additionally, SDD patients both at discharge and 30 days had a significantly lower procedure-related cost.

HEALTH ECONOMICS IMPLICATIONS
There does not appear to be any additional clinical benefits of late discharge of patients during the first 30 days post-procedure. Early discharge may be a more cost-effective approach in stable patients undergoing elective TR-PCI with up to 28% cost reduction per procedure. In elective patients undergoing low risk TR-PCI, same-day discharge seems to be safe and feasible, with significant potential savings to the healthcare system.
Health economic analysis of access site practice in England during changes in practice: insights from the British Cardiovascular Interventional Society


THE HEALTH ECONOMICS QUESTION STUDIED

Transradial access (TRA) for percutaneous coronary intervention (PCI) is associated with a reduced risk of mortality compared with transfemoral access, reduced access site–related bleeding complications, and shorter length of stay. However, while TRA is likely to be associated with cost savings, the economic impact on the healthcare system has not been examined.

METHODOLOGY

Data from 323,656 patients undergoing PCI between 2010 and 2014 were obtained from the British Cardiovascular Intervention Society database. Costs for TRA and transfemoral access PCI were estimated based on procedure cost, length of stay, and differences in the rates of complications (major bleeding and vascular complications). In the base case analysis, a propensity-matched data set between transfemoral access and TRA was used to directly compare the costs per procedure of transradial and transfemoral PCIs in England from 2010 to 2014 for each indication. A real-world analysis used the full data set to examine differences in procedure uptake and key cost drivers for transfemoral and transradial PCIs and the impact of recent trends in procedural access uptake in UK over time.

RESULTS

In Base case analysis (done on 248K patients) done across all indications and all years, TRA offered an average cost saving of £250.59 per procedure (22% reduction) versus transfemoral access with the majority of cost saving (76%) derived from reduced length of stay (£190.43) rather than direct costs of complications (£3.71) The greatest cost saving was in the STEMI indication (£348.26), followed by NSTEMI/unstable (£282.21) and elective/stable (£153.88).

In the real-world analysis (done on all patients) adoption of TRA was estimated to have provided cost savings of £13.3 million across England between 2010 and 2014; however, if operators in all regions had adopted TRA at the rate of the region with the highest utilization, cost savings of £33.40 million (£13.31 + £20.09) could have been achieved (Table). The main component of these savings is the reduction in hospital stay, and the highest risk acute cases (ST-segment–elevation myocardial infarction cases) had the greatest benefit associated with TRA.

Real-world analysis, events/costs avoided based on actual uptake and that based on region with highest utilization

<table>
<thead>
<tr>
<th></th>
<th>Events/Costs Avoided Based on Actual Transradial Uptake for 2010–2014 (% Change)</th>
<th>Additional Events/ Costs Avoided With Uptake Based on Region With Highest Utilization (% Change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient days</td>
<td>−29,248 (~4.1%)</td>
<td>−42,224 (~6.1%)</td>
</tr>
<tr>
<td>Major bleeds</td>
<td>−440 (~14.8%)</td>
<td>−715 (~28.2%)</td>
</tr>
<tr>
<td>Vascular complications</td>
<td>−355 (~14.5%)</td>
<td>−584 (~27.8%)</td>
</tr>
<tr>
<td>MACEs</td>
<td>−1048 (~13.6%)</td>
<td>−1326 (~20.0%)</td>
</tr>
<tr>
<td>Total costs</td>
<td>−£13,306,098 (~4.1%)</td>
<td>−£20,094,737 (~6.5%)</td>
</tr>
</tbody>
</table>

HEALTH ECONOMICS IMPLICATIONS

This analysis provides evidence that the transition to TRA is associated with significant cost savings, in addition to the well-established clinical benefits. The results of this study should, therefore, encourage a reduction in the variability in uptake, as further uptake of TRA will lead to even greater cost savings.
Length of stay following percutaneous coronary intervention: an expert consensus document update from the society for cardiovascular angiography and interventions


HEALTH ECONOMICS RELEVANCE
This expert consensus document update clarifies 2009 Consensus Statement of SCAI with the aim of offering contemporary guidance on LOS following PCI across the spectrum of clinical presentations including ACS in response to current data and reflecting current practice. This consensus update: (1) clarifies clinical and reimbursement definitions of discharge strategies, (2) reviews the technological advances and literature supporting reduced hospitalization duration and risk assessment, and (3) describes changes to the consensus recommendations on length of stay following PCI based on advances in vascular access techniques, stent technology, and antiplatelet pharmacology. The new recommendations are particularly relevant given the potential for cost savings.

KEY RECOMMENDATIONS
The framework for the updated consensus recommendations consider that readiness for discharge should address the “three P’s”: Procedure, Patient, and Program.

Procedure
In most cases a successful PCI is eligible for SDD. Certain high-risk angiographic or procedural situations as shown in the Table should still be considered for overnight observation. Any patient requiring prolonged post-procedure antithrombotic therapy should be considered for overnight observation.

Patient
The patient should be clinically stable, with baseline mental status and vital signs, and have completed the appropriate recovery period for conscious sedation. Baseline conditions such as diabetes, left ventricular dysfunction, and kidney disease should be stable and compensated.

Program
Post-PCI discharge management should take place within the context of a program that encompasses: (1) safe monitoring in the immediate post-PCI period; (2) guideline directed medical therapy including dual antiplatelet therapy and counseling on treatment duration; (3) compliance with PCI performance measures including secondary prevention and education, and (4) timely follow-up, including a phone call within 24–72 hours and a scheduled clinic appointment within 2–4 weeks.

In elective patients, ideally 3P can be achieved within 4-6 h post procedure, while in acute setting it takes 2-3 days.

Consensus recommendations for discharge following PCI

<table>
<thead>
<tr>
<th>Expedited and same-day discharge requirements and milestones</th>
<th>Factors unfavorable for same-day discharge</th>
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</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
<td>Clinically stable</td>
</tr>
<tr>
<td></td>
<td>At baseline functional and mental status</td>
</tr>
<tr>
<td></td>
<td>Baseline comorbidities (e.g., diabetes, CHF, COPD, PAD, ESRD) stable</td>
</tr>
<tr>
<td></td>
<td>Adequate hemostasis</td>
</tr>
<tr>
<td>Procedure</td>
<td>Uncomplicated ETO attempt</td>
</tr>
<tr>
<td></td>
<td>Regardless of number, length of stents used</td>
</tr>
<tr>
<td></td>
<td>Adequate hemostasis</td>
</tr>
<tr>
<td></td>
<td>Effective dual-antiplatelet therapy administered</td>
</tr>
<tr>
<td></td>
<td>Pretreatment not required</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Program</td>
<td>Adequate caregiver support</td>
</tr>
<tr>
<td></td>
<td>Patient and caregiver education</td>
</tr>
<tr>
<td></td>
<td>Provision of P2Y12 inhibitor and medication instruction</td>
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<tr>
<td></td>
<td>Contact information and follow-up appointment</td>
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</table>

Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive lung disease; ESRD, end-stage renal disease.

HEALTH ECONOMICS IMPLICATIONS
Adopting these new recommendations may help to optimize care of patients undergoing PCI and reduce overall costs associated with the procedure.
SCAI Expert Consensus Document Supports Decreased Length of Stay for PCI

INSIGHTS INTO THE NEW EXPERT CONSENSUS DOCUMENT
The following are excerpts from an interview with Arnold H. Seto, MD, MPA, Chief, Cardiology, Long Beach VA Medical Center, Long Beach, California. Dr. Seto was the chair of the Society for Cardiovascular Angiography and Interventions (SCAI) writing committee responsible for the recent publication Length of Stay Following Percutaneous Coronary Intervention: An Expert Consensus Document Update From the Society for Cardiovascular Angiography and Interventions (Seto AH, et al. Catheter Cardiovasc Interv. 2018;92(4):717-731). The interview helped to gain further insight into the rationale behind the recent update of 2009 Expert Consensus Document. At present, there are many physicians and programs who have resisted fully engaging in an established use of a same-day discharge (SDD) program due to the potentially restrictive recommendations in the 2009 guidelines.

WHAT WAS THE DRIVING FORCE TO UPDATE THE DOCUMENT?
The evidence is now clear that same-day discharge (SDD) is safe and has at least equal outcomes in terms of death, major adverse cardiac events (MACE), and readmissions. In terms of other evidence, data and experience suggests any complications a patient might have will generally occur within the first hours after percutaneous coronary intervention (PCI) or after 24 hours, and so the traditional overnight stay alone would not be expected to change the outcomes of those complications. So, the driving forces to update the document were that times have changed, the evidence has evolved, and SDD is a safe and reasonable, patient-centered option for PCI.

HOW CAN THE NEW CONSENSUS DOCUMENT REASSURE PHYSICIANS AND PAYORS ABOUT POSSIBLE MEDICO-LEGAL ISSUES ASSOCIATED WITH SDD?
Imagine a patient has a complication after PCI. If they were discharged the same day, an attorney might point to the 2009 document and say that the standard of care was violated. Updating the document to be more flexible and accommodating toward variations in discharge practices (in accordance with the evidence) can only be protective to our member physicians, and thus should have a significant impact as the only document people can point to in terms of guidance for how long a patient should stay in the hospital following a PCI.

ARE HEALTHCARE SYSTEMS READY FOR SDD?
I think the U.S. hospital system is ready, especially to avoid the costs associated with overnight hospitalizations. I think patients are ready, based on surveys that state that they prefer same-day discharge, provided that their practitioner feels it is safe and that they, the patient, feel comfortable with it. Practitioners are one potential resistance point and that will change over time; as providers see the clear evidence that SDD is at least equivalent to overnight hospitalization, they will feel more comfortable discharging patients the same day. I was surprised to see that only 26% of operators were routinely practicing SDD at the present time, but those rates are continuing to increase. We note that nationally, the rate of SDD is approximately 15% of all elective PCIs.

WHAT ARE THE HEALTH ECONOMICS IMPLICATIONS?
The rates of SDD will continue to increase based on the economic and patient drivers, and the clear evidence for patient safety.