Health insurance outcome-based purchasing

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Health insurance outcome-based purchasing: The case of hospital contracting for cardiac interventions in the Netherlands

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ABSTRACT

Innovative forms of value-based purchasing contracts, based on outcome instead of volume, are imperative to face the imminent cost crisis in health care. The objective of this study was to design and implement a model for an outcome-based purchasing contract between a hospital and a health insurance company. The model was implemented in 2015. A study cohort ($n = 14,944$) from patients with coronary artery disease or atrial fibrillation treated in 2014 was compared to a historical reference cohort from patients treated between 2010 and 2013. The outcome measures and the model are based on Porter's value-based healthcare principles. Improvements in outcomes were observed, leading to a financial incentive to be spent on further quality improvement. Implementation of this model is a first step towards enabling inclusion of patient-relevant outcomes in purchasing for healthcare. It aligns the focus of health insurance companies and hospitals on patient value.

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Quality; outcomes; healthcare systems; outcome-based payments; value-based purchasing; value-based healthcare

Background

As in many countries, healthcare costs in the Netherlands have increased over the last few decades [1–3]. Increased healthcare costs may result in the repression of other government expenditures, the exceeding of public debt, cost-sharing, and an increase in taxes and premiums [3–5]. Value-based healthcare (VBHC), aiming at maximizing patient value by focusing on outcomes and costs [6], is considered a strategy for solving these problems. One of the key elements of the VBHC strategy urges us to define a new reimbursement approach in which quality of care is leading instead of the number of procedures or consumables [7].

Measuring patient-relevant outcomes is increasingly performed in many countries [8]. In the Netherlands, outcomes of cardiac interventions are collected in a nation-wide initiative (*Meetbaar Beter*) [9–12]. The insights in risk-adjusted outcomes contribute to the continuous quality improvement and hence, gains in patient value [13]. In our hospital, routinely implementing improvement projects, based on measuring patient-relevant outcomes and applying VBHC principles, was initiated during 2013 onwards.

In Dutch healthcare, health insurance companies purchase healthcare by contracting hospitals [14]. So far, in these contracts, the main focus has been on finance and volume [15]. In some dimensions, these contracts contradict the concept of quality improvement as lower re-intervention rates can be counteracted by lower reimbursement levels due to lower

volumes. Implementing value-based contracts is an essential step in this respect [16]. As stated in one of the eight principles of value-based competition by Porter and Teisberg [17], ‘innovations that increase value must be strongly rewarded’. With growing interest in VBHC worldwide, there is a growing awareness that pay-for-service approaches should be replaced by pay-for-performance approaches or outcome-based payment [18–27]. Hence, payment approaches that reward value are suggested as a suitable direction for change [21].

In this study, we aimed at developing a model that includes VBHC principles, makes it possible to assess changes in quality and in which improvement in quality is financially rewarded and loss of quality leads to a reduction of financial compensation. The main goal of this paper is to describe the development of a model for an outcome-based purchasing contract between a hospital and health insurance company. In addition, the suitability of the model to assess changes of quality over time is evaluated.

Methods

Study population and inclusion criteria

The study population consists of coronary artery disease patients treated by either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), as well as atrial fibrillation patients treated with catheter pulmonary vein isolation (PVI). These

high-risk, high-impact treatments were selected because they are frequently performed. Patients who have undergone these treatments between 1 January 2010 and 31 December 2013 were included in the reference cohort; patients treated between 1 January and 31 December 2014 constitute the study cohort – regardless of their health insurance company. A detailed description of the inclusion criteria has been published elsewhere [11].

Purchasing model

A project group was formed to develop a model rooted in VBHC principles. This project group consisted of representatives of the hospital (i.e. physicians, VBHC experts, quality officer, and sales officer) and representatives of the health insurance company (i.e. purchaser and medical advisor). Development of the model, supported by an epidemiologist and a statistician, was based on the fundamental work by Porter [5] as well as on other leading examples [28].

Crucial principles of VBHC [6] are integrated in this model: the whole medical condition can be included; quality is measured by patient-relevant outcome measures concerning the entire care delivery value chain; outcomes are risk-adjusted; the outcome measures hierarchy is applied; and quality improvement is rewarded. These core VBHC principles underlying the model are described in more detail in Table 1.

The project group decided on the following arbitrary elements that were required for comparing cohorts, deciding on relevant changes in outcomes and consequences in the payment model:

Reference and study cohorts. It was decided that evaluation of changes in quality of care was done by comparing risk-adjusted outcomes over time within the same hospital. As quality improvement projects were implemented since the embedding of VBHC

principles in the heart centre's strategy, a study cohort from patients treated in 2014 was compared to a historical reference cohort from patients treated between 2010 and 2013. In this exploratory phase, both organizations – the hospital and the health insurance company – agreed to first choose patient target groups with relatively large numbers of patients and the availability of high quality data. Therefore within the medical conditions 'coronary artery disease' and 'atrial fibrillation' treatment options PCI/CABG and catheter PVI have been selected, respectively.

Initial conditions and outcome measures. A subset of the patient initial conditions and outcome measures as selected within *Meetbaar Beter* was used in this study [9,33]. These measures are almost completely aligned with the selection made by the International Consortium for Health Outcomes Measurement (ICHOM) [34]. The set of outcome measures for each procedure, the time periods that were used as end points and patient initial conditions are presented in Table 2.

Determining final result. The steps to determine the rate of quality improvement, based on the hierarchy principles by Porter [6], are presented in Figure 1. For each outcome measure, we analysed whether results from the 2014 cohort were better (+), indifferent (0), or worse (-) compared to the results of the four-year period before (Column 3). Second, success was determined per tier (Column 4). When two or more outcome measures were selected within one tier, the rate of success was determined by balancing the total effect for both/all outcome measures. Third, success on the medical condition or treatment level was determined by applying the outcome measures hierarchy (Column 5). Results of Tier 1 were dominant over Tiers 2 and 3. Likewise, in case of non-significant results in Tier 1, results from Tier 2 were dominant over Tier 3. In case both Tier 1 and 2 were not different

Table 1. VBHC principles underlying in the outcome-based purchasing model.

VBHC element	Application and explanation
Including the aggregate medical condition	It is important to include the whole medical condition in order to avoid selection bias [29]. This means that not only the results of a specific treatment should be evaluated, but the model should also be able to evaluate the results of treatments of all patients with a specific medical condition. Consolidated outcome measures, which refer to all treatments that can be performed when a patient has a certain medical condition, may be used [9].
Using patient-relevant outcome measures	When using quality as the key factor, relevant measures are a prerequisite. A limited number of outcome measures that are relevant for the patient needs to be selected and defined, based on the full cycle of care [30]. This is because care for a medical condition typically comprises various specialties and interventions, and many actors are involved in the treatment process of a patient [6]. Both short- and long-term effects should be investigated.
Risk-adjusted outcomes	To be able to analyse and interpret results properly, outcomes should be risk-adjusted to all risk factors [6,18]. When performing the statistical analyses (logistic regression analyses) to determine the rate of quality change over the years, the model corrects for relevant patient initial conditions.
Applying the outcome measures hierarchy	According to Porter, the outcomes for any medical condition can be ordered in a hierarchy framework consisting of three tiers, in which each tier can be subdivided into two levels [6]. Results on the lower tiers partly depend on the results of the higher tiers. A range of outcome measures covering all tiers of the outcome measures hierarchy is essential to include all significant outcomes that are important to the patient and to reveal the links between processes of care or pathways and the outcomes achieved.
Rewarding quality improvement	A possible step in solving the healthcare problem by applying VBHC is to create both financial and nonfinancial incentives for increasing the value [31,32]. For each treatment, an incentive of a predetermined amount can be earned by the hospital. The hospital receives a bonus for quality improvement and a malus for quality impairment. In case of no change, no incentives are given. All incentives are summed up to calculate the total amount the hospital or the health insurance company receives for the year.

Table 2. Overview of patient initial conditions and outcome measures regarding CABG, PCI, and catheter PVI.

Outcome Tier	CABG	PCI	Catheter PVI
1 Health status achieved or retained	120-day mortality ¹ 1-year mortality ¹	30-day mortality ¹ 1-year mortality ¹	30-day mortality ¹
2 Process of recovery	Surgical re-exploration ^{2,7} Deep sternal wound infection ^{2,7}	Urgent CABG ^{2,9}	Cardiac tamponade ^{2,7}
3 Sustainability of health	Myocardial infarction ^{2,8} Re-intervention ^{2,8}	Myocardial infarction ^{2,7} Target vessel revascularization ^{2,8}	Re-PVI ^{2,8}
Initial conditions	Age Gender Diabetes ² LVEF ³ Renal insufficiency ² Urgency of the procedure ⁴	Age Gender Diabetes ² LVEF ³ Renal insufficiency ² Previous myocardial infarction ² Multivessel disease ² Chronic total occlusion ² Resuscitation ² Shock ²	BMI ⁵ CHADSVASc Duration of atrial fibrillation LVEF ³ Previous mitral valve disease ² Previous ablation ² Type of atrial fibrillation ⁶

¹alive = 0; not alive = 1; ²no = 0; 1 = yes; ³left ventricular ejection fraction: >50% = 1; 30–50% = 2; <30% = 3; ⁴elective = 1; urgent = 2; emergency + rescue = 3; ⁵body mass index; underweight ≤ 18.5; normal weight ≥ 18.5 to <25; overweight/obesity ≥ 25; ⁶paroxysmal = 1; persistent = 2; prolonged persistent = 3; ⁷within 30 days; ⁸within 1 year; ⁹within 24 hours.

compared to their reference, results from Tier 3 determine the overall outcome.

An alpha of .25 was considered indicative for a relevant difference because of the low event rates in the relatively low number of patients in the study cohort. The rationale for this choice was that also small changes in outcomes should be remunerated by the model either as an incentive or a reduction in financial compensation. The project group decided that incentives ought to be granted on further quality improvement projects.

Statistical analyses

First, general descriptive statistics were used to describe patient characteristics, by focusing on demographic characteristics and initial conditions. Second,

descriptive statistics were used to describe the outcomes in the period 2010–2013 and the outcomes of the year 2014. Third, logistic regression analyses were conducted to measure the level of quality improvement over time. Different outcomes measures (e.g. 120-day mortality; 0 = event did not occur, 1 = event occurred) were the dependent variables. Patient initial conditions were included in the model as predictors. All analyses were done with the programme SPSS 23.0.

Results

Patient characteristics

Patients included in this study had a mean age of 65.0 years and 73.8% was male. Baseline characteristics of the three patient groups can be found in the [Appendix](#).

Note: + = improvement; 0 = no change; - = impairment

Figure 1. Steps in determining the rate of quality improvement in healthcare over time.

Short- and long-term evaluation of outcomes

In Table 3, the results are presented. Significant improvements in quality were found in all three medical treatments. Regarding CABG, significant improvements were found in Tier 1: a reduced 120-day mortality rate in 2014. In general, there was no change in outcomes in both Tier 2 and Tier 3. In Tier 2, the increase of surgical re-explorations is balanced by the reduction of deep sternal wound infections. Regarding PCI, significant improvements were found in Tier 1 and 2: a reduced 1-year mortality rate in 2014 and less urgent post-PCI CABG's in 2014, respectively. Since Tier 1 and 2 are dominant over Tier 3, the increase of myocardial infarction did not influence the overall outcome. In catheter PVI's, significant improvements were found in Tier 3 (less re-PVI's in 2014).

Financial incentives

In accordance with the purchasing model, the hospital is financially rewarded for the significant improvements of outcomes after CABG, PCI, and catheter PVI. For every patient group, an incentive was given for the purpose of further quality improvement projects in the heart centre.

Discussion

Outcome-based model

This paper describes an innovative VBHC-aligned outcome-based payment model. The model signifies that parties have been able to create shared targets and the needed level of mutual trust to implement new models creating a shared focus on value for patients. The observed quality improvements may be ascribed to different improvement projects that have been implemented in the hospital since the embedding of VBHC in the heart centre's strategy since 2013. A focus on outcomes led to several organizational changes and process optimizations. For example, the preferred treatment strategy of atrial fibrillation patients was changed as well as the supervision of the specialized atrial fibrillation outpatient clinic, resulting in less re-PVI's. In addition, more time was reserved for multidisciplinary heart team discussion, an intensive care specialist was added for the discussion of high-risk patients and a multidisciplinary patient review was arranged in the preoperative day, resulting in reduced mortality after CABG. Since pertinent improvements have been concluded, a financial bonus, as per contract destined for new quality projects, was provided.

Table 3. Results of quality improvement over time among heart patients treated with CABG, PCI, or catheter PVI, by using logistic regression analyses with different outcome measures (0 = event did not occur; 1 = event occurred) as dependent variable.

Regression analyses with different outcome measures (1 = event did not occur, 0 = event occurred, as dependent variable)							
		Uncorrected outcomes		Corrected outcomes ^{1,2,3}			
Tier	Outcome measures	2010-2013	2014	OR 75% CI	Results per outcome measure	Results per tier	Conclusion
CABG ¹							
1	120-day mortality	2.24% (79/3600)	1.16% (8/695)	0.60 0.387–0.934	+	+	+
	1-year mortality	3.08% (111/3600)	2.73% (19/695)	1.02 0.755–1.374	0		
2	Surgical re-exploration ⁴	5.38% (184/3604)	7.48% (49/704)	1.44 1.190–1.751	-	0	
	Deep sternal wound infection ⁴	1.32% (47/3604)	0.72% (5/704)	0.54 0.314–0.942	+		
3	Myocardial infarction ⁵	2.05% (69/3356)	1.51% (10/664)	0.73 0.493–1.089	0	0	
	Re-intervention ⁵	4.95% (167/3375)	5.99% (40/668)	1.22 0.986–1.500	0		
PCI ²							
1	30-day mortality	3.46% (242/7243)	3.06% (62/2.086)	0.89 0.725–1.079	0	+	+
	1-year mortality	6.38% (462/7237)	5.71% (117/2.048)	0.82 0.715–0.945	+		
2	Urgent CABG ⁶	0.61% (44/7271)	0.29% (6/2094)	0.52	+	+	
3	Myocardial infarction ⁴	1.23% (87/7136)	2.11% (41/1983)	1.53 1.220–1.928	-	-	
	Target vessel revascularization ⁵	6.70% (454/6773)	6.36% (113/1778)	1.05 0.920–1.199	0		
Catheter PVI ³							
1	30-day mortality	0.20% (2/997)	0% (0/272)	0.00	0	+	+
2	Cardiac tamponade ⁴	1.94% (19/996)	1.12% (3/272)	0.56 0.255–1.208	0	0	
3	Re-PVI ⁵	27.55% (281/1020)	22.65% (65/287)	0.25 0.615–0.914	+	+	

¹Corrected for: age | gender | diabetes | left ventricular ejection fraction | renal insufficiency | urgency of the procedure; ²Corrected for: age | chronic total occlusion | gender | diabetes | left ventricular ejection fraction | renal insufficiency | previous myocardial infarction | multivessel disease | resuscitation | shock; ³Corrected for: BMI | CHADSVASc | duration of AF (except for re-PVI) | previous ablation | left ventricular ejection fraction | previous mitral valve disease | type of AF; ⁴within 30 days; ⁵within 1 year; ⁶within 24 hours.

Impact for patients

The alignment in the focus on outcomes between hospitals and health insurance companies is a leap forward in the development of a VBHC system. The model introduces patient-relevant outcomes, and therefore the most relevant quality measures, into the purchasing for healthcare process in the Netherlands. The model applies to all selected outcome measures, including long-term outcome measures. Since these long-term effects are also largely determined by the quality of care in the referring centres, this means that the hospital takes on accountability for the results of the entire care delivery chain. Pressure on quality management in the entire cycle of care (i.e. also outside the treatment centre) is thus created. For patient safety, it is important that treatment is not refused for patients showing high-risk characteristics because of the possible poor outcomes. Adding the multidisciplinary heart team discussion is an important factor that optimizes the decision making in high-risk patients. The model is risk-adjusted and additionally offers the possibility to include the entire medical condition. This means that both patients treated with interventions and patients not treated or treated with medication form part of the model. This way, all patients with a certain medical condition can be included in the analysis.

Implications for international practice

Apart from the national healthcare system or purchasing models, our model makes it possible to motivate hospitals in case of quality improvement determined by outcome measures that are most important for patients. An advantage of the outcome-based purchasing model is that it can be implemented on top of other financing systems which means that it is not necessary to modify the current financing system. Hence, the model has the potential and offers the possibility to be applied in all countries – as long as the financier is not the healthcare provider. This model creates a shared goal for specialists, health insurance companies, and financial managers. Additionally, the model is attractive to be implemented in other countries and health systems since it offers the possibility of step-by-step implementation (e.g. for one specific treatment, disease, or specialism first).

In our model, long-term outcome measures are included based on VBHC compared to other systems that are mainly focused on intermediate outcomes [35]. By using long-term health outcomes, the hospital takes its responsibility for the ultimate result of the intervention even if further steps take place elsewhere in the care chain. Thus, integrated care across separate care delivery systems, as one of the principles of VBHC, is also applied.

The model can be adopted for other medical conditions as well. However, an outcome registry is then necessary to be linked to reimbursement [36]. Patient-relevant outcomes must be selected and measured, and risk-adjustment for patient initial conditions is necessary when applying the model. We recommend to make use of national registries and/or internationally developed standard sets. For example, the outcome measure sets as developed by ICHOM [34,37–39] can be used for this purpose.

Hurdles and aids of implementing the model

For a successful implementation of the outcome-based payment model, it is relevant to dare being transparent. It is impossible to design the perfect model at once, therefore it is partially learning by doing. We advise to work pragmatically and continuously evaluate whether the new model is better than the old one. On the other hand, the model requires a scientific basis as much as possible, thus expert opinions are needed in an early stage, for instance from the perspective of epidemiology. Furthermore, trust between both parties (i.e. hospital and health insurance company) is a precondition. In order to extend trust, it may help to involve a third party, especially for controlling data quality and reliability. In our case, we participate in ‘Meetbaar Beter’ that regularly performs data quality checks. We advise to use validated standard indicator sets which are already developed and used by others, preferably internationally, instead of reinventing the wheel (e.g. standard sets of ICHOM) [34,37–39].

In the first phase of implementation, the model introduces uncertainties. The model needs testing in practice. Therefore, we recommend using incentives with a limited financial impact in order to create a safe learning environment. However, small amounts of incentives may be not enough to change the way hospitals are doing business [40]. Therefore, we advise to increase incentives in the course of time.

It is important to choose large patient groups for which inclusion criteria should be clearly defined and patient identification should be clear. Outcome measures with sufficient positive events are preferred, and only outcomes that can be influenced by the healthcare providers should be included. Last but not least, it is most interesting and relevant when high-cost treatments are studied and finally improved.

Strengths and limitations

The model, which is theory-based and which satisfies the various criteria of VBHC [6,32], places patient-relevant outcomes at the centre of purchasing for healthcare. The hospital acts transparently and is continuously striving for the maximum achievable quality of care. The use of a limited set of both short- and long-

term patient-relevant outcome measures makes the model concise and broadly applicable in the field of cardiology, cardiothoracic surgery, and other medical specialties. The model stimulates improvements on all different tiers of the outcome measures hierarchy [6]. In case that outcomes, such as mortality, are not likely to change, outcome measures belonging to lower tiers of the outcome measures hierarchy become determinative. This means that the focus will be shifted to other patient-relevant outcome measures, such as complications and re-interventions, in order to create successful changes. Additionally, it is possible to add or replace outcome measures. Quality improvement is continuously stimulated through the agreement, as the incentives, the hospital may receive are to be used for further quality improvement in the heart centre. Finally, the model stimulates reduction of costs as well, as several outcomes are directly (e.g. myocardial infarction or target vessel revascularization) or indirectly (e.g. re-thoracotomy) related to costs in the Dutch payment system.

Some elements in the model may give rise to discussion. First, we chose a confidence interval of 75% instead of the commonly used statistical 95% reliability since clinical relevance is the prime concern. Improvements in or loss of quality at the 75% level are considered as relevant and are enumerated with an incentive of a reduction in financial compensation. The chance on a type I error increases, but parties agreed on this balance between spontaneous variations and the low frequency of certain outcomes in relatively small patient cohorts. This arbitrary choice will be subject to further evaluation. Second, the first implementation was performed with retrospective data and, therefore, the observed improvement in outcomes cannot be attributed to the implementation of the model. Third, in the early phase of implementing the outcome-based contract, the hospital and the health insurance company were not able to evaluate results at the level of the entire medical condition, but only at the level of treatments. Due to limited availability of retrospective data on the conservative treatment of coronary artery disease and the minimally invasive surgical PVI-group from 2010 to 2013 cohort these treatments are not included in this first study, excluding analyses at the level of the overall medical conditions. Optimal comparison and assessment of quality improvement with this model using prospective, consolidated data covering the entire medical condition will be possible in the near future.

Positive overall conclusions should not lead to over-looking elements requiring improvement. For example, we found an increase in surgical re-explorations after CABG and an increase in myocardial infarctions after PCI, obviously necessitating attention and further improvement.

Future challenges

This study describes the first step in setting up an outcome-based purchasing contract and further optimization of the model will take place. In the long-term partnership between the hospital and the health insurance company, the model will be evaluated and improved every year. For example, confidence intervals and reference groups should be reconsidered. The impact of the model on quality and costs in healthcare delivered will also be subject to evaluation. In the future, we will be able to analyse whether incentives that are used for further improvement actions will lead to additional cost savings. More patient-reported outcome measures, such as quality of life data, as well as outcomes for the full medical conditions should be integrated into the model. In time, QALY's might be used in the model, as the willingness to pay of patients was found to be related to QALY's [41]. Stimulating health education programmes for patients could help to change patient behaviour and consequently outcomes. Because the developed model uses standardized outcome measures and initial conditions, it can be applied by other hospitals and health insurance companies as well. In time, the patient value in terms of outcomes over costs can and should be introduced into the model, probably in a shared savings model.

Conclusion

A health insurance company and a hospital have succeeded in creating a reimbursement model in which VBHC principles are integrated and changes in quality can be measured and rewarded.

The presented model is a first step that offers great promise in aligning hospitals and health insurance companies in using patient-relevant outcomes in healthcare purchasing. To further increase patient value, on-going optimization of the model and evaluation of its impact on quality of care is necessary requiring new long-term collaboration models based on trust.

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No potential conflict of interest was reported by the authors.

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Appendix. Patient characteristics (N = 14,944)

	CABG (n = 4308)		P	PCI (n = 9329)		P	Catheter PVI (n = 1307)		P
	2010–2013 n (%) / mean (SD)	2014 n (%) / mean (SD)		2010–2013 n (%) / mean (SD)	2014 n (%) / mean (SD)		2010–2013 n (%) / mean (SD)	2014 n (%) / mean (SD)	
Age	65.7 (9.72)	65.4 (9.75)		65.2 (11.54)	65.8 (11.33)		61.1 (9.51)	59.6 (9.72)	*
Gender									
Men	2827 (78.4)	546 (77.6)		5205 (71.9)	1532 (73.4)		708 (69.4)	215 (74.9)	
Diabetes			*						
Yes	794 (22.0)	179 (25.4)		1381 (19.1)	364 (17.4)		–	–	
Unknown	0	0		112 (1.5)	70 (3.4)		–	–	
LVEF						*			
30–50%	424 (11.8)	90 (12.8)		172 (2.4)	138 (6.6)		–	–	
<30%	101 (2.8)	12 (1.7)		177 (2.4)	66 (3.2)		–	–	
Unknown	311 (8.6)	44 (6.3)		3509 (48.4)	1049 (50.3)		–	–	
Renal insufficiency						*			
Yes	760 (21.1)	149 (21.2)		1399 (19.3)	438 (21.0)		–	–	
Unknown	23 (0.6)	2 (0.3)		496 (6.8)	244 (11.7)		–	–	
Urgency of the procedure									
Urgent	106 (2.9)	13 (1.8)		1814 (25.0)	500 (24.0)		–	–	
Emergency + rescue	288 (8.0)	44 (6.3)		2904 (40.1)	799 (38.3)		–	–	
Unknown	0	0		3 (0)	0		–	–	
Chronic total occlusion									
Yes	–	–		525 (7.2)	147 (7.0)		–	–	
Unknown	–	–		10 (0.1)	0		–	–	
Previous MI						*			
Yes	–	–		1783 (24.6)	585 (28.0)		–	–	
Unknown	–	–		95 (1.3)	53 (2.5)		–	–	
Previous CABG						*			
Yes	–	–		992 (13.7)	232 (11.1)		–	–	
Unknown	–	–		57 (0.8)	38 (1.8)		–	–	
Multivessel disease						*			
Yes	–	–		3528 (48.7)	1102 (52.8)		–	–	
Unknown	–	–		1 (0)	0		–	–	
Resuscitation									
Yes	–	–		299 (4.1)	71 (3.4)		–	–	
Unknown	–	–		247 (3.4)	7 (0.3)		–	–	
Shock						*			
Yes	–	–		321 (4.4)	74 (3.5)		–	–	
Unknown	–	–		310 (4.3)	5 (0.2)		–	–	
BMI									*
25–30	–	–		–	–		491 (48.1)	153 (53.3)	
>=30	–	–		–	–		246 (24.1)	46 (16.0)	
ChadsVasc score									
Medium (2–4)	–	–		–	–		430 (42.2)	87 (30.3)	
High (>=5)	–	–		–	–		22 (2.2)	3 (1.0)	
Unknown	–	–		–	–		30 (2.9)	65 (22.6)	
Previous ablation									*
Yes	–	–		–	–		273 (26.8)	41 (14.3)	
Unknown	–	–		–	–		1 (0.1)	0	
Previous mitral valve disease									*
Yes	–	–		–	–		94 (9.2)	37 (12.9)	
Unknown	–	–		–	–		67 (6.6)	55 (19.2)	

Note: * $P < .05$; Significant differences: CABG diabetes $P = .049$; PCI LVEF $P < .001$; PCI renal insufficiency $P = .005$; PCI previous myocardial infarction $P < .001$; PCI previous CABG $P = .004$; PCI multivessel disease $P = .001$; PCI shock $P = .010$; Catheter PVI age $P = .014$; Catheter PVI BMI $P = .015$; Catheter PVI previous ablation $P < .001$; Catheter PVI previous mitral valve disease $P = .008$.