

Utilization and perception of same-day discharge in electrophysiological procedures and device implantations: an EHRA survey

Sebastian König^{1,2*}, Martin Svetlosak ³, Marcin Grabowski⁴, David Duncker ⁵, Vivien K. Nagy⁶, Stefan Bogdan⁷, Philippe Vanduynhoven⁸, Syed Mohammad Afzal Sohaib⁹, Katarzyna Malaczynska-Raipold¹⁰, Deirdre A. Lane¹¹, Radoslaw Lenarczyk ¹², Andreas Bollmann^{1,2}, Gerhard Hindricks^{1,2}, Tatjana S. Potpara^{13,14}, and Jędrzej Kosiuk^{4,15}

¹Department of Electrophysiology, Heart Center Leipzig at University Hospital, Strümpellstraße 39, 04289 Leipzig, Germany; ²Leipzig Heart Institute, Leipzig, Germany; ³Department for Arrhythmias and Cardiac Stimulation, National Institute for Cardiovascular Diseases, Bratislava, Slovakia; ⁴Department of Cardiology, Medical University of Warsaw, Warsaw, Poland; ⁵Department of Cardiology and Angiology, Hannover Medical School, Hannover Heart Rhythm Center, Hannover, Germany; ⁶Semmelweis University Heart and Vascular Center, Budapest, Hungary; ⁷Clinical Emergency Hospital of Bucharest, Clinical Electrophysiology and Pacing Laboratory, Bucharest, Romania; ⁸Department of Cardiology, Arrhythmia Clinic Aalst, Aalst, Belgium; ⁹Barts Heart Center, St Bartholomew's Hospital, London, UK; ¹⁰Royal Brompton & Harefield NHS Foundation Trust, Heart Division, London, UK; ¹¹University of Liverpool and Liverpool Heart and Chest Hospital, Liverpool Centre for Cardiovascular Science, Liverpool, UK; ¹²Department of Cardiology Congenital Heart Disease and Electrotherapy, Silesian Medical University, Zabrze, Poland; ¹³School of Medicine, University of Belgrade, Belgrade, Serbia; ¹⁴Clinical Centre of Serbia, Cardiology Clinic, Belgrade, Serbia; and ¹⁵Department of Cardiology, Helios Hospital Köthen, Köthen, Germany

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Abstract

The aim of this European Heart Rhythm Association (EHRA) survey was to assess the utilization of same-day discharge (SDD) in electrophysiology (EP). An online-based questionnaire was shared with the EHRA community between 12 and 30 June 2020 and recorded institutional information, complication assessment, recent experiences, and opinions regarding possible advantages or concerns with SDD. In total, 218 responses from 49 countries provided information on current SDD management. Overall, SDD was implemented in 77.5%, whereas this proportion was significantly higher in tertiary and high-volume centres (83.8% and 85.3%, both $P < 0.01$). The concept of SDD was most commonly used following implantations of cardiac event recorders (97%), diagnostic EP procedures (72.2%), and implantations of pacemakers with one or two intracardiac leads (50%), while the lowest SDD utilization was observed after catheter ablations of left atrial or ventricular arrhythmias. Within SDD-experienced centres, ~90% respondents stated that this discharge concept is recommendable or highly recommendable and reported that rates of increased rehospitalization and complication rates were low. Most respondents assumed a better utilization of hospital resources (78.2%), better cost effectiveness (77.3%), and an improved patients' comfort but were concerned about possible impairment of detection (72.5%) and management (78.7%) of late complications. In conclusion, >75% of respondents already implement SDD following EP interventions with a large heterogeneity with regard to specific procedures. Further research is needed to confirm or disprove existing and expected benefits and obstacles.

Keywords

Electrophysiology • Same-day discharge • Catheter ablation • Cardiac electronic device implantation • European Heart Rhythm Association survey

Introduction

The prevalence of cardiac arrhythmias has increased over the years and a further increase of patient numbers and concomitant electrophysiological (EP) procedures is likely for the future.^{1–7} Finding the optimal workflow to treat these patients safely and efficiently is therefore of great medical and socio-economic importance. Constantly improving technologies and experience in EP interventions and cardiac implantable electronic device (CIED) surgery led to a decrease in complication rates.^{8–11} This has resulted in the introduction of same-day discharge (SDD) concepts following various EP procedures to further optimize resource management. However, for most interventions there are no specific recommendations with regard to the preferable clinical management in official guidelines and data regarding the actual implementation of this practice are scarce.^{12–15} Therefore, the aim of this European Heart Rhythm Association (EHRA) survey was to (i) assess to what extent SDD is currently utilized with respect to institutional differences, (ii) describe experiences with SDD, and (iii) record clinicians' perceptions and opinions concerning the possibility of future implementation and expansion of this practice.

Methods

The questionnaire has been prepared by the EHRA Young Electrophysiologists group in collaboration with the EHRA Scientific Initiatives Committee. The survey was assessed prospectively and all EHRA members and members of the EHRA Young Electrophysiologists network were invited to participate from 12 to 30 June 2020 via an electronic link (the full Questionnaire is provided in [Supplementary material online](#)). The response was voluntary and anonymous. The online-based questionnaire (<https://www.surveymonkey.com>) was structured into four blocks including institutional information, physicians' experiences with SDD, opinions regarding possible advantages and concerns with respect to SDD and complication assessment within the corresponding centre. Centre volume was defined according to the median of performed EP procedures per year.

Statistical analysis

Statistical analysis was performed using SPSS version 17.0 (IBM Corp., Armonk, NY, USA). Relative distribution is given for each question as percentage within answers. In case of missing data for a particular question, percentages within respondents are shown and the number of n/N is given with n as the number of respondents for this question and N as the total number of respondents. Continuous variables were described with mean (\pm standard deviation) or median [inter-quartile range (IQR) as 25th to 75th quartiles] depending on the existence of Gaussian distribution which was tested by Kolmogorov–Smirnov test. Results were compared between groups with Student's t -test (for continuous variables) or Fisher's exact probability test (for dichotomous variables). χ^2 test was used to compute relationships between nominal variables. Kruskal–Wallis test was used to compare more than two subgroups with unequal variances. A double-sided $P \leq 0.05$ was considered statistically significant.

Results

In total, 218 participants (6.5% response rate with regard to all invitations) from 49 countries completed the survey. Most responses

came from Germany ($n = 23$), the UK ($n = 18$), and Italy ($n = 17$, see [Supplementary material online, Table S1](#)). Participants were affiliated most frequently to university or tertiary hospitals with a specialized department of cardiology (73.4%), followed by community or district hospitals with a specialized cardiological subunit (19.3%) and private hospitals (6.0%). Only three responses came from clinicians employed at community or district hospitals without a specialized cardiological subunit or private medical offices. The median numbers of EP procedures and device implantations per centre and year were 450 (IQR 473) and 500 (IQR 400), respectively, and they were performed by a median of 7 electrophysiologists (IQR 9).

Current same-day discharge practice

Overall, SDD following EP or CIED procedures was implemented by 77.5% of respondents. Centre type was a major contributor towards SDD utilization ([Figure 1](#)), with SDD being used in 83.8% in university hospitals/tertiary centres, 53.8% in private hospitals, 61.9% and 66.7% in district/community hospitals with and without a specialized cardiology subunit, respectively ($p < 0.01$, [Figure 1](#)). The SDD implementation was more common in high-volume centres compared with low-volume centres (85.3% vs. 64.8%, OR 3.15, 95% CI 1.54–6.44, $P < 0.01$). A median of 30% of all patients (IQR 52%) were discharged the same day and experience with SDD was present for a median of 5 years (IQR 7 years). SDD rates per country and geographic region (according to EURObservational Research Programme) are listed in [Supplementary material online, Tables S1 and S2](#).

In responses from centres with existing SDD concepts, their application varied with regard to specific procedures. SDD was most common following the insertion of implantable cardiac event recorders (97.0%), diagnostic EP studies (72.2%), implantation of pacemakers with one or two intracardiac leads (50%), catheter ablation (CA) of common atrial flutter (47.8%), and CA of specific supraventricular arrhythmias other than atrial fibrillation (AF) or atrial flutter (47.7%). Correlation between SDD utilization following EP and CIED procedures within one response was high ($R = 0.56$, $P < 0.01$). Concerning interventions in which SDD has not been used so far, for most catheter-based and device-related procedures at least 50% of respondents with overall SDD experience could imagine implementing it in the future. Only for left atrial CAs and CA of ventricular tachycardia, the practice of SDD was not a conceivable management option for most clinicians neither now nor in the future. More commonly, SDD was used following the latter procedures by respondents working in university hospitals/tertiary centres (34.3% vs. 3.4%, $P < 0.01$), high-volume centres (42.1% vs. 13.8%, $P < 0.01$), and in hospitals also implementing SDD following CIED procedures ($P < 0.01$ for each device). There were regional differences with SDD use in this subgroup in 88.9% in the UK, 50% in Spain but 0% each in Italy and Germany. Detailed results are shown in [Table 1](#) and [Figure 2](#).

Among centres not currently implementing SDD concepts, response rate regarding previous execution or possible future use of SDD was low ($n/N = 13/49$, 26.5%). Approximately 70% of respondents could envisage applying SDD approaches in the future following diagnostic EP studies, pacemaker implantations with one or two intracardiac leads, and insertion of implantable cardiac event recorders. Each slightly $< 50\%$ did so for CA of common atrial flutter and implantation of subcutaneous defibrillators. Regarding other procedures

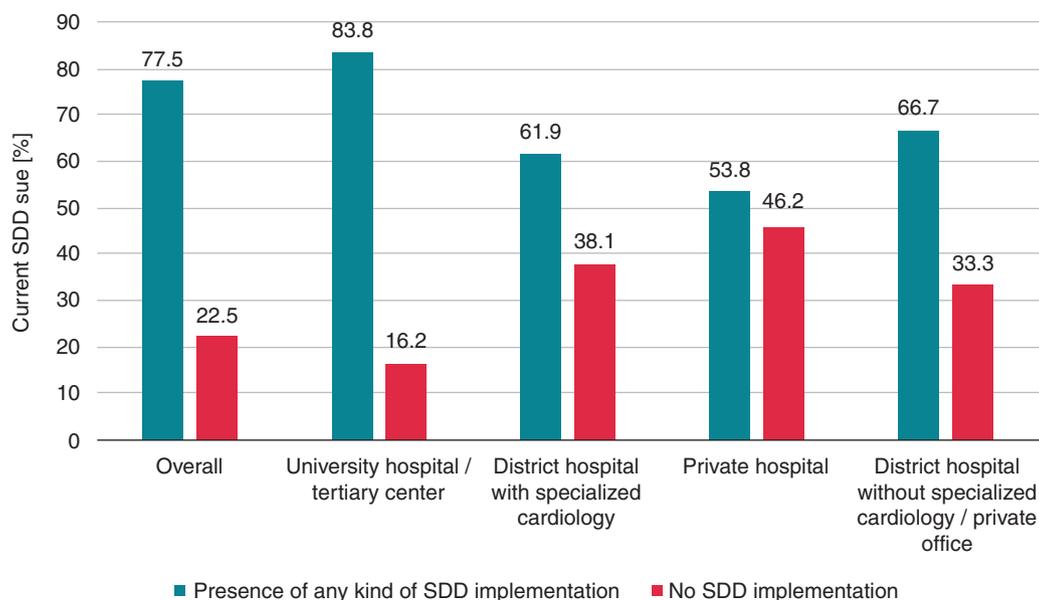


Figure 1 Utilization of same-day discharge following electrophysiological procedures or CIED implantations. CIED, cardiac implantable electronic device; SDD, same-day discharge.

Table 1 Utilization of same-day discharge within specific procedures/interventions

Utilization of same-day discharge within specific procedures/interventions				
Procedure/intervention	Response, n/N	SDD is implemented (%)	No SDD, but can be imagined (%)	No SDD, no future SDD (%)
PVI (cryo)	157/169	20.4	36.3	43.3
PVI (radiofrequency)	159/169	15.7	31.4	52.8
Left atrial CA (arrhythmia other than AF)	157/169	24.8	29.3	45.9
CA of common atrial flutter	157/169	47.8	35.0	17.2
EP study without ablation	162/169	72.2	21.6	6.2
EP with CA of other atrial arrhythmias	155/169	47.7	32.9	19.4
CA of VT (idiopathic)	157/169	24.2	26.1	49.7
CA of VT (scar-related)	156/169	6.4	10.9	82.7
pacemaker (1/2 chamber)	168/169	50.0	35.7	14.3
CRT-P/D	166/169	27.7	36.1	36.1
ICD (1/2 chamber)	166/169	39.2	34.9	25.9
Leadless pacemaker	154/169	18.2	43.5	38.3
Subcutaneous defibrillator	160/169	20.6	42.5	36.9
Cardiac implantable event recorder	167/169	97.0	2.4	0.6

CA, catheter ablation; CRT-P/D, cardiac resynchronization therapy-pacemaker/defibrillator; EP, electrophysiological; ICD, implantable cardioverter-defibrillator; PVI, pulmonary vein isolation; SDD, same-day discharge; VT, ventricular tachycardia.

queried, the majority of respondents also was reluctant to implement SDD in the future.

Perception of same-day discharge

In centres with SDD experience ($n/N = 168/169$, 99.4%), 89.3% reported that SDD was advised or strongly advised under certain conditions as opposed to 63.9% of respondents from centres

inexperienced in SDD ($n/N = 36/49$, 73.5%) who stated that SDD was not recommended ($P < 0.01$ for comparison of answering distribution between groups). Physicians reported negative experiences associated with implementing SDD ($n/N = 139/169$, 82.2%) related to patients' discomfort (24.5%), reimbursement issues (20.1%), or increased work load due to accelerated processes (12.9%). Less often considered negative attributes of SDD were higher rehospitalization

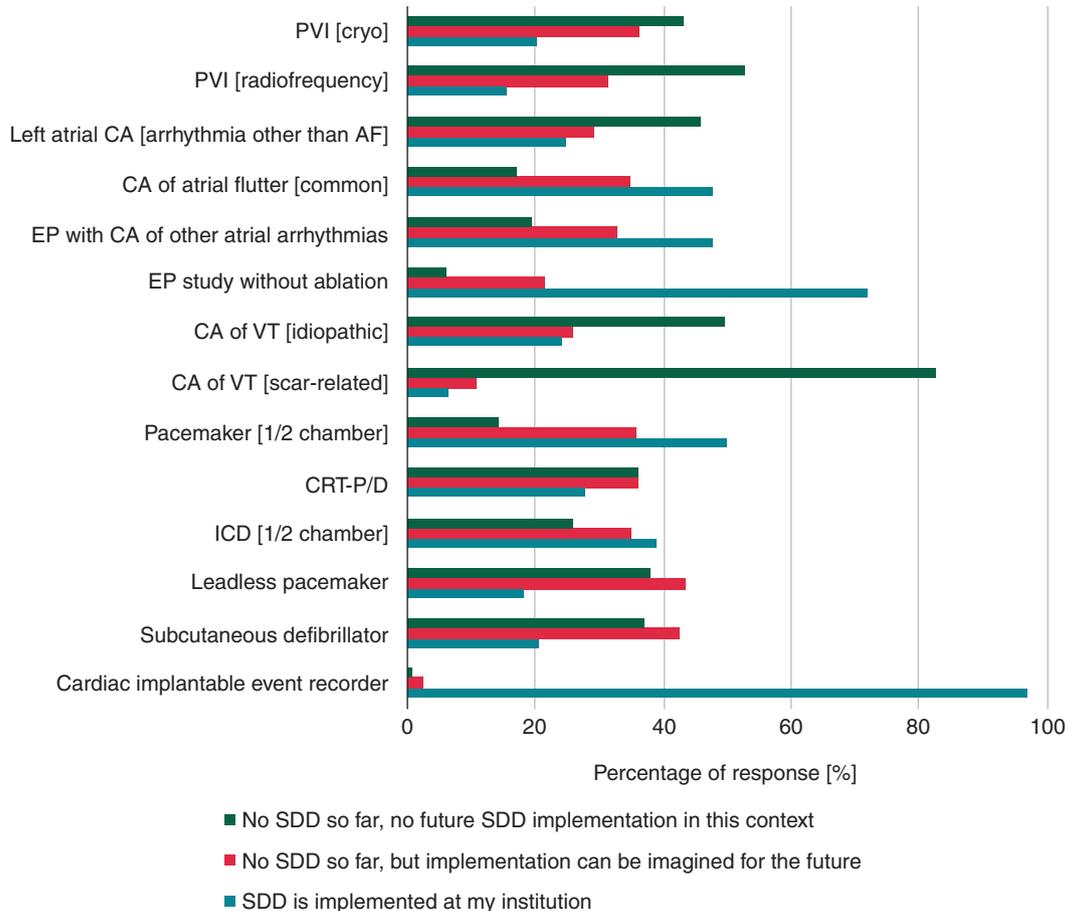


Figure 2 Utilization of same-day discharge within specific procedures/interventions in centres with SDD experience. AF, atrial fibrillation; CA, catheter ablation; CRT-P/D, cardiac resynchronization therapy-pacemaker/defibrillator; EP, electrophysiological; ICD, implantable cardioverter-defibrillator; PVI, pulmonary vein isolation; SDD, same-day discharge; VT, ventricular tachycardia.

rates (5.0%), complications (4.3%), or treatment costs (2.2%) as influencing factors. About half of the respondents (50.4%) denied any negative experiences associated with SDD.

Of all respondents ($n/N = 211/218$, 96.8%), a better utilization of hospital resources, improved cost effectiveness, and patients' comfort was expected by 78.2%, 77.3%, and 63.0%, respectively, whereas ~7% could not see any benefits neither for patients nor for clinicians. Respondents were concerned about delays in detecting (72.5%) and managing (78.7%) late complications following specific interventions and almost one-third (32.7%) feared of higher rehospitalization rates. An insufficient primary care network for patients to refer to after hospital discharge (53.1%), conflicting expectations of patients (46.4%), the need for additional personal (37.9%), and a lack of structural feasibility (31.3%) as well as reimbursement issues (30.3%) were seen as potential obstacles in further implementation and expansion of SDD. SDD was abandoned because of delayed detection of complications (8.8%, not specified whether feared or actually experienced), problems with regard to structural feasibility (5.9%) or reimbursement (3.9%), increased rehospitalization rates (4.4%), discomfort of patients (3.4%), and missing availability of patients'

transport post-discharge on the same day (1.0%). *Figure 3* juxtaposes overall negative expectations and actual past experiences with SDD.

Patient-related and procedure-related factors influencing same-day discharge

Patient-related and procedure-related variables being important to the majority of participating physicians ($n/N = 204/218$, 93.6%) were identified, with frailty (80.9%), ending hour of the procedure (75.5%), age (74.0%), recovery from sedation (72.1%), duration of the procedure (70.1%), and symptomatic heart failure with New York Heart Association functional class III/IV (70.1%) being the most relevant factors. All of the listed variables were important to 7.4%, and 1.5% of respondents stated that none of the mentioned factors was relevant to them in this context. The impact of anaesthetic protocols on SDD was further specified: 18.1% of respondents would use SDD irrespective to the type of anaesthesia, 23.0% would do so in patients who had someone to look after them for the first night post-discharge, 45.1% stated that SDD is an option only following conscious sedation but not general anaesthesia, and 13.7% would discharge patients the

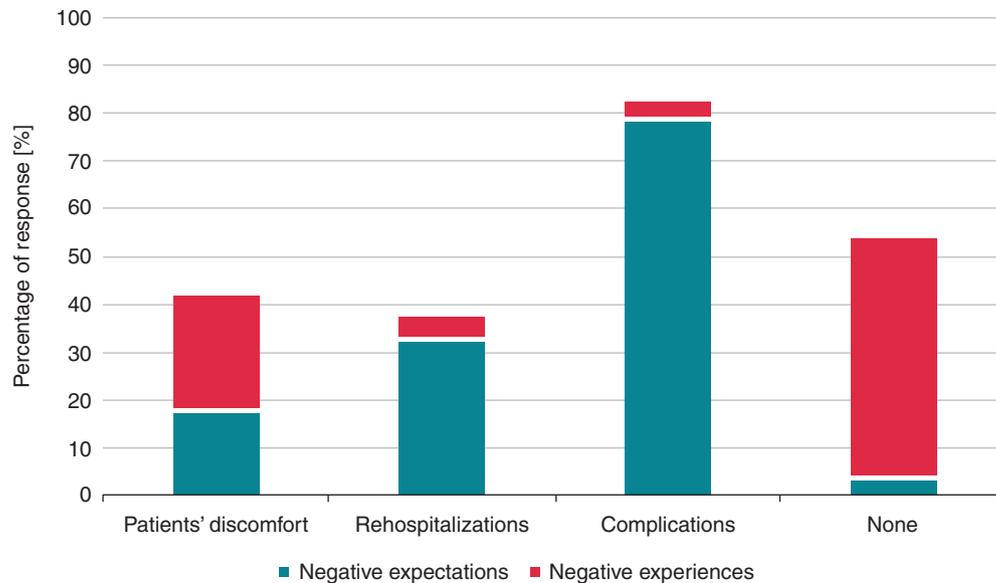


Figure 3 Comparison of electrophysiologists negative expectations and actual experiences with SDD. SDD, same-day discharge.

same day following procedures under local anaesthesia only. The results are shown in Figure 4.

Complication assessment

A structured assessment of complications following EP procedures and/or device implantations was reported by 75.9% of respondents ($n/N = 195/218$, 89.4%). In 9.7% and 2.1%, such quality measurement was only implemented following CIED operations or EP procedures, respectively, and 64.1% of respondents recorded complications for both kind of procedures. No structured complication registration was reported by 24.1% of respondents. Complication assessment following EP procedures correlated with SDD use ($R = 0.13$, $P = 0.048$), but overall complication assessment did not. The rate of complications detected after >6 h from the end of the procedure was requested and median estimated percentages were 3% following EP (IQR 4%, $n/N = 184/218$, 84.4%) and CIED procedures (IQR 8%, $n/N = 192/218$, 88.1%) each. In addition to physical examination, 84.4% of respondents routinely used other diagnostic tests to rule out procedure-related adverse events (71.1% following CIED surgery, 53.7% following EP procedures). Those examinations were usually performed the next day (63.1%) and less often on the day of the procedure (29.2%) or ≥ 2 days afterwards (7.7%). It seemed feasible and reasonable to perform the necessary diagnostic tests on the same day without deterioration of detection of complications for 62.1% of the respondents ($n/N = 195/218$, 89.4%).

Discussion

This physician-based EHRA survey provided a detailed insight into current implementation and perception of the SDD concept in the field of electrophysiology (EP) within the EHRA community. The main findings were (i) SDD was implemented in any form in 77.5% of

the respondents' hospitals in almost one-third of their patients, (ii) there were significant differences in SDD utilization with regards to the centre type/volume and geographical region, and (iii) SDD use was conceivable or already used for most procedures except left atrial CAs and CAs of ventricular arrhythmias. Moreover, 89.3% of respondents from centres currently implementing SDD concepts considered this concept to be recommendable or highly recommendable, whereas 63.9% of respondents from centres without SDD practice would not advise such discharge policy.

To the best of our knowledge, there is no comparable survey addressing discharge concepts following EP procedures or CIED surgery. The response rate within our survey is comparable with that of other recent EHRA surveys.^{16,17} However, guideline conformity could not be investigated as there are no specific recommendations for post-procedural patient management neither for catheter-based EP procedures nor for CIED operations.^{12–15,18} Overall, SDD is implemented in the majority of centres of participating physicians. The higher rates of SDD use within the university environment and in high-volume facilities compared with other centres is not surprising as similar trends were shown in patients with percutaneous coronary artery interventions.^{19,20} While the concept of day-care has already become established for specific procedures like diagnostic EP studies, SDD was not considered feasible by a relevant proportion of participants for other interventions. Our data showed, however, that respondents using SDD following EP interventions were likely to also implement this discharge concept after CIED surgery. Although with overall lower SDD utilization rates, respondents from non-university/tertiary centres more commonly discharged patients the same day following CIED compared with EP procedures which explains the higher SDD rates in this group.

There is a paucity of large multicentre datasets on patients' safety in the context of SDD in EP. Nonetheless, existing studies mostly contradict the perception of lacking feasibility. In the context of

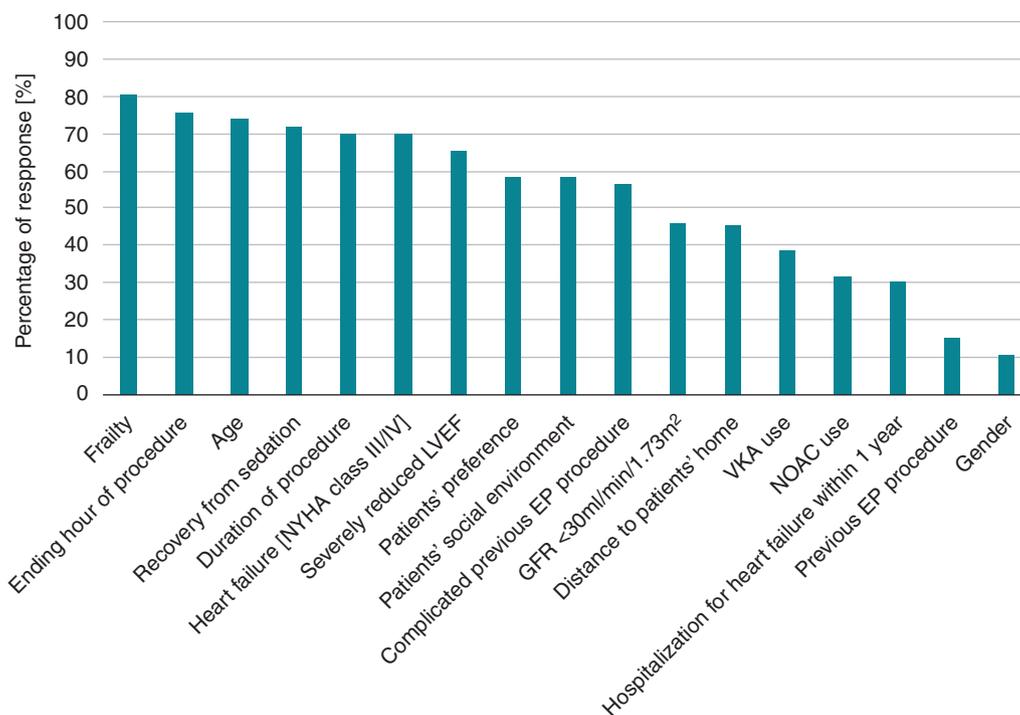


Figure 4 Factors influencing SDD decision making. EP, electrophysiological; GFR, glomerular filtration rate; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; NOAC, novel oral anticoagulants; VKA, Vitamin K antagonists; SDD, same-day discharge.

pulmonary vein isolation (PVI), the implementation of SDD could be achieved in up to 89% of cases with low complication and readmission rates compared with standard overnight care.^{21,22} Two single-centre studies reported that SDD also was also safe following selected ICD implantations and there was no increased risk of complications.^{23,24} This was confirmed by a large US registry showing no differences in the rates of death, all-cause readmissions, and device-related readmissions at 90 days post-ICD implantation with a corresponding increase in SDD rates within the inclusion period.²⁵ Even in the context of newer and less commonly implanted CIEDs like subcutaneous ICDs and leadless intracardiac pacemakers, day-care implementation in an experienced centre seems possible.^{26,27} However, no data are available for CAs of ventricular tachycardia, which is in line with the perception of the majority of participants of our survey.

Regarding negative experiences with SDD, patients' discomfort was most commonly reported, followed by economical and structural issues, while higher rehospitalization and complication rates and rising treatment costs were mentioned only by the minority of respondents which is in line with published data.²⁸ In terms of treatment costs, a significant reduction was shown for SDD concepts in left atrial CA.^{29,30} There are no data about patient beliefs on SDD in the field of EP. Referring to other patient cohorts, SDD has been perceived as favourable and was associated with high satisfaction scores in patients with minor non-cardiac surgery.^{31,32} Similar findings were reported in several patient cohorts following percutaneous coronary interventions.^{33–35}

Among factors potentially influencing decision making regarding SDD, procedure-related factors (duration/ending hour) were most commonly chosen in our survey. A longer procedural duration has been shown to predict a failing early discharge.^{30,36} However, procedural duration alone has not been associated with complication rates following CA of AF in a meta-analysis and should therefore not be used as the only criterion to exclude SDD in cases in whom a sufficient monitoring period can be ensured.³⁷ Recovery from sedation was also considered relevant and most respondents stated that SDD should be applied only following conscious sedation, but not following general anaesthesia. On one hand, the latter was used as an exclusion criterion in one trial evaluating SDD in patients after PVI.²⁹ On the other hand, two studies proved SDD to be safe in patients undergoing PVI irrespective of anaesthetic management.^{30,36} Patient-related factors like age, frailty, comorbidities, and in particular a severely reduced left ventricular ejection fraction are associated in variable extent with short-term complication risk following CA of atrial or ventricular arrhythmias and CIED surgery, thus understandably influencing the local discharge policy in our survey.^{38–41} Nevertheless, in cohorts who underwent left-sided atrial CAs, patients' age was not different between groups in whom SDD has been realized or not.^{30,36} Gender and treatment with different oral anticoagulants were considered relevant only by a minority of participants in our survey, as also reported in previous studies especially concerning CA of atrial arrhythmias, wherein those factors were not predictive for success of SDD.^{30,36} Moreover, improvements in anticoagulation regimens were made in the context of CA of AF, common atrial flutter, and in CIED surgery.^{42–46}

There is a lack of data regarding the timing of occurrence of complications following EP and CIED procedures especially when considering the mentioned changes in antithrombotic treatment. The vast majority of respondents assumed most adverse events to occur within the first 6 h post-intervention. At least one small PVI study reported no complications occurring after 6 h post-ablation but this has to be interpreted with caution due to the overall low number of included procedures.⁴⁷ However, it has not been proven whether the extension of the inpatient stay for another night leads to a relevant improvement of the detection of late complications. Of course, this only applies to a situation in which an adequate infrastructure to carry out all necessary examinations on the day of the corresponding intervention is in place to detect relevant complications.

Limitations

The response rate was 6.5% with respect to the number of emails sent out to the EHRA community and therefore the results of this survey represent the opinions and experiences of a highly selected group of physicians with most respondents working in university hospitals or tertiary centres. Generalizability of our findings may be limited. Due to the mode of physician selection and the invitation to the survey, there is the potential bias of multiple responses coming from one centre which would influence results. According to data protection requirements and anonymous response status, the data provide no further information in this regard.

Conclusions

This EHRA survey shows that >75% of all respondents and >85% of respondents from high-volume centres already implement SDD following EP interventions, but there is a large heterogeneity concerning specific procedures. Approximately 90% of participants from centres with SDD-experience found SDD to be recommendable or highly recommendable under certain conditions. Although several benefits of SDD can be envisaged, the fear of an insufficient post-interventional primary care limits a further increase in SDD use. More research is needed to confirm or disprove existing or expected benefits and obstacles.

Supplementary material

Supplementary material is available at *Europace* online.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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