USAGE OF ANESTHESIA INFORMATION MANAGEMENT SYSTEMS IN EUROPEAN COUNTRIES IN 2020 – A SHORT SURVEY

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Abstract

The theoretical aspects and benefits of Anesthesia Information Management Systems (AIMS) are well described in literature already. However, certain existing systems are much less researched with most studies concentrating on the USA. In our study, we sent a link to a Google questionnaire to 403 European hospitals and to 382 European authors who have published in the last five years in a renowned anesthesiologic journal. We have not researched AIMS usage in the Czech Republic, as we have covered this topic in our previous study. We asked responders for information on their AIMS (name, vendor, length of use) or to explain why they do not use one. We received 14 responses from the hospitals and 38 responses directly from the authors. With the return rate of 8 per cent we evaluated our study in qualitative terms. Among the 23 respondents that use AIMS there are 12 different systems including two self-developed systems. A number of these systems have not previously been mentioned in the literature. Most use their systems longer than five years but only three respondents are implementing AIMS at the moment. Both these findings show slower progress in this field than in the USA. Typical reasons given from non-users were financial constraints and inability to recognize benefits of AIMS. Incompatibilities with other medical software and medical devices in use were also mentioned. The heterogeneity of AIMS used and perceived barriers corroborate our previous study from the Czech Republic.

Keywords

AIMS, Anesthesia, Information System

Introduction

The most vital parameters need to be recorded during anesthesia every five minutes. That makes anesthesiology a field in which the physician makes the most thorough record of the present state of his patient. Any medication given should also be logged precisely. Surprisingly, the paper anesthesia records still widely used do not differ significantly from the first records introduced more than one hundred and twenty years ago [1].

Simple systems that automatically record available parameters are known as the Automated Anesthesia Record Keeping System (AARKS). First attempts to capture patient data electronically throughout anesthesia took place more than forty years ago [2]. AARKS decreases the workload of the anesthesiologist [3] and recorded data is more exact [4] since anesthesiologists tend to "smooth out" their manual records [5]. Even so, some information must be entered manually (e.g. medication given), which might result in an omission, as in paper anesthesia records [6, 7].

More advanced systems are integrated within a Hospital Information System (HIS). This arrangement facilitates continuity of care from the pre-operative to the post-operative phase. The integration of the clinical decision system has a measurable effect on the quality of care during the peri-operative phase [8, 9]. This complex system is usually known as the Anesthesia Information Management System (AIMS) [10]. Alternatively, AIMS might be part of an extensive HIS [11].

Although the theoretical aspects and benefits of AIMS are well-covered in literature, certain existing AIMS are much less researched [12]. Most studies are limited to the USA—according to these studies 75 per cent of academic hospitals used AIMS in 2014 with 84 per cent adoption expected in 2020 [13]. There is only one study from 2010 claiming 15 per cent adoption of AIMS in university-affiliated hospitals from twenty-two EU states [14]. In our previous work from 2019 [15] we have identified a 20 per cent adoption of AIMS in academic hospitals in the Czech Republic. Lack of funds was identified as the primary barrier to further adoption.

The aim of this article is to identify existing AIMS, their vendors and usage in different hospitals in Europe

and to compare its adoption in the Czech Republic to other parts of Europe. We also intended to identify non-users of AIMS, their possible intentions to introduce such a system, and their perceived barriers to AIMS usage.

Methods

For our research we have decided to use a google questionnaire to survey AIMS usage in leading European hospitals apart from the Czech facilities which we have covered sufficiently with our previous research. To identify our respondents, we used two sources—firstly we contacted European hospitals that provide anesthesia care and secondly, we queried European anesthesiologists directly.

Using Google and keywords ["list of hospitals"] + [name of country (e.g. Germany)] we obtained a page with a list of hospitals in each country. For the different countries we then selected a number of larger hospitals (judging from their name, description and / or position on that list). Further on we used a web page specializing in ranking hospitals [16] and chose to start with the best-ranked ones. We then obtained web pages for each of the identified hospitals. Using these, we tried to find the most suitable person to answer our queries (e.g. the head of the anesthesia department). In total we have gained 403 e-mail contacts (Sample A).

In order to extend our study sample, we reviewed articles published in the European Journal of Anesthesiology (ISSN 1365-2346, Lippincott Williams & Wilkins Company, Philadelphia PE, USA) between 2015 and 2020. We have identified 382 corresponding authors with affiliations to European hospitals (Sample B). At this stage we did not check for duplicities, so some hospitals could have been approached twice (albeit to different e-mail contacts).

We prepared a short google questionnaire to identify AIMS vendors and how long the system had been used in specific hospitals. In the case of non-users we asked whether they contemplated introducing such a system and why they did not already have AIMS. The questionnaire is set out in Table 1. We sent an e-mail requesting filling in the questionnaire with the link to the identified e-mail contacts (785 in total). In order to increase the return rate, we re-sent the same e-mail one week after the first one.

Table 1: Questionnaire sent to the identified e-mail contacts.

Section 1:

a) Where is your hospital? (country)
b) What is the name of your hospital?
c) Does your hospital use AIMS?

Section 2 (AIMS users):

a) What is the name of your AIMS?
b) Who is the producer of your AIMS? (Company name)
c) How long have you already been using AIMS in your hospital?
- 1 year
- 2 years
- 3 years
- 4 years
- More than 5 years
- More than 10 years
- Other
d) Do you use AIMS only as software, or with hardware components?
- Software only
- Also with hardware components
- Other

Section 3 (AIMS non-user):

a) Would you like to implement AIMS in your hospital in the future?
- Yes, we are preparing for it
- Maybe
- No
- Other

b) What is the main reason for the absence of AIMS in your hospital?
- Financial barrier - high acquisition and maintenance costs
- The hospital's management has other investment priorities
- Medical devices used are incompatible with the available AIMS
- We do not expect much benefit from AIMS
- We do not have competent staff for AIMS maintenance
- Incompatible HIS
- Other

Results

Out of 785 e-mails sent (May 2020) 148 were returned as non-deliverable (19 per cent). Our respondents filled in 52 questionnaires (response rate 8 per cent) from which 14 (27 per cent) originated from the Sample A. We did not get any duplicate replies. The

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result of these 52 responses was that there are 23 institutions using AIMS (44 per cent of the responses), 3 institutions that are installing AIMS now (6 per cent) and 26 hospitals that do not use AIMS at the moment (50 per cent). These results are shown in Fig.1. and in Table 2.
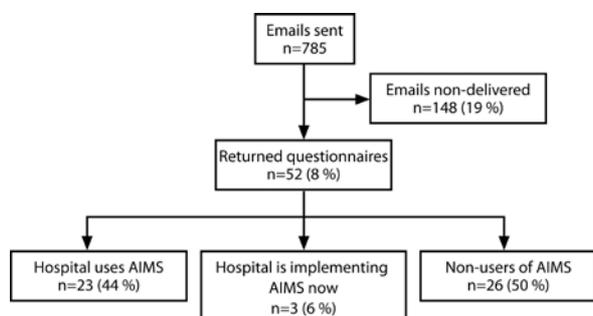
Fig. 1: E-mails sent, and responses received.

Table 2: Responses received – AIMS usage.

Country	AIMS		
	Users	Implementing	Non-users
Austria	2		1
Belgium	2		2
Estonia			1
Finland	1		
France	4		2
Germany	2		1
Great Britain			2
Greece			2
Hungary			1
Ireland			1
Italy		1	3
Latvia	1		
Norway			1
Poland	1		
Portugal	1	1	
Rumania			2
Slovakia	1		3
Slovenia	1	1	
Spain	1		1
Sweden	2		1
Switzerland	4		1
Turkey			1
Total	**23**	**3**	**26**

Among these 23 users from 13 European countries, 12 different AIMS are used, two of these being "in-house" produced. The most frequently used models are Metavision (iMDsoft, Needham MA, USA) – 7 responses, and Centricity Anesthesia (GE Healthcare, Chicago IL, USA) – 3 responses. For countries from which we received several responses, more than one system is always used. All AIMS identified in our survey are set out in Table 3.

Table 3: AIMS identified.

AIMS	Country	Quantity
B-Anesthetic [1]	Portugal	1
Centricity [2]	France	1
	Poland	1
	Spain	1
COPRA system [3]	Switzerland	1
DIANE Anesthesia [4]	France	3
FONS Enterprise [5]	Slovakia	1
GIDI [6]	Switzerland	1
ICCA [7]	Austria	1
	Sweden	1
ICIP [7]	Latvia	1
Innovian Anesthesia [8]	Germany	1
KWS [6]	Belgium	1
Metavision [9]	Austria	1
	Belgium	1
	Germany	1
	Slovenia	1
	Sweden	1
	Switzerland	2
Picis An. Manager [10]	Finland	1

Vendors of AIMS: [1]B-Simple [2]GE Healthcare [3]Copra [4]Bow Medical [5]STAPRO [6]Self-developed [7]Philips [8]Dräger [9]iMDsoft [10]PICIS.

Five AIMS users (21.7% from all users in this study) had utilized their system for more than 10 years, ten (43.5%) for more than five years and the rest (8 users, 34.8%) for less than five years. Nine (39.1%) AIMS users employ only the software and fourteen (60.8%) users also apply the hardware components.

Only three responders are implementing the AIMS at present. Nine of 26 "non-users" have plans to implement AIMS in the future and other 10 are planning to do so sometimes in the future. Only two "non-users" have flatly refused any plans to introduce AIMS in their hospitals.

In the "non-users" group we have furthermore queried about the reasons for the absence AIMS. The main reason given was lack of priority in acquiring such system and low expectancy of its benefits. In the "other" section more than one responder gave the answer, "*We have not up to now considered acquiring this technology*" and "*All reasons given in the questionnaire*". All the responses are set out in Table 4—some responders gave more than one answer to this query.

Table 4: AIMS non-users – reasons given for absence of AIMS.

Reasons given	Nr. of responses
The hospital's management has other investment priorities	16
We do not expect much benefit from AIMS	12

Financial barrier - high acquisition and maintenance costs	9
We do not have competent staff for AIMS maintenance	5
So far we have not considered acquiring this technology	4
Incompatible HIS	3
Medical devices used are incompatible with the available AIMS	2
All reasons given in the question-naire	2

Answers in italic – answers given as "other" in the questionnaire

Discussion

We have used a google questionnaire to identify AIMS users in European hospitals and to ascertain barriers to implement AIMS in hospitals that have not done so until now.

We have found out that a wide variety of AIMS is used in Europe. Some products from well-known vendors (Metavision Centricity Anesthesia, Innovian Anesthesia, etc.) were also identified in the previous study. Others from European producers (DIANE Anesthesia, BOW Médical, Amiens, France; B-Anestetic, B-Simple, Porto, Portugal and COPRA system, Copra, Berlin, Germany) have not been mentioned previously, as the earlier study was focused on the US providers [12]. We are able to demonstrate a substantial heterogeneity in this area with a wide plethora of AIMS vendors. Two hospitals also use a self-developed system. With the new EU regulations that are coming into effect [17] it might be very challenging for these institutions to comply with such incoming legislation. Most of the AIMS reported by our responders are also smaller independent systems intended solely for anesthesia. In our study, therefore, we have been unable to recognize the trend in the USA where AIMS is just a part of a large HIS, typically EPIC (Epic Systems Corporation, Verona WI, USA) [18]. This heterogeneity is quite consistent with our previous study from the Czech Republic, where three different systems are used (Centricity Anesthesia, Metavision, FONS Enterprise) [15].

What is remarkable also is the length of time during which the users have already employed their AIMS, since most of them introduced it five or even ten years ago. From the "non-users" the message is also clear that only a few are in the implementation process at present. Studies from the USA show an expectation of imminent proliferation of AIMS in academic hospitals [13], but our findings from European hospitals do not corroborate this. Most of the users implement their AIMS in combination with hardware components. Such a system might be seen as more advanced and more powerful when compared with mere software solutions, since the latter corresponds more closely only to AARKS.

Larger AIMS adoption in the USA might be facilitated by The Health Information Technology for Economic and Clinical Health Act (HITECH) which calls for adoption of electronic health record. However new issues arise as integration problems of AIMS into HIS are reported [19]. Much higher healthcare spending in the USA as compared to EU countries might also be a factor of higher AIMS adoption in the USA.

The most frequently perceived reasons for the absence of AIMS include financial barriers and other investment priorities. These are in accordance with previous studies [14, 20] and also with our previous study [15]. Financial barriers together with a general lack of funds might not be easy to overcome. Lack of recognized benefits of AIMS is also seen as a frequent barrier. According to the literature [21] anesthesiologists tend to recognize the benefits only after they have actually started using such a system. Some of the responders also mentioned HIS and medical devices incompatibility. This is indeed a serious issue which indicates a lack of standardization in medical software and a lack of technical standardization in connecting monitors and ventilators to other devices.

Clearly, the greatest limitation of this study is the low response rate. Improvement of such rates might be achieved by other means of communication (e.g. using the telephone instead of e-mail), but phone contacts are much more complicated to acquire. Authors should also ideally be native and really familiar with their surroundings if they are to be able to catch the attention of every respondent and therefore this type of survey is best limited to a national level. Since there is no official international registry of hospitals in European countries, we cannot be sure either that we have been able to approach enough relevant institutions. Previous studies chose only university-type hospitals, but response rates were not high nonetheless [14]. Considering the limitations stated above, our study should be perceived as qualitative rather than quantitative. Findings in our study (43 per cent of responders use AIMS) cannot be extrapolated for all major European hospitals.

Conclusion

Our study shows that there is a variety of AIMS vendors in Europe, some of them not described in previous studies. The AIMS used are mostly smaller anesthesia-dedicated systems (as opposed to a part of a large HIS as typically in the USA). It also appears that AIMS is not developing in Europe as fast as in the USA.

The most typical obstacles to broader AIMS implementtation are financial ones and also a lack of recognized benefits. HIS and medical devices incompatibility also present a continuing problem.

Acknowledgement

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