Anesthesia and mHealth - a Survey

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Abstract

Background mHealth, the practice of medicine aided by mobile devices is a growing market. Although the offer on Anesthesia applications (Apps) is quite varied, representative formal assessments on the views of anesthesia practitioners on its use and potential place in daily practice is lacking. This survey aimed thus to cross-assess the Belgian anesthesia population on the use of smartphone Apps and peripherals. Methods The survey was exclusively distributed as an online anonymous questionnaire. Sharing took place via hyperlink forwarding by the Belgian Society for Anesthesia and Reanimation (BSAR) and by the Belgian Association for Regional Anesthesia (BARA) to all registered members. The first answer took place on 5 September 2018, the last on 22 January 2019. Results 349 answers were obtained (26.9% corresponding to trainees, 73.1% to specialists). Anesthesiologists were positively confident that Apps and peripherals could help improve anesthesia care (57.0% and 47.9%, respectively, scored 4 or 5, in a scale from 0 - 5). Anesthesia trainees were significantly more confident that specialists on mobile Apps (72.1% and 51.6%, respectively). The usefulness of Apps and Peripherals was rated 1 or below (on a 0 to 5 scale) by 9.5% and 14.6% of the subjects. Trainees significantly used mobile apps more than specialists (66.7% vs. 37.4%, respectively). The preferred category of mobile Apps was dose-calculating applications (39.8%), followed by digital books (21.5%) and Apps for active perioperative monitoring (20.3%). Conclusions Belgian Anesthesia practitioners show a significant positive attitude towards smartphone Apps and Peripherals.

Background

Smartphones are an ubiquitous phenomenon. The massive production of these multisensory devices has reduced their overall cost and increased their societal penetrance. Their high processing capacity entails a rather useful leverage for healthcare in general, a sector where data is abundant and its processing relevant for clinical decision-making [1,2]. These advantageous features have been quickly assimilated by anesthesiologists, and dedicated anesthesia applications for various perioperative purposes have been continuously sprouting [3].

Commonly referred to as “mHealth” (abbreviation for Mobile Health), the practice of medicine aided by mobile devices is a growing market. In the United States of America (USA), this sector has been estimated to be worth more than 28 billion dollars in 2018, and predicted to surpass the 100 billion dollar barrier by 2023 [4]. Despite its exponential growth, regulation has been lagging behind and Food and Drug Administration (FDA) data shows that from a pool of more that 150.000 mobile applications (Apps) within the Health/Wellness category, only around 200 (0,1%) had been submitted to standardized governmental validation processes [5].

Despite the high mobile applications output, formal surveying of the views of anesthesia providers on these applications is scarce [3,5]. Green et al have conducted one of the most complete, although non-representative, studies on the pattern of utilization of smartphone applications by anesthesiologists in the USA [3].

The aim of the present survey was to specifically cross-assess the Belgian anesthesia population on this same subject, and to discuss the results with respect of the current legal European framework around mHealth.

Methods

The present study was approved by Ethical Committee of the Universitair Ziekenhuis Brussel, Belgium (Reference 2018/435, B.U.N. 143201837927), and registered at the ClinicalTrials.gov database (Identifier: NCT03750084).

The survey was exclusively distributed as an online anonymous questionnaire (Google Forms platform) for traceability purposes. Sharing took place via hyperlink distribution by the Belgian Society for Anaesthesia and Reanimation (BSAR)
and by the Belgian Association for Regional Anaesthesia (BARA) to all registered members. The first answer took place on 5 September 2018, the last on 22 January 2019.

The original survey can be consulted at: https://goo.gl/forms/7job24qgFOPXpUD12

It was divided in two main sections: one pertaining to Smartphone Applications themselves, another to Smartphone Peripherals. Each section was identically subdivided and sequentially evaluated the following topics:

· Confidence that Smartphone applications / peripherals can help improve Anesthesia care and why.

· Phase of perioperative care in which Smartphone applications / peripherals are most useful.

· Which sort of Smartphone applications appeal the user the most.

· Which Smartphone applications / peripherals the user employs in his/her daily practice.

· What are the user's wishes on the development of future Smartphone applications / peripherals.

Data presentation and statistical analyses: The data are presented as number, percentage and the 95% confidence intervals [95%CI] related to the evaluated questions are given. The data was analysed globally, and by subgroups (consultants vs. trainees).

Results

A total of 349 answers were obtained. Ninety-four (26.9%) responses were of Belgian Anesthesia trainees, 255 (73.1%) from Belgian Anesthesia specialists. A majority of the answering specialists (30.2%) had no dedicated subspecialty activities or were all-round specialists (Fig. 1). Anesthesiologists with an orthopedic anesthesia subspecialty accounted for 23.1% of the total, followed by cardio-thoracic anesthesiologists (18.8%), Pediatric Anesthesiologists (17.6%), Pain Clinic specialists (16.9%), Neuro-anesthesiologists (8.6%) and Intensive care specialists (7.5%). The remainder subspecialties were underrepresented (less than 2.5%).

When asked on how confident they were that Smartphone Applications (Apps) or Smartphone Peripherals (Peripherals) could improve anesthesia care, a majority of the Belgian anesthesiologists were positively confident that these could indeed help improve anesthesia care (57.0% [95%CI: 50.1 - 63.9%] and 47.9% [95%CI: 40.3 - 55.5%], respectively, scored 4 or 5, in a scale from 0 - 5) (Fig. 2). When subanalyzing the data per experience group, anesthesia trainees demonstrated a higher degree of optimism on Mobile Apps compared to Consultants (72.1% [95%CI: 61.4 – 82.8%] and 51.6% [95%CI: 43.1 - 60.1%], respectively) (Fig. 3). This pattern was not clearly observed for Smartphone peripherals (44.9% [95%CI: 35.8 – 54.0%] and 54.8% [95%CI: 41.3 – 68.3%], respectively) (Fig. 4).

Nine and a half percent [95%CI: 0 – 19.5%] of the surveyees rated Apps' usefulness in Anesthesia as 1 or bellow (on a 0 to 5 scale), and 14.6% [95%CI: 4.9 - 24.3%] gave the same rating when asked about Peripherals. From all the responders, 45.3% [95%CI: 37.3 - 52.9%] actively used Apps to aid their anesthesia practice, compared to only 3.2% [95%CI: 0 - 13.6%] that use Peripherals in their daily anesthesia practice. Again, a subanalysis of the answers per training group showed that a trainees use mobile apps in a significantly higher proportion when compared to specialists (66.7% [95%CI: 55.1 – 78.3%] and 37.4% [95%CI: 27.7 – 47.1%], respectively).

When questioned on which App category was more appealing, 39.8% [95%CI: 31.7 - 48.0%] gave preference to dose-calculating applications (dynamic and static calculation apps). The next bigger App preference were Digital Books (21.5% [95%CI: 12.2 - 30.8%]), followed by Applications used for perioperative monitoring (20.3% [95%CI: 11.0 - 29.7%]) and interactive anatomy models (12.6% [95%CI: 2.8 - 22.4%]) (Fig. 5).
Concerning the perioperative care phase in which Applications or Peripherals could be more useful, 71.1% [95%CI: 65.5 - 76.7%] and 57.0% [95%CI: 50.1 - 63.9%], respectively, considered them to have a potential use in all phases of the perioperative care (Fig. 6 and 7).

The categories in which anesthesiologists would like to see development of smartphone peripheral devices are illustrated in Fig. 8.

Discussion

According to data from the Belgian National Institute for Health and Disability Insurance (RIZIV / INAMI), in the beginning of 2016, Belgium had 2441 active anesthesia specialists (certified specialists and trainees) [6]. This sets this survey’s cross-sectional percentage at 14.2% of the total active Belgian anesthesiologists, 13.2% of the certified Belgian anesthesiologists, and 17.5% of the Belgian anesthesiology trainees. Concerning the accredited specialists (diploma-holding), it is however not known if all them are dedicated in exclusivity to anesthesia-related fields such as Intensive care, Emergency department or Pain clinic. It is thus possible that the representability percentage of this survey is different than calculated, although practically very difficult to confirm.

In general, these survey results agree with the findings of Green et al on the American anesthesiologists population: Apps enjoy a significant degree of confidence and believed to have a potential use on all phases of perioperative care [3]. Peripherals also enjoy a high confidence on potential use, rating 57.0% [95%CI: 50.1 - 63.9%] of the responders their confidence as 80% or higher that these can be useful in Anesthesia care. Nine and a half percent [95%CI: 0 - 19.5%] of the surveyees rated Apps’ usefulness in anesthesia as 1 or bellow (on a 0 to 5 scale), and 14.6% [95%CI: 4.9 - 24.3%] gave the same rating when asked about Peripherals. Thus, although there is a comparable optimism for Apps and Peripherals, the latter enjoy a proportionally greater degree of disbelief. The reasons for this discrepancy were not evaluated by this questionnaire, but one can speculate that the underdeveloped regulated market of smartphone peripherals for diagnostic aid is still not firmly established within today’s anesthesia practice. Although the major players have already created a dedicated peripherals market line (for example, Philips Lumify™ portable echography series), convincing of practitioners on their usefulness is still needed. Curiously, when asked on which peripherals they wanted to see developed, 61.7% of the anesthesiologists answered “Echography”. This area is one of the more exploited in terms of smartphone peripherals, and has been explored both by the major players in the medical device industry, as well as by less known competitors. Although not being able to put forward significance numbers, some of the answers on our questionnaire suggested that some of the practitioners did know of the existence of such products but found them economically inaccessible. Other, however, suggested they had no knowledge of such devices. Another possible reason that might contribute to the greater disbelief might relate to the medical use of an originally partially non-medical device. Although it seems logical that controlled CE-labelling (Conformité Européenne) of smartphone peripherals for medical use might help overcome this, the subjective factor cannot be underestimated. Just like heavy, well designed and good fitting over-head headphones feel subconsciously better than in-ear equivalents, traditional anesthesia monitors might still convey more confidence [7].

Another curious pattern observed on the surveyees’ answers was the fact that although 57.0% [95%CI: 50.1 - 63.9%] considered Apps useful in anesthesia (classification of 4 or 5 out of 5), only 45.3% [95%CI: 37.3 - 52.9%] reported actually using them in their daily practice. This gap was even bigger when analyzing smartphone peripherals (47.9% [95%CI: 40.3 - 55.5%], and 3.2% [95%CI: 0 - 13.6%], respectively), although easier to justify considering the underdeveloped smartphone peripherals market.

In line with the study of Green et al, dosage apps (static and dynamic) were chosen by the majority as the most useful [3]. Digital books and perioperative apps followed.
As opposed to the study of Green et al, our group found significant differences between anesthesia trainees and specialists. Although there was a major positivity towards mobile apps in both groups, training anesthesiologists displayed a significantly higher confidence on mobile apps than consultants (72.1% vs 51.6%, respectively). This positivity trend held for smartphone peripherals, although with overlapping 95% confidence intervals. The reasons for this differences can only be speculated on.

These definitely promising technologies are increasingly being introduced in our daily practice and play an important facilitating role. However, one must not forget that these freely available tools are not always subject to formal approval procedures that scientifically validate their clinical use. Most of these are part of the off-label/"use at own risk" category (commonly referred to as “Grey Area Apps”) - applications freely available without formal evaluation of their function for their stated (medical) use [8]. Taking this into mind, the European Union has created between 2016 and 2017 a workgroup for the development of mHealth assessment guidelines [8]. However, the group was not able to endorse concrete guidelines by failure to reach a minimal intra-group consensus [9]. As of this moment, Grey Area Apps remain unregulated. There is, however, a non-binding “privacy code of conduct on mobile health apps” that outlines the core values that should guide mobile health application development [10]. It provides a theoretical competitive advantage against non-conform Applications and speeds up an eventual CE-label request. As for applications aiming for a formal regulated national market entry, compliance with the EU regulation 2017/745 (from 5 April 2017) is mandatory. Together with the EU norm 2017/746, they regulate the European market of medical devices since May 2017. European Union state members fall, thus, under these norms.

It is thus obvious that mobile Applications and Peripherals are quickly permeating all phases of Healthcare, with the right steps are being taken for their scientifically validated integration. Peripherals still lag behind mobile applications although they constitute an economically and clinically important area. Care must still be taken owing the majority of available Apps fall within the unregulated category of “Grey Area Apps”. Last, but not least, care must also be taken to avoid over-reliability/dependency on Apps, with the consequent side-tracking of basic clinical skills.

Conclusions

Belgian Anesthesia practitioners show a significant positive attitude towards smartphone Apps and Peripherals, mirroring international reported trends within other medical sectors. There is evidence of an international recognition of the potential of these technologies within the healthcare domain, with consequently rising regulatory efforts from medical societies and national legislative bodies.

Declarations

1. Ethics approval and consent to participate

The present study was approved by Ethical Committee of the Universitair Ziekenhuis Brussel, Belgium (Reference 2018/435, B.U.N. 143201837927), and registered at the ClinicalTrials.gov database (Identifier: NCT03750084).

2. Consent for publication

Informed consent was obtained from every survey participant.

3. Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
4. Competing Interests
The authors declare that they have no competing interests.

5. Funding
No external funding was obtained for the present study.

6. Author's contributions
HNC and MV contributed to the design and the methods, HNC and MV acquired the data, HNC and MV analysed the data and are responsible for the integrity of the data and the analyses, all the authors contributed to the interpretation, HNC and MV redacted the first draft, reviewed and modified by PF and JP. All the authors approved the final version.

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References


Figures
Figure 1

Subspecialty stacked distribution of responding Anesthesia Specialists (one specialist can be accounted for more than once if he holds multiple subspecialty competences)

Figure 2

Apps (left - blue) vs Peripherals (right - orange) - Confidence level (scale: 0 to 5) ("How confident are you that Smartphone Apps can help improve anesthesia care?" / "How confident are you that combining your smartphone with a dedicated monitoring peripheral can help improve anesthesia care?")
Figure 3

Apps Confidence level (scale: 0 to 5): Specialists (left) vs Trainees (right)

Figure 4

Peripherals Confidence level (scale: 0 to 5): Specialists (left) vs. trainees (right)
Figure 5

Categorization of the most appealing Apps (absolute vote numbers per category) ("Which kind of Apps appeal you the most?")

Figure 6

Phase in which Smartphone Apps can be more useful (n) ("In which phase of perioperative care can Smartphone Apps be more useful?")
Figure 7

Phase in which Smartphone Peripherals can be more useful (n) (“In which phase of perioperative care can Smartphone Peripherals be more useful?”)

Figure 8

Wishes for smartphone peripheral device development per monitoring category (“Which peripherals would you like to see developed in the coming future?”)