

A solution containing 0.05% Lipovenös® appears clear to the eye and therefore it is perfectly possible that our centrifuged emulsions contained approximately 10 mg/dl triglycerides as suggested. Consequently, a part of a “direct lipid effect” may still be present even in the centrifuged emulsions. It should be noted, however, that Nadrowitz *et al.* used Lipofundin® and Intralipid® in their experiments, whereas we used Lipovenös®. Even though Lipofundin® and Lipovenös® contain a similar mixture of triglycerides containing long- and medium-chain fatty acids, presently it is unclear whether the medium-/long-chain fatty acid mixture of Lipofundin® or a different component (that may or may not be present also in Lipovenös®) is responsible for the inhibition of Nav1.5-mediated currents demonstrated by Nadrowitz *et al.* In this regard, it is interesting that although Lipofundin® inhibited Nav1.5-mediated currents, Intralipid® did not. It seems prudent to assume that this is due to differences in lipid content, however, at this point this is a speculation and warrants further exploration.

In our article, to validate the results, we compared the apparent reduction of the bupivacaine concentration as assessed by concentration–response analysis of the patch clamp experiments to the actual reduction of the bupivacaine concentration as assessed by gas chromatography–mass spectrometry. We found that both approaches yielded similar bupivacaine concentrations in the centrifuged lipid emulsions. Consequently, we do not expect that residual triglycerides have significantly affected our results.

Taken together, we do not think that the reasonable concerns raised by Hori *et al.* can explain the “direct lipid effect” as described in our article. Yet, we are grateful for their comment as it clearly points out that the nature of what we have called “direct lipid effect” in our article is, at present, unclear. In fact, it includes every effect that cannot be attributed to the lipid sink. Clearly, we cannot rule out that a part of this effect may be explained by limitations of our experimental approach, but most importantly, more experiments are necessary to explore the nature of this effect.

### Competing Interests

The authors declare no competing interests.

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### References

1. Wagner M, Zausig YA, Ruf S, Rudakova E, Gruber M, Graf BM, Volk T: Lipid rescue reverses the bupivacaine-induced block of the fast  $\text{Na}^+$  current ( $I_{\text{Na}}$ ) in cardiomyocytes of the rat left ventricle. *ANESTHESIOLOGY* 2014; 120:724–36

2. Nadrowitz F, Stoetzer C, Foadi N, Ahrens J, Wegner F, Lampert A, Koppert W, de la Roche J, Leffler A: The distinct effects of lipid emulsions used for “lipid resuscitation” on gating and bupivacaine-induced inhibition of the cardiac sodium channel Nav1.5. *Anesth Analg* 2013; 117:1101–8

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## Healthcare Technology: Is It Cost Efficient?

### To the Editor:

Your editorial titled “From heroism to safe design: leveraging technology,” by Peter J. Pronovost *et al.*,<sup>1</sup> made for interesting reading. The ideas expressed for use of integration of technology to improve patient safety are innovative.

We would like to add a few points:

1. Technology has been described as both part of the problem and part of the solution for safer health care. Healthcare providers can be so focused on data from monitors that they fail to detect potentially important subtle changes in clinical status.<sup>2</sup> If a clinician fails to prescribe a correct narcotic dose and fails to recognize a narcotic overdose, we think there is a lack of clinical acumen.
2. Use of high-end technology in simple clinical decisions would be shunning our responsibility as physicians.
3. Problems may emerge based on the sheer volume and the complexity of new devices.<sup>2</sup>
4. The race for providing healthcare technology is presently market driven dominated by a few multinational companies. There is no focus on making it inexpensive and widely available.<sup>3</sup>
5. Automated patient care systems also face problems of system downtime and data accuracy which further spiral costs of health care.<sup>4</sup>
6. We still have a long way to go till such technology becomes widely available, is used efficiently for patient safety, and becomes truly “productive.”

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The authors declare no competing interests.

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### References

1. Pronovost PJ, Bo-Linn GW, Sapirstein A: From heroism to safe design: Leveraging technology. *ANESTHESIOLOGY* 2014; 120:526–9
2. Powell-Cope G, Nelson AL, Patterson ES: Patient Safety and Quality: An Evidence-based Handbook for Nurses. Rockville, Agency for Healthcare Research and Quality (US), 2008, pp 207–20
3. Kumar RK: Technology and healthcare costs. *Ann Pediatr Cardiol* 2011; 4:84–6

4. Campbell EM, Sittig DF, Guappone KP, Dykstra RH, Ash JS. Overdependence on technology: An unintended adverse consequence of computerized provider order entry. *AMIA Annu Symp Proc* 2007; 11:94–8

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## Safe and Scalable Device Design: A Call for Open Standards

*To the Editor:*

We commend Pronovost *et al.*<sup>1</sup> for their recent comments regarding the paucity of automated and interconnected medical devices to improve patient safety. Although they identify that a big step forward occurred a year ago when technology companies agreed to share patient data with clinicians at the Patient, Safety Science, and Technology Summit, they did not emphasize that a key, although missing, piece preventing the interoperability of devices was a lack of a common digital code or language across all devices.

The history and political economic trajectory of the World Wide Web development from the 1990s provide our industry with a good roadmap to promote interoperability of our medical devices. Many of us would agree that one of the benefits and the power of the World Wide Web lies in that we can access information from different locations, different computers, and different operating systems including Apple, Windows, Linux, and Android *etc.* The strength and utility of the World Wide Web derives from the fact that the network is so vast because of the interoperability of all the different devices into common coding protocols. The fact that all of our Web browsers use the same address prefix (<http://www>) is not an accident—but a common coding agreement. Let us not forget that in the early 1990s, when Jim Clark and Marc Andreessen were developing the Mosaic Web browser (funded by the National Science Foundation), they emphasized a set of open protocols for the Internet, which was promoted by other computer scientists including Tim Berners-Lee, Vint Cerf, and Bob Kahn, to ensure that every system could “talk to each other.” These protocols still exist as some of the universal Internet acronyms such as FTP, HTTP, HTML, SSL, SMTP, POP, and TCP/IP. The private companies followed this trend when Microsoft, International Business Machines (IBM), and other technology companies developed XML (extensible markup language) and SOAP (simple object access protocol)—which, in the words of *New York Times* author Thomas Friedman, flattened the world of Internet technology so that individual companies would stop competing over market dominance of the Internet alone with proprietary code but rather focus on the quality of the products that the consumers used on the Internet itself.<sup>2</sup>

The medical industry needs a similar story to ultimately reach the same level of interoperability and automation of its

devices. However, this needs to be done *via* a joint effort of public policy and private industry. It is not enough for the medical device companies to merely share patient data with clinicians. We need the Food and Drug Administration (FDA) to promote an agreed-upon coding language and a set of “open protocols” for medical devices and electronic medical records before it grants FDA clearance. Once a common coding language or standard emerges, medical devices and records will truly be able to speak to each other. We will then be able to experience realistic “plug-in-play” capabilities within our wards, our operating rooms, and our intensive care units and realize the possibilities of patient safety design that Pronovost *et al.* have kindled in our minds. Such a common standard will also lower the coding barriers for entry into this product market thus allowing entrepreneurial clinicians and researchers to create decision support and data management systems that can be widely integrated in less expensive ways into care across the country. As clinicians, we need to promote this movement by voting with our hospital dollars when we make device purchases and we need to lobby the FDA to promote interoperability with sound public policy regulations to help advocate for the ultimate safety of our patients.

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The authors declare no competing interests.

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### References

1. Pronovost PJ, Bo-Linn GW, Sapirstein A: From heroism to safe design: Leveraging technology. *ANESTHESIOLOGY* 2014; 120:526–9
2. Friedman T: *The World is Flat: A Brief History of the 21st Century*. New York, Picador/Farrar, Straus and Giroux, 2005

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*In Reply:*

We thank Drs. Saluja and Kamdar for their comments on our recent editorial view entitled, “From Heroism to Safe Design: Leveraging Technology” which appeared in the March 2014 issue of *ANESTHESIOLOGY*.<sup>1</sup> We agree that technology has been proposed as a healthcare solution and is also viewed as an impediment to clinical care by many. This dichotomy is typical of an under-engineered system in which technical capabilities exceed the cultural and workflow processes that use the technology. We are not suggesting that technical solutions should or even can replace clinical decision making and acumen. However, the example of narcotics overdose is often used to highlight failures of our current system. The responses of patients to narcotics are highly