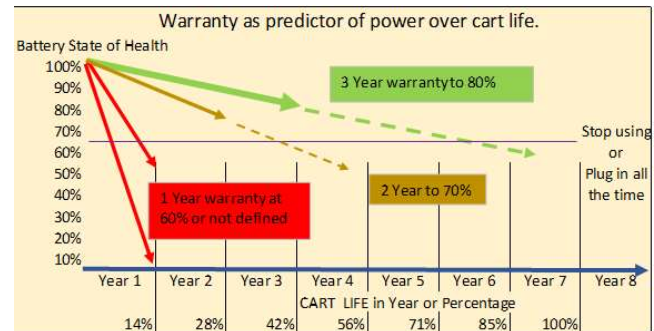


Going digital with new workflow, carts, software, IT on board and batteries is not cheap. Battery power seems relatively unimportant and expensive to those finally making the purchase decision. Yet, software aside, it is the most frequently ¹documented point of failure on Hospital carts.

The focus is all too often just on purchase price from a limited annual budget. So cheaper batteries with a 1-year warranty dominate the market. Such warranties may only cover functionality – or capacity to a low 60% level – at which, a Li-Ion battery is substandard in terms of reliability and safety, the plan-runtime is nearly halved at less than 15% of the carts predicted life!



There are multiple benefits of carts and digitalisation: cost efficiency in nurse time, test logistics and medication costs; improved data accuracy and thus patient outcomes; realtime information for doctors and management; legal clarity; improved cost overview; higher patient satisfaction, and better data for AI. All promise enormous gains, but all depend on documentation at the point of care.

A substandard battery system undermines this, by conditioning nurses to plug the cart in to charge the battery whenever possible. Cart location then changes; efficiency is lost, double documentation returns. This is the picture across many Hospitals worldwide.

Initially many carts used Laptops. But think about your own laptop. After 2 – 3 years, you will have seen that the battery runtime is massively reduced. In fact, you almost certainly plug it in most of the time. A full cycle – running it till empty is rare. Typically, a laptop battery is exposed to very few full cycles in its life. In the hospital scenario, often with a full cycle per day, the laptop battery declines much more rapidly creating high costs. Blaming too little capacity, the market turned to lead acid blocks, then NiMH and then Lithium Ion, without addressing the root cause of substandard batteries.

Many carts now use a 300-600Wh Lithium Phosphate Block battery with an inverter. The inverter will take c 20W per hour, so 240Wh per 12-hour day. Typically, IT applications needs 50W an hour, so 600w per 12-hour day. Total 840Wh. A 500Wh block with a 1-year warranty to 60% can be a 300Wh battery by the end of year 1- the cart still has 6 years to go. You don't need to be a mathematician to understand that this cart will not be fully mobile, it will have to spend most of its life plugged in, with the consequence that the full benefits of digitalisation will not be achieved!

The only power concept that can theoretically avoid plugging in and achieves 12 hours, let alone 24-7 power and thus full mobility is a hot swap system that aims to last the 7-year life of a cart. However, the trend is back to substandard laptop type batteries in All-In-One monitors! Back to the beginning, with the hope that such batteries can now magically survive the Hospital high cycle scenario. Why? Because they are cheap to sell / buy with the single year budget. If no-one cares about failure in year 2,3,4,5,6, & 7 that would be rational! Why is failure on this scale not acceptable for any part of the cart except the power system? It's not! The real issue is misleading sales practices coupled with a lack of awareness across multiple departments, where many decision makers genuinely have no concept of the devastating impact of unreliable and short-lived batteries.

¹ See "All Charged Up- The many challenges of battery maintenance" Martha Vockey, 2014 in Biomedical Instrumentation & Technology. Quotes FDA study: 50% of Hospital service calls are battery related.

The dilemma for the Hospital is to invest considerably more for a quality Hot Swap system, designed to run the cart for its complete life. The initial price will be clearly higher. But analyse the simple Total Cost of Ownership of repeat replacement purchases, and it is cheaper. Factor in all the costs of failure (nurse, admin, maintenance, logistics, disposal - time and costs), and the quality system delivers a significant saving.

But that is just a Power system cost. The real Return on the Hospital's massive investment must consider the impact on the overall digitalisation project. The cost benefit here is enormous. Medical staff costs often account for over half a Hospital budget. There is a shortage of qualified nurses and that is predicted to grow. Nurse time spent on IT is close to 50%. Doctor & Nurse time productivity should be a massive topic.² If a Nurse wastes 5 minutes an hour, walking to and from a plugged-in cart, logging in and out; the extra costs over 7 years of a cart life are over Euro 100,000. This is just a proportion of the potential savings lost. So, to save Euro 1000 - 2000 on a battery system, Hospitals take a massive productivity hit and ensure that the core benefits of going digital are undermined from the outset by opting for a substandard battery system.

Calculate – adjust to your rates. Nurse cost per Hour: Euro 40. 5 minutes lost per hour: $0,083 \times 40 = \text{Euro } 3.33 / \text{hour}$

Cart life in hours:	12 Hour day: $12 \times 365 \times 7 = 30660 \text{ hours}$	$(30660 \times 3.33 = \text{Euro } 102,097.80)$
	24 Hour day: $24 \times 365 \times 7 = 61320 \text{ hours}$	$(61320 \times 3.33 = \text{Euro } 204,195.60)$

Some points to consider.

Back and strain issues – not helped by pushing heavy carts and bending / stretching to plug in and out - represents a major productivity loss with a high percentage of nurses taking time off from work as a result³. Clinical staff may walk 8km a shift and spend hours fetching supplies. Dissatisfaction with time wasted around documentation away from the patient at the point of care is a key reason given for workplace dissatisfaction and the high dropout rates of qualified nurses.

An average European Hospital makes 800 mistakes per day⁴. Patient identification, medication errors, incorrect tests etc. Real time Point of Care documentation – avoiding delayed double documentation is the best method of countering this. Studies⁵ have shown that death rates fall by c 15% when P.o.C documentation is achieved - a massive patient outcome benefit!⁶

Conclusion

Only a fully mobile cart – no plugging in - no downtime for charging – available around the clock at the Point of Care effectively addresses these issues, empowering clinical staff to provide uninterrupted care with more face to face patient interaction. This is a Hot Swap solution!

The relevant pre-selection criteria for the Hospital should be about the impact of the battery system on Productivity, Workflow and Patient outcomes over the whole cart life. The Circadian Hot swap system is the best in class for this. This is all about value delivered and Whole Life Costs and should not just be – as is so frequently the case - about the lowest price available. That mindset forces Cart

² See Harvard Business review, Jan 10, 2019. TECHNOLOGY 3 Ways to Make Electronic Health Records Less Time Consuming for Physicians by Derek A. Haas, John D. Halamka and Michael Suk. "The annual cost of physicians spending half of their time using EHRs is over \$365 billion"

³ Nurses and Back Pain: June 18th, 2012, by Jennifer Olin, BSN, RN. Back injuries to nurses havea lifetime prevalence of 35-80 percent!

⁴ Martin Poppelaars, 2012: www.telecomengine.com/article/critical-condition-medical-device-connectivity

⁵ Archives of Internal medicine, January 2009; "Computers reduce odds of in-hospital deaths". Research by John Hopkins school of Medicine. Similar result in UK study – see MailOnline Oct 4th 2016: "Nurses' poor handwriting and maths is costing lives": Death rate at two hospitals falls 15% when staff were given electronic devices to record information.

⁶ Please contact DCPower4C at info@dcp4c.com for details on any facts and figures in this text.

resellers to offer the lowest cost (poorest performing) cell packs; and the Hospital then endures substandard battery performance, increasing reliability issues, high replacement costs and worst of all will not achieve clinical KPIs central to the Digitalisation project.