Syringes and Sustainability: Planet, People, Profit

The Royal Liverpool and Broadgreen University Hospitals NHS Trust
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Background

Syringes are used in their billions.[2] Individually they may not be an obvious candidate for improving the sustainability of healthcare but collectively they can make contributions to reducing carbon footprints. In this case study we look at reducing green-house gas emissions and material waste by procuring newly released 'green' syringes. We will also look at how new pre-filled syringes can provide cost savings and promote social sustainability by avoiding harm and improving quality of clinical care.

The Setting

The Royal Liverpool and Broadgreen University Hospitals NHS Trust is committed to sustainability, regeneration and corporate citizenship.[3] As a result:

> *Operational and project actions have been consolidated within a comprehensive action plan on sustainability, regeneration and corporate citizenship, including the outcomes of a rapid health impact assessment and an equality impact assessment. (Section 12.1)*

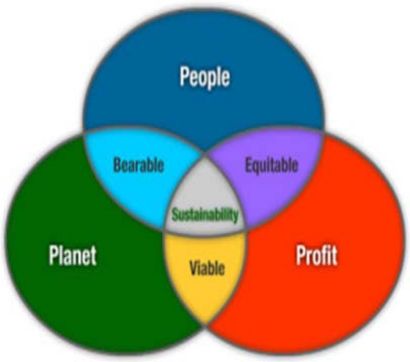
The Trust provides a full range of medical, surgical, diagnostic, rehabilitation and therapy services, to the local population in Liverpool. The Trust consists of 3 hospitals; the Royal Liverpool University Hospital, Broadgreen Hospital and the Liverpool University Dental Hospital.

The Royal Liverpool and Broadgreen University Hospitals NHS Trust is a teaching Trust with established links to both the University of Liverpool and John Moores University. The Trust is one of the largest and most significant employers in the city with over 5,500 staff including staff in service roles such as catering.

[1] With thanks to the Centre for Sustainable Development for editorial advice and to Becton, Dickinson and Company (BD) for providing data.
[2] Medigard, (2013). 8-24 billion, Available at: http://medigard.com.au/medical-device-market and http://answers.google.com/answers/threadview/id/375726.html. (Accessed: 23Aug13).
[3] RLBUHT, (2010), World Class Hospitals, World Class Services, Available at: http://www.rlbuht.nhs.uk/About%20Us/Documents/RLBUHT_Volume%201%20OBC_Apr%2010.pdf

The Model

The procurement of syringes has environmental, social and economic consequences. This is the sustainability triple bottom line: to achieve sustainable healthcare we must consider the effect of medical devices on the planet, people, and profit.



The environmental or planet costs typically are measured in tonnes of carbon dioxide equivalent emissions (tCO_2e). Most if not all healthcare activities expend energy and consequently have a tCO_2e cost. In the case of syringes, the manufacturing, transport, use and disposal of a syringe involves energy and the emission of greenhouse gases which impact on climate change.

Procuring and using a syringe involves more than CO_2e and financial costs. Syringe use affects people, both staff and patients, by exposing them to harm and by preventing or promoting the spread of disease.

Finally, syringes require financial investment which has obvious implications given that budgets are limited in healthcare organisations.

With the sustainability triple bottom line as a backdrop we look at the potential impact on the planet, people and profit of two new 'green' syringe types, namely the

1. BD Emerald, a "Green" Luer Slip Syringe, which we compare to the BD Plastipak, and
2. BD Posiflush, a pre-filled syringe, which we compare to manual preparations

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Note: *We have not compared syringes manufactured by different manufacturers and make no claims about the strengths or weaknesses of one brand over another. Our intent is to identify sustainability issues that should be taken into account when procuring syringes.*

The Planet

Most large organisations, including NHS organisations, are actively trying to reduce their carbon emissions, to become leaner, more efficient and to fulfil legal or reporting

requirements related to the "Government's target of an 80% reduction in carbon emissions by 2050"[4] (*NHS Carbon Reduction Strategy for England, 2009*).

The first stop in assessing the carbon impact of a syringe is to look at its life cycle, starting with the manufacturing process. Ideally an agreed, standardised description of the carbon footprint and other environmental impacts of a medical device would be provided by the manufacturer. BD, for example, which markets the Emerald explicitly as a 'green' syringe, cites the use of non-toxic materials and sustainable manufacturing practices such as wind power. Recently, in October 2012 BD was awarded the prestigious WindMade Label for BD's global operations. The WindMade label (*figure 1*) is;

"…backed by the UN Global Compact and conservation group WWF, that requires participating companies to obtain at least 25% of their electricity from wind power. BD, however, procures as much as 35% of its total electricity consumption from wind power"[5].

Figure 1, WindMade Label Illustration

BD reports that at the plant manufacturing the BD Emerald (in Fraga, Spain), 100% of the electricity used is from renewable sources and the quality management system in place is in accordance with ISO 14001:2004, which specifies requirements for an environmental management system. In addition, as result of implementation of sustainable manufacturing practices, from 2008-2010, annual electricity consumption in the Fraga plant decreased by 4.7 million kWh and annual water consumption in the plant decreased by 33.5 million liters. (see http://www.bd.com/sustainability/2012/ for more information on BD's sustainability initiatives).

Although it is difficult to apportion energy and material use to different products, it would be helpful to those making purchasing decisions to have environmental impact ratings at the level of the individual item.

One factor distinguishing one type of syringe from another is the amount of plastic used.

[4] Sustainable Development Unit, (2009), NHS Carbon Reduction Strategy for England. Available at: http://www.sdu.nhs.uk/documents/publications/1237308334_qylG_saving_carbon,_improving_health_nhs_carbon_reducti.pdf. Accessed: 23Aug13.

[5] WindMade, (2012), WindMade Label Awarded to BD for Global Operations, http://www.windmade.org/news/press-releases/windmade-label-awarded-to-bd-for-global-operations.aspx, (Accessed; 23Aug13)

The Royal Liverpool and Broadgreen University Hospitals NHS Trust is on target to procure 1,182,270 syringes in 2013. To estimate the carbon emissions resulting from manufacturing and moulding the plastic used in these syringes, we calculated the size mix (see Table 1). Knowing the number of syringes used and the weight of plastic in each syringe allows estimating the CO_2e emissions for the two types of syringe[6]. For example, the 'business as usual' production of BD Plastipak syringes given our assumptions is about 24 tonnes of CO_2e per year for the plastic alone. Switching from Plastipak to Emerald syringes would save about 21% or almost 5 tonnes of CO_2e per year.[7]

Table 1. Syringe size mix
Number of syringes: 1,182,270

	Syringe		
	2ml	5ml	10ml
Size Mix	14%	27%	58%

The same percentage savings would apply to other weight-based activities, such as transportation and disposal. For example, waste disposal costs currently stand at £450 per tonne which amounts to a total of £3,269 per year. A 21% reduction in waste disposal could be achieved by switching to low-plastic syringes, saving £682.

Table 2. CO_2e Emissions (kg)**				**Total**
	2ml	5ml	10ml	
Emerald	1,294	4,003	13,566	18,863
Plastipak	2,140	4,962	16,735	23,838
Savings				4,974

**Based on DEFRA conversion factor of 3,281 kg/tonne

Pre-filled flush syringes

Pre-filled saline syringes are specifically designed for flushing vascular access devices. Designed for a specific purpose they combine several steps in the manual preparation of a saline-filled syringe and thereby save materials, as shown in Table 3 and Figures 2-3.

Figures 2-3, Materials used in manual saline preparation and administration (left) and materials used in pre-filled saline preparation and administration (right).

[6] Defra, (2013). Based on 7265 kgs vs 5749 kgs plastic for Plastipak and Emerald respectively and DEFRA plastic to CO2e conversion factor of 3281 kg/tonne. Available at: http://www.defra.gov.uk/. (Accessed: 23Aug13).
[7] Environment Agency, (2012), CRC Performance League Table. Available at: http://crc.environment-agency.gov.uk/pplt/web/plt/public/2011-12/CRCPerformanceLeagueTable20112012. Accessed: 23Aug13.

The Royal Liverpool and Broadgreen University Hospitals NHS Trust uses around 411,000 pre-filled syringes each year. Although we have not estimated the CO_2e savings that could be achieved by converting to pre-filled saline syringes, it is clear that 411,000 fewer ampoules, preparation needles, alcohol swabs and other materials will make significant contributions to reductions in carbon footprint.

Table 3. Materials used in manual and prefilled saline preparation and administration

Manual	Pre-filled
- Ampoule - Alcohol swap - Steret swab - 10ml Hypodermic Syringe - Blunt drawing up needle - Gloves x2 pairs - Syringe Label - Syringe tip cover	- Pre-filled syringe - Steret swab - Gloves

People

When considering materials, CO_2e emissions and finances, it is easy to overlook the effects of medical devices on the people needing to use them.

Pre-filled syringes, for example, reduce the number of steps needed to perform a saline flush procedure from 14 to 6, saving time and seemingly increasing both staff and patient confidence.[8]

Pre-filled syringes also eliminate the use of preparation needles and help to reduce the risk of injuries caused by needles - one of the most common and serious risks to healthcare workers. Pre-filled syringes also help to comply with the EU Council Directive 2010/32/EU on the Prevention from Sharp Injuries in the Hospital and Healthcare sector which as of May 2013 has now been incorporated into health and safety law in Great Britain[9].

Similarly, the simplified preparation reduces the likelihood of breaks in aseptic technique and eliminates the potential for multi-dose cross contamination. In 2011, the prevalence rate of healthcare associated infections in hospitals in England was 6.4%[10]. Contamination of saline flushes contributes to healthcare acquired hospital infections which in turn impacts the welfare of both staff and patients.

[8] House of Commons Public Accounts Committee (2009). Reducing Healthcare Associated Infection in Hospitals in England.
[9] HSE, 2013, Health and Safety (Sharps Instruments in Healthcare) Regulations 2013. Available at: http://www.hse.gov.uk/healthservices/needlesticks/eu-directive.htm. Accessed: 23Aug13.
[10] Public Health England, 2013, HCAI and Antimicrobial Point Prevalence Survey. Available at: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/HCAI/HCAIPointPrevalenceSurvey/. Accessed: 23Aug13.

Profit: Cost and Cost-Benefit

Less material used translates to cost savings where, in Europe, commercial costs of the BD Emerald are around 20% less than the equivalent Plastipak syringe. It is important to note however that price comparisons are always difficult to estimate because they vary from one healthcare system to the next and depend to a large extent on negotiations with suppliers. Nonetheless, syringes using less material should cost less than standard syringes.

Conclusion

The Royal Liverpool and Broadgreen University Hospitals NHS Trust is committed to improving the sustainability of the healthcare it delivers. Procurement of syringes offers a classic example of sustainability's triple bottom line. Reducing materials use, avoiding toxic materials, and using renewable energy all contribute to sustainability of the planet. By increasing safety while reducing the complexity of procedures the impact on people is recognised. Finally by reducing primary costs, preventing contamination and reducing secondary costs of hospital stays, economic sustainability can be achieved.