

Healthcare waste management – 25 years on – what have we learned?

Edward Krisiunas

WNWN International, Connecticut, USA

doi: 10.3396/IJIC.v10i1.002.14

Abstract

Health Care Waste (HCW) – just one of the numerous terms used to describe the wide range of waste streams emanating from any health care facility in the world. In fact, this waste can also be generated in non-traditional settings such as the home (diabetic self-injectors), tattoo and body piercing parlors, and pharmacies where some immunizations are administered. We are a society that generates waste streams that fall into many categories. We also know that how waste is managed around the world varies. HCW is no exception. Management of the infectious portion of the HCW stream has posed interesting challenges in the past 25 years. What are those challenges and what have we learned?

Keywords: Medical Waste Disposal, Medical Waste, Needlestick Injuries

How did we arrive here?

Management of waste emanating from any health care provider gained more interest due to a combination of events that one can say engulfed the world. Part of this interest started with the introduction of disposable items around the early '60s.¹ Note that the use of single use items such as syringes, drapes and gloves gained acceptance based upon the financial ability for countries to afford such products. The increased interest in waste disposal in general and its impact on the environment and public health took on a

life of its own during the '60s and 70s with the eventual development of various conventions, acts and legislation of varying degrees to address the poor management that was taking place in not only poor countries but high income countries as well. The Stockholm Convention² addresses air emissions to the environment. The Basel Convention³ address the issue of illegal dumping of hazardous waste in poor countries. The British government lifted Crown Immunity⁴ from health care facilities relative to their impact on the environment through such activities as

Corresponding Author

Edward Krisiunas

WNWN International, PO Box 1164, Burlington, Connecticut, 06013 USA

Email: ekrisiunas@wnwnintl.com

poor incineration practices of waste generated in NHS hospitals. In the US, the USEPA developed Infectious Waste Management Guidelines (1986)⁵ to fill a gap that had been created when the Resource Conservation and Recovery Act (RCRA) was enacted in 1976.⁶

Serious interest takes off

Serious interest in HCW, specifically the infectious portion of that waste stream began over 25 years ago with beach wash ups of syringes, tubes of blood and other items in various parts of the world.⁷ While hospitals had been managing certain waste streams in a careful manner; laboratory waste such as microbiological culture plates and slants and tube of blood which were often treated by autoclaving, and tissue and body parts treated via on site incineration or cremation, the tide of interest clearly changed during the 1980s as a result of the public being exposed to news via any source of media at the time of Acquired Immune Deficiency Syndrome (AIDS).⁸ This heightened awareness as well as a new found disease spread via sex, IV drug use and in health care settings, by contact with blood and or body fluids changed the landscape of waste management for years to come.

Although transmission of other blood borne diseases such as Hepatitis B virus and Non-A, Non-B virus was clearly understood for some time, we had reached a point in society around the world where the dissemination of news, using what current information technology was available at the time and how it was interpreted by the lay community gave rise to a perception that much of the waste generated from health care facilities was dangerous. The public perceived it was more dangerous because they saw health care workers wearing protective equipment to minimize their exposure to patients with AIDS as well as other infectious diseases. Even on the pitch/field of a football/soccer match, medics were now wearing gloves to deal with any injury where exposure to blood was possible. Any degree of contamination was deemed a high risk in some quarters. Perception gave way to reality and a new industry was borne to address all the risk (perceived as well as real) from the waste generated from these activities. The '90s saw the development of more legislation and guidance documents including the publication of the well-known "Blue Book" from WHO otherwise known as "Management of Waste from Health Care Activities".⁹

The Conundrum of Definitions

Throughout the world, various terms have been used to define all the waste coming from a health care facility such as: Medical Waste, Clinical Waste, and now today Health Care waste. A debate even exists between the terms "health care" and "healthcare."

Infectious Health Care Waste*

While one can find a different waste stream for every letter of the alphabet with some having the potential to great impact on the environment such as heavy metals (lead and mercury), Infectious Health Care Waste (HCW) gained centre stage for some of the reasons mentioned above. This waste stream can include but is not limited to:

- Microbiological waste – culture and stocks from microbiology labs /items used for the manipulation of organisms
- Blood and body fluids – units of blood and blood products, large volumes of blood and body fluids collected from surgery, items grossly soiled with blood and body fluids
- Sharps – needles, syringes, scalpel blades, suture needles, tubes of blood (glass), items that can cause percutaneous injury
- Pathological waste – Tissue, body parts, organs, removed during surgery or autopsy

(*Comprises approximately 15% of the total waste stream in a health care setting¹⁰)

Not a Public Health Risk – Context!

The US government in 1992 issued a report from the Agency for Toxic Substances and Disease Registry (ATSDR)¹¹ that concluded HCW (Regulated Medical Waste in US terminology) was not a public health issue. However, exposures could occur to health care workers as a result of dealing with items such as sharps, blood, and laboratory waste. Waste workers were also at risk as they were likely handling HCW containers. The ATSDR report was written in the context of a high income country where in fact resources for collection and management of these waste streams were plentiful and waste disposal facilities were well controlled. Exposure did occur, primarily sharps injuries.¹² In the late '90s, a HCW treatment plant in Washington State gained notoriety for a large number of employees being exposed to *Mycobacterium tuberculosis*.¹³ Conversely,

in low to middle income countries, items such as sharps bins, proper coloured coded bags for collection and separation of waste and other bins were neither affordable nor available. Additionally, waste was being discarded on the grounds of some health care facilities in open pits, destroyed by open burning or taken off site for disposal in uncontrolled dumps sites where scavenging for medical products occurred. Clearly the risks, both for the public and health care workers, and the environment varied around the world.

During these past 25 years, a plethora of guidance, recommendations, policies and regulations have been introduced, with varying degrees of success. Additionally, a wide range of products for waste management were also introduced. They are described in some detail below.

Sharps bins

Basically nonexistent until the late '70s and early '80s, there are now a wide range of colours and capacities, most being single use that are available to collect items considered sharps – needles and syringes, scalpel blades, suture needles, glass tubes of blood. In some instances large single use surgical instruments are discarded in large capacity containers (40 to 60 litres). In areas where large quantities of containers are not available, staff has learned to use needle removers (the needle falls into the bin) and discard the syringe into a waste collection bin lined with an appropriately coloured bag (often red or yellow). The World Health Organization (WHO) has also been instrumental in developing standards for cardboard boxes that are procured at a low cost for use in low income countries. A major gap in sharps containment has been filled. The Safe Injection Global Networked (SIGN)¹⁴ was also instrumental in pushing the use of sharps bins for immunisation campaigns.

Safe needle devices

The introduction of safe needle devices has clearly contributed to the reduction in sharps injuries. However, these items still remain costly for low income countries although the introduction of Auto-Disable (AD) syringes has improved vaccine delivery as well as reduced reuse of the devices. Secondly, some safety features, when activated, actually increase the volume of waste being generating, basically increasing the

number of sharps bins being used. In the US, vacutainer holders are to be used only once and discarded due to potential contamination risks to staff.

Fluid Management

As with the development of sharps bins, there have been improvements in the management of larger volumes of blood and body fluids especially when generated during surgery. Various sizes of suction collection containers made from plastics have been widely introduced and used. Additionally, mechanical fluid collection equipment has been introduced in theatres as a way of managing very large volumes of blood/lavage (>20,000 cc).¹⁵ Containers used to collect urine and faeces have been developed from pulp are used once and discarded into equipment that will macerate the container so that it may flow easily through a sewer system. Reusable metal bed pans are still in place as well as disposal plastic products. Low income countries are still unable to afford some of these single use devices and continue to use a variety of older methods including glass collection bottles that will need to be decontaminated between uses.

Treatment technologies

Over the years, waste has generally been managed by basically two methods – burial or incineration. Due to concerns of infectivity and physical hazards (sharps), some jurisdictions have developed standards requiring treatment of such waste. Incineration, while a common technology for many years, has fallen out of favour due to the high cost of achieving environmental compliance. Where regulations and oversight are not strict, incineration remains the technology of choice. In jurisdictions where it is not, non-burn or Alternative Treatment Technologies (ATT)¹⁶ has replaced incineration. The most common ATT is autoclaving that uses steam to treat waste. It is used mainly due to a long history of use in health care. Other technologies include the use of microwaves or friction to heat waste after maceration or shredding to be treated. Chemicals are also used in some applications. No technology is perfect. Even well operated and designed incinerators will still be a source of air pollution albeit the concentration of pollutants may be reduced. Operators of autoclaves must address density and load configuration when processing waste. Technologies with a maceration or shredding process that is part of

the treatment cycle must be vigilant to ensure large metal objects are not introduced into the process as it may cause severe damage to the equipment and cause the operation to cease.

In low income countries, health care facilities may still discard untreated items into open dumps, potentially creating a risk for scavengers. In some instances, scavengers have recovered used syringes and needles, found a source willing to clean and repackage them and sell to unsuspecting users. Open burning also occurs. Some efforts have been made to provide these health care facilities with low cost options such as incinerators or pressure cookers/autoclaves to treat such waste before disposal. A multi-year, multi country project that was conducted by the UN Global Environmental Fund Med Waste project addressing HCW management in a number of low to middle income countries has just been concluded. Information can be found at <http://gefmedwaste.org/>.

Recycling / Reprocessing

The dynamics of recycling and reprocessing have carried over to the HCW management but in slightly different form of progression. Whereas limited resource countries had learned to manage limited supplies and were reprocessing items such as glass syringes and needles, the introduction of single use devices in high income countries filled endless numbers of waste containers. Initially, receptacles for HCW included anything generated in patient care areas. Health care facilities in these high income countries soon realized the need to police waste bins. Staff was trained to discard clean packaging in different containers versus items soaked with blood and body fluids. In the '90s, the seeds were sown to begin to recover and recycle these clean items such as surgical wrap (blue wrap), plastic bottles, glass etc. Organizations began looking at purchasing practices and soon a green movement¹⁷ was born in health care and has been evolving ever since. Concurrently, low and limited resource countries were beginning to also see the introduction of single use products. Some items were discarded after that single use just like their compatriots would in high income countries. However, some facilities learned there could be a market for decontaminated material for recycling. There is clear evidence as well that some of these waste streams, such as syringes

and needles, would be cleaned and repackaged and sold to unsuspecting individuals. There have been documented cases of Hepatitis B outbreaks as a result of these practices.

The interest in recycling has also carried over to the reprocessing side of single use medical devices. This remains a contentious issue as some countries have clearly embraced the process while other have shunned it due to patient safety concerns. None the less, the area of recycling and reprocessing of HCW is something more health care facilities are embracing around the world.

Summary: What have we really learned?

Twenty five years on we have learned there can be a wide range of HCW generated in health care facilities. Public perception then and now still drives certain waste management practices that leads to over classification of waste. Industry has clearly developed products and services to address the collection and management of these waste streams and to reduce costs. Much has been produced in the way of guidance, policy, and regulation. Whereas high income countries have begun to better manage and reduce their waste volumes following the concepts of the waste management hierarchy scheme, low income countries still have financial constraints that may not allow them to have the most appropriate tools and methods for dealing with HCW. Risks also appear to be greater in the lower income countries although some practices in high income countries are now being scrutinized as well. Success stories do abound across the continents and health care facilities should avail themselves of this information and determine what can work for them to reduce their impact on the environment.

Conflict of interest: None.

Funding: None.

References

- 1 Rutter R. Disposable hospital devices gain. The New York Times. February 5, 1961. Purchased archive article.
- 2 Stockholm Convention. http://en.wikipedia.org/wiki/Stockholm_Convention_on_Persistent_Organic_Pollutants [Accessed April 5, 2014]
- 3 Basel Convention. <http://www.basel.int/Home/tabid/2202/mctl/ViewDetails/EventModID/8295/EventID/443/xmid/8052/Default.aspx> [Accessed April 5, 2014]

- 4 Dobson F. Commons Sitting of 9 June 1986 Series 6 Vol. 99. http://hansard.millbanksystems.com/commons/1986/jun/09/lifting-of-all-crown-immunity#column_26 [Accessed March 10 2014]
- 5 EPA Guide to Infectious Waste Management. 1986. <http://nepis.epa.gov/Exe/ZyNET.exe/2000E1HP.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C86thru90%5CTxt%5C00000000%5C2000E1HP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL> [Accessed March 1, 2014].
- 6 RCRA. <http://www.epa.gov/solidwaste/inforesources/online/index.htm> [Accessed March 1, 2014].
- 7 Practice Green Health. <https://practicegreenhealth.org/topics/waste/waste-categories-types/regulated-medical-waste> [Accessed March 1, 2014].
- 8 CDC. Pneumocystis pneumonia - Los Angeles. MMWR 1981; 30(21): 1-3.
- 9 Pruss A, Giroult E, Rushbrook P. Management of waste from health-care activities <http://whqlibdoc.who.int/publications/9241545259.pdf> [Accessed March 1, 2014].
- 10 Characterizing Medical Waste. USEPA. <http://www.epa.gov/osw/nonhaz/industrial/medical/mwpdfs/rx/ch1.pdf> [Accessed March 2, 2014].
- 11 CDC. Summary of the agency for Toxic Substances and Disease Registry report to Congress: the Public Health implications of medical waste. MMWR 1990; 39(45): 822-824.
- 12 Preventing needlestick injuries in health care settings NIOSH Alert <http://www.cdc.gov/niosh/docs/2000-108/pdfs/2000-108.pdf> [Accessed March 8, 2014].
- 13 Johnson KR, Braden CR, Cairns KL, *et al.* Transmission of *Mycobacterium tuberculosis* from medical waste. JAMA 2000; 284(13): 1683-1688. [http://dx.doi.org/10.1001/jama.284\(13\):1683](http://dx.doi.org/10.1001/jama.284(13):1683)
- 14 Safe Injection Global Network. http://www.who.int/medical_devices/collaborations/network/en/ [Accessed March 2, 2014].
- 15 Surgical Products. <http://www.surgicalproductsmag.com/product-categories/safety/fluid-waste-management-products> [Accessed March 19, 2014].
- 16 Pruss A, Giroult E, Rushbrook P. Management of waste from health-care activities. Second edition <http://noharm-global.org/articles/news/global/new-who-handbook-healthcare-waste-management> [Accessed April 5, 2014].
- 17 Health care without harm. <http://noharm.org> [Accessed April 5 2014].