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Review

International governance structures for health-care waste management: A systematic review of scientific literature

M. Caniato [a, *], T. Tudor [b], M. Vaccari [a]

[a] Research Laboratory on Appropriate Technologies for Environmental Management in Resource-Limited Countries (CeTAmb LAB), University of Brescia, Brescia, Italy
[b] Centre for Sustainable Waste Management, School of Science and Technology, University of Northampton, Northampton, UK

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ABSTRACT

Significant differences exist in the management of health-care waste management, globally. This is particularly so between low, middle and high-income countries. A systematic review of scientific literature on global healthcare waste management spanning the period 2000 – current was undertaken, in order to identify key policies, practices, challenges and best practice. The findings were analysed considering the Gross National Income and the Human Development Index of each country. Effective regulation and operative definitions of waste categories are key-factors requiring improvement at the national level. The economic conditions in the country are an important factor, especially regarding treatment and disposal. Areas for improvement (e.g. the need for improved governance structures, the development of regional clusters, as well as sharps waste segregation) are suggested.

1. Introduction

During the last 15 years several efforts have been dedicated to improving the governance structures and policies for health-care waste management (HCWM), and to identify and disseminate appropriate practices at the local, national and international levels (Pruss-Ustun et al., 2013; de Titto et al., 2012; UNEP/SBC and WHO, 2004). Policy and regulatory issues are often key weaknesses in the governance structures, particularly in low- and middle-income countries (LMICs), and require support for institutional strengthening and capacity building (Tudor, 2012; Shannon and Woolridge, 2011; Wilson, 2007). Several health-care facilities (HCFs) in LMICs do not properly manage their HCW, and in particular, infectious and hazardous waste are frequently not effectively segregated (de Titto et al., 2012). Indeed, a legal and regulatory framework, which sets the standards to apply and, in particular, gives operative definitions, including of the different HCW categories, is the first step of a national strategy to improve HCWM (UNEP/SBC and WHO, 2004). This framework is extremely important because the appropriateness of HCWM can be evaluated only according to its compliance with regulation.

HCWM practices vary greatly from country to country, according to various factors such as socio-economic conditions, regulation, level of education, available resources, treatment technologies, and the capacity to monitor and best manage inadequate practices (Shannon and Woolridge, 2011). A key aspect is that HCWM terminology at the international level varies greatly. For example, the waste generated by all the HCFs, research centres, laboratories, and scattered sources is defined 'health-care waste' by WHO (Pruss-Ustun et al., 2013, p. 3). The U.S. EPA (2012) uses the term 'hospital waste', with 'medical waste' indicating only the hazardous component. In addition, 'regulated medical waste' is used instead of 'infectious waste', to underline both the possibility of infection transmission, and the application of a specific regulation. The International Committee of the Red Cross (ICRC) uses the term 'medical waste' with a definition similar to HCW (ICRC, 2011, p. 12). Meanwhile the Secretariat of the Basel Convention employs the term 'biomedical and health-care waste' (SBC and UNEP, 2003, p. 4). 'Clinical waste' is used in United Kingdom (UK) to indicate

Abbreviations: GNI, gross national income; HCF, health-care facility; HCWM, health-care waste management; HDI, human development index; LMIC, low- and middle-income country.

* Corresponding author. Via Branze 43, 25123 Brescia, Italy.
E-mail address: marcocaniato@gmail.com (M. Caniato).

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hazardous health-care waste (DH, 2013). EU directives use none of the previous definitions, but list wastes with a short description including either their characteristics or origin (European Commision, 2000).

This variation in terminology leads to significant issues and often confusion (Hossain et al., 2011). For example, the WHO's definition of 'infectious waste' is subjective, as it refers to the potential to be infectious (Pruss-Ustun et al., 2013, p. 4), which could be interpreted differently according to national circumstances, policies and regulations (SBC and UNEP, 2003).

International guidelines and manuals can be applied to develop local structures and standards (Rushbrook and Zghondi, 2005). The WHO's 'Blue Book' represents an important guidance document, particularly for LMICs (Pruss-Ustun et al., 2013). It introduces standards accepted worldwide and integrates the approaches suggested by key international agencies, such as the Secretariats of the Basel, the Stockholm, and the Aarhus Conventions (SBC and UNEP, 2011; SSC and UNEP, 2009; SSC and UNEP, 2007; SBC and UNEP, 2003; UNECE, 1998), WHO and the World Bank (e.g. WHO and UNEP/SBC, 2011; WHO, 2007; Rushbrook and Zghondi, 2005; WHO, 2005; WHO, 2004; Zghondi, 2002; Johannessen et al., 2000; Rushbrook et al., 2000; Pruss and Townend, 1998).

However, a holistic understanding of HCWM practices at the global and indeed in some cases national level is often limited (Hossain et al., 2011; Tudor, 2012; Pruss-Ustun et al., 2013). Thus a determination of how best to enhance governance structures for HCWM, particularly at the global level requires a stronger evidence-base upon which to develop strategies.

This paper aims to systematically review the scientific literature of the last 15 years, in order to assess HCWM worldwide, and identify gaps, best practice and opportunities for improvement, particularly within LMICs.

2. Methodology

The systematic review (Jesson and Lacey, 2006) identified articles in English on Scopus database with the terms 'hospital/medical/clinical/healthcare waste management', in the title or key words, published since 2000. This period of 15 years was chosen in order to any trends to be identified, as well as to have an acceptable number of papers, in particular about countries where publications in international scientific journals are limited. Moreover, 2000 is the first year after the publication of the first edition of the 'Blue Book', considered a milestone for the HCWM improvement worldwide (Pruss-Ustun et al., 2013). Articles of limited specific reference to the topic (e.g. dealing with wastewater, very specific waste categories, only treatment technologies, or providing little contribution because they were too generic) were eliminated. Papers focussing on countries that are generally poorly represented in the literature, especially LMICs, were a key focus. Thus the review analysed in particular papers from Africa, Asia, Middle East, and Latin America, with some papers about Europe, North America and Oceania. A total of 150 papers were reviewed. All the papers considered are reported in Appendix 1, divided according to the country they refer to, and the coverage of the studies analysed. Papers dealing with the topic worldwide were limited and often not very recent.

2.1. Evaluation of health-care waste management in a specific country

Each country was first attributed a score according to the World Bank classification of national economies (The World Bank, 2014b). Taiwan and Somaliland that were not present in the World Bank classification, were considered high- and low-income countries respectively. Generally LMICs (i.e. countries with low, lower middle

Table 1
Description of all the HCWM aspects taken into consideration, and the classes adopted for the evaluation.

HCWM aspect	Description	Classes
Country income group	Indicates the country's economy in 2012, in terms of gross national income (GNI), according to The World Bank (2014a).	4 classes: • 1 – High-income: GNI ≥ $ 12,616; • 2 – Upper middle-income: GNI = $ 4,086–$ 12,615; • 3 – Lower middle-income: GNI = $ 1,036–$ 4,085; • 4 – Low-income: GNI ≤ $ 1,035.
Country coverage by studies	Indicates if the papers considered give a representative picture of the whole country, or only a part of it.	2 classes: • Total; • Partial.
Level of national regulation	Indicates the completeness of the legislative framework against international standards.	4 classes: • 1: Complete and detailed, in accordance with international standards; • 2: Present, but improvements are required to meet international standards; • 3: Completely or almost completely missing; • N.A.: Information is not available or not clear.
Level of procedures at the HCF level	Indicates the quality of procedures in terms of completeness (covering all the possible cases), clearness to the staff (including being in written form), and applicability (customised to the HCF).	5 classes: • 1: HCWM practices comply with national/international standards in all the HCFs across the country; • 2: HCWM practices comply with national/international standards in almost all the HCFs, apart few cases; • 3: HCWM practices comply with national/international standards in few HCFs, while in the majority they do not; • 4: HCWM practices do not comply with national/international standards in almost all the HCFs; • N.A.: information is not available or not clear.
Level of awareness/training of HCF staff	Indicates what HCF staff know about hazards related to HCWM, internal procedures, and any other eventual indication.	
Level of personal protective equipment	Indicates the use of appropriate equipment, in particular for waste collection, internal transport, and handling in general.	
Level of segregation of sharps	Indicates if the sharps are safely and completely segregated, following all the precautions required.	
Level of segregation of other HCW	Indicates if the other HCW categories are segregated according to the standards.	
Level of HCW storage at the HCF level	Indicates if the wastes are safely stored (appropriate location in an appropriate way) for a suitable time.	
Level of treatment and disposal	Indicates if the waste produced by HCFs is safely treated for both human health and the environment, including the final disposal of by-products or residues.	