

# Safe and sustainable waste management of self care products

A safe and sustainable waste management system for self care products requires education and multisectoral approaches say **Ash Pachauri and colleagues**

**T**he global growth rate of self care medical devices is estimated to rise from \$10.5bn (£8bn, €9.2bn) in 2013 to \$16.8bn in 2019—a compound annual growth rate of 7.0%.<sup>1</sup> This increase directly correlates with the level of disposables entering the waste stream. Additionally, over half of the world's population is now at risk from occupational, environmental, or public health threats due to improper management of healthcare waste.<sup>2</sup> Waste management of products used for self care is largely unregulated and evidence is limited.

The World Health Organization defines self care as the “ability of individuals, families, and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a healthcare provider.”<sup>3</sup> Self care products include a variety of sexual and reproductive health commodities such as condoms, tampons, sanitary pads, and self administered injectables. An analysis of these commodities shows the magnitude of waste management challenges facing individuals, communities, and governments worldwide.

## KEY MESSAGES

- Self care will continue to grow, especially as it is seen as key to reaching universal health coverage by 2030, as part of the sustainable development goals
- Research is needed to clearly understand the effect of unregulated waste from self care products on human health and the environment
- National policies and regulatory frameworks are urgently required to enable the adoption of safe waste management techniques and the development of efficient production methods
- Safe and sustainable self care product waste management necessitates the development of cross sectoral partnerships and action by all players in the system

## Magnitude of the problem

The magnitude of waste arising from self care products depends on the amount of user generated and segregated waste and the quality of treatment and disposal by the wider waste management system. In the case of condoms, most for men and some for women are made of rubber latex, which is biodegradable, except in water.<sup>4</sup> Some condoms contain polyurethane, which is non-biodegradable.<sup>4</sup> Their primary and secondary packaging also adds to the waste burden. An estimated five billion packets of condoms are sold annually,<sup>5,6</sup> which contribute to beach litter, blockage of sewage systems, and breeding of vectors.<sup>7</sup> In 2013, during the New Jersey beach clean-up, volunteers removed 744 condoms or rubber bands, 511 gloves, and 3102 tampon applicators.<sup>8</sup>

Condoms are a critical, cost effective method of contraception when used correctly. Their continued availability remains important for reducing mortality and morbidity, but social marketing interventions hardly mention proper disposal, although they have the potential to do so.

Women who have access to menstrual hygiene products might use up to 10 000–12 000 during their lifetime.<sup>9</sup> Sanitary pads consist of up to 90% plastic and take around 500–800 years to biodegrade.<sup>9</sup> One sanitary pad may contain as much plastic as four supermarket bags.<sup>10</sup> This causes problems for waste management worldwide. In 2016, the British Marine Conservation Society found 20 sanitary items per 100 metres of shoreline.<sup>11</sup> The Menstrual Health Alliance estimates that 9000 tons of sanitary waste are generated annually in India.<sup>12</sup> Typically, this is disposed of with household waste. Disposal is often improperly managed by local authorities, with sanitary products ending up in the oceans and waterways.<sup>12</sup>

For many women and girls, disposable sanitary pads and tampons remain inaccessible or unaffordable.<sup>13</sup> Menstrual Hygiene Day, initiated by the German based non-governmental organisation WASH United, builds awareness,

particularly through social media, about the fundamental role of good menstrual hygiene in enabling women and girls to reach their full potential.<sup>13</sup> The initiative catalyses a global movement to promote safe disposal of these items through reduction, segregation, and treatment.<sup>14</sup>

The transmission rates of bloodborne viruses from patient to healthcare worker are up to 30% for hepatitis B (HBV), 1–3% for hepatitis C (HCV), and 0.3% for HIV due to improperly disposed sharps. These numbers may not result from inoculation of fresh blood as the viruses survive outside the body for varying lengths of time, from four days to three weeks.<sup>15,16</sup> In 2010, unsafe injections from re-use were responsible for 33 800 new HIV, 1.7 million HBV, and 315 000 HCV infections globally.<sup>17</sup> A study of 141 rubbish collectors in Karachi reported the prevalence of HBV as 18.8%, HCV 8.5%, and HIV 0.85%,<sup>18</sup> with baseline prevalence rates of 2.5%, 5%, and 0.1%, respectively, among adult populations in Pakistan.<sup>19,20</sup> In the same study it was found that 54% of them had had more than one needlestick injury. Self injection of contraceptives is expected to be increasingly available. This requires cross-sectoral partnerships and guidance for better manufacturing, distribution, and disposal of sharps.

## Implications of unregulated waste from self care products

Unregulated, and even regulated, improper waste disposal is not unique to self care products. Inappropriate waste burial may cause leaching of toxins and microorganisms into waterways,<sup>21</sup> incineration increases greenhouse gas emissions, and dioxins and furans have been associated with a wide range of human health problems.<sup>21</sup> Plastics, commonly used for packaging, break down into microscopic fragments (microplastics),<sup>22</sup> which are being ingested by people worldwide. However, little is known about their effect on human health and ecology.<sup>22</sup>

Access to good quality products when needed forms part of the right to healthcare. As we reduce dependence on hospitals

and enhance our reliance on community based systems, and self management, waste disposal of self care products will rise substantially. This adds a sense of urgency, as the need for such products is sometimes coupled with unregulated waste management. Economic and social inequities exacerbate the problem, with the poorest, most vulnerable populations in low and middle income countries at highest risk of adverse health and environmental effects. Evidence suggests that although per capita waste generation is highest in the developed world, these countries have better waste management practices that mitigate potential adverse health effects.<sup>23</sup>

#### Global practices of dealing with self care waste

Many countries have schemes for safe disposal of certain self care products outside healthcare facilities. These include drop-off container collection sites, residential special waste pickup services, mail back programmes, unused medicine take back and disposal options, syringe exchange programmes, and home needle destruction devices.<sup>24</sup> However, such opportunities are not universal and there is resistance to the collection of home medical waste in municipalities because its classification (as home or industrial waste), and hence management, is unclear.<sup>25</sup>

For large quantities of condoms, shredding or compacting is a recommended method of disposal,<sup>4</sup> eliminating the risk of scavenging and condom reuse. However, condoms are difficult to shred,<sup>4</sup> and anaerobic degradation (due to compacting or burial) of plastic and rubber produces carbon dioxide and methane,<sup>4</sup> both of which are major greenhouse gases. Some condom manufacturers are obtaining latex directly from rubber trees,<sup>6</sup> packaging in recycled paper boxes, and printing directions with vegetable ink.<sup>6</sup> Such products are easily available online and cost between \$1 and \$1.5 a piece.<sup>26</sup> Others have begun producing menstrual products using sustainable materials (eg, wood pulp replacing plastic fillers in sanitary pads) and reusable products (eg, menstrual cups),<sup>27</sup> thus dealing with equity and environmental considerations. Some of these are 100% biodegradable and 43% cheaper than the average retail price.<sup>28</sup>

#### Life cycle analysis and associated accountability

Disposal of a product is one of many costs incurred during its life cycle. Accountability can be ascertained by examining each stakeholder's role in key stages of a

product's manufacture, procurement, distribution, and use. For instance, United Nations Population Fund's (UNPFA) replicable green procurement strategy involved collaboration with donors, governments, beneficiaries, and suppliers. It clearly communicated details of the plan, thus leading to savings of 7.8 metric tons of CO<sub>2</sub>, 11.8 million kg of solid waste, and 587 598 m<sup>3</sup> of water in 2010.<sup>29</sup> Similarly, a study evaluating the effect of syringe acquisition on syringe disposal indicated that HIV positive injection drug users who obtain syringes from a safe source are more likely to dispose of them safely.<sup>30</sup>

Consumers are beginning to play an active part in making decisions about their health.<sup>31</sup> It is therefore necessary to develop a system that provides them with critical information, and sets a strong precedent for greener supply chains, reducing both the amount of waste and the cost of disposal. Some companies, however, seem to potentially mislead consumers by replacing restricted materials with little known and legally permissible materials that may have similar physiological effects (eg, replacement of bisphenol A with bisphenol S or bisphenol F<sup>32</sup>). Users and policy makers responsible for regulation of chemical usage require access to this information and the ability to evaluate it.

#### Facilitating holistic self care waste management through cross-sectoral partnerships

A robust self care system will depend on cross sectoral partnerships which create healthy communities, towns, and cities.<sup>33</sup> UNPFA's green procurement strategy is an example of collaborative action that included donors, governments, suppliers, and beneficiaries.<sup>29</sup> While building on existing systems, care must be taken to consider the broader effect of establishing more formal waste management. Thus, for example, the livelihoods and occupational safety of waste handlers in the informal sectors must be considered.<sup>34</sup>

Based on analysis of reports from the fields of healthcare waste management,<sup>21 35 36</sup> sustainability and the environment,<sup>22</sup> and waste management from home care and non-medical settings,<sup>37-39</sup> actions in specific sectors can be developed that lead to better waste management of self care products:

- **Governments**—The importance of integrated solid waste management by city governments based on the 3Rs—reduce, reuse, and recycle—is well recognised as the basis of sustain-

able development.<sup>40</sup> National governments could also improve their waste management. Targeted budgets could be developed to build and maintain cleaner technologies,<sup>41</sup> and policies that include environmental or health externalities in product pricing.

- **Non-governmental organisations**—While advocating promotion and use of self care, non-governmental organisations could implement home and community based programmes for waste management. Interventions to change behaviour, which have shown great potential in individual and community waste management practices, may also be introduced. These could educate communities and improve consumer knowledge, attitudes, and practices towards safe and sustainable waste management of self care products.<sup>35</sup>
- **Private sector**—The concept of a stronger, more circular economy offers the private sector an opportunity to promote the use of safe and efficient materials, reduce waste, and prioritise products with low carbon footprints. This would reduce energy costs, while creating environmental and health benefits.<sup>42</sup> The private sector could develop solutions to reduce the volume and toxicity of waste by using regulated materials and alternative, safe packaging. It may also include the social, environmental, and financial analyses used to evaluate performance and create greater value while exploring possibilities of waste collection that is not carried out by the municipality.
- **Consumers**—Education on reducing the volume of waste generated, on waste segregation, recycling practices, and on attitudes towards waste, has been shown to have a positive effect.<sup>35</sup> Thus, large scale public awareness could create a change in consumer attitudes.
- **Donors and development partners**—Donors can influence development<sup>43</sup> and could set priorities, affect policy, and make financing decisions to ensure sustainable waste management systems for self care products. They may also introduce and monitor such systems and support research needed to identify means for cleaning the environment and improving public health. By collaborating with the private sector and governments, donors might also be able to ensure sustain-

able waste management as health systems are expanded in developing economies.

- **Researchers**—The importance of research in protecting our planet and promoting public health cannot be denied.<sup>44</sup> Recognising the urgency of dealing with self care product waste, researchers should focus on understanding its effect on the environment. They should consider operational solutions, including production and packaging, inventory management, procurement strategies, disposal techniques, and routing and transportation. Interdisciplinary and trans-disciplinary research is required.

## Conclusions

Self care will form an important part of healthcare systems as governments strive to achieve universal health coverage by 2030, as part of the sustainable development goals. However, waste management of self care products cannot be neglected, particularly for poor and vulnerable populations. While waste generated by regulated hospitals continues to cause alarm, the problem of uncontrolled self care products waste appears to be quietly growing. This is an urgent call to understand its sustainability implications and facilitate the design of policies and development of programmes to promote sustainable waste management. This is the responsibility of all, and not only of the user. Countries should be supported to develop and adopt routes to sustainable self care waste management that include increasing access and developing methods to protect human and environmental health.

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- Transparency Market Research. Self-care medical devices market- global industry analysis, size, share and forecast 2013–2019. <https://www.transparencymarketresearch.com/self-care-medical-devices.html>
- Harhay MO, Halpern SD, Harhay JS, Olliaro PL. Health care waste management: a neglected and growing public health problem worldwide. *Trop Med Int Health* 2009;14:1414–7. doi:10.1111/j.1365-3156.2009.02386.x
- Levin LS, Idler EL. Self-care in health. *Annu Rev Public Health* 1983;4:181–201. doi:10.1146/annurev.pu.04.050183.001145
- UNFPA. Safe disposal and management of unused unwanted contraceptives. 2013. <https://www.unfpa.org/resources/safe-disposal-and-management-unused-unwanted-contraceptives>
- Neporent L. 7 Facts about condoms. ABC Medical Unit, 2011. <https://abcnews.go.com/Health/condom-facts-things/story?id=12869404>
- Stacey D. Can condoms be recycled? Very Well Health, 2018. <https://www.verywellhealth.com/can-condoms-be-recycled-906643>
- Ehiri JE, Birley M. Environmental impact of contraceptive use: an overview of available evidence. *Environ Manage Health* 2002;13:55–65. doi:10.1108/09566160210417822
- CBS New York. Hundreds of condoms, thousands of tampon applicators found among NJ beach trash. 2013. <https://newyork.cbslocal.com/2013/04/16/hundreds-of-condoms-thousands-of-tampon-applicators-found-among-nj-beach-trash/>
- Edraki F for War on Waste. Tampons, pads, menstrual cups, period underwear: what's best for the environment? ABC News, 2017. <https://www.abc.net.au/news/2017-10-27/which-period-product-is-best-for-the-environment/9090658>
- Cooper K-L. The people fighting pollution with plastic-free periods. BBC News, 2018 <https://www.bbc.com/news/world-43879789>
- Siegle L. The eco guide to sanitary products. The Guardian, 2017 <https://www.theguardian.com/environment/2017/oct/29/the-eco-guide-to-period-dramas>
- Plastic based sanitary pads are not only harmful to the environment but also your body. *Hindustan Times* 2018. <https://www.hindustantimes.com/fitness/plastic-based-sanitary-pads-are-not-only-harmful-to-the-environment-but-also-your-body/story-Kk4wrl6QOyCkP7bwEhOri.html>
- World Health Organization. Menstrual Hygiene Day. WHO, 2018. <http://www.who.int/life-course/news/events/menstrual-hygiene-day-2018/en/>
- Muralidharan A. Management of menstrual waste: insights from India and Pakistan. *Water Aid India, Menstrual Health Alliance India*, 2018. [http://menstrualhygieneday.org/wp-content/uploads/2018/06/WaterAid\\_Arundati-Muralidharan.pdf](http://menstrualhygieneday.org/wp-content/uploads/2018/06/WaterAid_Arundati-Muralidharan.pdf)
- Health and Safety Executive. Risk to healthcare workers. HSE, 2019. <http://www.hse.gov.uk/biosafety/blood-borne-viruses/risk-healthcare-workers.htm>
- Humboldt State University. Bloodborne pathogens: how long do these viruses live outside the body? 2019 <https://risksafety.humboldt.edu/sites/default/files/risksafety/Bloodborne%20FAQs.pdf>
- Pépin J, Abou Chakra CN, Pépin E, Nault V, Valiquette L. Evolution of the global burden of viral infections from unsafe medical injections, 2000–2010. *PLoS One* 2014;9:e99677. doi:10.1371/journal.pone.0099677
- Rauf MUA, Saleem MD, Anwer MO, Ahmed G, Aziz S, Memon MA. HIV, hepatitis B and hepatitis C in garbage scavengers of Karachi. *J Pak Med Assoc* 2013;63:798–802.
- Shakeel S, Iffat W, Rehman H, et al. Assessing the level of awareness and vaccination status of hepatitis B among young female community of Pakistan. *Bangladesh Journal of Medical Science* 2015;14:376–83. doi:10.3329/bjms.v14i4.25780
- Moin A, Fatima H, Qadir TF. Tackling hepatitis C-Pakistan's road to success. *Lancet* 2018;391:834–5. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)30462-8/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)30462-8/fulltext). doi:10.1016/S0140-6736(18)30462-8
- World Health Organization. Health care solid waste. <http://www.who.int/sustainable-development/health-sector/health-risks/solid-waste/en/>
- The Lancet Planetary Health. Microplastics and human health-an urgent problem. *Lancet Planet Health* 2017;1:e254. doi:10.1016/S2542-5196(17)30121-3
- Ziraba AK, Haregu TN, Mberu B. A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. *Arch Public Health* 2016;74:55. doi:10.1186/s13690-016-0166-4
- Majumdar A, Sahoo J, Roy G, Kamalanathan S. Improper sharp disposal practices among diabetes patients in home care settings: need for concern? *Indian J Endocrinol Metab* 2015;19:420–5. doi:10.4103/2230-8210.152792
- Hanashi Y. Investigation into the proper disposal of home medical waste. *Japan Medical Association Journal* 2011;54:271–6.



- 26 Pareek S. Low cost and eco friendly ideas which have revolutionized women's sanitary hygiene in India. The Better India, 2014. <https://www.thebetterindia.com/10917/india-women-menstruation-lowcost-ecofriendly-sanitary-pads/>
- 27 Barman A, Katkar PM, Asagekar SD. Natural and sustainable raw materials for sanitary napkin. *Journal of Textile Science & Engineering* 2017;7:308. <https://www.omicsonline.org/open-access/natural-and-sustainable-raw-materials-for-sanitary-napkin-2165-8064-1000308.php?aid=93070>.
- 28 Good Trade. These vegan condom brands want you to have world-changing sex. 2019. <https://www.thegoodtrade.com/features/ethical-condoms>
- 29 UNFPA. Greening the blue. Environmentally friendly male condoms. 2017. <http://www.greeningtheblue.org/news/unfpa-environmentally-friendly-male-condoms>
- 30 Coffin PO, Latka MH, Latkin C, et al, INSPIRE Study Group. Safe syringe disposal is related to safe syringe access among HIV-positive injection drug users. *AIDS Behav* 2007;11:652-62. doi:10.1007/s10461-006-9171-x
- 31 Cordina J, Kumar R, Olson E. McKinsey on Healthcare. Enabling healthcare consumerism, 2017. <https://healthcare.mckinsey.com/enabling-healthcare-consumerism>
- 32 Rochester JR, Bolden AL. Bisphenol S and F: a systematic review and comparison of the hormonal activity of bisphenol A substitutes. *Environ Health Perspect* 2015;123:643-50. doi:10.1289/ehp.1408989
- 33 Crisp N. What would a sustainable health and care system look like? *BMJ* 2017;358:j3895. doi:10.1136/bmj.j3895
- 34 Wilson D, Velis C, Cheeseman CR. Role of informal sector recycling in waste management in developing countries. *Habitat Int* 2006;30:797-808. doi:10.1016/j.habitatint.2005.09.005
- 35 Nichols A, Richardson J, Pahl S, Jenkin R, Wallace G, Bennallick M. Sustainable practice and behaviour change in healthcare waste management: a review of the literature. 1st World Sustainability Forum. 2011. <https://sciforum.net/manuscripts/551/original.pdf>
- 36 Lee B-K, Ellenbecker MJ, Moure-Eraso R. Analyses of the recycling potential of medical plastic wastes. *Waste Manag* 2002;22:461-70. doi:10.1016/S0956-053X(02)00006-5
- 37 USAID. *AIDS support and technical assistance resources (AIDSTAR-One) project. Disposal of expired ARVs and test kits in Nigeria. PEPFAR*. USAID, 2010. <https://www.jsi.com/JSIInternet/Results/article/display.cfm?txtGeoArea=INTL&id=527&thisSection=Results&ctid=na&cid=na&tid=20>
- 38 Miyazaki M, Imatoh T, Une H. The treatment of infectious waste arising from home health and medical care services: present situation in Japan. *Waste Manag* 2007;27:130-4. doi:10.1016/j.wasman.2005.12.018
- 39 American Academy of Family Physicians. Medical waste disposal in non-medical settings. 2003 <https://www.aafp.org/about/policies/all/medical-waste.html>
- 40 Ripley K. Regional forum promotes 3Rs, resource efficiency to achieve multiple SDGs. SDG knowledge hub: a project by IISD, 2018. <http://sdg.iisd.org/news/regional-forum-promotes-3rs-resource-efficiency-to-achieve-multiple-sdgs/>
- 41 World Health Organization. In: Chartier Y, Emmanuel J, Pieper U, et al, eds. *Safe management of wastes from health-care activities*. 2nd ed. 2014, [http://www.searo.who.int/srilanka/documents/safe\\_management\\_of\\_wastes\\_from\\_healthcare\\_activities.pdf](http://www.searo.who.int/srilanka/documents/safe_management_of_wastes_from_healthcare_activities.pdf).
- 42 World Health Organization. Sustainable procurement of health-care commodities. WHO, 2018. <http://www.who.int/sustainable-development/health-sector/strategies/health-care-commodities/en/>
- 43 Khan MS, Meghani A, Liverani M, Roychowdhury I, Parkhurst J. How do external donors influence national health policy processes? Experiences of domestic policy actors in Cambodia and Pakistan. *Health Policy Plan* 2018;33:215-23. doi:10.1093/heapol/czx145
- 44 Chauhan A, Singh A. Healthcare waste management: a state-of-the-art literature review. *Int J Environ Waste Manag* 2016;18:120-44. doi:10.1504/IJEW.2016.080400

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