Srishti / Toxics *Link*
**Factsheet**
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# Medical Waste

## The last mile: reaching rural India

The push for improving medical waste disposal practices in India is barely a few years old. In the first instance, the new law required that urban centres be focussed on, but soon facilities in rural areas will come under its purview. It may be said that when there is still so much to be done in the cities, why open up a new front? However, there are many pushes for understanding the dynamics of rural health care delivery urgently, including the new immunisation drives using disposable syringes and the expressed needs in that sector for solutions.

Also, there is already experience in the field that can help in finding solutions for rural areas, even though the operational dynamics are very different – both in terms of infrastructure available and types of solutions and training needed. This factsheet attempts to outline the challenges, and present the existing solutions. There is a need to study the operations here in greater depth, and for innovating new solutions, which are cost-effective, and can fit into rural operations. The classic mode of installing small furnace-like incinerators has only led to dysfunctional devices which pollute, burn mixed waste, and often, just do not operate.

In India, rural is defined as 'not urban.' More specifically, it is an area with a population of less than 5,000 persons at a density of less than 400 persons per sq km, with more than 25 per cent of the land used for agriculture. Rural India is home to about 72 per cent of the nation's population as per the 2001 census.

### The rural health care system in India

The delivery of health care in rural India is through a multi-layered system, starting from district levels and percolating to community levels.

### Multi-layered system of rural health care

**District hospital**

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**Sub-district hospital**

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**Community Health Centre:** A 30-bedded Hospital/Referral unit for four Primary Health Centres (PHCs) with specialised services. It has 30 in-door beds with one OT, X Ray, laboratory and other facilities. It serves as a referral centre for 4 PHCs. **There are 3043 CHCs functioning in the country[1].** It caters to a population of 80,000-1,20,000.

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**Primary Health Centre**: A referral unit for six sub-centres. It has around 4-6 beds manned with a Medical Officer incharge and 14 subordinate paramedical staff. The activities of the PHC involve curative, preventive, promotive and family welfare services. **There are 22,842 PHCs functioning in the country.** [2] It caters to a population of 20,000-30,000.

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**Sub-centre**: Most peripheral contact point between primary health care system and community. Manned with one female Multi-pupose Worker (MPW)/ANM and one male MPW. **There are 1,37,311 sub-centres functioning in the country.**[3] Sub-centres cater to a population of 3,000-5,000.

## AT A GLANCE

- **There are many pushes for understanding the dynamics of rural waste health care deliver urgently, including the new immunisation drives using disposable syringes and the expressed needs in that sector for solutions.**
- **The treatment options for the disposal of waste generated in rural areas needs to be carefully weighed to address the risks that operational deficienceies can pose.**
- **Among the growing number of cleaner and safer solutions are a combination of deep burial, small-scale steam sterilisation and simple devices such as needle-cutters, etc.**

## Waste generated

From the few studies carried out by Srishti as well as those already available, it has been found that a small rural health care setting of around 20 beds generates approximately 2 kg of infectious waste in a day.[4] The kind of waste that is generated includes the following:

- **Infectious waste:** Placentas, blood soaked cotton and bandages, body fluids.
- **Infectious plastic waste:** Disposable syringes, I.V. sets and tubes.
- **Sharps:** Metal sharps, mainly needles and scalpels; glass sharps, including broken glasses.
- **Waste generated from immunisation practices:** New widespread immunisation programmes are generating millions of single-use syringes globally. These programmes in particular need to incorporate effective systems for safe handling, treatment and disposal of these syringes.
- **General waste:** Packaging material, paper and food waste.

### Legislation for rural areas

The Bio-Medical Waste (Management & Handling) Rules, 1998, make it mandatory for all health care establishments to:

- Segregate waste at source.
- Ensure secure collection and transportation.
- Have a waste management system in place by December 31, 2002.
- Carry out deep burial of pathological tissues and animal waste (in regions with population greater than 500,000 persons).
- Provide for alternative treatment methods (non-incineration) for other bio-medical waste streams.

### Technology options for disposal of waste

The treatment options for disposal of the waste generated in rural areas needs to be very carefully weighed to address the risks operational deficiencies can pose. The unavailability or shortage of skilled manpower and necessary resources in such areas should also be considered while selecting a technology. Rural areas should learn from urban experiences and not depend on combustion technologies for overcoming the waste problem. Many cleaner alternatives are now available for safely treating and disposing off medical waste. These technologies are not only cheaper to operate but are also environmentally safer.

In the following section, we look at various low-cost options for treatment. It should, however, be kept in mind that a complete solution to the problem of medical waste lies not just in choosing an appropriate technology but also in laying due emphasis on such aspects as waste segregation, waste minimisation, training, etc.

Table 1: Existing practices in rural areas

| Waste Segregation | Waste Collection & Storage | Waste Transportation | Waste Treatment | Waste Disposal |
|---|---|---|---|---|
| Waste is generally mixed in a single bin/bag.<br>In some districts waste is being segregated into different categories. | Open bins and drums.<br>Bins are not lined with polybags.<br>Spilled over the floor at the time of generation.<br>No regular pattern of waste collection and the waste is collected as and when required. | Waste is transported manually from point of generation to final treatment/disposal site.<br>No protective gear is provided to the health care workers. Workers are not immunised, nor are there any accident-reporting formats. | No specific waste treatment pattern is followed, but in certain facilities reusable glass syringes are boiled before reuse. | Open dumping of waste around the health care facilities.<br>Open burning of waste.<br>Scavenging of waste by waste sorters and animals.<br>Furnaces for burning of waste in some PHCs.<br>In facilities near urban areas waste is being carried by centralised facility. |

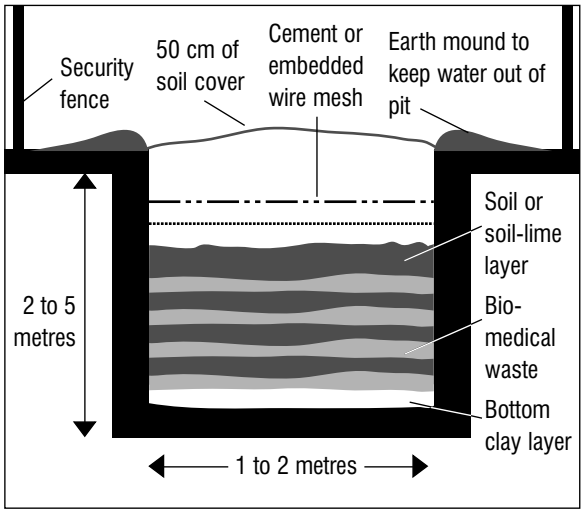
**Infectious waste**

Generally, infectious waste in rural areas is disposed of through open burning or dumping. However these practices should be totally discouraged as they pose a threat to the environment and the community.

Small clinics or rural areas that generate small volumes of waste may use on-site waste burial pits as per standards laid down in the Bio-Medical Waste (Management & Handling) Rules, 1998, in areas with population less than 500,000 persons.

A pit or trench should be dug about two metres deep. It should be half-filled with waste, then covered with lime within 50 cm of the surface before filling the rest of the pit with soil. On each occasion, when waste is added to the pit, a layer of 10 cm soil should be added to cover the waste. The deep burial site should be relatively impermeable and no shallow well should exist close to the site.

Figure 1. Infectious waste burial pit[5]

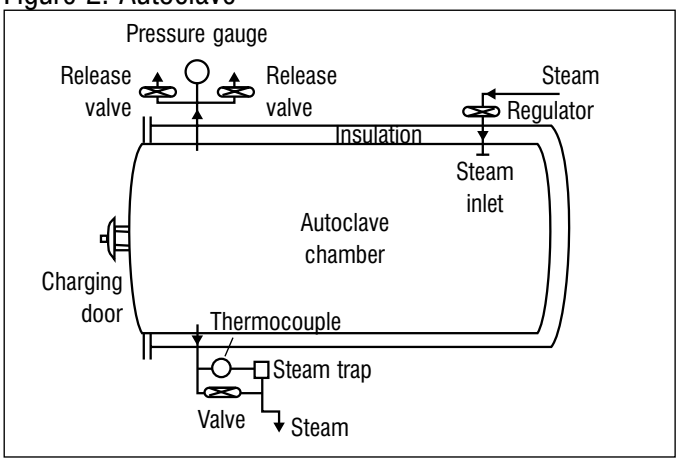



**Infectious plastic waste**

Autoclaves are standard equipment in hospitals and have been used for many years by institutes to sterilise reusable medical instruments and glassware. Autoclaves range in size from small portable units to vast units capable of treating several tonnes of medical waste per hour.

Since autoclaves are available in a wide range of capacities, the required size of the autoclave unit can be calculated based on the size of the

Figure 2. Autoclave




## SOLUTIONS

**Rural areas need to learn from the mistakes of urban India. Low-cost waste disposal technologies combined with good practices such as waste segregation and minimisation offer a solution to their impending waste problem**

safety boxes. For example, a cylindrical chamber autoclave with a minimum diameter of 22 cm (8.5 inches) and a minimum depth of 28 cm (11 inches) can fit a single five-litre safety box. Assuming a typical minimum treatment process of 121° C for 30 minutes, it would be possible to treat 300 syringes a day during a two-hour period, with the above mentioned autoclave capacity. It may be necessary to use autoclavable liners to prevent waste from sticking to the inner walls or metal trays, and to facilitate removal of the treated waste. Alternatively, for small waste loads, the sharps waste could be collected in a metal container with an opening to allow the penetration of steam, thus eliminating the cost of safety boxes.[6]

One advantage of the autoclave is that the equipment is simple enough to be manufactured locally in regions with a light industrial manufacturing sector. It may also be possible to build gas-fired or kerosene, electricity, locally available steam, or other energy sources. Autoclaves should be tested under representative conditions to ensure microbial inactivation.

**Sharps**

**Immunisation of sharps waste:** It is estimated that about 12 billion preventive and curative injections are administered worldwide annually, which amounts to almost 14 million injections per day[7]. About 95 per cent of these are therapeutic in nature. India alone administers an estimated 4.2 billion injections annually, many of which are said to be unnecessary. For every genuine vaccination, 20 therapeutic ones are administered. At present, 90 per cent of the syringes used are reusable in

Table 2. Estimated average availability of used syringes per centre by periodicity [9]

| Description | Urban Level | Rural Level | Total |
|---|---|---|---|
| Population 2001 | 20,503,597 | 55,223,944 | 75,728,541 |
| New infants born per year (@2.2%) | 451,079 | 1,214,927 | 1,666,006 |
| New infants to be catered by public health systems | 315,755 | 1,214,927 | 1,530,682 |
| No of injections/infant for full immunisation | 8 | 8 | 8 |
| Total no of Injections to be given per annum | 2,526,040 | 9,719,416 | 12,245,456 |
| Total no of existing institutions engaged in immunisation activities | 439 | 1,387 PHCs<br>10,568 SCs | |
| Average availability of AD Syringes/Centre/Annum | 5,752 | 7,008 per PHC<br>920 per SC | |

**NUMBERS**

**Of the 12 billion injections administered worldwide annually, 4.2 billion are given in India. The growing use of disposable syringes will add to the burgeoning waste in rural areas**

nature but due to the fear of spread of highly infectious diseases such as Hepatitis B and AIDS, the use of reusable syringes is being replaced with the single use of auto-disable (AD) syringes.[8]

The major challenges associated with the use of disposable syringes are the volume of waste that will be generated and its management. The volume of waste sharps will grow exponentially, with estimates of 700 million AD syringes being procured by 2005 for global immunisation programs alone (as estimated by WHO).

With around 85 per cent of the immunisations being provided in rural India (as estimated by PATH) and the growing use of disposable syringes, the quantity of waste generated in rural areas is on the increase. A growing concern over reuse of syringes due to their lucrative value has magnified the problem.

**Current immunisation practices:** Currently, in most cases, parents are encouraged to bring their own disposable syringes by the respective centres for administering immunisation injections to their children. Also, in most centres, reusable glass syringes are being used for immunisation, with boilers provided for the sterilisation of these syringes for reuse.

**Estimated availability of used syringes:** As per schedule, each infant needs to be given a total of eight injections for BCG, DPT, Hep-B and measles at specified intervals during the first year, for full immunisation. Taking the example of the State of Andhra Pradesh, the availability of used syringes for achievement of 100 per cent immunisation for infants through the public health system is summarised in Table 2 above.

The figures represent the estimated availability during the year 2002-2003, subject to the introduction of AD syringes for the entire program with effect from April 1, 2002. There will be a marginal increase in the availability during the next five-year period, in line with population growth. Assuming an average growth in population of around 1.6 per cent per annum, the availability would register an increase of about 10 per cent per annum after five years.

### Use of obsolete technologies

With the new worldwide trend of opting for AD syringes, it seems that the days of the glass syringe, which was sterilised and reused, are numbered. In India alone, more than 4.2 billion injections are administered annually, even though many of them are considered unnecessary. Some 4.2 billion AD syringes can result in

**NEEDS**

**Allocation of funds for health has been on the decline. The budgetary allocation of the States has declined from 7 to 5.5 per cent of their budget. Larger fund allocations and improved infrastructure is critical**

a lot of plastic and sharps waste! Injection safety experts argue that AD syringes will prevent reuse, but when it comes to the disposal of waste, they resort to the obsolete and polluting technology of incineration. Not having considered the problem of waste that the syringe will create, the experts defend this without considering other solutions. In fact, countries in Africa, Central Asia (Mongolia and China), South Asia, and Southeast Asia are being encouraged to install small rudimentary brick or metal-type furnaces to burn the syringes, irrespective of the resultant deadly environmental pollution and human health concerns that are raised.

Hundreds of such obsolete burners now dot their countryside in growing numbers, installed as part of immunisation drives. This is being done under the nose of agencies like the WHO and UNICEF who are well aware that the incineration of waste is being internationally discouraged in climate change and chemical treaties.

A recent report surveying these small incinerators in a few countries, released by the international NGO, Health Care Without Harm, clearly shows that these incinerators become dysfunctional after less than a year of use, and though meant for syringes, are used for all types of medical waste. The technology being proposed does not meet the weakest of environmental standards and falls far short of Indian regulations. In fact, no developed country would venture close to it.

## Growing number of alternatives

Among the growing number of cleaner and safer solutions are a combination of deep burial, small-scale steam sterilisation, simple devices such as needle cutters, and innovations like the needle puller done by the organisation known as PATH. The following section deals with some simple ways of handling the sharps generated.

### Sharps pit

Blades and needles waste, after disinfection, should be disposed in a circular or rectangular pit as shown in Figure 3. Such a pit can be lined with brick, masonry or concrete rings. The pit should be covered with a heavy concrete slab, which is penetrated by a galvanised steel pipe projecting about 1.5 m above the slab, with an internal diameter of up to 20 mm. When the pit is full, it can be sealed completely, after another has been prepared.[10]

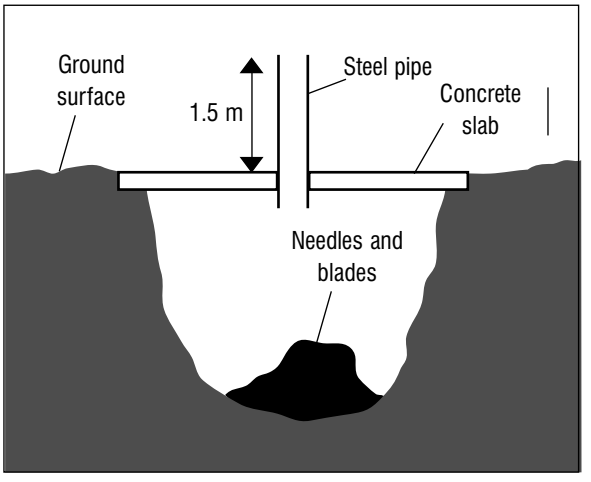
### Encapsulation

Encapsulation is also an easy technology for disposing sharps safely. Sharps can be collected in puncture- and leak-proof containers such as high-density polythene boxes, metallic drums or barrels. When the container is three-quarters full, filler material such as cement mortar or clay can be poured in until the container is completely filled. After the medium has dried, the containers are sealed and disposed in landfills.

### Needle destroyers/cutters

The needle destroyer is an electrical gadget that mutilates the needle. The destroyer has an exposed filament. When the needle is inserted, the circuit inside gets completed and a high-temperature electric arc is generated which burns the needle . The destroyer also has a cutter that cuts the nozzle of the syringe so that it can no longer be used. Needle destroyers range from battery-run portable devices to plug-in desktop units. Most are automated for

Figure 3. Pit for disposing of sharps[11]




## Table 3. Cost comparisons

1. Needle cutters ..... Rs 200-500
2. Needle destroyers ..... Rs 1,500-4,000
3. Portable autoclaves (350mm dia x 325mm ht) ..... Rs 2,500-5,800 (depending on aluminum or steel body)
4. Encapsulation ..... Rs 150-400 (depending on the size of the cement drums)
5. Sharps pit ..... Rs 10,000-20, 000 (with concrete walls and rust proof lining)
6. Cement encasing ..... Rs 500-5,000 (with concrete base)

one-hand quick operation to prevent needlestick injuries and minimise the time it would take away from the health care worker.

**Centralised treatment technology**

Rural communities can be served with a regional or district-level central facility utilising cleaner alternatives. A system of sharps collection, transport and centralised treatment can serve both urban and rural needs. In case of an immunisation campaign, the transport system could be arranged in conjunction with the delivery of vaccine supplies and safety boxes. The safety boxes or sharps containers can be brought back to a centralised facility or a PHC that uses an autoclave. In areas where technologies are not available, the centralised facility could use a combination of treatments with a disinfectant and cement encasing or encapsulation.

## Need of the hour for rural areas

**Training**

To overcome the improper disposal practices being followed by rural clinics, special emphasis must be given on training of health care workers. These training classes would raise awareness about the hazards of improper waste management. These sessions should generate awareness about issues of occupational safety as well. Awareness material and posters should be provided at the health care locations.

**Awareness**

Awareness levels of the community also need to be increased so that basic practices like over-use of injections by rural medical practitioners are questioned. These practitioners are very difficult to target and can only be made to change their behaviour from the demand side – that is, by raising community awareness. The injections are sometimes a major source of revenue for these practitioners, so the economic incentive is a major factor for them to continue with injections.

**Improving finances and infrastructural facilities**

The public health investment in the country over the years has been comparatively low. The central budgetary allocation for health, as a percentage of the total Central Budget has been stagnant at 1.3 per cent, while that in the states has declined from 7.0 per cent to 5.5 per cent. The current annual per capita public health expenditure in the country is no more than Rupees 200.[12] Given these statistics, it is no surprise that the reach and quality of public health services has been below desirable standards.

For outdoor medical facilities, funding is generally insufficient; the equipment in many public hospitals is often unusable and the buildings are in a dilapidated state. As a result of such inadequate public health facilities, it has been estimated that less than 20 per cent of the persons who seek OPD services, and less than 45 per cent of those who seek indoor treatment, avail of such services in public hospitals.[13] This is despite the fact that most of these patients do not have the means to make out-of-pocket payments for private health services except at the cost of other essential expenditure for items such as basic nutrition.

It is also necessary that all PHCs are equipped with modest lab facilities for doing simple tests. We should ensure that every PHC, CHC and Sub-centre of the country is properly equipped and manned.

**Increase in staff**

While there is a general shortage of medical personnel in the country, this shortfall is disproportionately impacted on the less developed and rural areas. In the rural health systems, 37.6 per cent of posts for doctors and 12 per cent of posts for paramedical staff lie vacant.

This problem of non-availability of staff should be tackled effectively.

***Compiled and written by Ratna Singh, with inputs from the Medical Waste team***


1. Bulletin on Rural Health Statistics In India – March 2002
2. Bulletin on Rural Health Statistics In India – March 2002
3. Bulletin on Rural Health Statistics In India – March 2002
4. Personal Communication with a hospital in Gaziabad
5. Diagram taken from Environmentally Responsible Management of Health Care Waste – October 2002 (working draft)
6. Environmentally Responsible Management of Health Care Waste – October 2002 (working draft)
7. Simonsen L, Kane A Lloyd J, Unsafe injections in the developing world and transmission of blood borne pathogens: a review. Bulletin of WHO 1997,77 (10): 789-800
8. Injection safety/ orgwhoboard.html
9. Techno-Economic Feasibility Study of Reprocessing Used Plastic AD Syringes in Andhra Pradesh.
10. As per the report of the committee constituted by the Ministry of Environment & Forest to formulate guidelines for implementation of Bio-Medical Waste (Management & Handling) 1998
11. Diagram taken from Guidelines for Biomedical Waste
12. Bulletin on Rural Health Statistics In India – March 2002
13. Bulletin on Rural Health Statistics In India – March 2002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