

Solid waste disposal in district health facilities

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Hospital waste is not necessarily difficult to dispose of. In most cases it can be safely dumped in a properly designed waste pit. Waste management problems at district hospitals in developing countries are usually caused more by lack of information than by financial or technical difficulties.

Solid waste disposal in health facilities in developing countries is felt by local health authorities to pose an enormous problem and is one of the least popular areas of concern. The signs in the majority of such health facilities are well known: hospital yards littered with all kinds of waste, including used hypodermic needles, smouldering refuse and scavenging animals.

The dangers arising from such conditions are numerous. Patients and relatives, in particular children, come into contact with the waste and are exposed to infection hazards, especially from needles and other sharp objects. Discarded drugs can also be found fairly often in hospital grounds, and may be collected and consumed or sold without professional advice. In addition to the health hazards, ecological risks have to be considered, such as microbiological and chemical contamination of soil and groundwater, and poisonous emissions from burning plastics.

This situation is caused mainly by unawareness of the problem. There is also an unwarranted respect for the waste disposal technology used in industrialized countries,

which is believed to be necessary but not affordable. In reality, however, most district-based health facilities in developing countries produce waste of much less critical composition, as their equipment is generally fairly simple and they do not usually use disposables. Another important reason for the inadequate treatment of hospital waste is the widespread lack of knowledge among local health personnel. This is to be expected, since the necessary instruction is not provided at school or during their training. Insufficient knowledge combined with disproportionate belief in "modern" technology is displayed by many donors, too. Hospitals are often built without any consideration of waste disposal requirements or are provided with fancy incinerators which soon become clogged with unburnt matter for lack of fuel.

This point is important: a technology, even if suitable, which cannot be operated in a sustainable way, makes the situation worse. In particular, rural health facilities are characterized by extremely limited resources, difficult logistics and academic isolation. Any solution for the waste problem must be adjusted to these adverse conditions, which in general involves finding a compromise between the requirements of health, ecology and practicability. We believe this can be done in a satisfactory way, at least in the district health context in developing countries.

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Criteria for solid waste disposal

This article concentrates on waste problems found in health facilities in rural areas and small towns, usually with no communal or private waste disposal service. More central hospitals present a different challenge, because they have to form part of a communal or urban waste removal structure. Moreover, such facilities may often produce hazardous waste, such as cytostatic and radioactive material, which must be treated in special ways beyond the scope of this paper.

Many countries have systematized the disposal of waste in health facilities by introducing categories which define danger potentials and the corresponding disposal methods. In Germany, for example, five categories are in use:

- A: household and analogous waste;
- B: waste needing special precautions during handling (e.g. used dressings);
- C: infectious waste including objects that cut or pierce ("sharps");
- D: body parts, tissue;
- E: toxic substances (laboratory waste, drugs, etc.).

This system is valid for large and specialized hospitals at tertiary level or higher.

As we have seen, the typical composition of solid waste in small hospitals or health centres in developing countries is less critical. The

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daily production of solid waste by rural hospitals in sub-Saharan Africa may range between 0.3 kg and 1.5 kg per bed, of which a mere 2–10% are estimated to be hazardous.

Typical figures for industrialized countries amount to 3–6 kg per bed with 5–20% hazardous waste (1). Hazardous waste in the sub-Saharan context would include:

- sharps;
- laboratory reagents and drugs (excluding cytotoxic and genotoxic matter);
- dangerous infectious waste (tuberculosis, HIV, hepatitis, cholera, etc.).

Bloodstained and soiled cloths and used dressings are generally not dangerous if handled correctly (see next section) and can be disposed of in appropriate landfills in the same way as domestic waste (2), as has been shown in industrialized countries. This would probably not be much different for rural hospitals in developing countries under normal circumstances (that is, if no acute epidemic is going on). Also, body parts and tissue are basically not regarded as hazardous waste, but they may require special treatment for cultural or ethical reasons.

Of course it would be safer to incinerate every bit of waste, but economically and ecologically this is unrealistic even for rich countries. A practicable disposal strategy can only minimize risks, it cannot exclude them. Minimizing risks involves ensuring that the disposal methods employed are sustainable in the long term and, at the same time, do not present long-term ecological hazards.

Waste management strategies

The general objective of any strategy can be defined as follows: permanently minimizing contact with waste for patients, relatives, personnel and the population potentially affected, while maintaining ecological stress at an acceptable level.

Waste disposal is a process with a chain of critical steps to consider:

- using the "Recycle - Avoid - Minimize" (RAM) waste strategy (3), which starts with the choice of reusable items when purchasing, disposable items only being obtained to curb special risks, such as HIV cross-infection from lancets;
- initial storage (waste bins);
- handling within the health facility;
- transport on facility and public grounds;
- disposal, treatment (pit, landfill, incinerator, autoclave, recycling);
- sealing the dumping site.

From this list it is evident that the procedure requires organization and coordination which is best expressed by the term "waste management".

The most important step in waste management is the intermediate storage and "segregation" (separation) of waste where it is produced, as for example in connection with the change of dressings, operations and injections. Basically, there should be bins in each room and at strategic points of the premises outside the buildings (chained if necessary) for all waste except sharps. Sharps (used needles, any broken glass, scalpel blades, lancets, etc.) must be collected in separate containers, for example in old infusion bottles or other receptacles which cannot easily be perforated and are of no value to anyone in the community. In cases where infectious waste can be safely incinerated or where emergency burning of contaminated material during epidemics is necessary, separate bins with a different colour must be provided. All bins must have lids to prevent access by insects, rodents and other animals. Particularly during epidemics the bins should be washed regularly with Javel water (hypochlorite solution), ordinary bleach or similar agents.

The waste separation scheme and any other relevant measure should be established and made known to all staff, patients and relatives

by the Hygiene and Sanitation Committee of the health district in question. The Hygiene and Sanitation Coordinator is responsible for the relevant activities, and monitors the

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execution of the waste disposal scheme. He or she should be made responsible for the supervision of waste treatment in the entire district.

The bins must be emptied at least daily. Emptying means carrying or driving the lidded bins to the treatment site. It is not a good practice to empty the bins into an open pick-up or wheel-barrow, for example, thereby risking contamination of the vehicle and of the surroundings. The workers involved with transport and treatment should wear protective garments such as coats and rubber gloves. Under epidemic conditions even the use of surgical face masks is recommended. The containers for sharps, when almost filled, should be sealed with stoppers, screw-caps or similar means and then put into a bin designated for general waste. In general, bottles or similar containers should be disposed of in ways that exclude the formation of open, stagnant water, where important vectors such as *Anopheles* or *Aedes* mosquitos can breed.

At or near most rural health facilities, sufficient space can be found for dumping, whereas incinerators are extremely scarce and usually out of order. The first choice of treatment is therefore the waste pit which must be properly designed and managed, as follows.

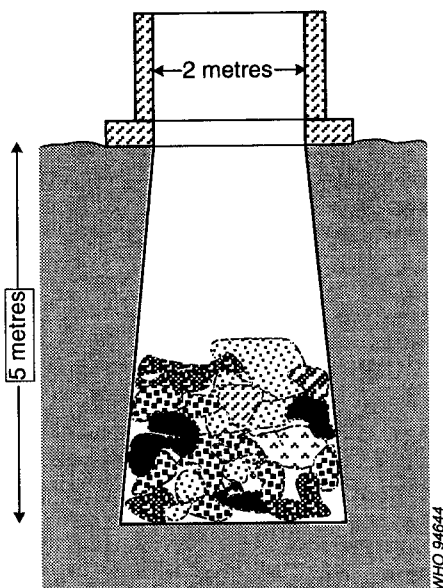
- The pit must be located where no ground-water or surface water can come into

contact with the deposit, and no leaching of liquids from the waste into groundwater can occur. The waste pit must never be built close to water sources, such as wells or springs.

- The site must not be located where the ground is likely to be used for agriculture or where land development could take place.
- The ground must be soft enough for manual digging but of low permeability. Laterite soils appear to be suitable in these respects.
- The pit must provide at least 1 m³ per bed to have a service life of approximately 5 years (4).
- The pit must be protected from scavengers (animals, birds and humans).

If there is any doubt as to the suitability of the pit site, an expert of the local water authority should be consulted.

Simple design for a waste pit



Protection from scavengers is best achieved by constructing a wall around the opening of the pit, which should not exceed 3 metres in diameter (see diagram).

The walls should be vertical or, ideally, have a negative slope. Pits like these can be used for a very long time without any need for maintenance or other expenses. In some cases abandoned pit latrines can be used as well. When the pit is filled, it can be emptied and the contents disposed of at safe landfills, perhaps using lime for treatment. Another option is to seal the pit with soil and concrete and to build a new one. The abandoned pit must be marked by an inscription in the concrete seal, warning against the use of the site for later construction below ground level. At the same time the sealed pit must be marked on the site plan of the health facility and any other relevant documents. It may be necessary to inform the local water authorities and other parties involved.

In situations where incineration is unavoidable, two options should be considered.

- In some cases there might be a cement factory within reach which would operate a high-temperature revolving kiln. Technically, small quantities of hazardous hospital waste can be burnt safely in such a kiln. The waste matter even constitutes additional fuel. The possibility of an agreement with the factory should be explored.
- If the only option is to burn hazardous waste on the hospital premises, a simple incinerator which operates without fossil fuel or with only minimum quantities of it (often old engine oil can be used) may be constructed (5). The incinerator must be placed as far as possible away from the hospital buildings and be protected from unauthorized access. Good ventilation in the operational area of the incinerator and prevailing winds must be taken into

account. The incineration process must be permanently monitored by a responsible health worker or technician. After incineration has been completed the residues must be removed immediately and put into the waste pit.

Once again, the important point is: hospital waste removal is not a question of a single method, but the combination of various measures resulting in a waste management system (6) as part of an overall hygiene concept. Whatever system is used, it is important to ensure that it complies with the relevant national laws and regulations, if they exist. In addition, the system must be supported and monitored (in general terms) by the central health authorities and backed by a national policy on hospital waste and hygiene and finally become part of local supervision systems.

Next steps

Reliable information on solid waste in health facilities in developing countries is very scarce. The above recommendations are based on information from industrialized countries combined with empirical observations in developing countries. Though there is not a wide range of choices in treating hospital waste, it is advisable to launch studies in developing countries to verify the recommendations in this paper. The topics most in need of research appear to be:

- quantities and composition of waste at different health facility levels;
- pathological contamination of fresh and old hospital waste compared with domestic waste;
- number and severity of accidents with waste;
- safety of waste pits in laterite soils, ecological criteria;

- cost implications of the various disposal methods and their reliability;
- knowledge, attitudes and practices of health workers regarding waste disposal.

These topics should not be very difficult to investigate, and this kind of research should be included in the planning of health projects, particularly district-based ones. Experts in this field are available, sometimes within the countries concerned.

To summarize, it can be said that the deplorable situation in the field of solid waste disposal in rural health facilities in developing countries can probably be avoided to a large extent by using relatively simple and cheap measures. Decision-makers, administrators and health workers in developing countries and from donor organizations are therefore urged to take the necessary steps. The author would welcome any comments, suggestions or information that would help to make these guidelines more complete and accurate. ■

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Note: A more inclusive bibliography can be obtained from the author.