

Guidelines for Environmental Health Management in Children's Homes in Sub-Saharan Africa

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Abstract: The field of environmental health focuses on the relationships between human health and well being and the influence of the physical, social and societal environments. Our understanding of the environment–health interface has progressed because of two relatively recent insights: First, the recognition that the unprecedented environmental changes of the last half-century are affecting global population health. Secondly, the recognition that children have greater vulnerability to environmental hazards and are inadequately protected by current regulatory standards. Efforts to redress this situation have shaped the current thrust in environmental health research toward preventing further harm to children's health. The disproportionate vulnerability of children to environmental hazards can be explained by several reasons. Children are not "little adults." It is known that children have greater risk of exposure and greater risk of harm compared to adults for many reasons that are unique to each developmental stage. Their behaviour and activity patterns bring them into greater contact with toxins. Children have important biological differences. Immature developing organs and tissues are more vulnerable to harm from toxic exposures. Immature metabolic and physiological systems less effectively protect the child from toxic exposure and effects. In addition, children have additional pathways of exposure that are not applicable to adults, e.g., in utero, via breast milk and via products such as toys, clothing, etc. Children also have a longer "shelf life." They have much more of their life ahead of them during which time they will be exposed and may develop health problems as a result. Finally, children are more often involuntarily exposed and unable to avoid exposures of their own accord [1]. Due to the AIDS catastrophe in Sub-Saharan Africa, the numbers of children in difficult circumstances have increased. To mitigate the effects of the catastrophe, charitable organizations have sprung up to establish homes for such children, especially those orphaned by AIDS or those infected with HIV. It is important to ensure that environmental health hazards and risks are minimized in these children's homes. By use of a conceptual synthesis approach, the authors attempt to generate guidelines from literature for environmental health management in children's homes in sub-Saharan Africa.

Keywords: Environment, health, environmental health, guidelines, children's homes

Introduction

Children in difficult circumstances are neglected, abused, exploited and impoverished. They include orphans, street children, children of urban poor, rural poor squatters, plantation workers, alcoholic parents and drug addicts. The number of children in especially difficult circumstances is increasing rapidly in slums, towns, villages and estates. These children lack a good environment to support their survival and development.

Their basic needs for food, clothing, shelter, love, leisure, education and health are hardly met. One of the main reasons for the increasing numbers of these children is HIV/AIDS, which is ravaging sub-Saharan Africa. To mitigate the effects of this catastrophe, a number of charitable organizations have sprung up to establish homes for such children, especially those orphaned by AIDS or those infected with HIV. It is important that these homes provide a safe and healthy living environment for these children.

The Human Dimension to Environmental Quality

The driving forces in the world today are leading to pressures on the environment in the form of pollutant emissions, resource depletion, land-use changes and others. These pressures affect environmental quality (the "state" of the environment). Degradation of environmental quality can, in turn, lead to adverse human exposures and eventual health effects. The extent of such exposures, however, depends not only on their level, but also on the proximity of populations to them. Thus even relatively small amounts of pollution can have major health impacts if released close to human communities.

Air, water and food are the principal exposure routes of environmental health hazards. Also heavily implicated are the manner in which household wastes and sewage are handled, the environmental conditions in which people live and work, and soil quality. Evidence is growing too that the changing global environment will impact adversely on human health and well-being.

This article presents guidelines for environmental health management in children's homes and might be found to be very useful to the managers of such homes.

Definition of Key Terms

1. *Environment*: Collective term used to describe all the living and non-living things that make up our surroundings. These include the biological, physical, cultural and social, economic and political environments [2]. For the purposes of this paper, environment will exclude the cultural, economic and political environments.
2. *Health*: A state of complete physical, mental and social well-being of an individual and is not necessarily the absence of disease or infirmity [3].
3. *Environmental health*: Defined as the control of those factors in the environment that may have deleterious effects on people's physical, mental, or social well-being [4]. OR The effects of various environmental conditions on human health (author's; derived from the definitions of environment and health).
4. *Conceptual*: Related to or based on ideas [5].
5. *Guidelines*: Rules or instructions that are given by an official organization telling you how to do something, especially something difficult [5].

Rationale/Justification

Sub-Saharan Africa continues to bear the brunt of the HIV/AIDS pandemic. More and more children in Sub-Saharan Africa in general and Kenya in particular are losing their parents, mostly due to the HIV/AIDS pandemic. To address the escalating orphan crisis, a number of charity organizations have stepped in to establish children's homes/orphanages for these unfortunate children.

To relieve the charity organizations of the burden of healthcare costs for communicable diseases and

environment-linked conditions and injuries, it is necessary that environmental health hazards and risks be minimized in children's homes.

To the best of the authors' knowledge, no guidelines for environmental health management, specifically in children's home in sub-Saharan Africa exist.

It is thus necessary to collect, synthesize and categorize the information into conceptualised guidelines and to disseminate it at any appropriate forums so that children's homes managers can access and utilize it for better management of the children homes.

Objective

To develop a conceptual framework for implementing, monitoring and evaluating environmental health activities in children's homes in Sub-Saharan Africa.

Methodology

Relevant literature on environmental health was reviewed to obtain factual information. The review-generated information was then conceptually synthesized, organized and categorized into guidelines for environmental health management in children's homes.

Guidelines

Housing - The Importance of Housing for Health

Housing is of central importance to quality of life. Ideally it minimizes disease and injury, and contributes a lot to physical, mental and social well-being. Over and above its basic purpose to provide shelter against the elements and a focus for family life, the home environment should afford protection against the hazards to health arising from the physical and social environment.

Table 1: Principles of healthy housing

<i>Principle</i>	<i>Through</i>
Protection against communicable diseases	Safe water supply Sanitary excreta disposal Disposal of solid wastes Drainage of surface water Safe food preparation Structural safeguards
Protection against injuries, poisonings and chronic diseases	Structural features & furnishings Indoor air pollution Chemical safety
Reduction of social & psychological stress	Adequate living space, privacy & comfort Personal security of occupants Access to recreation facilities Protection against noise

(Source: WHO, 1997)

Numerous factors in the home environment may influence health negatively. Lack of access to piped water or a nearby stand-pipe and lack of sanitary facilities are often considered key indicators of "unhealthy" housing, leading to high disease burdens, in both urban and rural areas. Housing factors such as high levels of noise, poor air quality, inadequate refuse storage and collection facilities, poor food storage and preparation facilities, temperature extremes and high humidity, overcrowding, poor lighting, inadequate or inappropriate construction materials, building defects and pests may also influence health significantly [2] (Table 1).

Crowding

Crowded and cramped conditions facilitate transmission of diseases including tuberculosis, influenza, meningitis, acute respiratory infections (ARI), diarrheal diseases and measles. Children living in overcrowded households are particularly more susceptible to ARI. Crowding can also cause psychological distress in children and promote physical violence. It is suggested that each child should have a minimum of 1m³ of space in the home.

Dampness

Damp housing may harbor viral and bacterial agents, as well as house dust mite, which can cause respiratory problems, especially wheeze. Damp conditions also encourage the growth of mould, long considered to be a source of respiratory allergens [6]. Damp housing is also thought to be a contributory factor to rheumatism and arthritis [7].

Indoor Air Pollution: "Rule of One Thousand"

High levels of indoor air pollution arising from the use of open fires, unsafe fuels and inefficient stoves for cooking and/or heating probably represents the single most serious health impact from air pollution worldwide. The domestic combustion of biomass fuels, coal, and kerosene by poor communities both in developing and developed countries, can lead to extremely high levels of indoor air pollution (especially particulates). This poses special risks to the respiratory health of women and young children who are most exposed and vulnerable. Even the use of gas stoves may result in increased levels of NO₃ inside homes.

Indoor air pollution can be particularly hazardous to health because it is released in close proximity to people. The "rule of 1000" states that, a pollutant released indoors is 1000 times more likely to reach people's lungs than a pollutant released outdoors. The major source of indoor air pollution in developing countries is household use of biomass and coal for heating and cooking, usually involving open fires or stoves without proper chimneys. Pollutant concentrations can be extremely high, exceeding WHO guidelines by more than a factor of 100. Women and children are affected most.

In addition to fumes from combustion, indoor pollutants originate from building materials, paints, solvents used in the home and environmental tobacco smoke. Indoor air quality is also affected by outdoor pollution sources e.g. garages, petrol stations, manufacturing plants, burning charcoal and quarrying [2].

Environmental Tobacco Smoke

Active tobacco smoking is a major cause of ill-health [8]. Concern is also increasing about the effects of passive smoking, i.e. exposure to environmental tobacco smoke (ETS). ETS is that portion of tobacco smoke released into the surrounding air, either directly (side-stream smoke) or after being exhaled by smokers. It is much less damaging per unit of emissions than the mainstream smoke inhaled directly by the active smoker. But since it is often emitted in spaces inhabited by non-smokers, it can have a large impact per unit of emissions even compared to large outdoor sources.

Over 4000 components of cigarette smoke have been identified; many are established carcinogens or other types of toxin. Those of health concern include suspended particulate matter (SPM), CO, nicotine, nitrosamines, benzene, formaldehyde and benzo[a]pyrene. Studies show that the extent of ETS exposure and its health effects are determined by the number of cigarettes smoked in indoor environments. Children are at a high risk of contracting acute respiratory infections (ARI) if they are exposed to environmental tobacco smoke [2].

Health Impacts of Other Types of Air Pollution

In addition to particulates, other "classic" air pollutants of concern from a health point of view include ozone (O₃), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), and carbon monoxide (CO). A continuum of health effects at different levels of exposure to O₃ may occur, including respiratory symptoms, changes in lung function and airway inflammation. O₃ exposure has also been associated with increased hospital admissions for respiratory conditions, including the exacerbation of asthma. The acute effects of SO₂ include lung function changes, increases in specific airway resistance and symptoms such as wheezing and shortness of breath. CO combines with hemoglobin to form carboxy-hemoglobin, which reduces the oxygen carrying capacity of the blood.

The largest number of deaths as a result of air pollution is estimated to occur in India, followed by sub-Saharan Africa. It is believed that total excess deaths from exposure to air pollution in these regions are probably due to higher levels of indoor air pollution as compared to developed countries [2].

Precautions to Guard against Indoor Air Pollution (Suggested by Authors)

- 1) The children's home should not be located close to major sources of pollutants e.g. petrol stations, manufacturing plants, garages, and quarries.

- 2) Ensure that buildings housing the children's home are well ventilated.
- 3) All fireplaces in the home must have properly designed chimneys to dispose of pollutants.
- 4) In homes that use jikos (charcoal stoves), home management should ensure that there is adequate air exchange whenever the stoves are in use.
- 5) The home environment should preferably be declared a *no-smoking zone* to protect the children from environmental tobacco smoke and to decrease any chances of children copying from adults the unhealthy habit of smoking.

Other Factors

Other factors such as the efficiency of heating and ventilation systems and insulation and housing design features impact on the indoor microclimate. Extremes of hot and cold can have marked impacts on peoples' health. Construction and design of buildings can also have a significant impact on noise levels in and around the home, which, at high levels, can lead to various health effects such as sleep disruption and psychological stress [2].

Water Management & Usage

Rainwater Harvesting from Roofs

In order to save on costs of municipal water supplies, administrators of children's homes should consider and install rainwater-harvesting technologies. This will ensure that the home takes advantage of God-given water during rainy seasons. The local plumbers can act as consultants for the installation of such technology.

Also, in many parts of Sub-Sahara Africa, the quality of municipal water supplies is not always guaranteed due to poor treatment or no treatment at all. Hygienic rainwater harvesting and safe storage will minimize the risk of infection by poorly treated municipal water supplies [2].

Treatment of Drinking Water

Drinking water to be used by children should be of a good quality to eliminate the risks of infections. In cases where the quality of municipal water supplies is suspect, a simple water treatment method such as boiling should be used. Locally available chlorine-based commercial water disinfectants can also be used for treating drinking water in a children's home. Treated drinking water should by all means be kept in safe and hygienic manner to prevent any contamination that might render such treatment counterproductive.

Diseases Transmitted through Water

In order for orphanage workers to realize the importance of proper domestic water management, it is necessary for them to know the risks and consequences of

handling and usage of unsafe water. It is important to note that studies have documented a median reduction of 26% in diarrhoea morbidity and 65% median reduction in diarrhoea morbidity as a result of improved water supply and sanitation respectively [2].

Table 2: Diseases transmitted through water

<i>Disease type</i>	<i>Mode of transmission</i>	<i>Examples</i>
Water-borne diseases	Water acts a passive vehicle for the infecting agents; depend also on poor sanitation.	Cholera, typhoid, bacillary dysentery, infectious hepatitis, leptospirosis, giardiasis, gastroenteritis.
Water-washed diseases	Due to lack of adequate quantity of water; poor personal hygiene creates conditions favourable for spread; intestinal infections due to improper human waste disposal	Scabies, yaws, leprosy, lice & typhus, conjunctivitis, bacillary dysentery, amoebic dysentery, salmonellosis, paratyphoid fever, ascariasis, trichuriasis, whipworm, hookworm
Water-based diseases	Infecting agents spread by contact with or ingestion of water; life cycle of infecting agent takes place in an aquatic animal; some are affected by waste disposal.	Schistosomiasis, guinea worm, filariasis, onchocerciasis, threadworm.
Water-related vector-borne diseases	Mosquitoes, flies and other insects breed or bite near water, especially active and aggressive near stagnant open water.	Yellow fever, dengue fever, rift valley fever, bancroftian filariasis, malaria

(Source: WHO, 1997)

Water Sampling

Water supplies to children's homes should be periodically sampled and tested to ensure that it is of a safe quality. The administration of children's homes should seek the assistance of the local public health personnel or other qualified experts who should sample the water and take it for analysis, usually at a cost-sharing fee.

Waste Management

Health Risks of Inappropriate Excreta Disposal

Human excrete consists of urine and faeces. Urine is relatively harmless, other than with respect to the spread of schistosomiasis in tropical countries. But human faeces are dangerous to human health everywhere because of the pathogens they contain. Pathogens enter the human body via contaminated drinking water and contaminated food, via hands contaminated with fecal matter, and, in the case of some helminthic worm infections, directly through the skin. Ingestion of fecal pathogens can cause diarrheal disease, cholera, intestinal worm infections and typhoid fever. If a dangerous pathogen, such as *Vibrio cholerae*, is introduced into a community with poor sanitation, poor water supply and poor food safety, epidemic cholera may ensue.

Diarrheal diseases are closely associated with poor sanitation and hygiene, and resultant contamination of water and food with fecal matter. Not surprisingly, the regions of the world suffering the highest morbidity and mortality due to these diseases are those where sanitation services are least developed and poverty most deeply embedded.

Diarrheal episodes occur in all types of country but are 5 to 6 times more common in developing countries [9]. Children under the age of 5 are at highest risk, but diarrheal disease can also be fatal among the elderly and frail [10].

Most of the global burden of diarrheal diseases occurs in children in developing countries [11] and it is estimated that approximately 90% of the diarrheal disease burden is related to the environmental factors of poor sanitation and lack of access to clean water and safe food [2].

Table 3: Relationship between poor sanitation and selected diseases

<i>Disease</i>	<i>Relationship</i>
Diarrhoeal diseases	Strongly linked to poor excreta disposal, poor personal and domestic hygiene and unsafe drinking water.
Schistosomiasis	Strongly related to unsanitary excreta disposal and absence of nearby sources of water
Infection with intestinal helminthes	Strongly linked to poor excreta disposal, poor personal and domestic hygiene and unsafe drinking water.

(Source: WHO, 1997)

Achieving Proper Disposal of Excreta in Children’s Homes - Suggestions by Authors

- 1) Ensure that the home has adequate user-friendly sanitary facilities. In case the toilets are flush type, it is preferable that the toilet bowls be the squatting-

type instead of the sitting-type. This is because the former are more convenient to use by children and are also recommended for communal use.

- 2) In case the home uses pit latrines, they should be the modern improved ventilated pit latrine (VIP). These should be constructed under the supervision of the local public health officer or technician.
- 3) The home management should provide adequate anal cleansing materials e.g. old newspapers, toilet paper, water, etc. This will discourage the children from using their bare hands for anal cleansing and smearing excreta on the toilet walls.
- 4) Children should be taught to observe strict personal hygiene. Washing of hands after visiting the toilet should be made mandatory. Water in stand-pipes or leaking cans must be provided by home management.

Health Risks of Solid Waste

Solid wastes can come into direct or indirect contact with human beings at several stages in the waste cycle i.e. generation, storage, collection and disposal. The groups at risk are therefore broad and numerous and include: the population of unserved areas, especially pre-school children; waste workers; workers in facilities that produce infectious and toxic material; people living close to waste disposal facilities, and populations whose water supplies have become polluted due to waste dumping or leakage from landfill sites.

Table 4: Selected infectious diseases associated with solid waste

<i>Type of Waste</i>	<i>Diseases Associated with Waste</i>
Infected sharp waste	Staphylococcosis, hepatitis B, hepatitis C, AIDS, Streptococcosis, tetanus
Waste-generated infected dust	Anthrax, trachoma, mycosis, conjunctivitis, pneumonia
Vectors breeding in or living in waste generated ponds	Malaria, filariasis
Stray animals and rodents feeding on waste	Rabies, plague, leishmaniasis, hydatidosis

(Source: WHO, 1997)

The health risks of uncollected solid waste are obviously most severe for those actually living in unserved areas. Notably, pre-school children are at risk of injury, intoxication or infection since they are likely to be exposed to uncollected waste in streets or at unofficial dump sites. Uncollected organic domestic wastes in particular *areas* pose serious health risks since they ferment, creating conditions favorable to the survival and growth of microbial pathogens, and especially if they become intermixed with human excreta due to poor

sanitation. Organic wastes also provide feeding stock and a natural environment for insects, rodents and other animals which are potential carriers of enteric pathogens. Uncollected solid wastes can also obstruct storm water run-off, resulting in flooding or creation of stagnant water bodies, which become habitats and breeding places for waterborne vectors of tropical diseases.

Measures to Achieve Better Solid Waste Management in Children's Homes - Suggestions by Authors

- 1) Provide proper waste receptacles e.g. plastic bins with lid.
- 2) All waste generated should be stored covered in the bins to await collection in case a collection service is available.
- 3) In case a collection service is not available, the waste can be separated into combustible, non-combustible and biodegradable types. Combustible waste e.g. plastics, papers and polythene should be disposed of by burning while biodegradable waste can be applied at the home garden as organic fertilizer. Non-combustibles such as metal cans, etc should be disposed of into a pit.
- 4) For (3) above to be achieved, source separation of waste is advisable i.e. there should be specific bins for each type of waste. In this case, three bins are required, each preferably marked according to waste type to be received.
- 5) Children should never be allowed to play with or near waste storage or disposal sites.

Malaria Prevention & Control

Around 90% of the malaria burden is estimated to occur in Africa, south of the Sahara, almost all due to *Plasmodium falciparum*, the parasite species associated with the most severe and fatal malaria [12]. Malaria is one of the most serious health problems facing African countries and a major obstacle to their social and economic development. Children under the age of five years and women in their first pregnancy are the most vulnerable. Approximately 1 million deaths among children under 5 years of age can be attributed to malaria alone or in combination with other diseases.

As nearly all malaria is associated with environmental conditions, including land and water management, it is estimated that 90% of the global burden of this disease is attributable to environmental factors.

Measures for Prevention & Control - Suggestions by Authors

- 1) Provide all children resident in the home with insecticide-treated bed nets.
- 2) Carry out indoor residual spraying (IRS) in the home after every six months.
- 3) In areas with high mosquito density such as lowlands, provide window screening made of fine wire-mesh.

- 4) Use of insecticide-treated materials (ITMs) e.g. curtains, *mbu* cloth (i.e. piece of cloth treated with insecticide and hung on walls) is also encouraged in high-density mosquito areas.
- 5) Any receptacles such as tins, old tyres, old cups, etc that may collect rainwater and encourage mosquito breeding should be collected and disposed of appropriately.
- 6) Any stagnant water in or around the home should be drained by digging drainage channels or the pools filled with earth to prevent water from standing.
- 7) Bushes and long grass should not be allowed to proliferate in the home compound.

Prevention & Control of Vaccine-Preventable Diseases

Measles

Measles is a highly infectious viral disease transmitted via droplets produced by the cough or sneeze of an infected individual. An extremely small dose of virus particles in air is sufficient for transmission. Its spread is therefore facilitated in places, such as schools, crowded living quarters and even hospitals where people congregate in close proximity [2].

The poor in developing countries continue to be at risk. They live close together and have very limited access to health services, particularly immunization services. Many children are therefore not immunized and the cycle of infection thus maintained. Research has shown that a child who goes to market on his or her mother's back can become infected even if exposed only briefly [13]. On returning home, the infected child may sleep close to siblings and even neighbours' children, ensuring their prolonged exposure to the virus throughout the night. In this setting, all children not previously infected are likely to contract the disease. Also, because they are exposed to a much higher infecting dose than was the primary case, they may suffer a worse, perhaps lethal attack of the disease. Crowding and poor living conditions are clearly key environmental factors contributing to the spread of the disease [14].

Thus although better housing and sanitation have contributed to reduction of measles incidence, they are not sufficient in themselves to eradicate this disease. Massive investment in vaccine and immunization services is also necessary. Increasing coverage with measles vaccine has already led to a steady decline in disease incidence. Indeed, because of the virus' ability to seek and infect non-immune individuals, no country has made progress in measles control without use of the vaccine [2].

Poliomyelitis

Poliomyelitis (commonly known as polio), like the diarrhoeal diseases, is essentially transmitted via the faecal - oral route. Unsafe drinking-water and poor sanitation promote its spread. Starting as an infection of the intestines, the polio virus can also infect the spinal

cord and cause permanent paralysis, most often in the legs. The majority of polio cases occur in children under 5 years of age [2]. The other immunizable diseases include pertussis, diphtheria, and tuberculosis.

Precautions against Vaccine-Preventable Diseases - Suggestions by Authors

- (a) Before admitting any child into the home, his/her immunization status should be checked. The authority, relative or guardian from whose custody the child is taken should be able to provide this information.
- (b) If the child's immunization status cannot be determined, then immediate advice should be sought from the local medical officer of health or the local health centre.
- (c) All children in the home must be immunized against all the vaccine-preventable diseases mentioned above.

Prevention of Physical Injuries

Accidents in the home

If crowding combines with poor-quality housing materials, incidence of injuries and accidents rises significantly. Many accidents happen in shelters made of flammable materials, and when protection (especially of children) from the dangers of open fires or stoves is neglected [15].

Environmental hazards associated with home accidents are also related to faulty design, poor maintenance of dwellings, and use of defective or improperly installed equipment and appliances. Falls and burns frequently result from poorly sited or maintained heat sources (such as open fires, wood, gas or kerosene burners), poor-quality floor coverings and surfaces (particularly in bathrooms), poorly designed stairways or storage areas, and improperly designed or located windows [2].

Physical violence/intentional injuries

In a children's home, some children are more aggressive than others and there is a high probability of physical violence being unleashed on weaker children. Violence can result in serious injuries or even deaths. It should therefore be discouraged at all costs. It is prudent that the home management implements a strict non-violence policy e.g. by frequently reminding children about the policy and severe humane punishment of children who flout the rules. Any dangerous play that might result in injuries e.g. shadow-fighting or TV-type wrestling should also be strictly discouraged.

Children's play facilities

Ideal children's homes usually have play facilities for children. These include:

- a) Merry-go-round
- b) Slide
- c) Swing
- d) Toys
- e) See-saw
- f) Tunnel i.e. tyres placed vertically in a straight line with the lower ends slightly dug below the ground surface.

These play facilities if made of metal or wood, should be smooth without any sharp or abrasive edges to prevent piercing or abrasive injuries to children. Swings should be placed in such a way as to allow free movement. The suspension strings/ropes/chains of the swings should be periodically tested to determine their tensile strength to ensure that it is adequate to carry the live loads when in use.

There should always be a supervisor to oversee how children play in this equipment. S/he should ensure that the swing is not pushed too high and that the child is correctly positioned on the swing to prevent falls. Moreover, s/he should always ensure that the speed of the swing is not too fast to prevent children from being catapulted from the swing. Similarly, the seesaw should not always be overloaded i.e. the supervisor must ensure that it carries only the number children it has been designed to carry.

The foundations of these play facilities should be sunk and strengthened with concrete when in place and then covered with soil and grass planted. This will eliminate the risk of equipment overturning accidentally and injuring children.

Nutrition

Though nutrition is not in the domain of environmental health per se, it is necessary to mention it briefly as it has significant impacts on child health. To ensure that the children eat a balanced diet, there should be predictability of the foods to be eaten on particular days of the week. This requires that a meal plan be prepared showing the foods to be eaten for breakfast, lunch and supper on given days of the week. This will eliminate the risk of management being inclined to feed children on particular foods only. The meal plan prepared should be taken to a nutrition officer for possible revisions and approval.

To monitor the nutritional value of the foods that the children eat, a nutrition officer may visit the home periodically, say once a year, to conduct nutritional assessments on the children.

Food Safety

Food is essential to a healthy life, but it can also be a major exposure route for many pathogens and toxic chemicals. These contaminants may be introduced into food during cultivation, harvesting, processing, storage, transportation and final preparation. Inspection and

monitoring of food quality is therefore necessary to ensure food safety. Health impacts of food-borne illnesses range from mild indisposition to life-threatening illness [2].

Biological and chemical agents in food represent the two major types of food-borne hazard. Biological agents tend to pose acute hazards with incubation periods of a few hours to several weeks before the onset of disease, whereas chemical hazards usually involve long-term, low-level exposures. While most biological hazards can be controlled by appropriate cooking, chemical agents often remain in food unless specifically deactivated or removed [2].

Biological Hazards in Food

Sources of biological contamination of food are diverse and include polluted water (e.g. wastewater, irrigation and household water), dirty hands, flies, pests, domestic animals; dirty cooking pots and utensils, and human and animal excrete. Foods themselves are also frequently the source of contaminants, as they may harbor pathogens naturally or may have been derived from infected animals. Cross-contamination of foods can also occur [2].

Table 5: Biological agents of important food-borne diseases and main epidemiological features

<i>Disease agent</i>	<i>Important reservoir/carrier</i>	<i>Examples of food that can become contaminated</i>
<i>Bacteria</i>		
<i>Bacillus cereus</i>	Soil	Cooked rice, cooked meats, vegetables, starchy puddings
<i>Brucella spp</i>	Cattle, sheep, goats	Raw milk, dairy products
<i>Campylobacter jejuni</i>	Chickens, dogs, cattle, pigs, birds	Raw milk, poultry
<i>Clostridium botulinum</i>	Soil, mammals, birds, fish	Fish, meat, vegetables
<i>Clostridium perfringens</i>	Soil, animals, humans	Home-preserved honey, cooked meat, poultry, gravy, beans
<i>Escherichia coli</i>	Humans, cattle, poultry, sheep	Salads, raw vegetables, cheese, undercooked meat, raw milk
<i>Mycobacterium bovis</i>	Cattle	Raw milk
<i>Salmonella spp.</i>	Humans, animals	Meat, poultry, eggs, dairy products, vegetable salads
<i>Shigella spp.</i>	Humans	Potato, egg salad
<i>Staphylococcus aureus</i>	Humans	Ham, egg salads, poultry, cream-filled bakery products, ice cream, cheese
<i>Vibrio cholerae</i>	Humans	Salads, shellfish
<i>Vibrio parahaemolyticus</i>	Seawater, marine life	Raw fish, crabs and other shellfish
<i>Yersinia enterocolitica</i>	Water, wild animals, pigs, dogs, poultry	Milk, pork, poultry
<i>Viruses</i>		
Hepatitis A virus	Humans	Shellfish, raw fruit, vegetables
Norwalk agents	Humans	Shellfish, salads
<i>Protozoa</i>		
<i>Cryptosporidium spp.</i>	Humans, animals	Raw milk, raw sausage (non-fermented)
<i>Entamoeba histolytica</i>	Humans	Vegetables, fruits
<i>Giardia lamblia</i>	Humans, animals	Vegetables, fruits
<i>Toxoplasma gondii</i>	Cats, pigs	Undercooked meat, raw vegetables
<i>Helminths</i>		
<i>Ascaris lumbricoides</i>	Humans	Soil-contaminated food
<i>Trichuris trichiura</i>	Humans	Soil-contaminated food
<i>Taenia saginata</i>	Cattle	Undercooked beef
<i>Taenia solim</i>	Pigs	Undercooked pork
<i>Trichinella spiralis</i>	Pigs, carnivores	Undercooked meat
<i>Fasciola hepatica</i>	Cattle, goats	Watercress
<i>Paragonimus spp.</i>	Freshwater crabs	Undercooked/raw crabs

Bacillus cereus, *Staphylococcus aureus* and *Clostridium perfringens* are food-borne pathogens that cause diseases frequently accompanied by diarrhoea and gastroenteritis/stomach pains. Their incidence could be much higher than is always reported but the infections are not a focus of public health attention as they are often self-limiting [2].

On the other hand, infection due to *Clostridium botulinum* is rare but attracts much public attention due to its high case-fatality rate. Most cases of botulism occur as a result of faulty preservation or processing of food in the home [2].

Chemical Hazards in Food

Many chemical hazards in food are produced naturally by organisms in the environment, such as *Aspergillus flavus*, which produces aflatoxin. Others are inherent components of food itself, as in the case of poisonous mushrooms. Pollutants such as lead, cadmium and polychlorinated biphenyls (PCBs) in air, water and soil can also lead to high levels of toxic chemicals in food which have serious health effects when chronically ingested [2].

Naturally-Occurring Chemicals

Mycotoxins, plant toxins and marine biotoxins can contaminate food and be hazardous to health. Mycotoxins are widely present in the food supply and have a variety of toxic effects. Aflatoxin is probably the best-known mycotoxin and attacks the liver, while the naturally occurring mixture of aflatoxins and aflatoxin B1 has been classified as a human carcinogen. Aflatoxin production is associated with environmental factors, including certain weather conditions and poor postharvest handling [2]. Outbreaks of acute aflatoxin poisoning may be associated with high mortality rates. For example, an outbreak of aflatoxin food poisoning killed over 100 persons in Kenya's Makueni district in May 2004 [16].

Examples of plant toxins include many wild mushrooms and many plants which can grow as weeds among food crops [2].

Precautions for Food Safety in the Homes - Suggestions by Authors

- 1) All kitchen workers involved in food preparation and handling must undergo medical examination after every six months. This will eliminate the risk of them acting as reservoirs/carriers of food-borne disease pathogens.
- 2) All foods must be properly and thoroughly cooked.
- 3) Kitchen workers must maintain proper personal hygiene i.e. washing hands after visiting toilet; short kempt hair; clean wear; short fingernails.
- 4) Food store should be clean, well aerated and free from any dampness that might encourage the growth of *Aspergillus flavus* (a mould) on grains.

- 5) Proper kitchen management should be observed i.e. cleanliness, separation of food preparation areas from waste storage area, cooking area and serving area and proper storage and disposal of kitchen waste.
- 6) To prevent the risk of consuming chemically-contaminated vegetables, the home management should verify the source of their supplies and prove that the vegetables are not grown on polluted soils e.g. sewage-irrigated fields and waste dumping sites.
- 7) Home management should ensure that beef and pork supplies to the home are duly inspected by the relevant authorities. Verification can be done simply by looking at inspection stamp or certificate.

Sexual Safety

In mixed sex children's homes, girls are likely to be more vulnerable to sexual violence than boys. Sexual safety in these homes should therefore be of a major concern to management. It is important to maintain safety in the homes to protect girls from sexual violence, unwanted pregnancies and sexually transmitted infections.

Precautions for Sexual Safety - Suggestions by Authors

- 1) Improved security around the home to guard against sexual predators;
- 2) Rape-prevention education amongst girls in the home. This can be facilitated by a local anti-rape organization or a children's rights lobby group within the region;
- 3) Sex and AIDS education. This can be conducted by teachers or health personnel. The focus should be on management of children's (including adolescents) sexuality i.e. the appropriate conduct of both sexes towards each other.
- 4) Adolescent boys and girls should sleep in separate room;
- 5) Both boys and girls should not be presented with tempting opportunities e.g. allowing adolescent boys to visit girls' rooms.
- 6) If sexual safety cannot be guaranteed at the home, options for making it a single-sex home should be considered.

Prevention of Chemical Poisoning/Chemical Safety

Poisonings frequently result from inadequate storage of poisonous substances and dangerous items (such as medicines, insecticides, pesticides and cleaning products).

Precautions to Safeguard Chemical Safety- Suggestions by Authors

- 1) Do not keep chemicals in containers that the kids are familiar with and might confuse them e.g. soda bottles;
- 2) Keep all chemicals and medicines out of reach of children, probably in a lock-and-key store;

- 3) Dispose of chemical containers safely e.g. by burying deep in the ground or incineration;
- 4) Keep chemicals away from kitchen and food store to eliminate the danger of any accidental contamination;
- 5) Teach children the dangers of handling any chemicals.

Environmental Hygiene

The management of those in the physical environment that may cause disease is known as environmental sanitation or hygiene. It is one of the most important aspects of primary prevention of disease. Apart from disease prevention, environmental hygiene controls any eyesores in the home compound.

The physical environment of the home should be kept clean and tidy. The collection of refuse in the compound can be done manually by children, but if the home is well endowed financially, then a subordinate staff can be recruited for that purpose. A dustbin (or dustbins) should be provided for storage of refuse. An appropriate disposal site should be identified and prepared for disposal of the refuse.

Eye Health

Eye conditions of concern include conjunctivitis, trachoma, and vitamin A deficiency.

Conjunctivitis

Conjunctivitis is an acute inflammation of the conjunctivae, and may be infectious (viral or bacterial), allergic or irritative. Infectious conjunctivitis is often endemic and may become epidemic in conditions of poor hygiene. Secondary infection may lead to keratitis and subsequent blindness. Viral conjunctivitis is often preceded by a cold. Symptoms include "red eyes" (injected conjunctivae) with or without a purulent discharge [2].

It is advisable that if conjunctivitis is noticed in the home, management should step up all efforts to ensure that children maintain high standards of personal hygiene. This will prevent the disease from spreading in the home.

Any child presenting with this condition should be referred to a medical practitioner for treatment.

Trachoma

Trachoma is the world's major cause of blindness. It is usually endemic and contagious. Its occurrence is associated with poor hygiene, lack of water and overcrowding. Preventive measures include: provision of adequate quantities of water and soap, personal hygiene (hand washing, eye toilet) and sensitizing children on the dangers of poor personal hygiene, especially failing to wash eyes in the morning which is common in young children if they are not continually reminded [2].

Vitamin A deficiency

Nutritional deficiency of vitamin A principally affects infants and young children [2]. Clinical manifestations are often precipitated by an acute febrile illness (measles, diarrhea etc) and signs may evolve very quickly (in hours). A notable clinical feature is night blindness. Night blindness is difficult to observe in infants and young children, but at nightfall they may stop playing or become fearful. To prevent vitamin A deficiency, home management should provide children with locally available foods that are rich in vitamin A e.g. yellow fruits especially papaya and carrots, green leafy vegetables, red palm oil, liver, eggs, etc [2].

Rodent & pest control

Pests associated with housing include lice, bedbugs, fleas, flies, cockroaches, ticks and mites, as well as rats and mice. Recent studies have demonstrated that allergic sensitivity to cockroaches may be widespread among people living in infested housing [17]. Cockroaches can infest a variety of building types, and thrive in dark, warm, moist conditions, particularly if food is available and waste-disposal systems are poor. In houses which become infested with rats (often in urban areas) dead spaces in walls and behind panelling provide nesting sites. Rats in rural areas may also be common and are frequently associated with farming activities. Rats transmit a large number of diseases (such as plague), and parasitic infections, commonly carrying roundworm and tapeworm parasites. In urban areas they may also act as disease vectors [2]. (See common pests and rodents and their control measures in Table 6).

Fire Safety

The purpose of instituting fire-safety measures is to ensure that kids and their entire home are protected from accidental fires that might arise.

Preconditions for Fires

For fire to start, three elements must be present:

- 1) Oxygen (from atmosphere)
- 2) Combustible material (fuel)
- 3) Heat -to ignite the fire

To prevent/stop fire, remove any of these elements.

Common Causes of Fires:

1. Electrical faults
2. Smoking
3. Friction
4. Overheated materials
5. Hot surfaces

If all these ignition sources are removed, the other two sources i.e. fuel plus oxygen will not cause fire.

Table 6: Common Pests & Rodents and their Control Measures

<i>Pest/Rodent</i>	<i>Occurrence</i>	<i>Control agents</i>	<i>Remarks</i>
Bed bugs	Rooms; beds; furniture (also chicken nests)	Malathion; ronnel; dichlorvos; diazinon	Apply lightly to mattress surfaces and more heavily to bed frame. Allow to dry before using. Never apply to children's crib.
Cockroaches	Enclosed spaces such as kitchens or store-rooms.	Residual sprays	Apply to hiding places and runways. Use a spray and not a mist. Pay attention to warm humid places. Do not treat where children are likely to contact surfaces.
Fleas	Dusty floors.	Diazinon; ronnel; malathion	Spray floor and base boards and walls to a height of 10cm.
Flies	Refuse and manure pits; pit latrines	Ronnel; malathion	Treat garbage, refuse, manure and other fly breeding sites.
Lice (head, body and pubic lice)	Head, body or pubic area.	Lindane	Keep out of eyes and mucous membranes. Sterilize clothing and beds by laundering. Do not apply to eyes and clothes.
Mites	Clothing	Any mosquito repellent is toxic to mites.	Keep out of eyes.
Rats	Rooms, pit latrines	Any rodenticide locally available in the market.	Rodenticides are highly poisonous even to humans and precautions should be taken to prevent potential food contamination and access by children. (See guidelines on chemical safety).

Structural Features and Exits

In the case of planned children's homes, fire resistance should be incorporated at the planning and design stage whereby the potential spread of fire should be checked both horizontally and vertically through walls, floors, elevator shafts, stairwells, etc.

All fire exits must conform to the conditions below: -

1. No parts of building to be far from exit leading to the outside
2. Each floor must have at least one exit;
3. A clearly visible sign post to direct fire escapees;
4. No obstruction to the fire exit; direct its location;
5. Outside stair ways and fire escapes not lead in to interior court yards;
6. Doors opening outwards or sliding doors.

Fire Extinguishing Equipment

The following provisions should be made for extinguishing any fire outbreaks:

1. Hose pipes (water must be available)
2. Dry sand
3. Portable fire extinguishers

How to Extinguish Various Fires

Different methods fire extinguishing methods are recommended for specific classes of fire (see Table 7 below).

Table 7: Classes of fire [18]

<i>Class of fire</i>	<i>Source</i>	<i>Precautions/equipment</i>
A	Carbonaceous solids, wood, paper, and rubbish.	Water jets – they quench the fire and cool the material below its ignition temperature.
B	Flammable liquids, solvents, liquifiable solids, oil, paints etc.	Blanketing method (foam, sand etc.).
C	Gases – fractured gas main.	Stop gas leak.
D	Metals: magnesium, sodium, potassium with water	Dry powder.
E	Electrical equipment	De-energize the equipment, then follow as in class A or B.

(Source: Omwega, TM, 2003)

Fire Alarms: The children's home should have an alarm system to warn occupants if fire starts. The alarm should be audible everywhere in the home.

Fire fighting Training: The staff in a children's home should receive some basic training on firefighting skills to enable them deal with any fires in the event of an outbreak.

Housekeeping

Definition of housekeeping

For the purposes of this paper, we shall define housekeeping as maintaining a state of cleanliness, a good state of repair and maintenance, creating a place for everything and putting everything in its place. Housekeeping is not just cleanliness. It includes keeping work areas, such as the kitchen, neat and orderly; maintaining rooms and floors free of slip and trip hazards; and removing of waste materials (e.g., paper trash) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole space, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

The Purpose of Housekeeping

Poor housekeeping can be a cause of accidents, such as: tripping over loose objects on floors and stairs

- a. being hit by falling objects;
- b. slipping on greasy, wet or dirty surfaces;
- c. striking against projecting, poorly stacked items; or misplaced material cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire, etc.

Benefits of Good Housekeeping Practices

Effective housekeeping results in:

- a. fewer tripping and slipping accidents in the children's home
- b. decreased fire hazards
- c. lower children's exposure to potentially hazardous substances e.g. medicines, detergents, paraffin
- d. more efficient equipment cleanup and maintenance
- e. better hygienic conditions leading to improved health
- f. more effective use of space
- g. reduced property damage by improving preventive maintenance
- h. aesthetic appeal of the interior environment

Elements of an Effective Housekeeping Program

Dust and Dirt Removal: Vacuum cleaners are suitable for removing light dust and dirt. Dampening floors or using

sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, light fixtures, windows, cupboards and lockers may require manual cleaning.

Children's Facilities: Children's facilities including beds, beddings, toilets, toys, swings, etc, need to be adequate, clean and well maintained. Lockers are necessary for storing children's personal belongings. Washroom facilities require cleaning once or more each week to reduce slipping hazards.

Floors: Poor floor conditions are a leading cause of accidents in the interior environment, so cleaning up spilled oil and other liquids at once is important. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard. Floors should also be free of debris and accumulations of dust.

Maintain Light Fixtures: Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly.

Kitchen Tools and Equipment: Keeping tools neat and orderly can be very important to everyone's safety, whether in the kitchen, utensils rack, or in the washing area. Kitchen knives, forks, and sharp edges of sufurias can be especially dangerous to children who inevitably consider them as play things.

Storage: Materials such as medicines and household chemicals should be stored out of reach of children. All storage areas should be clearly marked.

Stairways: Stairways should be clearly marked and kept clear of objects that can cause trips and falls. Stairways require adequate lighting. There should be hand rails in the stairway to offer support to children, especially while descending.

Drug and Substance Abuse

Environmental tobacco smoke (ETS) is a mixture of several toxic compounds and is the primary cause of poor indoor air quality and respiratory health problems in children [2]. The children's home environment should ideally be declared a no-smoking zone to protect children from the deleterious effects of environmental tobacco smoke.

Training of Management Staff

In order for these guidelines to be effectively implemented, training of implementing staff is essential. It is suggested that a five-day training workshop is adequate. Facilitators can be drawn from the departments of public health, environment and occupational health and safety, or any local health training institutions.

Conclusion and Recommendation

The authors have strived to unearth and present information relevant for environmental health

management in children's homes. These guidelines might not be exhaustive and are therefore subject to review and fine-tuning by any interested experts and practitioners of environmental health or other interested parties. We are optimistic that stakeholders shall find this work useful.

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