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Environmental Assessment of Alexandria Medical Research Institute

Bassant A. Y. A. Easa, Mamdouh H. M. Abdou[1], Aleya H. Mahmoud[2] and **Mamdouh A. El-Meseiry[2]**

Medical Research Institute Hospital, Alexandria, Egypt,
[1]Faculty of Meteorology, Environment, and Arid Land Agriculture, King Abdulaziz University, Saudi Arabia,
[2]High Institute of Public Health, Alexandria University, Egypt

Abstract. The evaluation of the temperature and humidity in the different sites of the Medical Research Institute (MRI) revealed that, allover the year, the temperature ranged between 19 and 28 degrees Centigrade, while the humidity ranged between 67% and 90%. Ideally, temperature should be adjusted between 22 and 26°C, and relative humidity should be kept at 30% to 60%. The adequacy of ventilation depended on the location of the hospital unit. The cost-free wards, the kitchen, the laundry, the chemotherapy unit, and the surgery D ward had poor ventilation. Some of the hospital departments depended on air conditioning systems and others made use of natural ventilation. The light adequacy in the different departments and units depended on their site as regards exposure to the sunlight. Examples for units with poor natural lighting were the cost-free wards, the kitchen, the chemotherapy unit, and the bacteriological laboratory. Most of the units had to use artificial lighting during the daytime apart from the natural light to ensure adequate illumination. The assessment of cleanliness revealed that the areas that had the priority for good cleaning practices had the highest score for cleanliness. The patients in the operating theatre, cardiac care units and renal dialysis unit are more susceptible to infection than those in general wards. Cleaning was therefore of particular importance in these areas. Despite the use of vector control measures on both the hospital and unit levels, vectors were present in the hospital, *e.g.* mice, cockroaches, and houseflies. This may be due to the irregular use of pesticides and rat control measure. The quality of the laundry services was found inadequate and did not fulfill many of the laundry requirements. Color coding was not used in linen

containers' identification. Furthermore, there was complete dependence on natural drying, as the dryer was not working. There was also no bacterial evaluation for the laundry before and after washing. The present study concluded that the Medical Research Institute was mostly good in its environmental conditions, except for some defects in certain services.

Keywords: environmental assessment, hospital, hospital natural light, hospital temperature, hospital humidity, hospital natural ventilation, hospital vector control, hospital laundry services.

Introduction

Few studies have been conducted to assess the sanitation of hospitals. A full environmental sanitation for the Medical Research Institute (MRI) has never been studied; so, this study was conducted to evaluate the environmental sanitation of the MRI. The MRI is one of four main branches into which the Institute is divided. These four branches are: the scientific departments, the hospital, the blood bank, and the administration. Other auxiliary services include a kitchen and a laundry department cooperating with the hospital in serving the patients. All these branches and departments were included in this study.

Although, the trend in ventilation of hospitals shifted from the natural to the mechanical, with air conditioning as a desired goal, natural ventilation and illumination are still required for both psychological and financial reasons (Mitwally and El-Sharkawy, 1995). One of the most significant problems in contemporary buildings - including hospitals - is **"sick building syndrome"**, which is caused by sealed buildings and a total dependence on mechanical systems for heating, ventilation, and air conditioning, where windows cannot be opened (Malkin, 1992).

In a hospital, heating and ventilation are very complex issues that require careful consideration. A delicate balance must be maintained between relative humidity and temperature in order to avoid problems of condensation or static electricity (WHO, 1997).

In patient areas, the temperature should be adjusted between 22 and 26 °C and the relative humidity should be kept between 30 and 60% to prevent risks of static electricity (Emmerson, 2001). Temperature and humidity are namely known to affect wound healing. Also, special consideration should be given to the elimination of drafts by making sure

that doors and windows are closed tightly, and by the use of Thermo-pane insulating glass (WHO, 1997).

The environment significantly influences the multiple factors in the chain of infection, that's mainly why the Occupational Safety and Health Administration (OSHA) requires that patient care areas, laboratories, and other spaces be kept clean and in good sanitary conditions. Hence, these areas should be cleaned daily, periodically, or as needed. The purpose of cleaning is to remove dust, which may contain bacteria resistant to disinfection (*e.g. Clostridum difficile*, *Staplylococcus aureus*), and to keep equipments and surfaces dry. A surface that is clean and dry will not support the growth of most bacteria (Schull, 1998).

Cleaning schedules and methods vary according to the area of the hospital, type of surface to be cleaned, and the amount of dust present. Disinfectant detergent formulation should be used for environmental surface cleaning, but the actual physical removal of microorganisms by scrubbing is probably as important (Castle and Ajemian, 1987).

Infection spread by the vector route has an animal or insect as intermediate host between two persons (Castle and Ajemian, 1987). Vectors such as rats, flies, and cockroaches, who feed or breed on organic waste, are well known passive carriers of microbial pathogens. Their populations may increase dramatically where there is mismanagement of waste (Prüss, *et al*., 1999).

Although soiled linen has been shown to be a source of large number of pathogenic microorganisms, the risk of actual disease transmission is negligible. It was found that effective laundering destroyed all known pathogenic organisms (Damani, 1997 and Cottenden, *et al,* 1999).

Smaller healthcare facilities with in-house laundries and some large institutions may elect to combine the environmental services and laundry department. Management should ensure that all staff and laundry contractors responsible for handling or laundering linen are appropriately trained (Damani, 1997).

This work aimed at studying the existing environmental sanitary conditions of the Medical Research Institute Hospital and to evaluate the adequacy of the sanitary services available. The present study was carried out through a descriptive cross-sectional approach.

Materials and Methods

Temperature and humidity in all hospital departments were measured using a thermometer and a hygrometer respectively at about 11.00 am 3 times per week in the middle of each season. To assess the adequacy of ventilation subjectively, 3 items were considered and included in the observation sheet. These items are: presence of open windows of suitable size to allow natural ventilation, or else a working air-conditioning system (with adequate filters) that is kept clean, presence of appropriate spaces between beds (at least 1 m) in multi-bed patient wards, and absence of bad odor (Environmental Protection Agency, 2003).

A scoring system for adequacy of ventilation was developed based on the former items as follows: presence of all 3 items was judged "good", absence of one or two items was considered "fair", and absence of all three items was deemed "poor".

To assess the adequacy of lighting subjectively, 4 items were observed at noon in the different units (Forster, 2004). They included the presence of windows of suitable size to allow enough natural light, freedom from glare, freedom from shadows, and extreme contrasts, absence of visual strain during reading. A scoring system for adequacy of lighting was developed based on the former items as follows: presence of all 4 items was judged "good", absence of one or two items was considered "fair", and absence of three or all four items was deemed "poor".

Level of cleanliness was assessed subjectively through observation of several items, including (NHS Estates, 2004): for patients' rooms: Floors, walls, ceilings, windows, waste-baskets, bedside tables, bed linen, and air freshness. For corridors: Floors, walls, ceilings, windows, and air freshness. For bathrooms: Floors, toilets, lavatories, showers, and air freshness. To assess the different cleaning practices, cleaning staff was interviewed about frequency of cleaning and cleaning agents used in different units of the MRI. For each place or object, three items were taken in consideration, *e.g.* the floor was considered good if there was no dust, no solid waste, and no sputum; and considered fair if it was polluted

with any of the above; and poor if it was polluted with 2 or 3 of the above. The score for cleanliness was calculated through taking into consideration all single items describing the cleanliness of each of the places or objects in the patients' rooms, the corridors or the bathrooms. For example, a patients' room had a score of 100% if all three items describing the cleanliness of floors, walls, ceilings, windows, bedside table, waste-basket, bed linen and air freshness (amounting to 24 items) were present and good. Vector control measures and their effectiveness were assessed through interviewing. Hospital staff (nurses and workers) were asked about many items including the following (Franceys, *et al*., 1992 and Mathews, 1997): Vector control measures, at which level the vector control measures were done, who was responsible for vector control, what forms of vector control were used, whether chemical, biological or physical, and if chemical, whether aerosol or dusting, frequency of application of vector control measures, and the most common types of vectors.

Laundry services were assessed through interviewing with hospital staff. Nurses and workers were asked about many items of laundry services (Damani, 1997, Ayliffe, *et al*., 1992, and Centers for Disease Control and Prevention, 2003).

This study was carried out along one year starting from autumn 2002 to summer 2003, where October, January, April, and July represented the middle months of the four seasons. The collected data were reviewed for accuracy and completeness, and appropriate statistical procedures were then applied (Mason, *et al*., 2003 and Sparks, 2000).

Results and Discussion

Table 1 shows the average seasonal means of temperature and relative humidity in different units of MRI. Regarding the hospital temperature, it was found that in autumn and spring the temperature in different hospital units ranged from 25 to 28°C, in winter from 19 to 23°C, and in summer the temperature ranged from 26 to 28°C.

Table 1. Seasonal means of temperature and relative humidity in different units of MRI, Alexandria, 2003.

Seasons and Parameters / Units	Autumn		Winter		Spring		Summer	
	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)
Theater Large*	26	80	23	79	26	80	27	76
Medium	26	78	23	78	27	83	27	76
Small	25	78	23	80	25	78	27	77
Recovery**	26	78	20	83	26	77	28	80
New ward	27	74	22	78	27	74	27	80
Surgical wards								
Surgery A	27	77	22	78	27	77	27	81
Surgery G	27	77	20	80	27	77	27	81
Surgery D	27	77	19	84	27	77	27	76
Medical wards								
Female medicine	27	77	22	77	27	76	27	76
Male medicine	27	77	22	77	27	71	27	77
Dialysis unit***								
Large unit	26	71	21	85	27	78	27	72
Small unit	26	70	20	83	26	71	27	78
Coronary unit								
First class*	25	67	19	88	25	67	26	73
Second class	27	78	20	87	27	78	28	75
Free class	27	80	19	90	26	80	28	76
Endoscopy unit*	26	76	20	84	27	77	26	76
Chemotherapy unit	27	80	20	81	28	83	26	81
Pharmacies								
Private pharmacy	26	81	20	84	26	84	27	77
Free pharmacy	27	80	20	85	27	80	27	77
Human genetics	26	81	19	79	26	82	28	75
Bacteriology lab	27	81	20	78	27	82	27	77
Parasitology lab	27	80	20	79	27	82	27	77
Blood disease lab	27	80	20	78	28	81	27	76
Radiology unit	26	81	19	81	26	83	27	76

* Working air conditioning system

** Presence of air condition but not working during measurement.

*** Presence of air conditioning system working in all seasons except winter.

Table 1. Continued.

Seasons and Parameters / Units	Autumn		Winter		Spring		Summer	
	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)	Temp. (°C)	Relative Humidity (%)
Chemical Pathology	26	81	22	79	27	84	27	77
Applied medical	28	79	22	77	28	79	27	77
Physiology	28	80	20	78	28	81	27	77
Clinics lab	26	80	20	80	27	83	26	78
Biochemistry	26	80	20	78	27	82	27	76
Immunology	27	81	20	81	28	84	27	76
Pharmacology	27	82	20	78	28	83	27	76
Tumor cell biology	27	80	20	78	28	79	28	75
Blood bank	28	81	21	80	28	83	27	77
Pathology	27	80	20	77	28	82	27	77
Kitchen	28	81	20	77	28	81	27	76
Laundry*	27	82	20	78	27	83	26	81

* During measurement the laundry machines were not working

With respect to relative humidity in the MRI, in autumn, it ranged from 67% to 82%, in winter from 77% to 90%, in spring from 67% to 84% and in summer from 72% to 81%. It was found that air conditioning was used in some hospital units, like the large operation room, dialysis unit, and first class room of the coronary care unit. These units depended totally on the air conditioning system because of its important role in ventilating these units as no windows were opened.

In operating rooms the temperature and humidity of the incoming air should be automatically controlled, both for comfort of the patient and staff, and to minimize anesthetic explosion risk. Also, in the dialysis unit air conditioning system plays an important role, as adjusted temperature is required in this unit for the working dialysis machines. The temperature of the machines becomes elevated during dialysis session and during machine disinfection, and the air conditioning system help to reduce the machines temperature. In addition, adjusted temperature is very important for the kidney dialysis patient, as he stays in hemodialysis for four or five hours and he must feel comfortable during his long session (Mitwally and El-Sharkawy, 1995, Health Department of Western Australia, 1998, and Haglund, *et al*., 1996).

The temperature of the operation room, which depended on air conditioning all the year round, ranged from 23-27°C and the humidity

ranged from 76-83% during the four seasons. Ideally the theatre temperature should be about 25°C and relative humidity about 65% (Mitwally and El-Sharkawy, 1995). The deviation of the temperature and relative humidity from the desired average may be explained by the low efficiency of the operation room air conditioning system or the lack of specific maintenance.

Normally the body temperature adjusts rapidly to the temperature in the air. If humidity is high and air temperature is low, people become more susceptible to hypothermia, arthritis, and bronchitis. A combination of high temperature and high humidity encourages the spread of bacteria (Hosny, *et al*., 1992).

Humidity in hospitals can influence a multiplicity of factors: It can affect the persistence of an agent at its source, its transmission through the air, and the effectiveness of host's mucous membranes in resisting infection. In addition, the agent's survival is influenced by the temperature, humidity, pH, and the radiation at its reservoir or source (Brachman, 1998, Jackson and Lynch, 1998 and Weinstein, *et al*., 1998).

Air quality, temperature control, and air movement directly affect infection control, comfort, and safety in critical care units and consequently affect the patient care (Strawser and Grengory, 1993).

Table 2 shows adequacy of natural ventilation in different units of MRI. It was found that most of institute units were fair in their natural ventilation, especially the labs. The new ward (medical and surgical sections), surgery A, and the coronary unit's first and second classes were good in their natural ventilation as they had all the desirable criteria, like presence of suitable windows, one meter between beds, and no bad odor (Environmental Protection Agency, 2003). On the other hand, surgery D, the free class of the coronary unit, the kitchen and the laundry had poor natural ventilation. This may be due to their internal locations compared to the other hospital units and due to the small windows in these units. Also, the kitchen and laundry are present on the underground level of the hospital. The rest of the hospital units had air conditioning, like the dialysis unit, the theatres, and the recovery room.

Many respiratory pathogens can adapt to the comfortable indoor environment and are able to move around the building through airflow

movement, whether natural (due to temperature gradients or pressure differences) or mechanical (forced airflow through ductwork) (Mills, 2004).

Hospitals that depend for their ventilation on throwing open windows and doors have usually less frequent outbreaks than those with full air conditioning. The full dependence on wholly artificial means of air control can impose intolerable difficulties when sophisticated systems break down and prompt efficient maintenance cannot be relied upon. On the other hand, a naturally ventilated hospital will be affected by the climate. In tropical countries, the warm humid climate would dominate most of the year (Cox and Groves, 1994).

Table 2. Natural ventilation adequacy in different units of MRI, Alexandria, 2003.

Status / Units	Good	Fair	Poor
New ward	+		
Surgical wards			
Surgery A	+		
Surgery G		+	
Surgery D			+
Medical wards			
Female medicine		+	
Male medicine		+	
Coronary unit			
First and Second class	+		
Free class			+
Chemotherapy		+	
Pharmacies			
Private pharmacy		+	
Free pharmacy		+	
Human genetics lab		+	
Bacteriology lab		+	
Parasitology lab		+	
Blood disease lab		+	
Radiology unit		+	
Chemical pathology		+	
Applied medical chemistry lab		+	
Physiology lab		+	
Out patient lab		+	
Biochemistry lab		+	
Immunology lab		+	
Pharmacology lab		+	
Tumor cell biology lab		+	
Blood bank		+	
Pathology lab		+	
Kitchen			+
Laundry			+

Table 3 shows the light adequacy in different units of MRI. It was found that most of the units were assessed as fair, especially the labs, as

Table 3. Natural light adequacy in different units of MRI, Alexandria, 2003.

Light intensity / Units	Good	Fair	Poor
Theater			
Large theater	+		
Medium theater	+		
Small theater	+		
Recovery		+	
New Ward	+		
Surgical wards			
Surgery A	+		
Surgery G		+	
Surgery D		+	
Medical wards			
Female medicine		+	
Male medicine		+	
Dialysis			
Large room	+		
Small room	+		
Coronary unit			
First class	+		
Second class	+		
Free class			+
Endoscopy		+	
Chemotherapy			+
Pharmacies			
Private pharmacy		+	
Free pharmacy	+		
Human genetics lab		+	
Bacteriology lab			+
Parasitology lab		+	
Blood disease lab		+	
Radiology Unit			+
Chemical pathology lab		+	
Applied medical chemistry lab		+	
Physiology lab		+	
Out patient lab		+	
Biochemistry lab		+	
Immunology lab		+	
Pharmacology lab		+	
Tumor cell biology lab		+	
Blood bank		+	
Pathology lab		+	
Kitchen			+
Laundry			+

they depended totally on artificial illumination instead of natural light. This can be explained by their natural locations away from good daylight, compared to most of the hospital clinical departments (*e.g.* theatre, new ward, dialysis unit, and first and second classes of coronary care unit) which have good natural light from large windows.

On the other hand, it is apparent in Table 3 that the free class of coronary care unit (CCU), chemotherapy unit, bacteriology lab, radiation sciences lab, kitchen, and laundry were considered poor in their light adequacy. These places did not have enough windows, and even if present they were always kept shut. The chemotherapy unit, kitchen, and laundry were present on the same floor (underground) and were poorly lighted with natural light, so artificial illumination was required in these units.

Hospital lighting is not just a matter of ensuring that all staff working in the various hospital components enjoy **"**optimum seeing**"** conditions, but also important for the associations of light to mood, and the need for individuals to be able to control lighting levels for different activities (Hosking and Haggard, 1999, and Walder, *et al*., 2000).

Numerous studies have shown the significance of full-spectrum light in a hospital more than elsewhere, whether the light was natural sunlight or from an electrical source (Malkin, 1992 and Iwata, *et al*., 1997). Extending the natural working day is possible by electric lighting, but for hospitals the use of artificial lighting occurs to a much greater extent than in normal commercial and industrial premises. The first objective is the provision of adequate illumination. Attempts to save energy by under-lighting are a false economy, as without sufficient light errors and mistakes increase and visual fatigue reduces the rate of work (Forster, 2004).

Most hospital designs utilize daylight with the use of large windows and skylights, clerestory windows, and so on. The effects of daylight on emotional well-being seem to be well enough documented to make it worth while installing full-spectrum "daylight" in a number of patient areas (Forster, 2004 and Iwata, *et al.,* 1997).

Table 4 presents cleanliness levels in different units of MRI. The findings of the present study revealed that the operating theatre, recovery room, new ward, coronary, and endoscopy units were generally good in their level of cleanliness, as their scores were (92%-100%). At the same time, surgery A, surgery G, male medicine, and dialysis units were generally good, but with less scores (71%-88%).

Table 4. Cleanliness levels in different units of MRI, Alexandria, 2003.

Patients' rooms:

Cleanliness Level / Units	Floor			Bed linen			Basket			Ceiling			Wall			Windows			Bed side table			Bad odor	
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Not Present	present
Theater	+			+			+			+			+			+			Not applicable			+	
Recovery	+			+			+				+		+				+		+			+	
New ward	+			+			+			+			+			+			+			+	
Surgery A		+			+			+			+		+				+			+		+	
Surgery G		+			+			+			+		+				+			+		+	
Surgery D			+			+		+			+		+				+				+		+
Female medicine			+		+			+			+		+				+				+		+
Male medicine			+		+			+		+			+				+				+		+
Dialysis unit	+				+		+			+			+				+		+			+	
Coronary unit	+				+			+			+		+				+		+			+	
Endoscopy unit	+			+				+		+			+			+			Not applicable			+	

Table 4. Continued

Patients' bathrooms:

Cleanliness Level / Units	Floor			Toilets			Showers			Lavatories			Bad odor	
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Not Present	present
New ward	+			+			+			+			+	
Surgery A		+			+		+				+		+	
Surgery G		+			+			+			+		+	
Surgery D			+			+		+				+		+
Female medicine			+			+		+				+		+
Male medicine			+			+		+				+		+
Dialysis unit	+			+			Not applicable				+		+	
Coronary unit	+			+				+			+		+	

Table 4. Continued

Corridors:

Cleanliness Level / Units	Floor			Wall			Ceiling			Windows			Bad odor	
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Present	Not present
Theater	+			+			+			+				+
Recovery	+			+			+				+			+
New ward	+			+			+			+				+
Surgery A		+			+		+				+			+
Surgery G		+			+		+				+			+
Surgery D		+			+		+				+		+	
Female medicine		+			+		+				+		+	
Male medicine		+			+		+				+		+	
Dialysis	+			+			+				+			+
Coronary	+			+			+				+			+
Endoscopy	+			+			+				+			+
Chemotherapy	+			+			+				+			+
Pharmacies		+		+				+			+			+
Labs		+		+				+			+		+	
Laundry	+				+			+			+		+	

On the other hand, surgery D and female medicine were generally fair with scores 58% and 63%, respectively, and the hospital as a whole is good in its level of cleanliness with a score of 84% of good.

It was found that the patients' bathrooms in the new ward, dialysis and CCU were generally good with score 100%. At the same time, surgery A and surgery G were generally good with scores 83% and 67%, respectively. On the other hand, surgery D, female medicine, and male medicine were generally fair with score 58% of good. The hospital as a whole was good regarding the bathrooms' level of cleanliness with score 78% of good.

As regards vector control measures in different units of MRI, there were employees from the Faculty of Agriculture responsible for the control of cockroaches, using the liquid method. On the other hand, in the different units, the methods used were using aerosols for houseflies and dusting for cockroaches. Added to this, natural control methods through screening and the use of attraction to light phenomena were used.

Regarding the frequency of using the vector control methods, it was found that the hospital as a whole was sprayed with liquid insecticides routinely every 6-12 months. In the different units and wards methods for control of insects were usually applied when needed. For the operation room, for example, using aerosols for houseflies was applied every other day. Rodents were present only in the blood diseases lab and were controlled by using rodenticides.

Hospitals throughout the world provide an ideal site for cockroaches. The construction of hospital building and their interior design are often the main reasons for the ease with which cockroaches' infestation is established and for the difficulties encountered in their control. The hollow supports of benching and trolleys provide ideal shelters with little access for cleaning or treatment. Trolleys provide an excellent method for disseminating cockroaches throughout the hospital (Saad and Shehata, 1994 and Interdepartmental Working Group on polychlorinated dibenzo-para-dioxins and polychlorinated dibenzo-furans, 1989). The presence of cockroaches in hospital environment can play a principal role in the spread of infection. Cockroaches spread from a focus of infestation which is usually a storage area, a receiving, or a preparatory area serving the kitchen (Clayton and Clayton, 1982).

Table 5 shows the laundry services in MRI. The observation revealed that the laundry was located in a separate building away from the other hospital departments at the underground level of the hospital. Personnel responsible for transporting and washing soiled linen were well trained. So, a strict separation was done between soiled and cleaned linen, and the recommended temperature was used in the laundry process. The storing area for clean linen was cleaned regularly and kept dry. On the other hand, color coding was not used in linen containers' identification. In addition, there was no separation between heavily soiled and other used linen in transportation, and there was no special care for infected linen. There was also no room in the hospital for isolation, so there was no linen from isolated patients.

Table 5. Laundry Services in MRI, Alexandria, 2003.

Laundry Requirements	Status
- Training of personnel responsible for collecting, transporting, and washing of soiled linen.	+
- Using color coded containers for used linen.	-
- Separation between soiled and clean linen transportation	+
- Separation between heavily soiled and used linen transportation.*	-
- Special care for infected linen.	-
- Special precautions for handling linen from isolated patients.	-
- Using recommended temperature in the laundry process.	+
- Availability of complete dryness for washed linen.**	-
- Ironing of linen and patients gowns.***	-
- Distance between laundry and other hospital departments.	+
- Presence of laundry chutes.	-
- Regular cleaning and disinfection of storing area.	+
- Keeping storing area dry.	+
- Presence of a hand-washing facility	-
- Bacterial evaluation of the laundry practices.	-

* Separation was done inside the laundry not before transportation.

** Depending on natural dryness (as the dryer was not working).

*** Ironing of linen was done for the new ward only.

As Table 5 reveals, there was also complete dependence on natural drying, as the dryer was not working. Ironing was not available, except for the linen of the new ward and for some uniforms of the hospital staff (doctors and nurses). No laundry chutes were present; and there was no bacterial evaluation for the laundry to assess its microbial content before and after washing and determining the efficiency of the laundry services.

Recommendations

- Mechanical ventilation or air conditioning should be considered for patients' areas, where the possibility of giving or receiving airborne pathogens exists. These systems allow the rooms to be pressurized in a way that controls the movement of air from 'clean' areas outward in a cascading pressure regime towards the less critical areas and, ultimately, the 'unclean' areas.
- The cleaning of walls and ceilings should be carried out sufficiently to prevent accumulation of visible dirt, but intervals between cleaning should not usually exceed 12 months in patient treatment areas or six months in operating theatre.
- In order to help with vector control, hospital staff should keep food covered and remove spillage and waste. Drains should be covered; leaking pipe work repaired; and damaged surfaces made good. Windows and doors should be close-fit, and fly screens should be provided in order to exclude pests from hospital buildings. Sticky detectors or traps should be used for controlling of cockroaches and other crawling pests.
- Special color-coded bags should be used for collecting soiled linen. Complete dryness and ironing should be carried out in the laundry processes.
- Laundry chutes should be used, to ensure minimal handling of contaminated linen and to prevent contamination of air, surfaces, and persons. Chutes should be properly designed, maintained, and used in a manner to minimize dispersion of aerosols from contaminated laundry.

References

Ayliffe, G. A., Lowbury, E. J., Geddes, A. M. and **Williams, J. D.** (1992) *Control of Hospital Infection,* 3rd Ed., London: Chapman & Hall Medical.

Brachman, P. S. (1998) Epidemiology of Nosocomial Infections, In: Bennett J.V., Brachman P.S., *Hospital Infections,* 4th edition, Philadelphia: Lippencott, Raven Publishers; pp: 3-16.

Castle, M. and **Ajemian, E.** (1987) *Hospital Infection Control: Principles and Practice,* New York: John Wiley & Sons; pp: 68-71.

Centers for Disease Control and Prevention. (2003) Guidelines for Environmental Infection Control in Health-Care Facilities: Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC), *MMWR;* **52**: No. RR-10.

Clayton,G. D. and **Clayton, F. E.** (1982) *Patty's Industrial Hygiene and Toxicology,* 3rd edition, New York: John Wiley & Sons; Vol. II, pp: 3947-57.

Cottenden, A. M., Moore, K. N., Fader, M. J. and **Cremen, A. W.** (1999) Is there a risk of cross-infection from laundered reusable bedpans? *Br J Nurs*., **8** (17): 1161-3.

Cox, A. and **Groves, P.** (1994) *Hospitals and Health-Care Facilities: A Design and Development Guide,* Oxford: Butterworth-Heinemann Ltd.

Damani, N. N. (1997) *Manual of Infection Control Procedures,* London: Greenwich Medical Media Ltd. pp: 16-200.

Emmerson, A. M. (2001) Emerging Waterborne Infections in Health-Care Settings, *Emerging Infectious Diseases,* **7** (2): 272-6.

Environmental Protection Agency (EPA) (2003) *Professional Engineer's Guide to the ENERGY STAR Label for Buildings.* EPA 430-F-01-XX. New York: EPA, Office of Air and Radiation.

Forster, R. (2004) *Efficient Hospital Lighting*, Business briefing: Hospital facilities & Management 2005, Bnn New York: Touch Briefings,

URL *www.touchbriefings.com/pdf/1140/Hosp_05_Contents.pdf*

Franceys, R., Pickford, J. and **Reed, R.** (1992) *A Guide to the Development of On-Site Sanitation,* Geneva: World Health Organization.

Haglund, J. A., Finer, D., Tillgren, P. and **Pettersson, B.** (1996) *Creating Supportive Environments for Health,* Geneva: World Health Organization.

Health Department of Western Australia. (1998) *Private Hospital Guidelines: Guidelines for the Construction, Establishment and Maintenance of Private Hospital and Day Procedure Facilities,* 3rd Ed., Western Australia: Facilities & Asset Branch of Health Department of WA.

Hosking, S. and **Haggard, L.** (1999) *Healing the Hospital Environment: Design, Management, and Maintenance of Health Care Premises,* London: E&FN Spon; pp. 68-100.

Hosny, F. A., Bedier, N. A., El-Sebaie, N. A. and **Ragheb, M. S.** (1992) Hospitalized patient's perception of comfort and safety measures in hospital environment, *The Bulletin of the High Institute of Public Health,* **22** (1): 37-41.

Interdepartmental Working Group on Polychlorinated Dibenzo-para-dioxins and Polychlorinated Dibenzo-Furans. (1989) *Dioxins in the Environment*, London: Her Majesty's Stationary; pp: 7-39.

Iwata, H. N., Ichii, S. and **Egashira, K.** (1997) Effects of bright artificial light on subjective mood of shift work nurses, *Ind. Health,* **35** (1): 41-7.

Jackson, M. M. and **Lynch, P.** (1998) Ambulatory Care Settings, In: Bennett J.V., Brachman P.S., *Hospital infections,* 4th Ed., Philadelphia: Lippencott, Raven Publishers; pp: 431-7.

Malkin, J. (1992) *Hospital Interior Architecture: Creating Healing Environments for Special Patient Populations,* New York: Van Nostrand Reinhold, pp: 50-80.

Mason, R. L., Gunst, R. F. and **Hess, J. L.** (2003) *Statistical Design and Analysis of Experiments,* 2nd Ed., Wiley-Interscience, A John Wiley & Sons Publication.

Mathews, P. (1997) Pest Control and Prevention in NHs Premises, In: Holdaway K., Kogan H., editors, *Healthcare Management Handbook,* 2nd Ed., London: Kogan Page Ltd; pp: 200-22.

Mills, F. (2004) *Indoor Air Quality Standards in Hospitals*, Business briefing: Hospital facilities & Management 2005, New York: Touch Briefings; December.

URL: *www.touchbriefings.com/pdf/1140/Hosp_05_Contents.pdf*

Mitwally, H. and **El-Sharkawy, F.** (1995) *Environmental Health Core Course,* 3rd Ed., Alexandria: High Institute of Public Health.

NHS Estates. (2004) *Revised Guidance on Contracting for Cleaning,* Leeds, UK: NHS Estates, Department of Health.

Prüss, A., Giroult, E. and **Rushbriik, P.** (1999) *Safe Management of Wastes from Health-Care Activities,* Geneva: World Health Organization, Chapter 7: Handling, storage and transportation of health-care waste.

Saad, L. M. and **Shehata, S. D.** (1994) Hospital environment as impacted by cockroaches "Periplaneta Americana", Damanhour hospital (Case study), *The Bulletin of the High Institute of Public Health,* **24** (1): 37-41.

Schull, P. D. (1998) *Safety and Infection Control,* Springhouse: Springhouse Corporation.

Sparks, T. (2000) *Statistics in Ecotoxicology,* Ecological & Environmental Toxicology Series, WILEY, New York.

Strawser, R. A. and **Grengory, M. M.** (1993) Design considerations for heating, air conditioning, and exhaust systems in critical care units, *Crit Care Nurs Q*., **16** (3): 27-30.

Walder, B., Francioli, D., Meyer, J. J., Lancon, M. and **Romand, J. A.** (2000) Effects of guidelines implementation in a surgical intensive care unit to control nighttime light and noise levels, *Crit Care Med*., **28** (7): 2242-7.

Weinstein, J. W., Hierholzer, W. J. and **Garner, J. S.** (1998) Isolation Precautions in Hospitals, In: Bennett J.V., Brachman P.S., *Hospital infections,* 4th edition, Philadelphia: Lippencott, Raven Publishers; pp: 189-90.

WHO (1997) *Guidelines for Drinking Water Quality: Surveillance and control of community supplies,* 2nd Ed., Geneva: WHO.

التقييم البيئي لمعهد البحوث الطبية بالإسكندرية

بسنت علي يوسف، وممدوح حنفي عبده[١]،
وعلية حنفي محمود[٢]، وممدوح عبد المنعم المسيري[٢]

مستشفى معهد البحوث الطبية بالإسكندرية، مصر
[١] وصحة البيئة بكلية الأرصاد والبيئة وزراعة المناطق الجافة بجامعة الملك عبدالعزيز – المملكة العربية السعودية
[٢] والمعهد العالي للصحة العامة – جامعة الإسكندرية – مصر

المستخلص. في هذه الدراسة تم فحص بعض الخدمات البيئية الصحية في معهد البحوث الطبية، لإلقاء الضوء على الوضع الصحي والبيئي للمعهد، وقد أظهرت الدراسة من تقييم درجات الحرارة والرطوبة على مدار العام، أن درجات الحرارة كانت تتراوح بين ١٩ و٢٨، في حين كانت الرطوبة تتراوح بين ٦٧٪ و٩٠٪، وبالنظر إلى مدى ملائمة التهوية الطبيعية في وحدات المستشفى، فإن عنابر المرضى المجانية، والمطبخ، وحجرة الغسيل، ووحدة العلاج الكيميائي، ووحدة الجراحة (د) كانوا يعانون من سوء التهوية. كذلك فإن بعض أقسام المستشفى تعتمد تماما على مكيفات الهواء، في حين تعتمد أقسام أخرى اعتماداً تاماً على التهوية الطبيعية، أما مدى ملائمة الإضاءة الطبيعية لحاجات المرضى والعاملين بأقسام ووحدات المستشفى المختلفة، فقد اعتمد ذلك على موقع القسم، أو الوحدة، من حيث التعرض لضوء الشمس الطبيعي. وكانت الوحدات ذات الإضاءة الطبيعية الضعيفة، هي عنابر المرضى المجانية، والمطبخ، ووحدة العلاج الكيماوي،

ومعمل البكتريولوجي، وكان استخدام الإضاءة الصناعية في معظم وحدات المستشفى شائعاً خلال النهار، لتوفير قدر ملائم من الإضاءة، وأظهرت الدراسة فيما يختص بتقييم ممارسات التنظيف في وحدات المستشفى المختلفة، أن الوحدات التي لها أولوية في التنظيف هي الوحدات التي حققت فيها ممارسات التنظيف أعلى النتائج، وذلك لأن المرضى في حجرات العمليات الجراحية، ووحدة القلب، ووحدة الغسيل الكلوي، يكونون أكثر عرضة للعدوى من المرضى الآخرين، ولذا فإن للنظافة في هذه الأماكن أولوية كبيرة، وبالرغم من اتباع أساليب متعددة على مستوى المستشفى ككل، وعلى مستوى الوحدات المختلفة للقضاء على ناقلات الأمراض من حشرات وقوارض، فإنه تمت ملاحظة وجود بعض الفئران والصراصير والذباب؛ وقد يعود هذا لعدم الانتظام في استخدام وسائل القضاء على هذه الحشرات والقوارض من مبيدات وغيرها، وفيما يختص بخدمات المغسلة، فقد أظهرت الدراسة أنها غير ملائمة ولا تحقق الكثير من الاشتراطات الواجب توافرها في حجرة غسيل الملابس بالمستشفيات. كان العاملون بالمغسلة في مجملهم مدربين تدريباً جيداً، ومع ذلك فلم يكونوا يقومون بفصل الملاءات وملابس المرضى الشديدة التلوث، عن الملاءات وملابس المرضى الأقل تلوثاً أثناء عملية النقل؛ كذلك لم يكن هناك عناية خاصة بالملاءات وملابس المرضى التي قد تنقل العدوى؛ أيضا لم يكن هناك استخدام للأكياس ذات الألوان المختلفة للتعرف على نوعية الغسيل، كما تنص منظمة الصحة العالمية؛ وقد خلصت الدراسة الحالية إلى الكثير من النتائج، منها أن معهد البحوث الطبية كان غي الغالب في حالة جيدة بالنسبة لمعظم الظروف الصحية البيئية، وإن كان هناك بعض القصور في بعض الخدمات الصحية البيئية.