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HOUSING HYGIENE IN MEDITERRANEAN COUNTRIES

Report on a WHO Workshop

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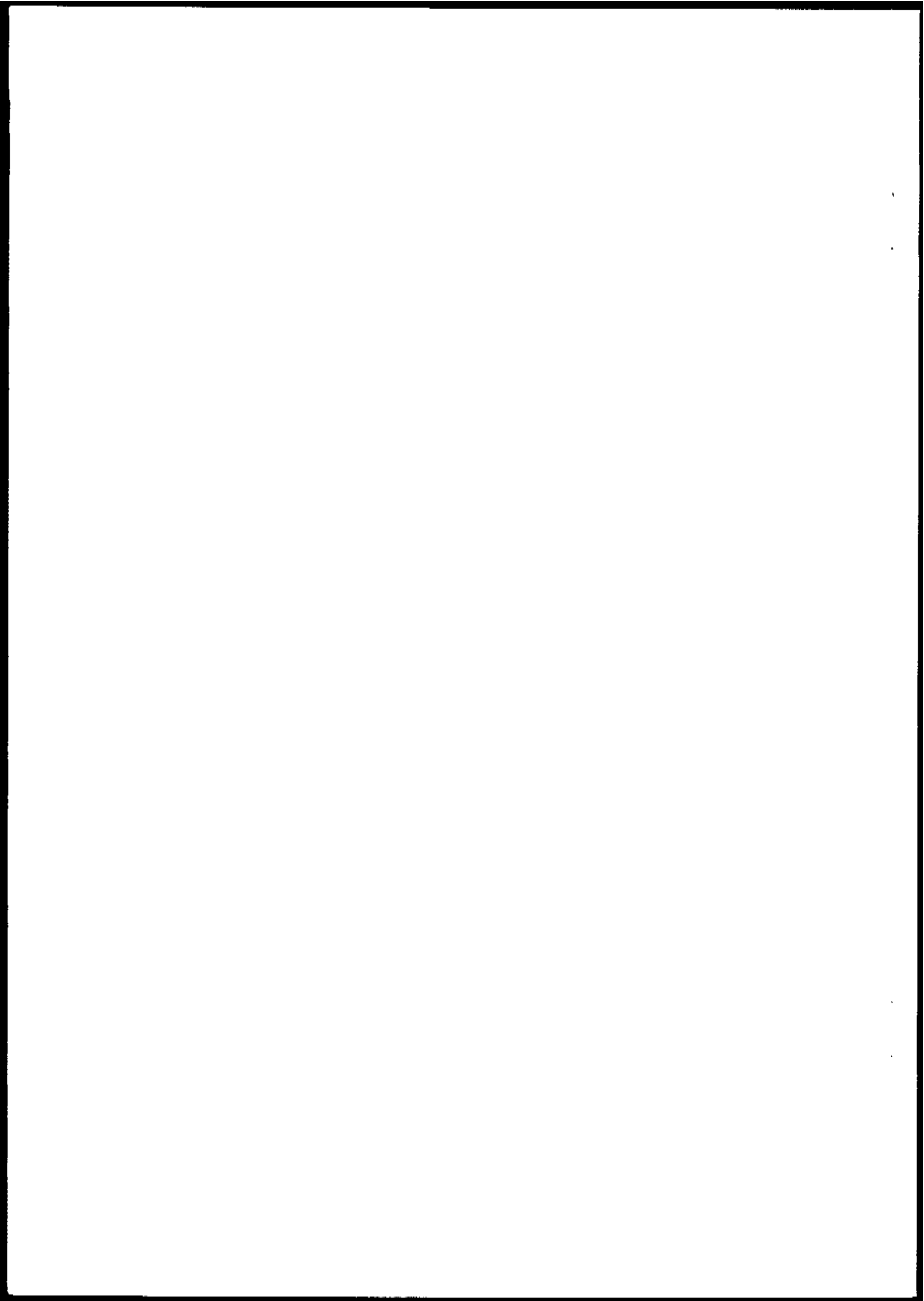
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CONTENTS

	<u>Page</u>
1. Introduction	1
2. Main epidemiological factors associated with housing and infectious diseases	2
2.1 Respiratory infections	2
2.2 Enteric infections	2
3. Housing hygiene factors associated with home injuries	3
3.1 Introduction	3
3.2 Design features of the dwelling	4
3.3 Safety features of products in the home	5
4. Mental health aspects of housing	5
5. Structural considerations of healthful and safe housing	6
5.1 Structural stability and durability	6
5.2 Weather-proofing, damp-proofing and insulation	6
5.3 Fire safety	6
5.4 Toxicity of building materials, appliances and furnishings	6
5.5 Repair and renovation of housing	7
5.6 Housing situated in seismic areas	7
6. Spatial characteristics and healthful and safe housing	7
6.1 Suggested minimum floor space	8
6.2 Arrangement of habitable areas	8
7. Housing hygiene and the microclimate of dwellings	8
8. Physical factors of housing and the environment affecting the health of occupants	9
8.1 Noise and the accoustical environment of dwellings	9
8.2 Ionizing and nonionizing radiation in dwellings	9
8.3 Illumination of dwellings	11
9. Chemical factors of housing affecting the health of occupants	11
10. Hygiene problems of dwellings associated with shanty towns and squatter settlements	12
11. General characteristics of hygienic dwellings	13
12. Conclusions	14
13. Recommendations	16
References	18
Annex 1 Selected bibliography of WHO publications and documents on housing and health	21
Annex 2 List of participants	22



1. Introduction

The existence of numerous housing hygiene problems in the Mediterranean countries and their interrelations with the programmes of WHO, the Regional Activity Centre of the Priorities Action Plan, which is part of UNEP's Mediterranean Action Plan, the United Nations Centre for Human Settlements, and the Committee for Housing, Building and Town Planning and the United Nations Economic Commission for Europe and its Subcommittee for Southern Europe led the WHO Regional Office for Europe to convene a workshop to review the situation and to recommend programmes of remedial action that take into account the cultures and climate of the area. The Federal Government of Yugoslavia, the Government of the Republic of Croatia, the city of Split, and the Institute of Town Planning of Dalmatia collaborated in the organization of the Workshop, which was attended by physicians, health scientists, sanitary engineers, architects, town planners, economists and other specialists from countries of the Mediterranean Region and southern Europe. The International Union of Architects sent three observers from three Mediterranean countries. The list of participants is attached as Annex 2.

The meeting was opened by Mr F. Gasparovic, Adviser, Committee on Housing, Building and the Environment of Croatia. Mr A. Kulic, Deputy President of the Council of Local Communities of the Municipality of Split, Mr E. Katacic, Representative of the Yugoslav Association of Architects, and Mr D. Matosic, Director, Town Planning Institute of Dalmatia, welcomed the participants. Speaking on behalf of Dr Leo A. Kaprio, Director, WHO Regional Office for Europe, Mr E. Giroult expressed his appreciation to the collaborating groups for their participation in convening the Workshop.

Mr B. Kalogjera was elected Chairman and Mr M. Hundsalz Vice-Chairman. Professor E. Mood was appointed Rapporteur.

Housing hygiene poses a major public health problem in the Mediterranean area because of the large number of persons who live in dwellings of poor sanitary quality. A recent report released by the Committee for Housing, Building and Town Planning of the United Nations Economic Commission for Europe estimated that 34% of the European population resided in dwellings with less than 8 m² of floor space per inhabitant, 42% of the dwellings were not properly heated and 27% lacked basic sanitary facilities. Many of these substandard houses are located in shanty towns and squatter settlements that are on the fringes of many Mediterranean cities.

The promotion of housing hygiene in the Mediterranean Region involves the development of programmes and the mobilization of resources that will substantially improve the quality of the numerous substandard dwellings of this area and raise the level of health and wellbeing of the occupants.

Since human habitations may adversely affect the health of inhabitants in many ways, the participants of the Workshop considered that it was necessary to examine housing hygiene problems by such factors as occupancy, space and density; structural characteristics pertaining to stability and soundness; the occurrence of injuries in and around dwellings; provisions for heating, lighting, ventilation and insulation; sanitary facilities; noise; vermin infestation; and the presence of toxic concentrations of indoor air pollutants. Also, the participants agreed that considerable insight into housing hygiene problems could be obtained by a review of data collected through the epidemiological study of groups of diseases known to be associated with housing, e.g. respiratory diseases and enteric diseases.

The International Conference on Primary Health Care, held in Alma-Ata in 1978, under the joint sponsorship of the World Health Organization and the United Nations Children's Fund, identified hygienic housing as a major supportive activity of primary health care (1). The participants in the Workshop noted that the Conference placed particular emphasis on the following characteristics of housing:

- (a) plentiful supply of clean water;
- (b) safe disposal of wastes and excreta;
- (c) appropriate adaptation to local climatic and environmental conditions;
- (d) adequate protection against disease-carrying insects and rodents;
- (e) easy-to-clean structures, particularly kitchens and sanitary facilities.

2. Main epidemiological factors associated with housing and infectious diseases

Since its formation, WHO has convened several meetings to study and analyse the relationship between housing conditions and the health of occupants. The studies and analyses, supported by other researchers, have identified that housing and health may be linked by one of four pathways, namely:

- (a) housing may cause ill health by not providing an environment that will fulfil the basic physiological requirements of the occupants;
- (b) housing may be associated with domestic accidents;
- (c) housing may be related to mental illness by a failure to provide an environment relatively free of stressful situations, which are often found in substandard and overcrowded dwellings;
- (d) housing may increase the transmission of infectious agents to occupants of the dwelling.

Insanitary and/or substandard housing may not be a causal factor of mortality or morbidity in some cases, but may be a contributing factor in many situations.

Most human contacts with disease agents occur in human settlements. Certain characteristics of a dwelling and the way in which it is used are acknowledged as favouring person-to-person transmission of some infectious agents. Common factors that associate ill health with housing include crowding, lack of essential facilities and services and the presence of rodent vectors of disease. Concomitant problems include poverty and lack of education.

2.1 Respiratory infections

Studies conducted in the nineteenth century in North America and the United Kingdom showed housing conditions such as crowding, dampness and lack of ventilation to be associated with tuberculosis (2,3). Airborne infections due to bacteria, Rickettsia and viruses are common diseases of human beings (4,5). Droplet nuclei that harbour microorganisms are transmitted from person to person through the air as well as by direct contact or ingestion (6). Infectious agents, other than bacteria, have been estimated to be responsible for approximately 95% of cases of acute disease of the upper respiratory tract and a considerable, if lesser, proportion of cases of disease of the lower respiratory tract (7).

Poor nutrition and a lack of hygiene are known to predispose to tuberculosis (5). These conditions are often found in association with substandard housing (8). Overcrowding, also a characteristic of many unhygienic dwellings, facilitates the transmission of the infectious agent from an infected individual to a person lacking in immunity to the disease agent (9).

A study involving two African neighbourhoods with different types of housing demonstrated a negative correlation between the airspace available per member of the household and the number of airborne bacteria of the upper respiratory tract and the incidence of meningococcus meningitis (10). Other studies conducted in various areas of the world among military personnel have demonstrated a close association between crowding and acute upper respiratory diseases (11).

Improved housing in the Mediterranean area will not prevent some types of acute respiratory infection, particularly those of viral origin (12). However, respiratory diseases that are caused by bacteria will occur less frequently among persons who are housed in uncrowded, well ventilated and hygienic dwellings than among those who are not so housed.

2.2 Enteric infections

It is an acknowledged fact that the lack or the inadequacy of sanitary facilities favours the spread of foodborne and waterborne enteric infections. However, their mere availability is not sufficient to reduce the rate of these diseases if the occupants of the housing do not know how to make proper and full use of such facilities.

Epidemiological studies in various areas of the world have demonstrated the following:

- (a) Shigella infections in children 10 years of age and under who live in housing with no inside water supply occur at approximately twice the rate as in children who reside in dwellings with an inside water supply (13);

(b) the prevalence rate for Shigella infections, the incidence of Ascaris parasitism, and the morbidity from diarrhoeal disease are associated in an inverse manner with the availability of water (14,15);

(c) the availability of hand-washing facilities is an important factor in reducing the incidence of Shigella infections (16);

(d) enteric diseases are less prevalent among residents of dwellings with inside flush toilets than among persons who live in housing lacking in these facilities (2,17,18);

(e) a community programme of installing bored-hole privies for housing lacking inside flush toilets significantly reduced Shigella infections and diarrhoeal disease among children 10 years of age and under (19).

The control of flies is important in the prevention of enteric diseases, since they may play a significant role in the faecal-oral route of transmission of infectious agents (20). Several studies have demonstrated significant reductions in the prevalence of Shigella infections and diarrhoeal diseases by the control of flies (20-22). One study showed that fly control per se was not important, but that exclusion of flies from faecal material in and around privies was of great importance as it broke the chain of transmission (19).

Since some enteric infections are caused by contaminated food, housing hygiene programmes must consider the facilities to preserve and protect the quality of food in the dwelling. Included within the scope of this requirement are facilities and equipment for the storage, the preparation and the consumption of food (23).

As a means to prevent enteric infections, dwellings should be provided with:

- (a) a potable and palatable water supply, which is provided continuously under pressure by sanitary plumbing preferably into each dwelling unit;
- (b) a sanitary means for the disposal of sewage or excreta, preferably an inside flush water closet, connected to an approved disposal system;
- (c) environs in the immediate vicinity of the dwelling that are free from faecal pollution;
- (d) sanitary facilities for the storage, collection and disposal of rubbish and other solid wastes;
- (e) provisions for the protection of food from insect vectors of disease, particularly house flies;
- (f) a means for the sanitary storage of milk and food at cool temperatures.

3. Housing hygiene factors associated with home injuries

3.1 Introduction

Prevention of accidental injury in the home is an important public health activity, since accidents are a major cause of morbidity for all age groups and of mortality for the very young and the elderly (24). Epidemiological studies have identified some characteristics of accidental injury occurring in the home according to such factors as age, sex, etc.

In general, it is obvious that the more time spent in and about a dwelling by an individual, the greater the accidental injury rate. Infants, preschool children and the elderly spend a larger proportion of time at home than do schoolchildren, adolescents and young and middle-aged adults and are, therefore, more exposed to the risk of a home accident irrespective of other factors. Among adults, women generally spend more time in the home than men, and, again, this is reflected in the numbers and rates of their home injuries.

Apart from risk and exposure, other factors are involved. Babies are totally unable to protect themselves and must rely on their adult protectors and guardians for their safety. Children 1-4 years of age have the largest number of home injuries of any age group. This is attributed to their inability to appreciate danger and their physical immaturity, coupled with their exploration of the environment. The elderly are at special risk because of their increasing frailty, lack of balance, decreased sight or hearing and, particularly, because of their lessened ability to repair and heal damaged tissues quickly.

Accidental injuries occurring in the home may be reduced by three methods, namely:

- (a) education of the occupants of the dwelling concerning hazardous aspects of the dwelling and the various products and equipment in the structure;
- (b) alteration of the characteristics of the agent of the injury by making it less harmful;
- (c) modification of the environmental circumstances under which the agent and the person came into contact with one another to produce the accidental injury.

3.2 Design features of the dwelling

The prevention of home injuries involves, among other things, certain design and structural features of the house. Although the proper design and construction of residential structures are functions of architects, designers and builders, it is a responsibility of health workers to indicate to the proper persons hazards associated with design practices, uses of materials, methods of construction, etc. Failure of health personnel to fulfil this obligation will result in the continuing design and construction of dwellings in which there will be an increased liability for accidents.

3.2.1 Design of kitchen, cooking and heating appliances

Kitchens of dwellings must be so designed that the cooking and preparation of food may be done efficiently (ergonomically) and safely. Particular attention should be given to the design and place of the cooking stove so that it may be used in a safe manner. The heating of water is an important factor to consider as many home injuries involve scalding. Contact with hot water at a temperature of 43°C for only 10 seconds will produce significant discomfort and a partial burn will result from contact with water at 50°C for 10 seconds.

Carbon monoxide production from the incomplete combustion of some fuels is of great public concern and the design of kitchens and heating appliances should provide for the appropriate venting of these units to outdoors.

3.2.2 Electrical safety in dwellings

Although a very large proportion of the dwellings in the Mediterranean area are furnished with electricity, in many respects the electrical wiring is grossly inadequate for its intended use. To reduce injuries from electrical shocks and burns, it is important that electrical wiring and the installation of electrical appliances be in accordance with the regulations in force. These regulations should preferably be consistent with the standards developed by the International Electrotechnical Commission.

3.2.3 Stairs and steps

Stairs and steps are the second most common place of accidental home injuries, the most common location being the kitchen. Some design features that will minimize accidental injuries involving stairs and steps include the following:

- (a) uniform tread widths and riser heights;
- (b) structurally sound and easy to grip handrails;
- (c) banisters that are installed vertically and that are not more than 10 cm apart;
- (d) appropriate natural and artificial illumination without glare.

3.2.4 Windows and doors

The minimum glass area in windows is regulated in most of the countries of the Mediterranean area by building standards. However, a number of safety measures should be considered. These include the installation of safety devices to prevent children from falling out of opened windows; locks on windows to ensure safety from intruders, and the use of safety glass (laminated or hardened) in rooms where persons may fall against a window. The design and position of doors should be such as to minimize accidental injury, to provide privacy and security, and yet allow easy entry into and exit from the dwelling unit.

3.2.5 Balconies

Many residential structures in the Mediterranean area are equipped with balconies. An important feature relating to the possible occurrence of accidental injury involves railings. Studies have suggested that an effective minimum height is 1.2 m.

3.2.6 Bathrooms

An important deterrent to accidental injuries in bathrooms is the prevention of slips and falls. Elderly persons may have difficulty in getting into and out of the bath and may slip and fall. Showers tend to be less hazardous than baths. Structurally sound handrails, conveniently located, and non-slip surfaces are effective in reducing the incidence of accidental injuries in bathrooms.

3.3 Safety features of products in the home

Many injuries that occur in dwellings are related not to the design and construction of the building, but to the use of appliances and devices within the home. To reduce their occurrence, health personnel should investigate the circumstances of the accidental injury to determine whether the product has been inadequately designed and manufactured or has been improperly used. Upon determination of the cause of the injury, health personnel should initiate appropriate corrective and preventive action.

4. Mental health aspects of housing

In 1938, the Committee on the Hygiene of Housing of the American Public Health Association, functioning as an unofficial national committee for the Housing Commission of the Health Organization of the League of Nations, developed a list of 30 basic principles of healthful housing (25). Seven of the principles were characterized as "fundamental psychological needs" of the occupants. An underlying concept was that fulfilment of these needs was necessary to ensure that the housing would not adversely affect the mental health and wellbeing of the occupants. These seven principles are as follows:

- (1) adequate privacy for the individual;
- (2) opportunities for normal family life;
- (3) opportunities for normal community life;
- (4) facilities which make possible the performance of household tasks without undue physical and mental fatigue;
- (5) facilities for maintenance of cleanliness of the dwelling and the person;
- (6) possibilities for aesthetic satisfaction in the home and its surroundings;
- (7) concordance with prevailing social standards of the local community.

Many studies during the recent past attempted to evaluate the presence of a relationship between housing conditions and the mental health and wellbeing of occupants. However, little definitive information has been derived from them, partly because it has been virtually impossible to segregate for identification and selective evaluation those housing conditions that may affect the mental health and wellbeing of the occupants from other factors, such as poverty, social class, etc., that may also be related.

Several researchers have found that city areas that have substantial amounts of housing of poor or substandard quality also have higher rates of hospitalization for psychoses than the areas where housing is of good quality (26-28). Other studies have demonstrated clearly that higher prevalence rates of mental disorders, mainly schizophrenia, occur among people of the lower social classes who may be identified as persons with lower incomes, less education and usually living in housing of poor or substandard quality (29-31).

According to some behavioural scientists, juvenile delinquency is a form of mental illness. Several studies have shown that juvenile delinquency rates are higher in the areas characterized by crowded dwelling units, high-population densities and a preponderance of housing lacking basic facilities (32-34).

It is a generally accepted and recognized fact that a safe and sanitary dwelling that satisfies all public health requirements cannot "cure" the existing mental illness of its occupant, but that it may prevent its development (35). Further, some conditions associated with substandard housing, such as crowding and lack of personal and family privacy, are known to cause stress in a substantial number of persons and that such stress may contribute towards the onset of some types of mental illness (36).

While present knowledge of the relationships between housing and the residential environmental on the one hand and mental health or illness on the other are inconclusive, housing hygiene programmes should aim at the attainment of housing that is not overcrowded, that provides for personal and family privacy and does not contribute to stress.

5. Structural considerations of healthful and safe housing

One of the paramount functions of dwellings is to provide shelter to the occupants from all external hazards of weather and intrusion. The quality and effectiveness of the shelter provided depend upon such factors as the characteristics of the walls, floors, roofs, doors, windows, etc. Basic to these factors are the following:

- (a) structural stability and durability;
- (b) weather-proofing;
- (c) damp-proofing;
- (d) insulation;
- (e) fire safety;
- (f) lack of toxicity.

5.1 Structural stability and durability

Residential structures should be designed, constructed and maintained to withstand for a considerable number of years the loads and stresses applied through normal use and by climatic forces, e.g. wind pressure. Special consideration should be given to structures built in areas of considerable seismic risk.

5.2 Weather-proofing, damp-proofing and insulation

The building should protect the occupants from the weather, e.g. cold, rain, wind, etc. The floors, walls and roof should be impervious to moisture and should not be subject to rapid deterioration when damp or wet. Insulation should be provided to prevent excessive loss or gain of thermal energy, not only in the areas that may be subjected to cold winter-time conditions but also in those that may become hot in summer. Such insulation is highly desirable to minimize undesirable solar heat gain during periods of time of high ambient air temperature.

5.3 Fire safety

Fire safety is an important structural consideration of dwellings, as fires cause an excessive loss of life in all countries. It is virtually impossible to build residential structures that are absolutely fire-proof. However, houses may be built with fire-resistant materials and flame-spread deterrents and with easy means of rapid evacuation in the event of a fire. In recent years, inexpensive but highly effective smoke-detecting devices equipped with alarm systems have become widely available. Many building and construction standards now require the installation of these devices in all new residential structures and recommend their installation in existing dwellings.

In some areas of the Mediterranean, gas is available for heating and/or cooking. This fuel may be supplied by a central network of mains and distribution pipes to buildings or as a compressed gas in liquid form supplied in cylinders for localized use. Residential structures so equipped should comply with regulations, standards and/or guidelines that will minimize the possibility of an explosion.

5.4 Toxicity of building materials, appliances and furnishings

Of considerable health concern is the utilization in building materials and household appliances and furnishings of materials, which by their very nature are toxic if ingested or inhaled, or which are capable of emitting gases and fumes, etc., into the enclosed environment of

dwellings that may be hazardous to human health at low concentrations. Some of the important health effects of these pollutants have been examined thoroughly by a WHO working group in 1979 (37).

5.5 Repair and renovation of housing

Much of the housing in the Mediterranean is old, particularly in or near the urban centres that have not been substantially rebuilt. Some of this older housing is considered as substandard, largely owing to the lack of sanitary facilities and central heating. Where such conditions exist, it is considered to be good policy to repair and renovate such housing by installing central heating with the necessary flues, conduits, pipes, etc., and plumbing, including water heating facilities, baths and/or showers and water closets, provided they are connected to a sanitary and accepted means of disposal of the sewage and waste water. However, special consideration may have to be given to the ground and lower floors of these buildings which have small windows that open on to tiny courtyards or narrow streets, either of which may be devoid of direct sunlight during a significant portion of the day. Under such conditions, these lower levels should not be used for human habitation but for business or commercial purposes.

Old residential buildings that are not structurally sound and that lack basic facilities should be demolished as quickly as practicable as a preventive health measure. However, such demolition may have to await the construction of other hygienic dwelling units to rehouse the persons to be displaced.

5.5.1 Self-help rehabilitation

In the repair and renovation of existing housing, much may be done by self-help action utilizing locally available materials and methods of construction. In some Mediterranean areas, governmental regulations prohibit such repairs and renovation. The participants in the Workshop felt that there should be a concerted effort to change restrictive regulations so as to permit more self-help rehabilitation and to allow greater use of locally available materials. Instruction programmes may be necessary to teach local residents self-help techniques of building repair.

5.6 Housing situated in seismic areas

Much of the Mediterranean area is characterized as having a high potential for seismic activity on the one hand and dense population residing in older buildings, usually in urbanized areas, on the other. These two factors create a problem of considerable public health and safety importance, as many of these older buildings were not designed and built to withstand seismic energy. Several serious earthquakes have occurred in the Mediterranean area in recent years with considerable loss of life, personal sorrow and suffering. To reduce health and safety hazards in areas where seismic activity is present, much basic work needs to be done. Remedial action includes seismic and seismogeological studies in each region where there is danger of earthquakes; studies on the earthquake resistance of existing buildings and the design and construction methods used to erect new human habitations; the development of practicable ways of making existing buildings more resistant to earthquakes; the implementation of existing knowledge of safe design criteria for seismic-resistant structures and the application of that knowledge by architects and engineers.

6. Spatial characteristics of healthful and safe housing

The provision of sufficient space for all normal household activities by all members of a family is an important requirement of healthful housing. However, there is much difficulty in defining the minimum amount of space that is deemed to fulfil the requirement of sufficiency. Differing sociocultural patterns dictate various amounts of minimum space required by people in housing. Similarly, differing patterns of lifestyles, of economic values, etc., establish other requirements of space.

In addition to considering sufficient space as defined by occupiable or inhabitable floor space, it is necessary to consider the proportioning of the space, i.e. the ratio of width to length, as this factor affects the utilization of the space and such conditions as daylighting of the area.

Special consideration must also be given to room volume, as this greatly influences the quality of air in the enclosed space. However, once a decision has been made concerning minimum ceiling height, room volume requirements may be the primary determinants of minimum floor areas.

Under the customary conditions of heating, ventilation and lighting of human habitation, there are no health requirements for minimum ceiling heights except that persons wearing their usual footwear should be able to move about a room freely without striking their heads against the ceiling or any ceiling-mounted lighting fixture and should be able to pass through doorways while being erect. In the Mediterranean area, a minimum ceiling height of 2.2 m, which has been recommended by some authorities, is usually more than adequate.

6.1 Suggested minimum floor space

Among the countries of Europe, North Africa and the Middle East that have recommended or required minimum areas or sizes of rooms, there is considerable variation, ranging from 8 m²/hab. to 16 m²/hab. (38). The participants in the Workshop felt that a desirable minimum space standard is 12 m²/hab. However, in those areas where there is an acute shortage of hygienic housing, an interim minimum space standard of 8 m²/hab. of the net living space would be acceptable.

Of great importance is the way the space is being utilized by the inhabitants. Efficient use of space may not be regulated, but is achieved through education.

6.2 Arrangement of habitable areas

The provision of the minimum amount of space is not the only criterion to the attainment of a quality of housing that may be deemed healthful. The arrangement of space, i.e. the position of rooms in relation to each other, is important in facilitating the performance of household tasks and in attaining privacy. Dining areas should be in or adjacent to the room where food is prepared. Access to a water closet compartment in a dwelling occupied by a family should not be through a bedroom. Efficient arrangement of the habitable space is important in reducing some varieties of stress that may adversely affect the health of occupants.

7. Housing hygiene and the microclimate of dwellings

The microclimate of a dwelling is determined by the temperature of its walls and furnishings and by the temperature, moisture, movement and exchange of the air within it (39). While the human body has considerable ability to adjust to the environment, its thermo-regulatory powers can compensate for only a relatively small range of climatic conditions. Therefore, within human habitations, it is desirable to create microclimates that do not cause any physiological distress to the occupants and that are comfortable for persons of all ages, particularly the very young, the elderly and the handicapped.

Thermal comfort involves physical as well as physiological and psychological factors. It is dependent on the operative temperature of the environment, the insulating value of clothing, and the level of metabolism of the individual. The metabolic rate of humans varies with sex and age. Usually, a person is comfortable when metabolic heat is dissipated at the rate at which it is produced.

Extensive studies have indicated that the metabolic equilibrium is achieved for the average, sedentary, lightly clothed person when the air in a "standard" room has a temperature of 34.5°C, a relative humidity of 40% and an air velocity of 0.25 m/s (40). Individual variations will occur depending upon some of the previously named factors.

Conditions for the thermal comfort of dwellings will vary from one geographical area to another according to the habitation and the acclimatization of the inhabitants. Also, diurnal and seasonal variations in physiological functions will affect the sensations of comfort. For example, investigations made in the USSR have shown that the range of acceptable temperatures in winter in dwellings is 21-22°C in cold climates and 17-18°C in warm climates; in summer, the temperature range is 23-25°C (39).

Comfort standards in the United States of America have been developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). These standards acknowledge that 80% of all adults dressed for indoor winter conditions find ambient air temperatures comfortable between 20°C and 23.5°C, with a relative humidity of between 30% and 60% and air velocities not greater than 0.25 m/s (41). For indoor summer conditions, comfortable ambient air temperatures are found within the range of 23 to 26.5°C. If the occupants of the dwelling are very lightly clothed, the range of ambient air temperatures deemed comfortable is 26-29°C.

The vertical temperature gradient within dwellings is also important in establishing comfortable thermal conditions indoors. Unpleasant sensations are experienced if the difference between the temperature at floor level and at a height of 1.5 m from the floor is greater than 3°C (40). Similarly, the horizontal differences of the ambient air temperature should not exceed 1-2°C.

A WHO working group in 1982, which examined the housing indoor climate impact on the health of the elderly, concluded that there was minimal risk in the winter to the health of elderly, sedentary persons who are appropriately clothed if the ambient air temperature of their dwellings is between 18°C and 24°C, provided there is negligible air movement, i.e. not greater than 0.2 m/s and provided there is not significant radiant heat loss (42).

Radiant heat loss or gain may be minimized by the insulation of floors, walls and ceilings (roofs) of dwellings and the double or triple glazing of windows and glass doors (43).

8. Physical factors of housing and the environment affecting the health of occupants

There are several physical factors of the environment that need to be controlled or regulated to protect the health of occupants of dwellings. Of major importance are noise, nonionizing radiation and illumination.

8.1 Noise and the acoustical environment of dwellings

Noise in and around dwellings has become an increasingly important problem. Noise can disturb rest, sleep and communication and may be detrimental to health (44). A healthful dwelling is one which provides a quite, peaceful and restful environment.

The prevention of excessive noise in dwellings is a complex technical, political and social problem (45). Many sources of noise in dwellings are external, e.g. motor vehicle traffic and industrial noise. Other sources may be internal, e.g. loud speech, radio and television sets, the playing of musical instruments, the slamming of doors, children playing and babies crying.

Noise control in dwellings includes the following:

- adequate sound insulation between rooms and other dwelling units;
- limitation of noise generated outside the structure and transmitted into it by induction or by the airborne route;
- prevention of noise inside and outside the dwelling at its source.

To reduce the transmission of noise from one room of a dwelling to another room or from one dwelling unit to an adjacent unit in the same structure, changes in building materials and methods of construction may be necessary. Generally, it may be said that greater use of sound absorbing materials in the walls and on or in the floors will significantly reduce much noise in dwellings. Also, thermal insulation of the walls, floors and windows often reduces noise transmission.

Goromosov enumerated several methods designed to protect the home from internal and external noise (39). In the planning and construction of cities, measures used for reducing noise in residential areas include the zoning of cities into residential, commercial, industrial, etc., areas; proper planning of the location of roads, highways, airports, railways, etc.; and reduction or prohibition of heavy vehicular traffic in residential streets.

The working group on noise control in buildings in 1976 proposed some permissible maximum sound levels in buildings. The values pertaining to dwellings are given in Table 1.

8.2 Ionizing and nonionizing radiation in dwellings

During the past several decades, public health authorities have recognized the potential presence of harmful ionizing and nonionizing radiation in some dwellings. Non-ionizing radiation is sometimes referred to as microwave radiation and is often defined as that portion of the electromagnetic energy spectrum encompassing the frequency range of 300 to 300 000 MHz.

8.2.1 Sources of ionizing radiation in dwellings

While there are several sources of ionizing radiation in the residential environment that may adversely affect the health of dwellers, the principal radioactive substance found in homes usually is radon-222. When radium-226 decays by alpha emission, it transmutes to its daughter radon-222, an inert gas having a half-life of 3.8 days.

Table 1. Maximum permissible sound levels in dwellings

Type of room	Maximum permissible sound level inside ^a dB(A)							
	Noise from installations ^c (L _A)							
	Noise intruding from outside ^b (L _{eq})		Type of district ^d					
			Type 1		Type 2		Types 3-5	
	Day	Night	Day	Night	Day	Night	Day	Night
Living-rooms or bedrooms	40	30	30	20	35	25	40	30
Other rooms (excluding store-rooms)	45	35	35	25	40	30	45	35

Legend: L_{eq} - equivalent sound level
L_A - sound level measured in dB(A)

^a In dwellings, the levels apply to empty rooms (unfurnished). If measurements take place in furnished rooms, the levels should not exceed values which are 5 dB(A) lower. If measurements are available for rooms in both empty and furnished states, those for the empty state are decisive. In all other buildings, the levels apply to rooms furnished for normal use.

^b According to ISO R 1996 (1971), the equivalent sound level should be reckoned over a relevant time period, which may be set according to the specifications of local authorities, e.g. the eight most unfavourable consecutive hours during daytime and the most unfavourable half-hour of the evening or night. For noise during the night, it may also be advantageous to set an absolute limit for the sound level. Accidental atypical noises occurring during the measurement should not be considered.

^c All types of installations belonging to the building. The requirements are applicable to each installation or appliance separately. For plumbing noise, 5 dB(A) higher levels may be acceptable. Levels apply to neighbouring dwellings only.

^d The types of district are rural residential, hospital zones and recreational areas; suburban residential, with little road traffic; urban residential; urban residential with some workshops or with shopping streets or main roads; all other districts.

Source: Reference 44.

The main sources of radon are soil, water, coal which may contain up to 0.1% uranium, natural gas, liquid petroleum gas, uranium milling wastes and phosphate mining minerals (46). Studies have revealed that substantial amounts of radon may be found in homes built of concrete slabs or blocks (47), on land reclaimed from phosphate mining (48) and whose water supply originates from wells drilled into certain geological substrates (49,50).

The most serious and likely adverse health effect of residing in a dwelling with substantial amounts of radon in the air is bronchogenic carcinoma (37). Radon levels in dwellings may be kept at acceptable levels by high rates of ventilation. However, this is an impracticable measure during cold weather when attempt are made to conserve thermal energy used in home heating. Radon in well water may be purged effectively by aerators which release the radon gas to the atmosphere. Separate ventilation of the crawl space under some dwellings is effective in reducing the movement of radon gas from the soil into the house.

8.2.2 Sources of nonionizing radiation in dwellings

The principal sources of nonionizing radiation or microwaves generated within a dwelling are electronic products. Outside the structure, major sources include selective occupational environments, television-transmitting apparatuses and radar stations. A potential internal source of nonionizing radiation which may result in adverse health effects is a microwave oven, which may be found in many houses in developed countries. However, if microwave ovens are designed and constructed with the proper shielding and interlocks and are serviced and maintained appropriately, there is no significant hazard to human health (51,52).

8.3 Illumination of dwellings

Proper illumination by natural and artificial means is vital to good health, particularly the prevention of accidents. Many factors, some of which are variable, must be considered in the provision of adequate and comfortable illumination in living spaces.

Goromosov has identified six basic requirements for domestic illumination, namely:

- (1) optimum intensity of illumination in all working places and in their surroundings within the field of vision;
- (2) avoidance of great variations in brightness within the field of vision, thus avoiding interference with the normal adaptation of the eye;
- (3) protection of the eye against glare from direct or reflected light;
- (4) avoidance of sharp shadows on working surfaces;
- (5) adequate contrast in brightness and in colour between details and background;
- (6) optimal biological activity of the light (39).

These requirements are important, particularly in view of the general demand for greater intensity of illumination in the home than was acceptable in the past.

8.3.1 Natural illumination of dwellings

Natural illumination varies greatly within the course of a day from sunrise to sunset; it also varies with geographical location, the season of the year and meteorological conditions. The size and position of windows and skylights are important factors in ensuring adequate natural illumination.

The ability of daylight to enter into a dwelling is influenced to some degree by the position of windows and by objects such as adjacent buildings near windows. An adequately lighted room from natural illumination is one in which the light is relatively evenly distributed. The use of light-coloured surfaces helps to reflect and diffuse illumination throughout the room.

8.3.2 Artificial illumination of dwellings

Artificial illumination of dwellings should be considered both quantitatively and qualitatively. It is important to ensure an adequate degree of brightness and to provide comfortable illumination within all areas of the dwelling. In general, a different optimum level of illumination exists for each type of visual work. Many nations have established standards or recommended levels of illumination for various areas of dwellings and/or tasks to be performed.

9. Chemical factors of housing affecting the health of occupants

Current problems concerning chemical factors of human habitation are limited virtually to chemical pollutants of the indoor air. These problems have been reviewed by the working group on health aspects related to indoor air quality in 1979 (37) and the working group on assessment and monitoring of exposure to indoor air pollutants in 1982 (53). Also, several comprehensive books and reports have been published on the subject (40,46,54).

The current problems of chemical pollution of the air in dwellings have become dominant largely as the result of the introduction of new materials into housing, such as paints, household items made of plastic or synthetic fibres, chipboard and particle-board, urea-formaldehyde foam insulation and the conservation of thermal energy by making residential structures more airtight and reducing rates of ventilation. The chemical quality of air in dwellings has always been and

continues to be affected by pollutants generated outdoors. However, the control and prevention of such pollution are matters involving community public health.

The principal chemical pollutants of indoor air in dwellings include tobacco smoke (passive smoking), carbon monoxide, carbon dioxide, nitrogen oxides, sulfur oxides, formaldehyde, asbestos and mineral fibres.

Current knowledge does not allow quantitative assessments of the public health impact of indoor air chemical pollution. The strategy at present is to keep the concentrations as low as practicable.

Important sources of some indoor air pollutants are unvented combustion devices. These may produce significant quantities of carbon monoxide, nitrogen dioxide and several aldehydes. As a specific public health measure, in each country or region, there should be prohibitions against the burning of carbonaceous fuels in unvented or inadequately vented devices, particularly in rooms used for sleeping.

Owing to the severity of the acute and long-term health effects of emission of formaldehyde and asbestos fibres into the air of dwellings, prohibitions of their use in residential structures are highly desirable. However, substances containing asbestos may be used if the asbestos fibres are bound into the material in such a way that they will not be released into the atmosphere of the dwelling.

10. Hygiene problems of dwellings associated with shanty towns and squatter settlements

In the Mediterranean area, as in almost all other parts of the world, shanty towns and squatter settlements pose a major housing and health problem. Some historians suggest that this type of housing began to appear in the Mediterranean countries during the great economic depression, which occurred in the 1920s following the First World War; others disagree. Nonetheless, these housing settlements pose major health problems, and participants in the Workshop considered that more attention should be given to them by health and other authorities.

During the past several decades, many attempts have been made to develop remedial programmes to the problems associated with shanty towns and squatter settlements, but these have failed to improve the quality of housing for most of the occupants.

One of the early attempts by the United Nations to develop an effective, efficient and economical programme to provide safe, decent and healthful housing for the occupants of such housing was the convening of the group of experts on metropolitan planning and development in 1961, which was followed by a United Nations symposium on the planning of new towns in 1964 (55). These meetings identified the rapid increase of the urban populations in almost all cities in the world and noted that housing was not provided for these residents at the same rate as the growth of the urban populations.

It was reported that early control action by governments to cope with the problems of shanty towns and squatter settlements failed to provide effective, economical and acceptable solutions for a number of reasons; the two main ones were as follows:

- (1) control activities were supported only by the national government without the active participation of local governments and without community participation and contributions;
- (2) the control actions were not based upon comprehensive, integrated and long-range plans of metropolitan growth and development; rather, they were founded on ad hoc temporary solutions of limited scope.

An example of the scope and magnitude of problems of shanty towns and squatter settlements in the Mediterranean area is that which Morocco now faces. At the present time, approximately 20% of the urban Moroccan population live in these types of housing settlements. This means that about 1.8 million persons of the total population of the country live in shanty towns and squatter settlements. Some of the shanty towns have as many as 80 000 inhabitants, which is more than the population of several middle-sized cities in that country. According to data collected in a survey conducted in Casablanca, Salé and Meknès in 1978 by the Ministry of Housing and Town Planning, the average amount of living space in dwellings in shanty towns and squatter settlements is only slightly more than 2 m² per inhabitant, with a common occupancy density ranging between five and eight persons per one-room dwelling. This and other studies showed that the population densities inside shanty towns range from 500 to 1300 inhabitants per hectare.

In all countries, one of the major problems in the development of a workable programme to rehouse inhabitants of shanty towns and squatter settlements is poverty. Most of the inhabitants of these housing settlements do not have the financial resources to rent or buy safe, sanitary and decent housing, even though the cost of dwellings has been subsidized by the government. Therefore, such programmes as the construction of low-rent dwellings with offsetting financial subsidies from the government are being discontinued in some countries in favour of programmes of improvement of existing shanty towns and squatter settlements. The following are some of the activities carried out in municipalities in the Mediterranean area:

- (1) widening and straightening of streets in these settlements;
- (2) allocating at least 60 m² of land area per single family dwelling unit;
- (3) installation of water pipes and sewers to serve the residents;
- (4) paving and lighting of streets;
- (5) constructing schools, health facilities, etc.

To offset the problems created by poverty, attempts are being made to locate new industries in or near squatter settlements and shanty towns.

Participants in the Workshop felt that greater emphasis should be placed on the use of self-help housing as a means of assisting low-income families in shanty towns and squatter settlements to become more adequately housed. Also, there appears to be a need to investigate some of the legal problems associated with the construction of dwellings on land not owned or rented by the builders. Tenure of land upon which these houses are built poses complex legal problems for the inhabitants of shanty towns and squatter settlements.

11. General characteristics of hygienic dwellings

The WHO expert committee on the public health aspects of housing established the fundamentals of a hygienic dwelling (24). These should consist of a safe and structurally sound, adequately maintained, separate, self-contained dwelling unit for each household if so desired. Further, each dwelling unit should provide at least the following:

- (1) a sufficient number of rooms, usable floor area and volume of enclosed space to satisfy human requirements for health and for family life consistent with the prevailing cultural and social pattern of that region, and utilized so that there is neither overcrowding of living nor sleeping rooms;
- (2) at least a minimum degree of desired privacy, both between individual persons within the household and for the members of the household against undue disturbance by external factors;
- (3) suitable separation of rooms, as used for sleeping by adolescents and adult members of the opposite sex, except husband and wife, and the housing of domestic animals apart from the living area of the dwelling unit;
- (4) a potable and palatable water supply, piped by sanitary plumbing into the dwelling unit or in the courtyard, in quantities ample enough to provide for all the personal and household uses essential for sanitation, comfort and cleanliness;
- (5) a safe and sanitary means for the disposal of sewage, rubbish and other wastes;
- (6) sufficient facilities for washing and bathing;
- (7) appropriate facilities for cooking, dining and the storage of food, household goods and personal belongings;
- (8) appropriate protection against excess heat, cold, noise and dampness;
- (9) adequate ventilation and internal air free of toxic or noxious agents;
- (10) sufficient natural and artificial illumination.

The participants in the Workshop acknowledged the importance of these fundamentals as a means to promote and protect the health and wellbeing of all. As an interim objective to WHO's goal of health and healthful housing for all by the year 2000, housing hygiene programmes should strive to provide dwellings in all urban areas that have at least the following characteristics:

- (1) security of tenure of a dwelling on a plot of land is provided through leasehold or freehold titles;
- (2) the dwelling is situated on a plot of land that measures at least 60 m² per dwelling unit;
- (3) the size of the building is sufficient to provide at least 4 m² of floor space per occupant with an ultimate goal of 8 m² of floor space per occupant;
- (4) occupants of dwellings are provided security against intruders and protection from the elements;
- (5) a potable and palatable supply of water is provided continuously within 100 m of each dwelling unit;
- (6) a sanitary method of excreta disposal is provided for the private use of each household, e.g. a sanitary, fly-proof pit privy, a flush water closet with a sanitary disposal system or a similar device;
- (7) appropriate facilities are provided for the sanitary storage, collection and disposal of all rubbish and household refuse;
- (8) adequate protection is provided against insect and rodent vectors and reservoirs of disease;
- (9) the dwelling is located in such an area that it may be served by the community medical, social, educational, welfare and cultural facilities.

12. Conclusions

The participants in the Workshop reached a number of conclusions that were widely shared and pertained to the elimination of many of the hazards to health associated with housing and town planning, particularly as related to the conditions prevailing in the Mediterranean area.

1. If the goals of WHO's strategy for health for all are to be attained, increased emphasis must be placed on housing hygiene programmes by all governments and public and private agencies, and greater cooperation will be needed among public health professionals, architects, town planners, financial management experts, economists, sociologists and others concerned with urban housing and human settlements.
2. Housing hygiene programmes embrace various aspects of health, including the physiological, psychological and mental health needs of occupants. These programmes should aim at creating an enclosed environment that will minimize the transmission of infectious agents and the occurrence of accidental injury, provide protection and security from external natural and man-made hazards, create and maintain a favourable indoor microclimate, and provide an adequate amount of living and sleeping space and a safe and healthful residential environment for the occupants.
3. Housing hygiene problems in the Mediterranean area are influenced to a high degree by rapid industrialization and urbanization changes that are putting great pressures on society and governments alike.
4. In the development and implementation of programmes involving housing hygiene and town planning, special consideration should be given to the possibility of bringing about irreversible ecological changes. Therefore, solutions to existing housing problems must be sought that will not have adverse effects on the ecology or other biological systems.
5. Housing hygiene problems vary extensively according to the factors involved. However, they can be divided into three general classes, depending on population size and location:
 - totally urban problems are those found in urban centres, usually involving older housing, overcrowding and lack of modernization;

- suburban problems are those associated with housing located on the outskirts of towns and cities, where some or all of the basic amenities are lacking, and where buildings may have been constructed in conflict with the existing codes, standards, norms and/or guidelines relating to land use and the methods and materials of construction;
 - rural housing problems are those associated with isolated dwellings or with small villages that tend to be extremely substandard.
6. Overcrowding is one of the major problems of housing hygiene in the Mediterranean area and increases the vulnerability of the occupants to the spread of infectious agents.
7. The minimum conditions that ought to apply to all hygienic housing in the Mediterranean area are the following:
- a sufficient number of rooms and an adequate amount of floor space to minimize the transmission of disease agents, and to meet the basic needs for privacy and for freedom from stress created by overcrowding;
 - the separation of domestic animals from areas of housing used for human habitation, preferably in distinct structures;
 - a potable and palatable water supply, piped under continuous pressure by sanitary plumbing into each dwelling or in the courtyard or to a standpipe in the immediate vicinity of the dwelling;
 - a sanitary means for the collection, treatment and/or disposal of sewage and human excrement (with particular emphasis on the need to ensure that an ecological balance is maintained);
 - a sanitary means for the storage, collection and disposal of rubbish and other solid wastes;
 - sufficient and convenient facilities for washing and bathing;
 - appropriate facilities for cooking, eating and storing of food;
 - protection from insect and rodent vectors and/or reservoirs of disease;
 - adequate lighting, insulation, ventilation, heating and noise control;
 - an atmosphere inside the dwelling unit that is reasonably free of biological and chemical impurities.
8. Greater emphasis is needed in most housing hygiene programmes in the Mediterranean area on the reduction of morbidity and mortality from home accidents, particularly those involving the very young, the elderly and the handicapped.
9. According to reported data, falls, burns and the ingestion of toxic substances are the major causes of domestic accident injuries in the Mediterranean countries.
10. Structural damage to dwellings caused by seismic forces is a major public health concern in many areas of the Mediterranean. This concern is based upon the knowledge that, in some areas of the Mediterranean, many buildings were not designed and constructed to withstand seismic forces.
11. Greater attention should be given to the design and construction of new residential structures in areas where the potential for seismic activity is great in order to give greater protection to the health, safety and wellbeing of the occupants.
12. Many Mediterranean cities and towns seem to lack adequate green space and recreational areas, particularly in or near the centre.
13. Insufficient attention has been given to the height of buildings and to the proximity of one building to another, with the result that dwelling units on the lower levels of some buildings are devoid of sunshine and natural illumination.
14. The health and wellbeing of many occupants in the Mediterranean area are threatened by apparently undesirable microclimatic conditions in a considerable number of dwellings.
15. Existing indoor air pollution is intensified by the continuing use of tobacco products by some residents and is a hazard to the health of all the occupants.

16. Some of the most serious and widespread problems in the Mediterranean area involve shanty towns and squatter settlements.

17. To resolve the problems associated with shanty towns and squatter settlements, new approaches must be developed by governments and other agencies to deter their further growth and development, to rehabilitate existing substandard housing that is economically worthy of such an effort, and to demolish housing units that are grossly substandard. Such programmes will involve the construction of large numbers of healthful dwellings to rehouse those persons who are displaced.

18. WHO and other United Nations specialized agencies are not directing sufficient resources towards solving the acute health problems found in shanty towns and squatter settlements.

13. Recommendations

1. A code of practice should be developed for the sanitary inspection of dwellings in the Mediterranean area to determine the quality of dwellings and to evaluate the progress made in housing improvement programmes, in the planning, design and construction of new houses and in the renovation and rehabilitation of existing dwellings.

2. Criteria and guidelines should be formulated specifically for the hygiene requirements of housing in the Mediterranean area, taking into account such local conditions as climate, lifestyle, patterns of living, availability of building materials and the conservation of energy in heating, cooking and lighting. These criteria and guidelines should be developed cooperatively by public health specialists, architects, town planners and other specialists and should be coordinated with the housing standards developed by ECE.

3. The housing materials and methods of construction used in the building of new dwellings and the rehabilitation of existing structures should provide adequate, safe and healthful housing not only for the immediate future but also for a long time to come.

4. Special attention should be given to the orientation of dwellings in relation to the sun and to prevailing weather patterns to maximize the beneficial uses of solar energy and to prevent the creation of undesirable indoor microclimates.

5. Existing technology should be used by architects, builders, construction experts and others to upgrade existing substandard dwellings and make them safe, healthy and decent at a low cost. Research should be initiated into the most economical ways of doing this.

6. Within the Mediterranean coastal areas, there is an abundance of historical, cultural and picturesque sites. Methods should therefore be developed and programmes initiated to restore, rehabilitate and protect them, particularly when they are endangered by urbanization.

7. Some epidemiological studies indicated an association between housing conditions and health. Further studies should be carried out to identify the causal relationships which could then be made use of in remedial programmes.

8. Those Mediterranean countries whose building and construction legislation is inconsistent with the standards of ECE should review and revise their legislation to reach a greater degree of conformity with the practices in other countries.

9. Building research institutions in the Mediterranean area should initiate a research programme into the increased use of locally available building materials and traditional working methods.

10. The Mediterranean area is subject to much seismic activity and many residential structures are in the immediate vicinity of faults in the earth's crust. Courses should therefore be developed for public health specialists, architects and other housing specialists to acquaint them with the hazards associated with seismic activity and with the means of making such dwellings more resistant to seismic forces. Such courses should place special emphasis on protecting the life and safety of occupants of older buildings.

11. One of the causes of migration of people from rural areas to urban centres is substandard housing in the rural areas without the necessary amenities. Health, architectural and town planning agencies should therefore investigate in cooperation with other specialists various practicable and economical means of improving the quality of housing and of life in the rural areas.

12. Among other standards to be developed, consideration should be given to adopting 12 m² per inhabitant as the standard of minimum indoor space for existing housing in the Mediterranean area. If and when such a standard is adopted, periodic indepth reviews should be conducted to determine its adequacy.

13. Present research on the effects of noise and other physical factors of housing on the health and wellbeing of occupants and on practicable means of preventing and/or controlling these factors should be continued. The results should be made available to architects, builders and others involved in the physical planning, design, construction, repair, remodelling and/or rehabilitation of dwellings.
14. Current studies of the effects of the indoor climate and of the exposure to indoor air pollutants on the health of occupants should be continued, expanded and accelerated, and the results of these studies should be incorporated into the planning, design, construction and maintenance of residential structures.
15. Tobacco smoking in dwellings causes a rapid deterioration in the quality of the air, and has clearly been observed to cause or contribute to the ill health of the occupants. Overt methods of health education should therefore be initiated and continued to make occupants aware of the effects of smoking in dwellings not only on their health but also on that of other occupants, such as children.
16. Investigations should be initiated to evaluate objectively the nature and degree of public health hazards created by the present widespread practice of building water closets without an outside window or with limited ventilation and natural lighting.
17. Since accidents in and around buildings cause much human misery, suffering and death, the importance of the environmental aspects of accident prevention as pertains to children, the elderly and the handicapped should be taken into account in the planning and construction of residential structures.
18. With a view to preventing squatter settlements or shanty towns, legal research should be initiated to determine whether or not legislation may be used as deterrent to the use of these places for human habitation.
19. A more vigorous attack should be initiated by all governments in the Mediterranean area and in southern Europe to prevent the spread of squatter settlements or shanty towns; they should investigate all of the causative forces that bring about these living conditions and identify practical means of preventing this type of housing.
20. Cooperative programmes should be undertaken to develop practical plans of action that are consistent with the principles of urban planning, to limit future growth of existing squatter settlements or shanty towns, and to eliminate those already in existence where the housing is deemed hazardous to the health and wellbeing of the occupants.
21. Owing to the existence of many squatter settlements and shanty towns in the Mediterranean area, a workshop, seminar or conference should be convened as soon as possible to discuss ways and means of eliminating or drastically reducing the serious hazards to the health of their occupants.
22. A vigorous campaign of health education in basic sanitation should be launched through various media to teach urban dwellers, particularly newcomers to urban areas and residents of squatter settlements and shanty towns, that they have a responsibility to maintain their home and its environs in as clean and sanitary a condition as practicable in order to reduce the hazards associated with the transmission of infectious agents and with accidental injury.
23. Owing to their importance as preventive measures and as a basic step towards the achievement of the goal of health for all by the year 2000, programmes of housing hygiene should be given high priority.
24. Public health officials, architects, town planners, builders and others concerned with, or involved in, housing and health activities should be constantly alert to new technology as it becomes available and should apply it as quickly as practicable.
25. Parks, recreational areas and green spaces with a variety of vegetation should be increased in size and number in all urban areas. Policies should be formulated and implemented that will preserve and protect the existing natural environment in and around urban areas.

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Annex 1

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