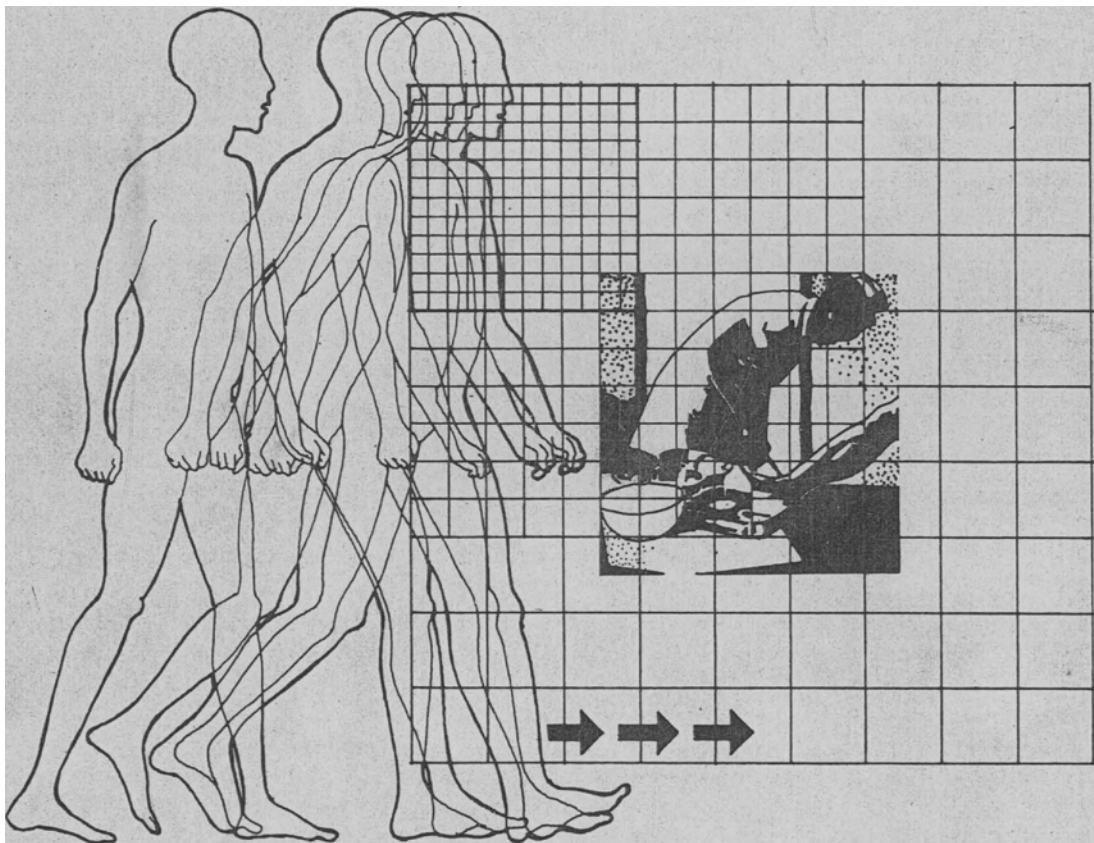


THE CLINIC BUILDING



KRISNO NIMPUNO

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P R E F A C E

This is an interim report on the building functional studies executed at the Outpatient Department (O.P.D.) in the district hospital of Kiambu in Kenya.

These studies aimed simultaneously at two objectives. In the first place, being part of a series of studies of Outpatient Departments in less developed countries, they hoped to contribute to the economic functional design of health facilities.

Secondly they aim at developing new methods in Building Functional Research.

The preparation for the project has been extended over several years and has included field surveys of Health Centres and clinics (in Ethiopia (1968-69), Kenya (1970) Indonesia (1971) and Tanzania (1973-74))and repeated visits of the Machakos and Kiambu KNEPOROS* projects of the Medical Research Centre in Nairobi.

It was especially the lively and inspiring discussions with Dr. L. C. Vogel the head of the KNEPOROS project which led to the conclusion that organisational, medical and architectural planning all influence the medical care which is to be given in the Outpatient Departments and that changes in one sector are bound to effect the others. An architectural, especially a building function analytical, follow up would therefore be most desirable in any major revision of the O.P.D. system.

The KNEPOROS project aspired to find the solution to the operational weaknesses which earlier research had detected in the Outpatient Services and started by building a facility which would allow for frequent lay out changes in the Outpatient Department.

* The Medical Research Centre has been established in Nairobi with the support of the Royal Tropical Institute of Amsterdam. KNEPOROS (the Kenya-Netherlands Project for Operations Research in Outpatient Services) is the particular project in this institute which allowed ARKPLAN AB of Sweden to execute the architectural research at its facility at Kiambu.

This approach, often used in Swedish architectural research under the name of full scale studies, was here boldly applied as a living clinic for medical operational research.

From there it was a small step to apply the Swedish experiences in architectural research for a building functional follow up of the KNEPOROS study. Although the programme was approved by the Ministry of Health as early as March 1975, it was not until November 1976 that the financial problems had been solved and that the actual tests could start.

This report of a study of Outpatients services in Kenya describes the attempts to utilise full scale building functional testing techniques for the design. The study could be started under most favourable conditions because of the great body of research that had been executed by the medical research team in Nairobi. It was not only the availability of statistical and medical data which formed the ground for our study, but above all detailed operational studies of patient flows in the specially built research clinic.

It had for a great many years been our aspiration to do full scale studies of O.P.D.'s and the chance to do a follow up of the work of the Nairobi Medical Research Centre was a challenge. All the conditions were here readily available for the required tests, most of the basic data on the O.P.D. and its operation had already been collected and analyzed and the clinic hall fulfilled most of the requirements for a full scale building functional laboratory. True, the low ceiling height would hamper the use of vertical camera registration, but otherwise all that was needed was available. But, even more important than that was that the Kiambu Clinic offered the advantage of staff and patients completely used to layout changes, observers and other studies and the possibility to combine simulation tests with a feed back from revised clinic spaces.

In other words here was a real life clinic that could be changed repeatedly without the staff and patients finding anything peculiar about it.

The methodological aspects of the study appeared therefore most interesting. The possibility to alternate between simulation and then revised reality would greatly improve the scope of the design process and nowhere but in Kiarnbu the basic conditions for such studies would be found.

It was against this background that the Swedish Building Research Council found it fit to support this project. But the purpose of the project was not solely to explore new research methods, but equally strong to aim at the development of functional spaces which would improve the facilities for medical care in East Africa.

This working paper is now circulated in a limited number to invite commentary for a later publication.

It is the intention that the final report will have two separate volumes, one describing the functional aspects and presenting design proposals, the second reporting on the methodological experience and dealing with the development of architectural research methods.

The draft in front of you still lacks substantial segments, which for reasons of time and resources could not be included. Neither is there any attempt to acknowledge the many and various forms of support which the project received.

This working paper is not intended for wider circulation and should not be quoted without the author's consent, but it is hoped that the reader will provide advice and criticism for the benefit of the final report.

Nairobi, June 1977

Dr. Krisno Nimpuno, architect SAR
for ARKPLAN AB
Stockholm-Sweden

For correspondence
Postal address:
Dr. Krisno Nimpuno
c/o United Nations
P. O. Box 4595
MAPUTO, Mozambique

ABBREVIATIONS

CL	Clerk
CO	Clinical Officer
CWR	Central Waiting Room
DR	Dressing Room
ER	Examination Room
IR	Injection Room
LAB	Laboratory
LDC	Less Developed Countries
MCH	Mother and Child Health Clinic
MO	Medical Officer
OPD	Outpatient Department
PH	Pharmacy
RN	Registered Nurse

1.0.0

BUILDING FUNCTIONAL STUDIES IN AN
OUT PATIENT DEPARTMENT

1.0.0

BUILDING FUNCTIONAL STUDIES IN AN OUT PATIENT
DEPARTMENT

1.1.

FUNCTIONAL DESIGN AND OUT PATIENT DEPARTMENTS

This report of a study of Out Patient services in Kenya describes the attempts to utilise full scale building functional testing techniques for the design of certain vital departments in health institutions. The study could be started under extremely favourable conditions because of the great body of research that had been executed by a medical research team in Nairobi. It was not only the availability of statistical and medical data which prepared the ground for our study, but above all detailed operational studies of patient flows in the specially built research clinic, with movable walls.

It had for a great many years been our aspiration to do full scale studies of Out Patient Departments, and the chance to do a follow up of the work of the Nairobi Medical Research Centre* was a very challenging **opportunity**. All the conditions were here readily available for the kind of tests which would be required, most of the basic data on the Kiambu OPD and its tests were already collected and analyzed and the clinic hall fulfilled most of the requirements for a full scale building functional laboratory. True, the low ceiling height (2.80 m) would hamper the use of vertical camera registration, but otherwise all that was needed was available. But even more Clinic offered the advantage of staff and patients being completely used to layout changes, observers and on-going research and the possibility to combine simulation tests with a feed back from revised clinic spaces.

In other words, here was a real life clinic that could be changed repeatedly without the staff and patients finding anything peculiar about it.

The methodological aspects of the study appeared therefore also very interesting. The possibility of alternating between simulation and then revised reality would greatly improve the scope of the design process - and nowhere but in Kiambu would these basic conditions for such studies be found.

It was against this background that the Swedish Building Research Council found it fit to support this project. But the purpose of the project was not solely to explore new research methods, but equally strong, aiming at the development of functional spaces for OPD which would improve the facilities for medical care in East Africa.

- *) The Medical Research Centre in Nairobi has been set up in cooperation between the Government of Kenya and the Royal Tropical Institute of Amsterdam, Holland. The KNEPOROS Project was a special research project of the Royal Tropical Institute and the Medical Research Centre.

1.2

TO ACHIEVE LOW COST HEALTH FACILITIES

The objective of constructing low cost health buildings is not simply to build cheaply, but rather to construct fully adequate facilities for the lowest possible cost; or, in other words, to achieve a maximum health care capacity from each invested dollar. This may seem to be a very superficial remark, but there are in reality staggering differences in costs between hospitals of equal capacity within almost each of the LDCs, which give us ample reason for questioning the present practice. Does anyone really believe that medical care is ten times more effective in a ten times costlier hospital bed? Does anybody believe that a reasonable hospital bed/population ratio can be achieved with high rise, air conditioned hospitals in countries with a GNP/Capital of less than \$500:- per annum?

The answer is naturally no. Nobody believes that. But why do governments and technical assistance agencies build such costly facilities?

The answer is that the elites taking those decisions are not sincere in their proclaimed efforts to provide equal care for the whole nation. The elites use the national resources primarily to build facilities to their own taste and standard. Doctors and architects prefer to portray their own role in society as a socially motivated and unselfish serving function. In reality, however, the representatives of these two professions have excelled throughout history in prospering remarkably themselves while tending the needs of the poor people. Simple calculations comparing available resources for health care and the national needs rapidly reveal the hollowness of the claims of health care development and urban elites that is reality today in most LDCs. One cannot but sympathise with President Nyerere of Tanzania who, a few years ago, inaugurating the splendid Mwanza Hospital remarked that it would have been better for the nation if the hospital had not been built. Already ten years ago Maurice King and Richard Jolly at the Makerere Symposium pointed out that the Mityana Hospital was built for \$1,820/bed, whereas other hospitals were constructed at the same time for \$14,000/bed.

It is therefore that we should modify our first assumption and indeed match the resources with the needs: That is to build with the available amount and not to build to achieve a certain standard that reflects the taste of the privileged. and not the need of the people.

The question then arises, "How does one go about building low cost health facilities?"

An important step is to economise construction costs by emphasizing a very thorough planning and design. A larger design input with the objective of reducing building costs can indeed create both long term savings and in maintenance and reductions immediate construction costs. We would like to mention a few factors by which a greater design effort can serve to reduce costs. Not all of the factors mentioned here will be applicable everywhere, but many of the below mentioned factors can be used to economise health buildings:

1. Functional design to reduce construction volume.
2. Distinguishing between a high quality component and other parts of variable standard.
3. Phased design to spread capital investment over a long period of time, and to design for quantitative and qualitative growth.
4. To build for locally manageable maintenance without need for imported spare parts or know-how.
5. To build with nature and not by controlling environment.
6. To design for self help and independence.

These principles are not to be taken as theoretical and unpractical ideas but, to the contrary, as practical guidelines to achieve adequate and economic facilities. We would therefore like to elaborate on these six points.

1.2.1

FUNCTIONAL DESIGN - Increasing effectivity and reducing volume

Functional design has two objectives: Firstly to adapt the space to the function it is to house or to tailor make the room to the action in it and secondly to reduce the construction volume.

The first effect is to increase the efficiency, the second is to save money. It should be stressed that construction volume is the single most important factor in construction costs and savings here will not only be substantial but will also reduce most secondary costs in other areas. The usual argument against functional design is that it destroys flexibility in buildings. This is not entirely without foundation but one should then specify which kind of flexibility one refers to. The flexibility within a room where functional studies have made great efforts to reduce spare requirements is certainly less. The flexibility of the whole building or part of it, however, is another matter. This flexibility depends on the type of construction. If an independent frame allows for free alterations between the load bearing parts, the overall flexibility of the building is not restricted. This type of flexibility is certainly valuable. The internal flexibility within the rooms however is less desirable.

The need of flexibility within the individual spaces in health facilities stem from factors which may be relevant for the industrialized countries but much less so for the LDC's. The argument of flexibility is valid for two reasons, both of which are not of great importance for the LDC's. If the functions of a certain space are subject to frequent changes, a flexible space can easily be adapted to the new requirements but a functionally designed space cannot. In the industrialized countries such has been the case due to the process of mechanisation of health care. It is not likely and certainly not desirable that the LDC's will follow this trend of replacing nursing staff with expensive machines.

The second argument concerns technical developments in medical care which change the space requirements of the function. Although some of these techniques may be of importance for medical care in the LDC's, the vast majority of these changes do not effect the working practice in the most important health buildings, e.g., the Out Patient Departments and the nursing units. We do therefore believe that the argument of flexibility can be valid for the specialized treatment and service departments such as the X-Ray and surgical units and the laboratories, but that the bulk of the buildings should be designed with great functional care,

aiming at efficiency as well as at reducing construction costs.

1.2.2

PERMANENT FRAME - Variable components

One of the weaknesses of low cost construction is often that the entire structure is of low quality. The image that low cost is inferior is seldom a factor deciding against conscious low cost planning.

It is fair however that any normal building has a variable durability for its various parts. Where the base structure should not last less than 60 years, a renewal of its interior is in many cases wanted every 30 years, with even much shorter maintenance cycles for many details. In the case of an Indonesian hospital which I surveyed in 1966, the basic frame had remained unaltered for over 80 years but as many as 10 renewals had taken place in one and the same building since. The objective of reducing building costs should never be an argument to construct an inferior frame. A strong foundation and a reliable permanent roof which will provide adequate shelter for at least 60 years are elementary requirements. It is however very acceptable to use a less permanent and very cheap material for many parts of the construction. The use of traditional material such as round wood, mud bricks, and split bamboo mattings can greatly reduce construction costs without impairing the usefulness of the building. The principle of a separate base construction also facilitates the internal and external developments of the building in the future which is an important requirement in health buildings.

1.2.3

PHASED DESIGN

At the WHO - UIA conference in Nairobi 1974 on Health Facilities under conditions of limited resources, several speakers noted that almost all African Hospitals built before the seventies had grown from a modest start as a clinic or a nursing home. The same phenomena can be

noted in Asia. It is not unreasonable to expect that many of the rural clinics and health centres of today will grow to become hospitals as time goes by. But today such expansions are almost never a part of the design and when the day of extension arrives many unnecessary design and construction difficulties have to be faced. Planning means looking ahead and for low cost health facilities it means to be prepared for both expansion and for standard improvements in the existing units. These two aspects of growth should be a part of the original design.

A phased design is the basis for such growth; it allows for the maximum health care capacity at the minimum cost and an elementary standard, but intends to improve the environmental quality within the units in the future by gradual development of the facility. The effect is distribution of capital invested over a longer period of time and therefore to provide elementary medical care to a larger part of the people now. The phased design also aims at allowing for future expansion if such needs would arise.

1.2.'+

LOCAL MAINTENANCE

To construct for easy maintenance need not increase the building costs and reduce the operating expenditures for the facility. It requires careful planning and design. Maintenance of health buildings is today a major restraint for health care in LDC's, partly because all too many buildings have been designed with little attention for maintenance economy in general and partly because the necessary maintenance often requires locally unavailable spare parts and know-how. The Mwanza Hospital in Tanzania, which we mentioned before, has to bring in the elevator maintenance man by chartered plane from Nairobi, Kenya. This is far from a unique example and it offers a solid illustration of the kind of ignorant or indifferent planning which is so common for projects by foreign consultants. Planning for local maintenance results in buildings which are unsuitable as status symbols and this might be a reason why architects, doctors and politicians do not harbour a great love for it.

12.5

TO BUILD WITH NATURE

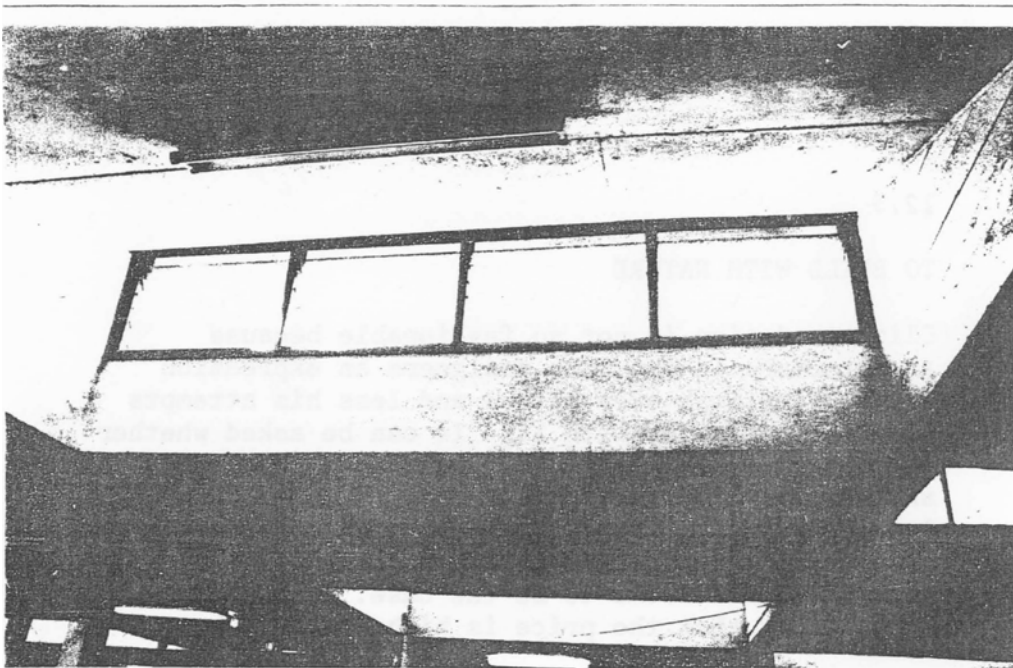
Climatic design is not so fashionable because architecture is for many designers an expression of man's triumph over nature and less his attempts to live in harmony with it. It can be asked whether the people of the LDC's in need of health care should pay the price for such aspirations. But looking at many of the great architectural designs executed in the form of splendid hospitals in the LDC's this seems to be the case. And there is no doubt that the price is high indeed.

High rise buildings, air conditioning systems and shading structures are very expensive but can be avoided without any loss in comfort and with great effects on the building and maintenance costs. Low rise, cross ventilated, east-west orientated pavilion hospitals are cheaper and more efficient than any other type of layout and can offer very pleasant environmental qualities close to the human scale. These advantages should have a greater value than the vanity of the planners. Building with climate instead of against it is a question of efficiency and should be a matter of principle for the design of all health buildings in the LDC's.

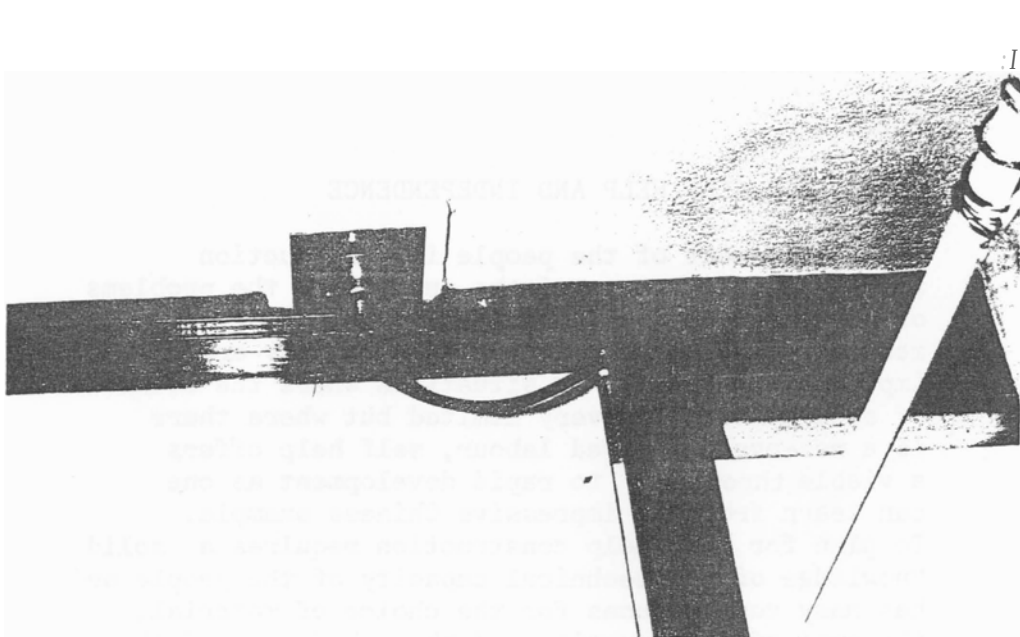
1.2.6

DESIGN FOR SELF HELP AND INDEPENDENCE

The involvement of the people in construction activities can be one of the answers to the problems of creating the necessary facilities for development of which health facilities certainly are important elements. In situations where the means of accumulation are very limited but where there is a reserve of unused labour, self help offers a viable throughway to rapid development as one can learn from the impressive Chinese example. To plan for self help construction requires a solid knowledge of the technical capacity of the people and has many consequences for the choice of material, the type of construction and the scheduling of the project. Design for self help requires an early involvement of the people and participation in decision making and should therefore be executed on the spot.



Roof lights provide the entire hall with daylight.



Electrical outlets are placed throughout the building in the ceiling.

In many respects moreover self help construction is superior to contractor executed work because the responsibility for the facility and the identification with it forms a valuable factor for development. The choice of techniques should be guided by factors like the local availability of material, the choice of a technique which rapidly can be mastered by a great number of people and the possibility to construct the facility during slack periods in the agricultural cycle. The utilisation of large construction projects as a form of mobilisation is very suitable to create a spirit and consciousness of development and can therefore become a step in the process of emancipation and liberation.

1.3 .

THE AIM OF THE PROJECT

The previous six principles cover a wide field determined by locally variable factors. The project described in this report covers only a study concerning the first of the principles: Building Functional Studies of Out Patient Departments to Achieve a Functional Design.

The aim of this project is two-fold:

1. To develop a design of Out Patient Departments (OPD's) for East African conditions; and
2. To develop design methods within the discipline of building function analysis.

The first of the two objectives was shared by a number of other researchers in the medical and architectural field. Maurice King has for many years done pioneering work in this field and is still today a source of many practical and theoretical ideas.

The Housing Research and Development Unit of the University of Nairobi is engaged in studies concerning low costs health facilities and the Ministries of Health and Works in East Africa are regularly producing proposals in this field. The second of the two objectives is a development of research and design methods based on the Swedish work in the field of building function analysis, a discipline pioneered by Professor Carin Boalt of the University of Lund. The design of medical facilities has always been a field where building functional studies were successfully applied in Sweden. The project in Kenya would therefore in many ways fit in well with the second objective. Our contact with the Vogel-Dissenvelt studies at the Medical Research Centre in Nairobi proved to very rewarding already in 1970. Vogels later project, KNEPOROS, led to the cooperation which in 1976 resulted in our building functional studies in Kiambu. The project proposal was jointly drafted after discussions in late 1974 and early 1975. The following excerpts still give a fair picture of the intentions and set up of the project.

1.3.1

THE ORIGINAL PROJECT PROGRAMME

1.3.2

BACKGROUND

KNEPOROS, the Kenya Netherlands Project for Operations Research in Out Patient Services, is a series of operations research studies, undertaken on request of the Kenya Ministry of Health aiming at the improvement of Out Patient services. To this end, an experimental clinic with a flexible internal structure has been built in Kiambu* and is in use now since January 1974. It may be expected that the results of these studies will also be of relevance to the vast health centres construction programmes which in the 4-8 years to come will be undertaken in Kenya as well as Tanzania and Ethiopia.

The recommendations of the KNEPOROS team, which is to terminate its work in 1976, will be in the medical, organizational and architectural field. Whereas no professional architect is employed in the research team, it was felt that outside support in analysing the use of space in the OPD could be of great value. In this way a translation of the results from the operations research studies in architectural terms can be provided.

Three fields of architectural-functional studies present themselves in this context:

To find requirements for the functional elements in an OPD, and combine these in possible layouts, using the outcomes of the O.R. studies as a guideline.

It is hoped that the physical environment for the optimal OPD organization can be obtained.

Interior planning and equipment design for rooms, based on dimensioning experiments.

The choice of technology i.e. material and construction techniques, which choice is determined by the requirements of the optimal layout and the constraints of the environment (e.g., availability of materials, climatological conditions).

*Kiambu is a district capital, about 20 km north of Nairobi.

1.3.3

OBJECTIVES

The proposed study has as its objective the determination of the optimal relation between space and function in an Out Patient Department in the East African Medical Environment.

As a result of the study the following documents will be obtained:

a detailed schedule of accommodation and a full architects brief.

a prototype design of some special spaces under study.

general criteria for site selection and site planning.

The following functional elements will be the main objects of study:

Waiting rooms

Medical assistants examination room

Injection room

Dressing room

Pharmacy

In a later stage, it will be discussed whether it is feasible to set the following sub-objectives:

To collect information about the attitude of groups of users of existing future OPD furniture based on available anthropometric material.

1.3.4

METHODS

The method of full scale tests for Building Function Analysis has been used at the School of Architecture of the University of Lund - Sweden for a considerable time. It aims at achieving an optimum relation between function and space.

- (1) Observation and analysis of functions. This can be done by observing and analysing the different elements of a function, for instance by measuring movements patterns, ergometry, flow analysis and time studies. This part of the study can take place under field conditions and provides some basic data for the later test programmes and problem identification. Little technical equipment is needed at this stage and a considerable body of data can usually be borrowed from literature.
- (2) Registration and Measuring. These methods require suitable space for full scale testing, accommodating registration equipment such as interval and still cameras for horizontal and vertical pictures. The possibility of altering room dimensions wall position and openings is desirable. This phase also aims at determining the efficiency of furniture and equipment.
- (3) Dimensioning studies in variable space. These experiments use anthropometrical data and consist of laboratory tests with test subject under varying spacial conditions, in order to find out optimum space function relations.

1.3.5

PHASING

The study will have the following phases:

- (1) Observations in the existing layout, problem identification and programming.
- (2) Registration and measuring in the experimental OPD building at Kiambu of the five mentioned functional elements during normal clinic operations.
- (3) Details studies of the individual functional elements with variable layouts and test subjects and with special attention to fixed furniture and optimal room dimensions.
- (4) Analysis and reporting to take place partly during the laboratory testing, partly after that. The report entails accommodation scheduling and briefs, as well as prototype design, especially for low cost technology in rural conditions.

The report will also address itself to the problems of site selection and design and general layout planning.

The first simulation of an injection room layout was an enlightening experience in this respect. When the clinic staff was invited to inspect the full scale mock up, the project staff took care to refrain from explaining the intentions of the layout. It proved not to be necessary. The nurses immediately perceived the intention of each part of the room and their comments of the effect of the arrangement on the functions were very straight forward. The most important intentions of the design - for instance to separate staff areas and patient areas, were immediately identified.

1.3.6

EQUIPMENT

The project used the following equipment:

1. Three motorised 35 mm cameras with remote control mounted in ceiling brackets and used to take vertical pictures in various locations:

- 1 Canon with 28 mm lens
- 2 Nikon's with 35 mm lenses

These cameras were made available by the Department of Building Construction, Chalmers University of Technology, Gothenburg, Sweden.

Originally it had been planned to use the standard equipment from the full scale laboratory in Lund, Sweden : Three motorised Asahi Pentax - Sportmatic Cameras with wide angle lenses. These cameras proved however at the last moment to be needed in Lund during the same period.

Daylight conditions were used to avoid unnecessary disturbances with flashes or spotlights. Standard 400 ASA black and white film proved to be adequate.

2. Hand held 35 mm cameras for horizontal and diagonal still pictures:

- 1 Minolta SRT Super (28mm, 50 mm and 100 - 200 lenses)
- 1 Minolta SRT - XE - 1 (28mm, 50 mm and 100 - 200 lenses.)

l Practica - (35 mm and 135 mm lenses}
 l Canon - (28 mm and 50 mm lenses)

Here also 400 ASA black and white film was used, and Kodachrome 64 colour slides. In the last case, an electronic flash was used to compensate for the slower film speed.

3. A hand held Super 8 film camera Nizo - S8L was used to register the patient flow and the test methods using Ektachrome colour film and daylight conditions.
4. A hand held National Panasonic 212 D Cassette Tape Recorder for interviews and to register comments during the tests.

It should be emphasised that direct observations and measuring constituted the most important method. The photography was mainly useful to register certain situations and to serve as illustrative material. In a few cases, photographs were used to analyse situations afterwards but the tests could have been executed successfully even without the above mentioned technical aids. The use of the Video -TV Camera and the use of sequence cameras was ruled out because of the time consuming picture interpretation it would require. It was decided instead that critical dimensions would be marked on the floor and walls during the tests and measured afterwards.

1.3.2

FULLSCALE BUILDING FUNCTIONAL STUDIES OF THE OUT
PATIENT DEPARTMENT IN KIAMBU

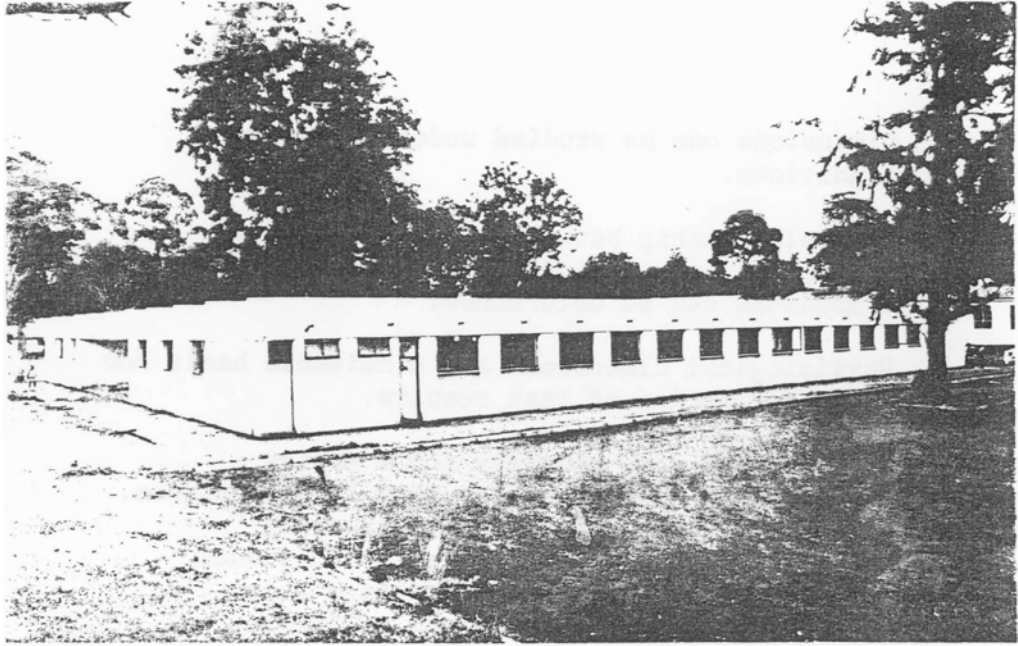
A multidisciplinary team has for a number of years been engaged in operational studies in Kenya: The Kenya Netherlands Project for Operational Studies in Out Patient Service -(The team led by Professor L. Vogel from the Royal Tropical Institute of Amsterdam), is based at the Medical Research Centre in Nairobi and has full scale testing facilities in Kiambu. The studies which have dealt with medical, operational, statistical economic, sociological and organisational aspects were centred around the studies in the experimental clinic in Kiambu, which KNEPOROS erected as a part of its research programme.

This clinic, operating with a normal staff and serving a permanent patient population, is housed in a large concrete hall with movable partition walls and flexible power and water connections. This allows for variable layouts and makes tests of alternative patient flow possible. These operational duties have however not included the type of methods which can serve to transform the operational conclusions in a form suitable for the formulation of an architects brief or for the preparation of a construction programme.

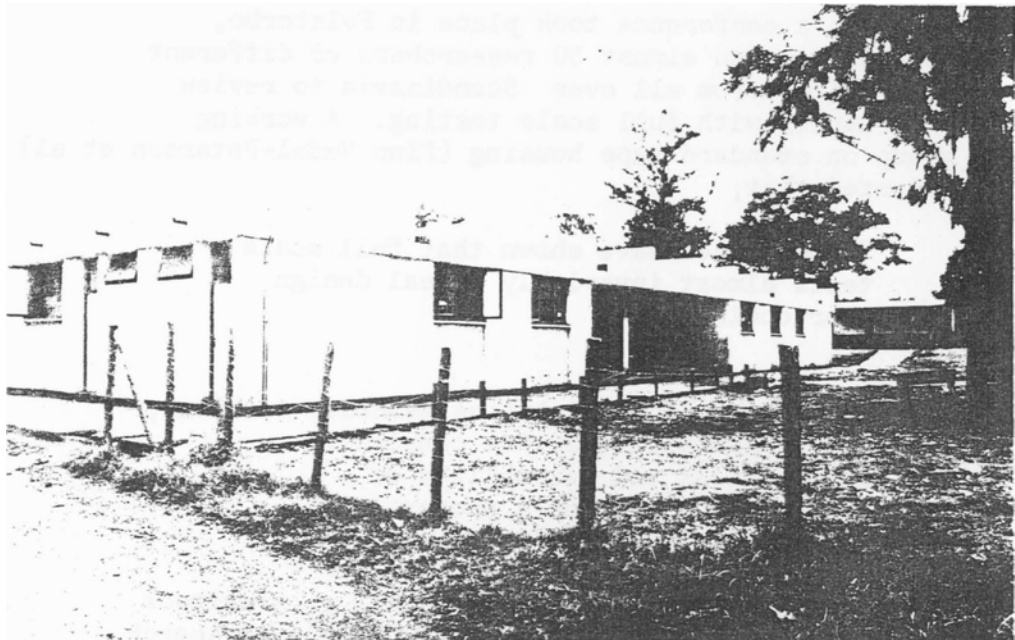
The programme for building functional studies presented in this report aimed at bridging this gap. By studying the relation between the individual and the environment and the effects these have on the efficient execution of necessary tasks in that environment this programme aimed at formulating the requirements in an architects brief so that a suitable and economical design will be possible. Building functional studies are a series of methods which analyse the effects of the environment, especially of the space, on the performance of individuals. Sven Thiberg) has mentioned several groups of such effects which can be determined by measuring environmental characteristics:

Certain dimensions in the environment can be identified as more suitable than other dimensions.

The reactions of individuals can be measured and registered.



The K EPOROS Building at Kiambu - an Out Patient Department, with movable walls.



The Entrance of the Out Patient Department - in the background is the office used by the research team.

Dimensions can be studied under laboratory conditions.

The relationship between the environmental dimensions and the individuals physiological dimensions can be determined.

Physiological dimensions are a suitable basis for a generalisation of test results.

These factors are very relevant for a design programme and this is the reason that the techniques of full scale testing are gaining increasing recognition. There are however many individual reactions and individual characteristics which cannot be measured by these methods. Different people react and behave differently according to their cultural, psychological and social identity. Such factors are difficult to take into account in a general architectural programme. In the design process itself however, factors of this nature should be very much on the architect's mind and be expressed in the final result. To attempt to define these factors in a set of data as part of the architects brief is beyond the scope of it.

In 1967, a conference took place in Falsterbo, Sweden, between almost 50 researchers of different disciplines from all over Scandinavia to review experiences with full scale testing. A working group on standard type housing (Finn Vedel-Petersen et al) reported that:

"Experiences have shown that full scale tests almost invariably reveal design shortcoming

"The architects simulating methods: sections, scale models etc, do not convey the full feeling and suitability of the design, even for a professional let alone for laymen".

In the same conference, Roar Bjorkto, an architect from the Norwegian Institute for Building Research reports: (in full scale studies).....

"It is possible to register the following measurable conditions:
dimensions
proportions
position

environmental qualities
functional characteristics
economy
comfort"

Full scale testing has now become a regular part of the Swedish architectural training in Lund and Stozkholm and is frequently used as part of design preparations for larger projects.

The full scale testing facility at the University of Lund is probably the best equipped, staffed and utilized laboratory in this field and its experiences are very useful in gaining an understanding of the possibilities, methods and limitations of full scale testing as a development instrument. The laborato2y hall is 6 meters high and has an area of 260 m usable floor. Along the side walls of the laboratory rails support an observation platform of 8 x 13 m which can be raised or lowered. The platform has a removable floor. The arrangement facilitates observation and registration and can also serve to construct two storeyed structures in fullscale.

The laboratory is equipped with light partition elements of 60 x 250 em, 10 em thick which easily can be put together to form rooms of any dimension. There is a well equipped storage with a great number of wardrobes, cupboards, kitchen and bathroom equipment and furniture. Doors and windows are part of the system. A complete new test set up can even be constructed in one day.

The most used methods are the common sociological methods of:

interviews
questionnaires
observations
sociometri
role-play and budget plays

Then there are technical methods which are specially suitable for fullscale tests:

tv/video - registration
interval photography (Sequences photography)
still pictures (In three directions)
simultaneous electronic mass interviews
(Elopin)
dynamic space tests



The first: injection room & simulation: measuring the space needed for a rtonther with chiLd (here a steel drv.mJ wh n passing t:-3-cween ot-her pa-cl-z.nt and cLerk.



The first injee-r; com y; om -n .ceedback: The clerk car. J-Jr-cYc2- the pati.C3YLt flow 1...n the treatrnt area, but :...n ;Lc c contro: ngu. :...ati8nts who enter the room for reg.:strator.. :;one Zusion: _ 2rr.: YI?Lt-S y; be abZe to look into the

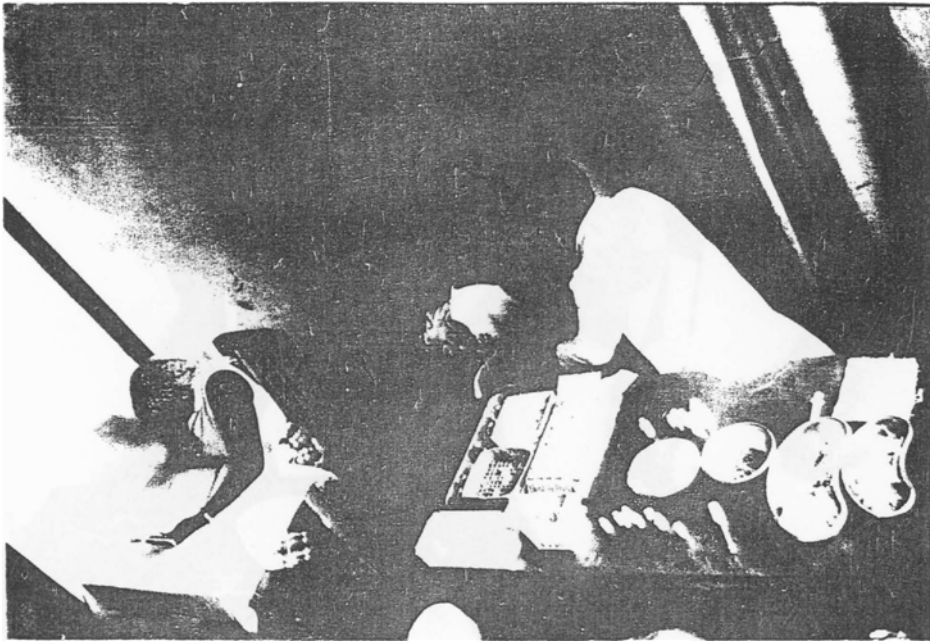


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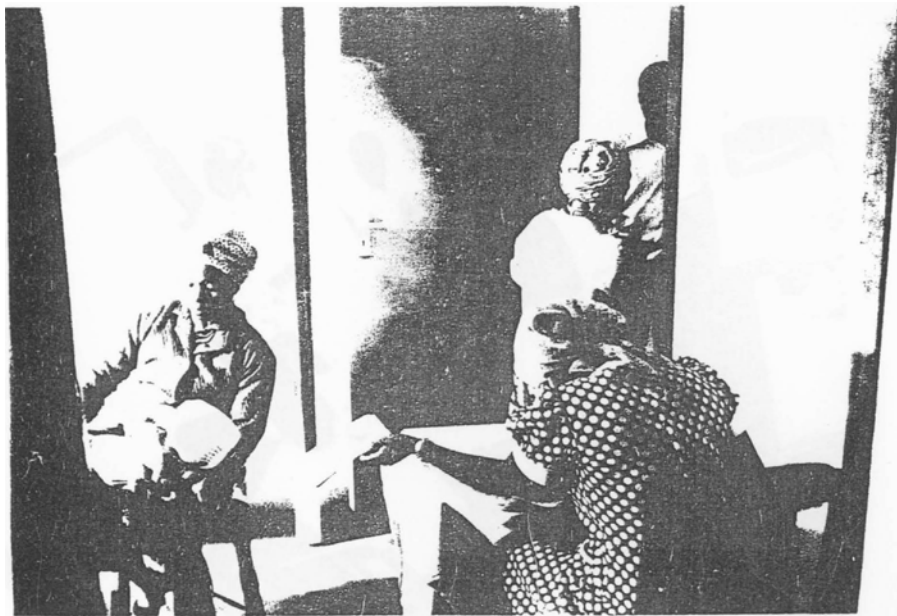
Discussion of mock up with patient.



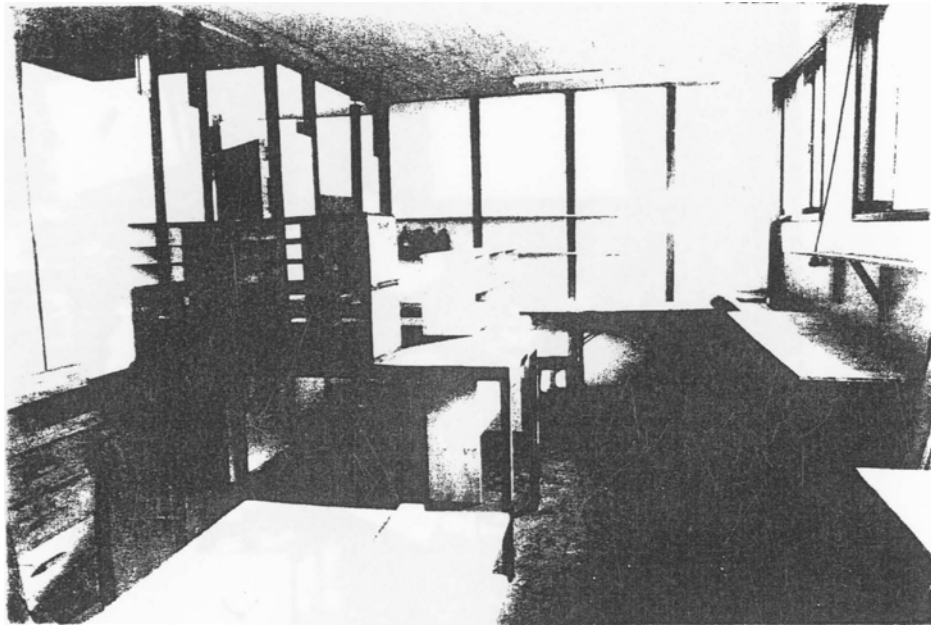
Discussion of mock up with staff



The second injection room during feedback: From left: clerk receiving patient card another patient with baby on her back large child behind her and sma?l child on her lap receiving injection from male nurse. Behind the curtain is a couch.



First injection room in feedback. At left mother with child to be injected. Foregr'ound: clerk. Background: and example of backflow: pati:ent leaves the room after treatment against the patient; flow through the entrance.



The mock up of the pharmacy design.

No integrated simulation tests were made for the pharmacy. The flow in the pharmacy is not a flow of people but a flow of drugs which can easily be analysed on paper.

This full scale mock up served two purposes:

- (1) to discuss the lay out with the staff*
- (2) to execute simulations of individual activities.*

In this way passage space and furniture dimensions could be tested for each of the functional units.



Photomontage:

The use of vertical photographs in a collage proved to be a valuable method to analyse and illustrate yet untried lay outs.

Interval or sequence studies are executed with robot cameras or movie cameras (super 8) and are specially used to analyse the details of movements and of space requirements.

Still pictures are very useful to measure exact dimensions during the use of the space. If great accuracy is required, then the tests are often arranged as a simulation of a small part of the sequence and the still pictures are then taken with a scale grid in the background to facilitate later detailed analysis.

Elopin interviews use a mentometer device which allows a great number of respondents at the same time to answer questions with a number of alternative answer choices. Dynamic space tests study the development of a certain working sequence within a gradually reduced space. The tests continue until the work no longer can be performed. The results give information on the minimum space requirements for each task and demonstrate how functional adjustments to minimum or subminimum space develop.

A typical project would contain the following phases:

1. Observations in normal conditions in existing facilities. For instance, a study of the normal activities taking place in a patient room in an existing ward. In this phase the test programme is defined, the listed activities are selected for simulated tests and existing room functional difficulties are noted.
2. Laboratory studies where replicas of the space are used to study the selected activities. If possible, test persons are selected from the original observed institution.
3. The results are used to formulate the design programme for a new facility or for a renewal of the original facility.

Although the techniques have been developed considerably since the early beginning one should be aware that a full scale laboratory never fully can replace the 'normal' situation. Test persons often remark that the laboratory environment is

is 'difficult', 'complex' or 'not real'. The feeling of space, the texture and colour of the walls, the absence of a ceiling, all can contribute to the feeling that reality is not there.

The tests in Kiambu do in this respect offer a unique difference. The clinic is the regular facility in the local hospital and there is no reason why staff and patients would have any noticeable reaction to the environment as often has been the case in the Swedish full scale laboratories. Indeed the long periods that patient flow were measured at Kiambu should contribute to the feeling that observers are part of the clinic routine.

A very interesting aspect was the possibility of executing parallel programs of real clinic studies and simulations where notions can be simulated and tested in the laboratory tests, and after reaching satisfactory results can be inserted into the real clinic situation simply by changing that set up. The possibility to achieve such an echo situation should also eliminate the normally very disturbing time intervals between the different phases of the study. It was therefore hoped that a series of tests and applications in tandem could lead to a new method in using full scale testing as a part of the programming and design process.

1.3.2.11

THE KNEPOROS CLINIC BUILDING IN KIAMBU

In January 1974, the Out Patient Department (OPD) building became operational after a long period of planning and construction. The intention of the Kiambu facility was to create a space suitable for out patient services (OPD and MCH) with unlimited layout flexibility. The concrete building offers therefore a largely uninterrupted space of 37 x 48 meters with few columns and a great number of connection points for water, drainage and electricity. Movable timber partitions make it possible to change layouts within a very short time. The facility is quite large in relation to the normal space requirements of out patient services. In a recent series of tests 80% of the hall (total 1800 m²) was not used for functional spaces or not used at all. As a result a full layout is possible with simultaneous space available for full scale testing in a simulated situation.

The main thrust of the operational studies has during the KNEPOROS studies been in the organisational field. The studies have at regular times been complemented with studies in 'normal' clinics in the same province to compare qualitative aspects of the changes made at Kiambu. Samples of the studies are:

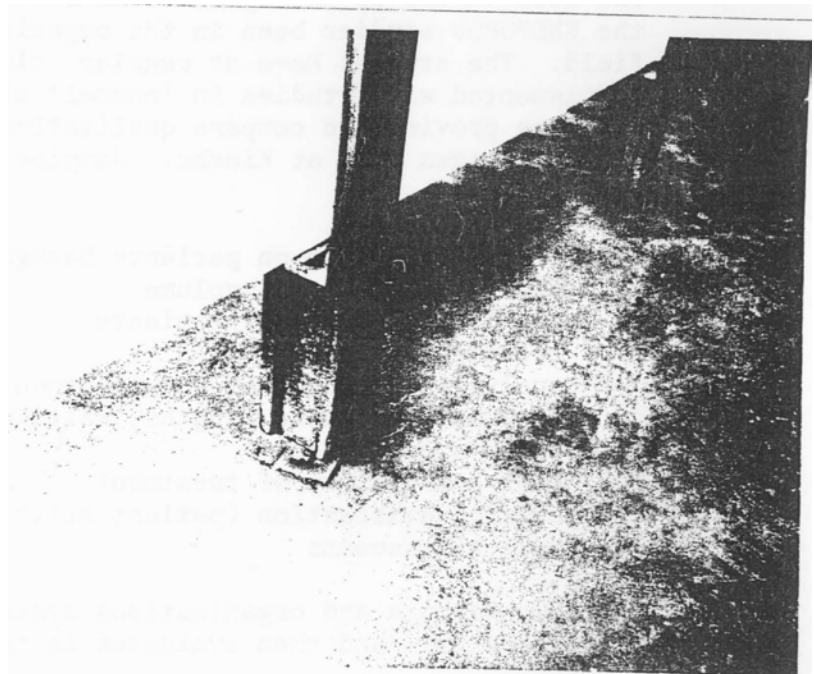
- statistical data on patients background flow-directions and volume
- station sequences of patients
- treatment data
- analysis of diagnoses and treatments
- flow speeds (queue lengths, waiting time)
- daily flow cycles
- cost and quality of treatment
- client satisfaction (patient attitudes)
- care assessments

Several layouts and organisations systems have been tried out, and then evaluated in this way.

The different tests led to considerable changes in staffing and organisation of the departments. The changes of the layout were a result of the organisational changes mainly and not of the observed interaction between space and function in the first place. It is obvious though that the KNEPOROS research team was somewhat aware of these



The columns are fixed with pressure plates to floor and ceiling



The foot of the column rests via a pressure plate on the floor - The partition is fixed with a L-Profit in the slot of the column.

relations and that the experiences with space played in on the formulation of the charges.

It seemed however that a thorough registration of the conditions and the interactions would be a great step toward an architectural interpretation of the findings. The possibility of mounting cameras in the ceiling would already be a step forward and determine the space utilisation and zoning of the department.

1.3.2.12

The first phase of our programme consisted of evaluation of the earlier KNEPOROS results and extraction of factors relevant to the spacial arrangements. The initial question of determination of the critical functions and actions in the building was decided with the help of earlier programme studies of OPD's from different countries. The question of design and building construction limitations in L.D.C.'s was to be observed at this stage.

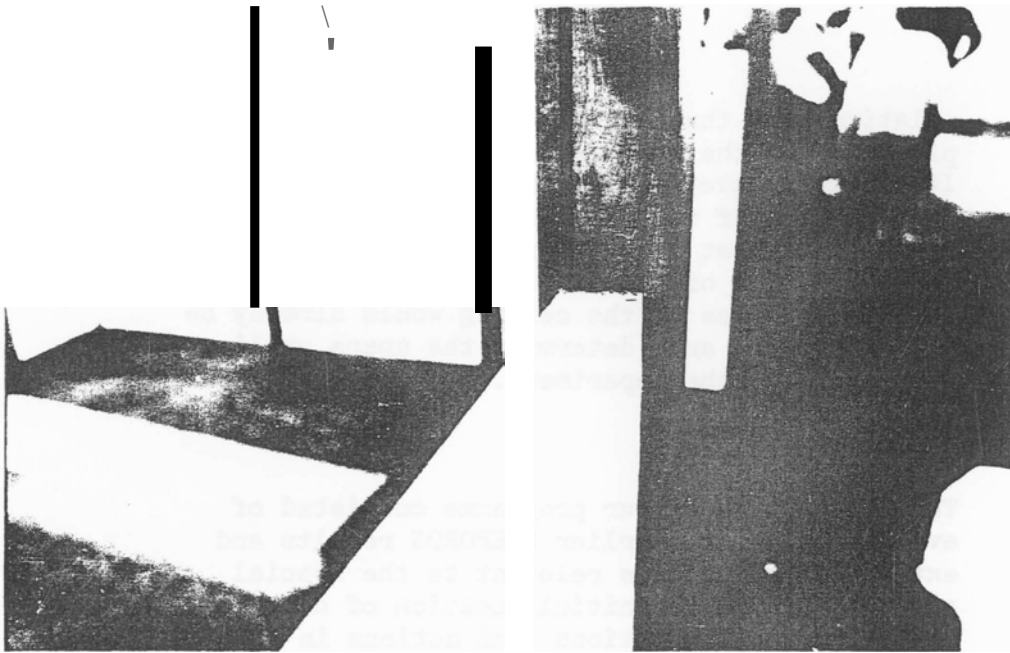
Direct observations in the clinic were, during Phase One, used to determine the critical functions and activities and to identify a general series of relations between individual and space. In the first phase of the study, no technical aids were used.

The second and third phase of the study consisted of two parallel series of full scale studies within the same building:

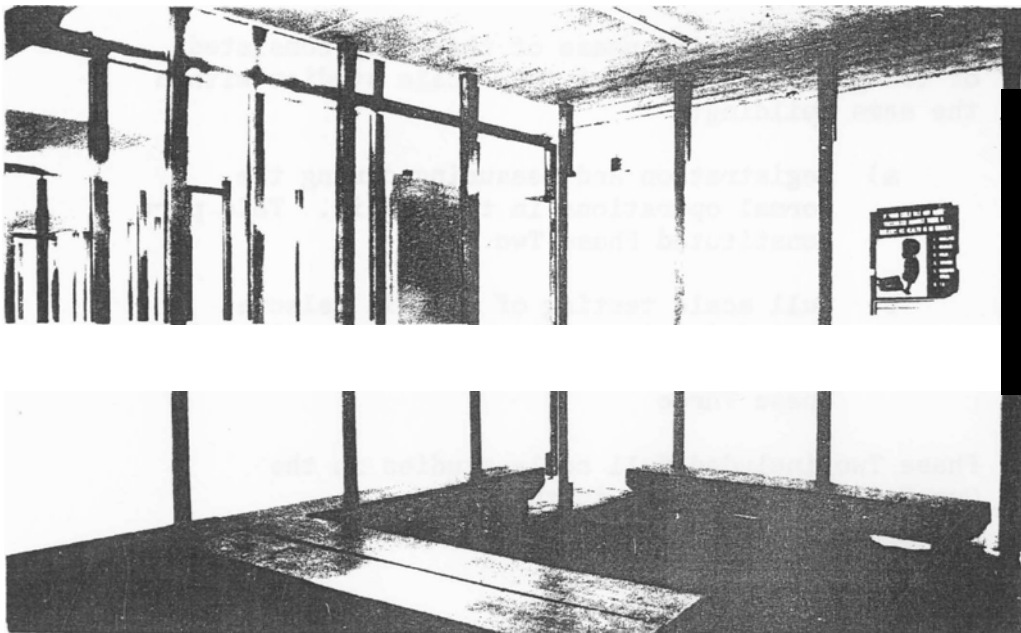
- a) registration and measuring during the normal operations in the clinic. This part constituted Phase Two
- b) full scale testing of certain selected activities in a full scale simulation with test persons. This part constituted Phase Three

Phase Two included full scale studies in the Out Patient Department in the:

- waiting space
- examination room
- dressing room
- injection room
- pharmacy



These panels fit into the slots of the columns.



The sub-waiting room in front of the injection room. Half partitions have been used for the waiting area and full partitions for the rooms. Note the gap at the top and bottom of each partition leaving an open space at the floor and ceiling.

On the basis of the observations made during Phase One the programme consisted of:

- observations
- space studies of individual movements
- photographic registration
- measuring
- interviews

The intention was to identify the effect of the working space on the work, especially shortcomings which can be studied in the simulation tests (see Phase Three) and to note the suitable criteria for the architect's brief.

Phase Three consisted of simulation of certain activities selected during the preceding period. The study, executed with test subjects in a separate part of the building, studied each activity in variable spacial arrangements, e.g. diminishing room dimensions and alternative furniture layouts. These studies aimed at creating a dialogue between the clinic and the variable test situation in order to achieve an optimum design.

Once a satisfactory design had been achieved, the clinic staff were consulted to propose changes and analyse the shortcomings and merits of the layout. Finally, when all concerned agreed that a variable solution had been achieved, then the clinic itself was changed accordingly and observations started all over again to determine whether reality confirmed the thought advantages of the changes.

Phase Four was to consist of analysis and reporting in close cooperation with the KNEPOROS staff in order to achieve architects briefs and prototypes which fully reflect the experiences of the KNEPOROS work and which lead to an economic design. This part of the project could not be executed due to a 30% reduction in the project budget.

1.3.2.2

THE RELEVANCE OF FUNCTIONAL DESIGN IN O.P.D.'s

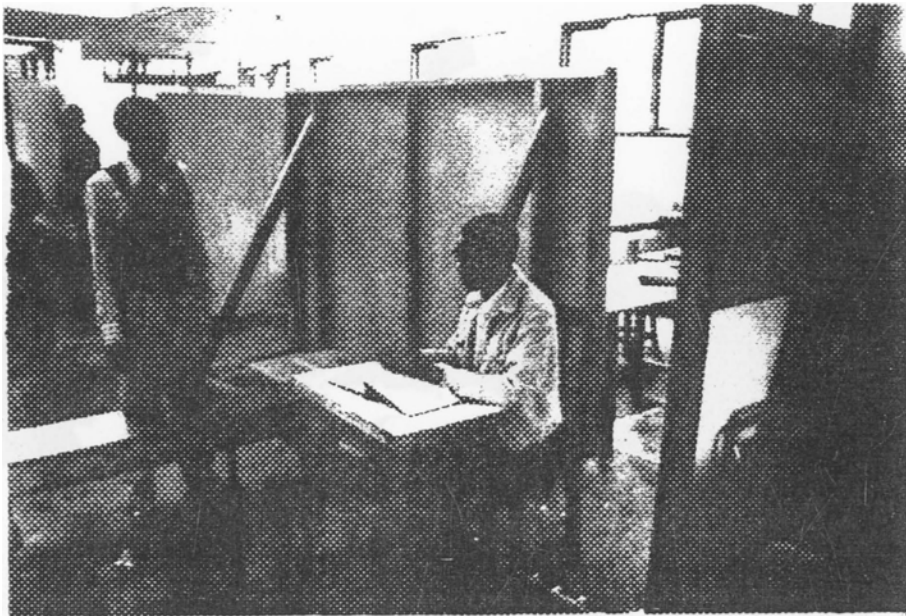
The units described in this study are meant to be equally suitable for district hospitals, health centres and dispensaries. As the design aims at following the function, it does not aspire functional flexibility, but rather functional adequacy. This should not be confused with structural flexibility, as it is very well possible to achieve a strict



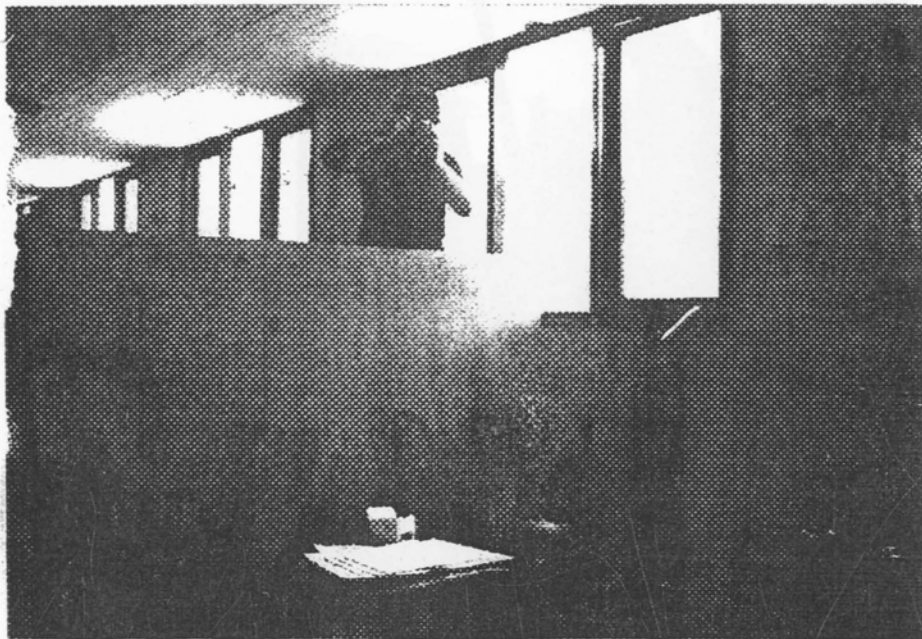
...mounting the partitions for an observer's cubicle.



The high observer's stool makes it possible to conduct various activities in the 8x8 room. Later when the cubicle is built around the stool the observer is concealed behind a curtain.



Movable walls used for the simulation room



Taking a diagonal picture in the simulation room.



By using the
with
camera
by using a X'ubbex bali.



Hand held cameras were used during simulations.

functional design within a structurally flexible building.

The question of functional flexibility cannot be left unmentioned. It may be unkind to state that functional flexibility often is used by doctors and architects to conceal their ignorance of the detailed activities in and functions of the rooms, but it is not without foundation. Although medical technology is changing very rapidly and thus, greatly effecting the spaces in the medical buildings, there are few changes which radically effect the examination and treatment rooms in an OPD. Complicated and large machines which would require much space can do very little about the basic diagnostic task of examining 200 patients a day, the majority of which have minor complaints only. In general OPD's, it is the less refined part of medicine that is practiced and here it concerns a labour intensive operation of which little can be mechanised.

We therefore hold that there is no foreseeable development in the next few decades which warrant other functional arrangements than can be determined today.

To build rooms for "functional flexibility" on the other hand is more costly because it increases volume and it is more laboursome for the staff because excess space causes many unnecessary movements.

This study aims therefore at the design of units which are difficult to use in a wrong way. It also hopes to reduce building volume and building costs. The units can be linked in different numbers and ways to suit the special requirements of various OPD's.

Structurally it aims at a wide variety of materials which can be used, while the climatological requirements of different areas equally easily can be followed.

But the functional units as defined here are meant to be basic elements which should be equally suitable in larger as well as in smaller health institutions in all different locations.

1.3.2.21

THE CHOICE OF METHODS

When the experiments with full scale simulation in Kiarnbu started, the aim and scope of the original proposal was still unaltered. In the first place the project aimed at developing adequate spaces for the main activities as organized by the KNEPOROS project.

The second aspect concerned the special methods which could be used in Kiarnbu as a unique possibility to combine simulation and instant feedback to the real situation.

The first phase of the project - a month's long series of observations in the KNEPOROS building - had confirmed the relevance of the selected subjects and now the detailed programmes could be formulated.

The correlation between simulation and feedback to the real clinic would be valuable in three of the selected functions, e.g., examination room, injection and dressing room. There, one would be faced with a large number of simple movements by the staff and the interaction with a great many patients passing through the room. It seemed clear that the possibilities of unforeseeable situations would be great and that a design exercise on paper or even a full scale simulation alone would not give an adequate picture of reality. It was therefore decided that for these three functions the full sequence of simulation and feedback would be used:

- 1) Observation and registration in the clinic
- 2) Analysis of essential space requirements for individual work sequences
- 3) Full scale tests of work sequences
- 4) Full scale simulation in mock up with diminishing dimensions with test persons
- 5) Review of simulation results by clinic staff
- 6) Re-building of clinic
- 7) Observation and registration in the clinic.

It was felt that the interaction of patient movements and staff duties produces a complicated pattern which is difficult to grasp with traditional analytical methods.

For the two other functions in the OPD, the waiting room and the pharmacy, there is no such interaction. The pharmacy staff can do its preparation without any interference from the public, whereas the functional requirement of the working areas appear to be quite straightforward.

In the case of the pharmacy, it was therefore decided to take a purely traditional approach: first, observations and analysis, and then simple full scale tests in a mock up of the room. For the waiting room, it was deemed to be sufficient to change directly the set up in the OPD without any attempt at simulation.

Because of the late start of the experiments - one year later than planned - and the time limit imposed on the study due to the termination of the KNEPOROS project, it was decided to compress the whole test series in the period of one month. This meant executing the different studies parallel to each other and in some cases operating different parts of one study at the same time in different parts of the building.

In the case of the injection room, for instance, full scale simulations of a new set up were already on their way, while in the clinic the first feedback - testing with real staff and patients in the rebuilt room was opened for operation. The concentration of the whole study within such a short period of time was bound to have effect on the development of the work. On the one hand, it was unavoidable that project staff and clinic staff alike were aware of alternative solutions tested elsewhere in the clinic and were not always able to limit the discussions to the special solution at hand. On the other hand, the physical presence of alternative solutions sometimes added a living and multi-dimensional consciousness to the discussions.

THE CONDITIONS AT KIAMBU

The clinic in Kiambu offers most of the conditions wanted in full scale studies. The hall offers a large, almost uninterrupted space, with reasonable light conditions through side windows and roof

lights and multiple connection points for electricity and water services. The partition wall system would allow for rapid changes and offered enough flexibility to create rooms of any desirable dimension.

Remarkable above all is that here patients and staff alike appear quite indifferent about changing layouts and the presence of observers. Even the use of cameras - in East Africa an instrument with many taboos - failed to provoke any noticeable reaction. Many of the patients do not seem to have any fixed concept of what an OPD should look like and even the staff, used to working in widely variable conditions throughout the country, accepted the clinic as a given condition. This situation eliminated all the problems of the laboratory conditions which in Swedish Studies always have to be taken into account. There the test persons are all too aware to be engaged in a simulation and that certainly affects their behaviour.

To test the feasibility of instant feedback from simulations to realities as an attempt for developing design methods, the conditions were ideal indeed. The Kiambu facilities proved to have few drawbacks, but some minor observations should be mentioned. The panel system made it difficult to mount any equipment and furniture on the walls. As a result, the KNEPOROS layouts became two-dimensioned and failed to utilize all possibilities of a three dimensioned space. The timber columns are often bent and warped, the fixing places at both ends of the columns are a bit unstable and partitions would sometimes come loose. The whole panel system proved difficult to keep clean. This seemed to take alarming proportions in certain rooms: It can be asked if full scale studies of health facilities are justified if very unhygienic conditions cannot be avoided. The system of floor drains, the panel system, the poorly finished concrete floor and the strange haphazard collection of standard issue furniture all contributed to a disturbing hygienic situation which the staff obviously was unable to handle.

The low ceiling height of the concrete roof (280 cm) was another negative factor. The concrete roof together with the gaps between the partitions and floor and ceiling created unnecessary adverse acoustic conditions and allowed dust and dirt to move freely from room to room. The use of vertical photographic registration was greatly hampered

by the insufficient free room height. The unused access space in the hall influenced the layout patterns used by the KNEPOROS team and contributed to a lack of clarity in the plan of the clinic.

A frequently made observation was that visitors studying the KNEPOROS project failed to perceive that the aim of the KNEPOROS layout was to propose a better flow and a better organizational set up and not to develop a prototype clinic. As early as in 1974, the visitors from the WHO-UIA Conference on the Health Facilities Under Conditions of Limited Resources criticised the structure of the Kiarnbu clinic, in spite of the fact that the KNEPOROS teach for reproduction.

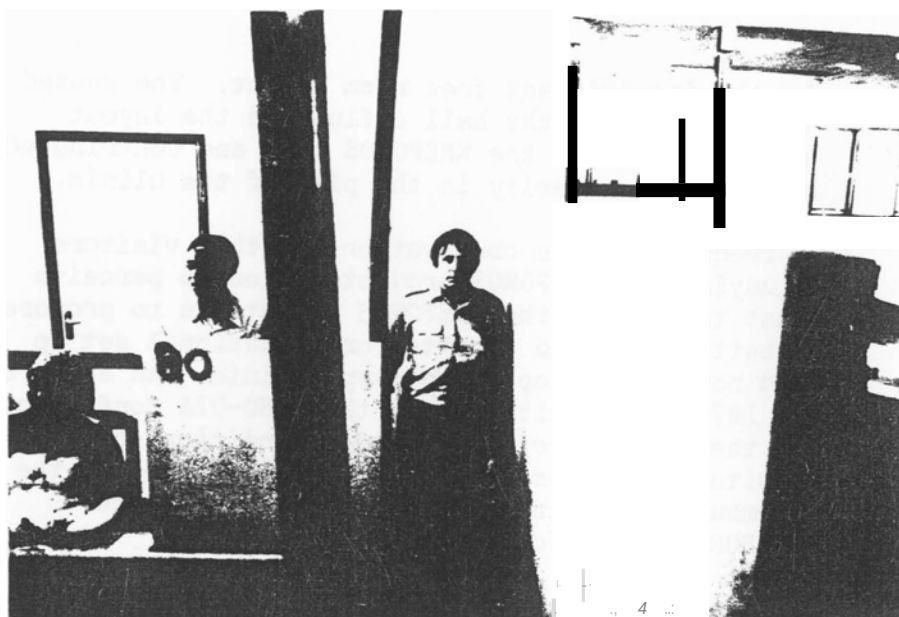
Similarly, it was suggested during our tests two years later by a high-powered delegation from the Ministry of Health that the present layout should be made permanent and serve as a model clinic for the whole country, in spite of repeated statements from the project staff that the KNEPOROS layout demonstrated the flow pattern only and was not a suitable layout. There seems to be a danger that full scale testing for most laymen comes across as prototype development and attracts a lot of misplaced and unjustified criticism because of much misunderstanding.

It can therefore be argued that full scale studies alone should be avoided and that a continued programme with a prototype demonstration always is justified in full scale studies. Research which conveys the wrong message to the user is a doubtful blessing. The great advantages of full scale simulation are only fully utilised if a rapid translation into real structures prevents the confusion created by misunderstanding. In this respect, our experiences from Kiarnbu showed that patients and staff were quick to appreciate their possibilities to take part in the design process.

1.3.2.23

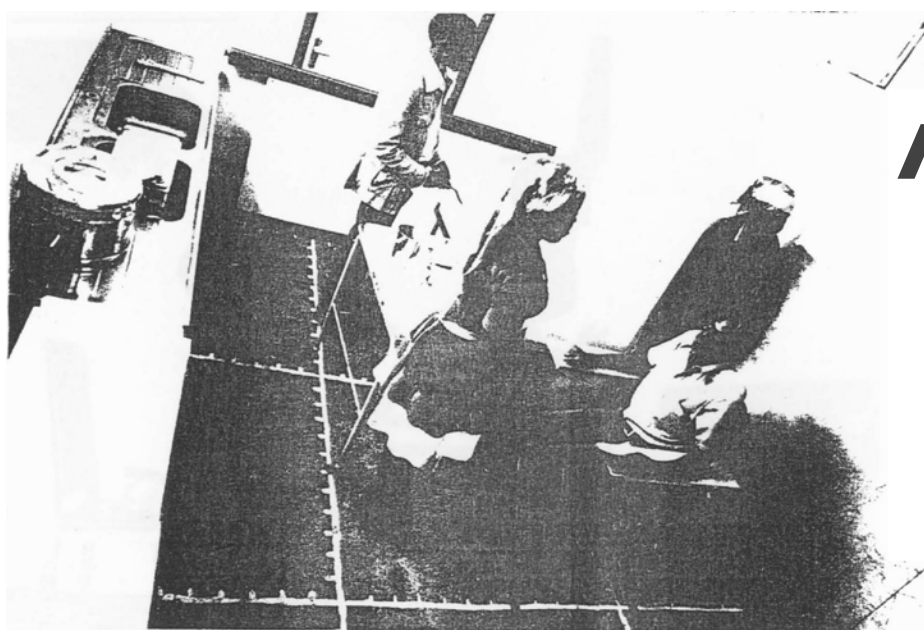
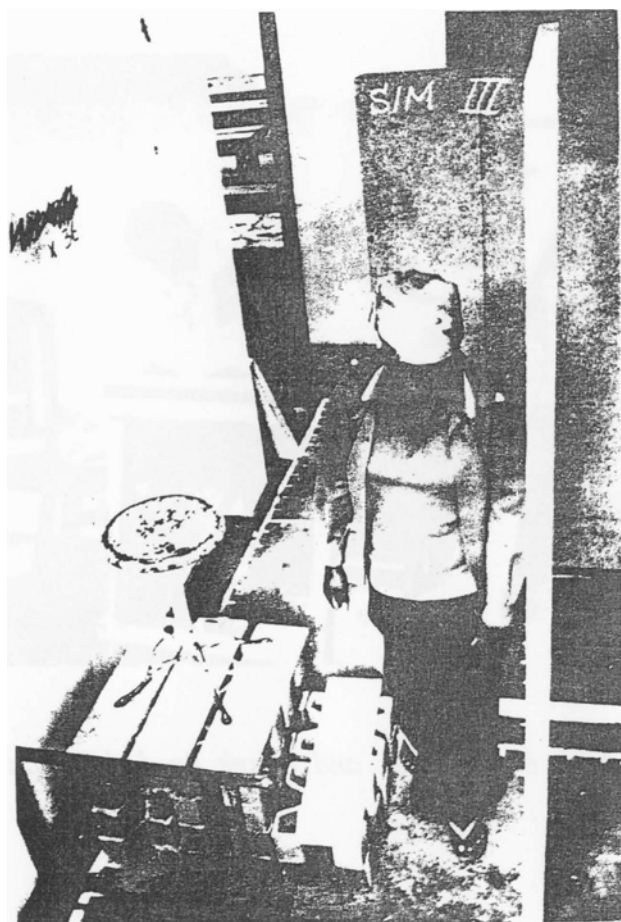
PHASE ONE: OBSERVATIONS AND PROBLEM IDENTIFICATION

The first phase of the study covered the period April - August 1976 and aimed at the general preparation for the full scale tests. An important part of this period was used for studies of the KNEPOROS results and for a general review of

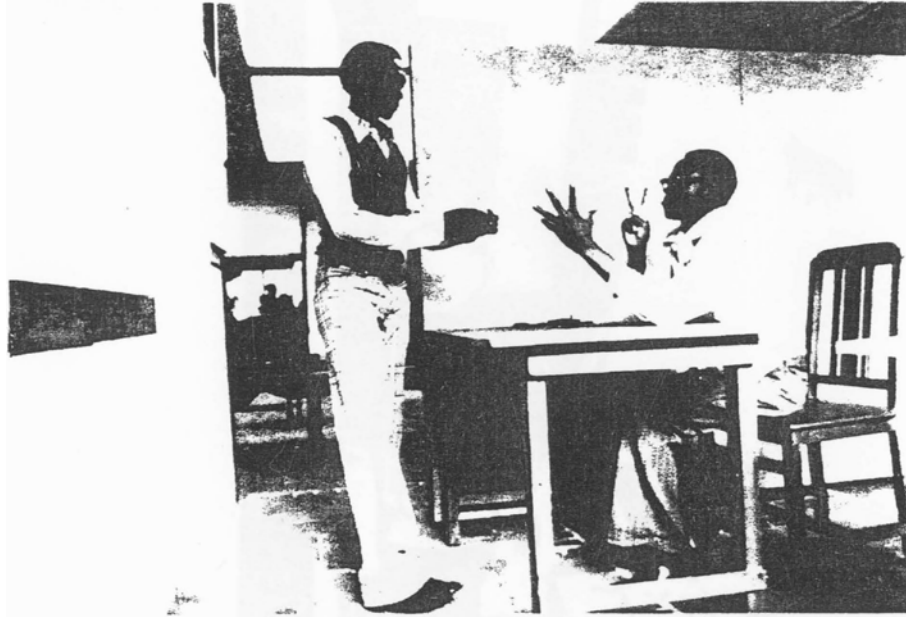


esting size of functional units.

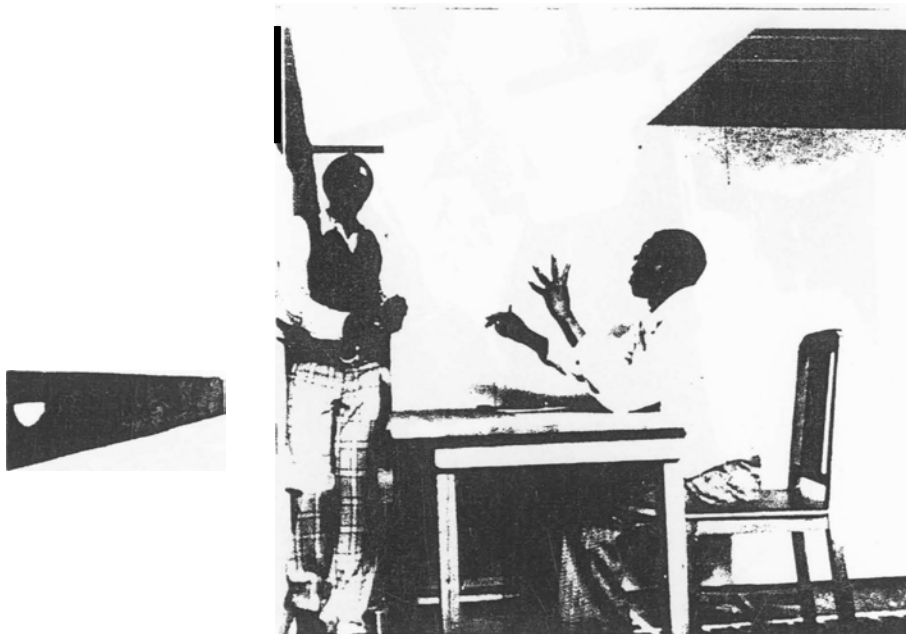
A serie of space
decreas ng tests
were carried out
in each treatment
station.



The treatment stations were standardized according
to the lay out principle and the span preferences.
A series of transversal space decreasing tests were
then ca ried out.



Door opening of 70 cm patient and clerk in injection room simulation.



The door opening has now been reduced to 40 cm - the passage space is now insufficient.

relevant literature. The KNEPOROS building in Kiambu and its system of out patient care was studied in detail during the months of July when Nimpuno stayed in Kiambu for the project preparations.

BUILDING

It was found that ceiling mounted cameras would cover the central area of the rooms and thus be able to register details of the special needs for the main activities. But for general registration of the utilisation of its rooms, vertical cameras would not give the answer. Diagonal pictures at the other hand would easily cover the whole room and could provide illustrative material for the report. The open space between the top of each partition and the ceiling almost invited the use of this angle. The advantage of diagonal pictures is the greater readability compared with vertical pictures. The disadvantage is that the material cannot be used for measuring and for determining spatial requirements in any detail. It was decided that both methods would be used and the location for camera brackets in the ceiling was determined.

Space for simulations was found in the general waiting area. There the conditions of the treatment rooms could easily be reproduced and two movable walls would be sufficient to create rooms of any reasonable dimension. The Kiambu Institute of Science and Technology proved to be able and willing to assist in the execution of the required construction work before and during the tests. A sufficient number of spare panels were available for possible changes in the clinic. It was found that the architect's intention to limit the transport of mud on the soles of patients into the building had not materialised and that the footwashing basins had never been used. As the building is surrounded by red laterite soil, and no scraper irons were placed at the entrance, the soil would be carried to all parts of the building. To keep a satisfactory level of cleanliness under these circumstances is extremely difficult.

Although the building had been planned as a free usable space for the tests of variable layouts it seemed obvious that the shape of the building greatly influenced the tests which KNEPOROS undertook. In all the tested layouts the rooms were laid out by the KNEPOROS team along the periphery

of the building using its outer walls for the rooms and limiting the need for loose partitions in the set up. Consequently the layouts turned out to be extended rather than concentrated leaving huge unused areas in the middle. It seems that this in itself became an obstacle to achieve a balanced impression of the layout * and once the layout was erected, it became difficult for casual visitors and for the KNEPOROS staff to see that the same operational working order could have been achieved by entirely different positioning of the different sections. This observation is noteworthy because in the future similar research programmes should take into account to which extent dimensions of the test hall would influence the results of the final design.

OBSERVATIONS

The operational conditions in the clinic and the spacial arrangements were studied by prolonged observations in each room during clinic hours. The observer would sit in a corner and write and thus make himself unavailable for communication. This was completely in line with earlier KNEPOROS practice and proved to be effective. Little reaction from staff and patients could be noticed and the observations provided sufficient information to plan the coming simulations. In the final stage concealed observation boxes allowed the observers to look into the rooms from behind a curtain and over the partition wall.

The most striking first impressions during the first series of observations concerned two aspects of the KNEPOROS set up. True to its name, the KNEPOROS study had concentrated strongly on the operational aspects of the OPD organisation. Both positive and negative developments from this elementary position could be noticed. Further, one could see numerous signs of conflict between the operational intentions and their physical consequences.

As to the first factor, one could observe that certain efficiency measures would clash with appreciation of the staff of other aspects of the work. It was in fact not difficult to see that certain excellent efficiency proposals failed to arouse positive reactions from the staff. It seems that many deviations from the KNEPOROS blue print in the practice as it later developed can be explained in these terms. It was later for instance noticed that staff members of different

qualifications would switch tasks - obviously to break the monotony. Later observations confirmed this resistance to a purely efficiency oriented approach.

The second aspect concerning the constructive and spacial consequences of the intended layouts was most apparent in the internal arrangements in the individual rooms. The acceptance of most unsuitable furniture as a part of the KNEPOROS tests contrasted sharply with the projects remarkable and great investment for the premises. Although suitable furniture could have been acquired for an insignificant additional sum, the intentions of the layout were now greatly hampered. Similarly, no attempts were made to achieve unified room dimensions with a unified spar so that the various rooms could be joined into one building in future applications of the KNEPOROS results in OPD's.

In view of these observations, it seemed justified to pay some attention to the possibilities for modular coordination of the units and to study the influence of furniture and equipment on the effectiveness of the room layouts.

It was noticed that the demarcation of waiting areas by using low partition (125 cm) walls was very successful. It created a clear impression of the waiting areas as a limited, demarcated space. It also seemed to be a very effective measure to control flow of patients in the waiting areas. In a permanent design various alternatives could be available, such as the construction of dwarf walls, the use of screens and room dividers or the use of plant and flower screens. The creation of shielded areas which would convey the feeling of a room is an important quality for waiting rooms.

The clinic building in Kiarnbu seemed to have few facilities for environmental control and the questions of light, acoustics, cleanliness and ventilation would need special attention after development of the functional spaces.

Although some sociological studies within the KNEPOROS project were describing staff and patient satisfaction, it seemed that many other sociological criteria remain to be covered. The effect of spaces on people of many on non-production oriented human reactions, and the resistance to job monotony seemed to us relevant factors to be included in the discussions.

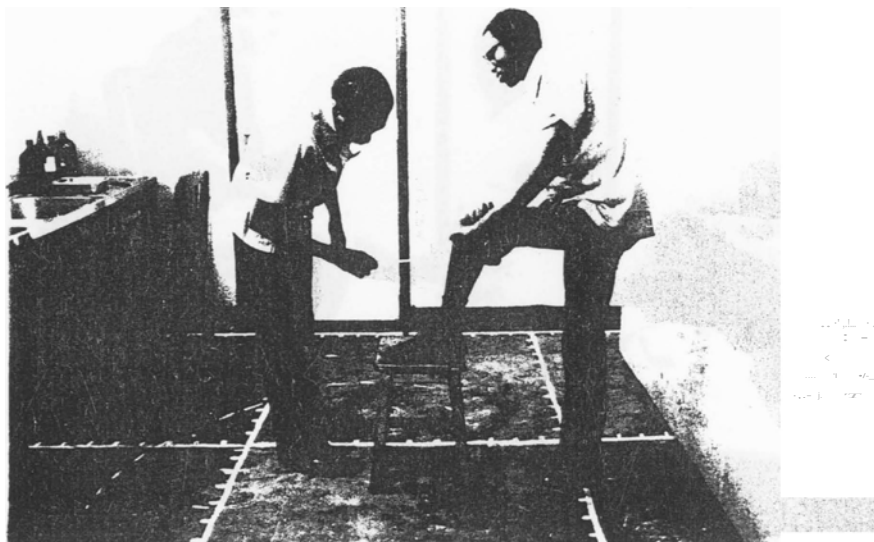
The first phase of our studies resulted in individual test programmes for each of the sections of the project.

1.3.2.24

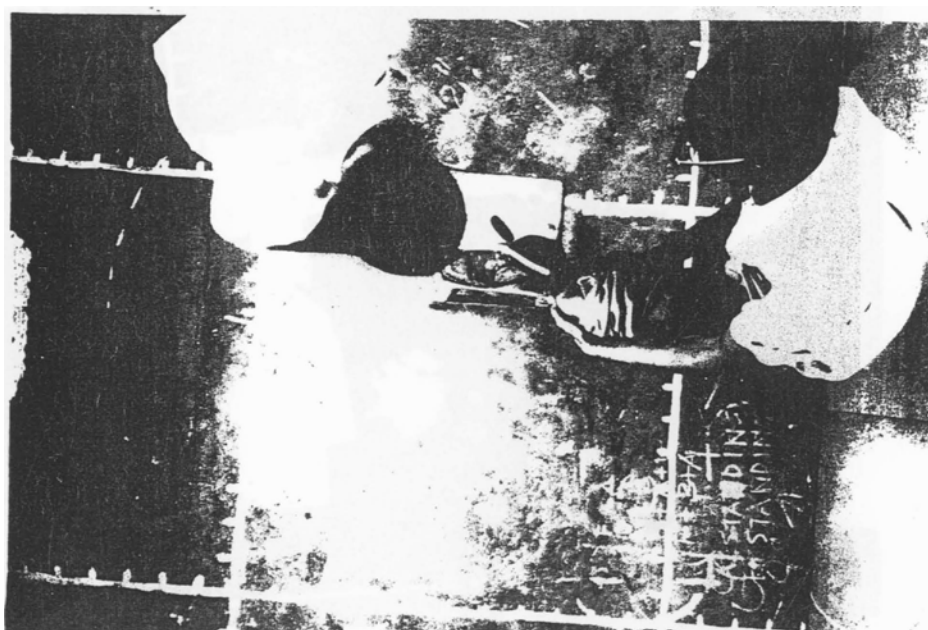
PHASE TWO AND THREE: OBSERVATION, SIMULATIONS AND FEEDBACK

The next two phases of the project took place in Kiambu from the middle of October to early December 1976. The different members of the team had been briefed on the project during the summer and studied background literature, interim reports and photographs of the clinic. Three Swedish architects had been recruited to participate and it had been decided that each would take responsibility for a separate function in the OPD. All participants had previous experience in East Africa and were familiar with building functional analyses techniques. Architect Lars Nordin would study the waiting areas and the general problems concerning patient flow in the OPD. Architect Ettore Nobis was to concentrate on treatment rooms and would therefore engage very much in simulations. Architect Paula Nilsson took responsibility for the study of the pharmacy. In each case the subject had been studied from literature and certain dimensional basics selected to work sequences in the respective department had been determined prior to the start of the second and third phase of the project. Professor Carin Boalt attended the actual test period in Kiambu and gave the whole team continuous advice on methodological and practical aspects of the studies. The following chapters are organised in separate sections for each functional unit and cover reports on both the second and third phases of the project.

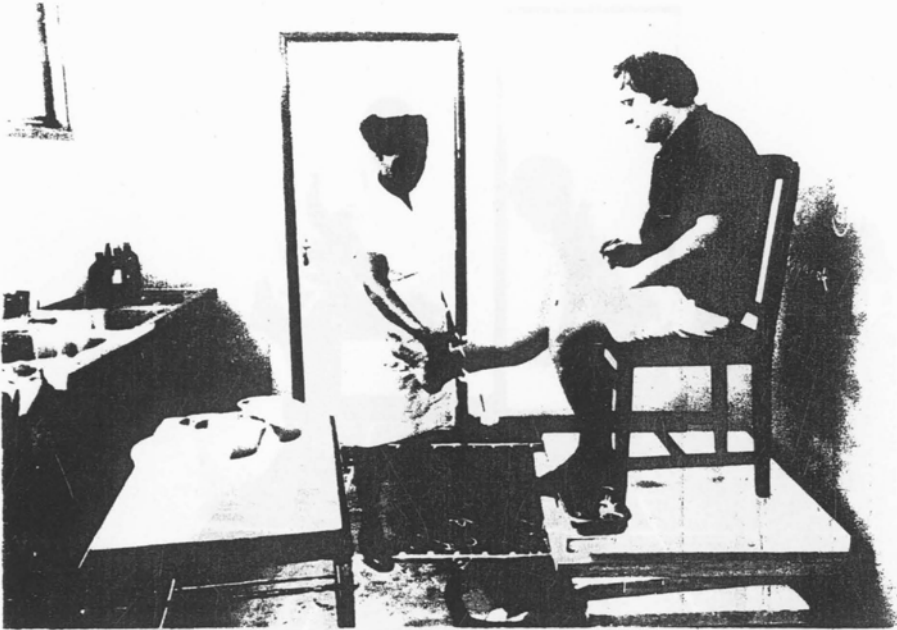
The first draft of the test reports had been made by each responsible participant, who also produced the drawings for his or her section. For each section, the problem analyses and introduction was prepared by Nimpuno, who also wrote the final draft for this report. The actual simulation tests were mainly executed in the period 1st November to 20th November, 1976, whereas the remainder of the time in Kiambu was used to produce a first report draft.



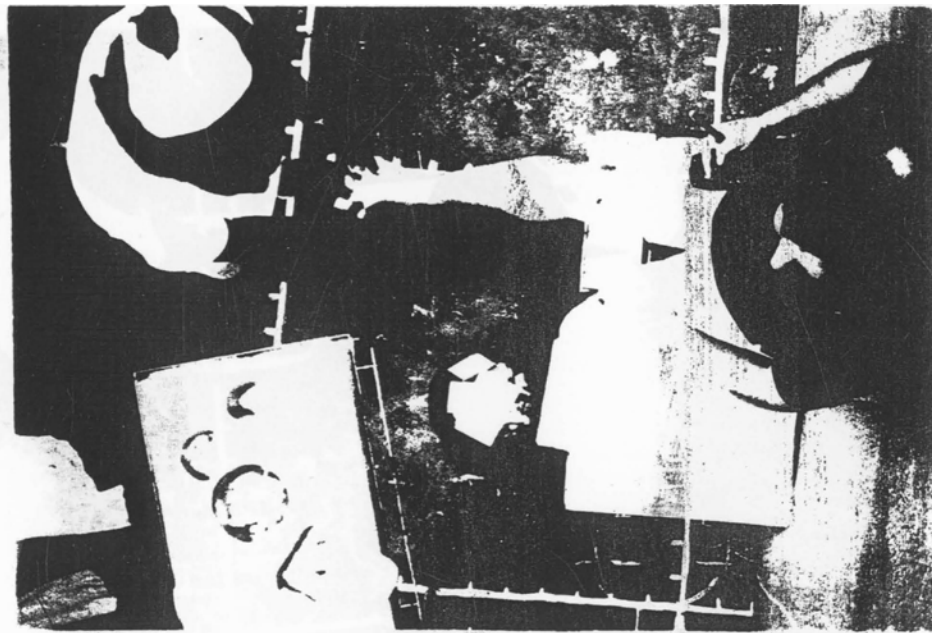
*Testing space requirements treating standing patient:
hand held camera.*



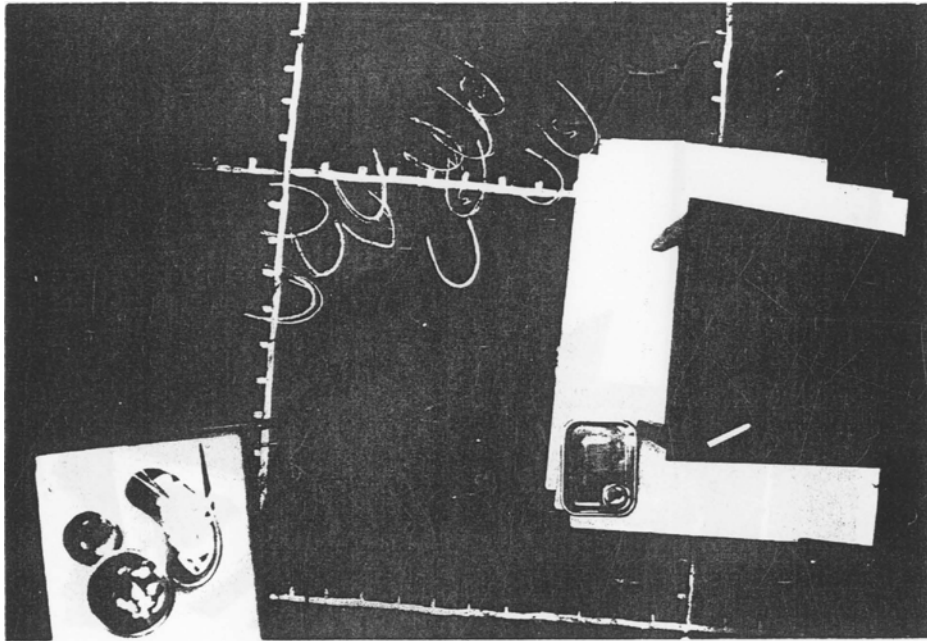
*Testing space requirements treating standing patient:
Registration with ceiling camera and chalk marks on the
floor.*



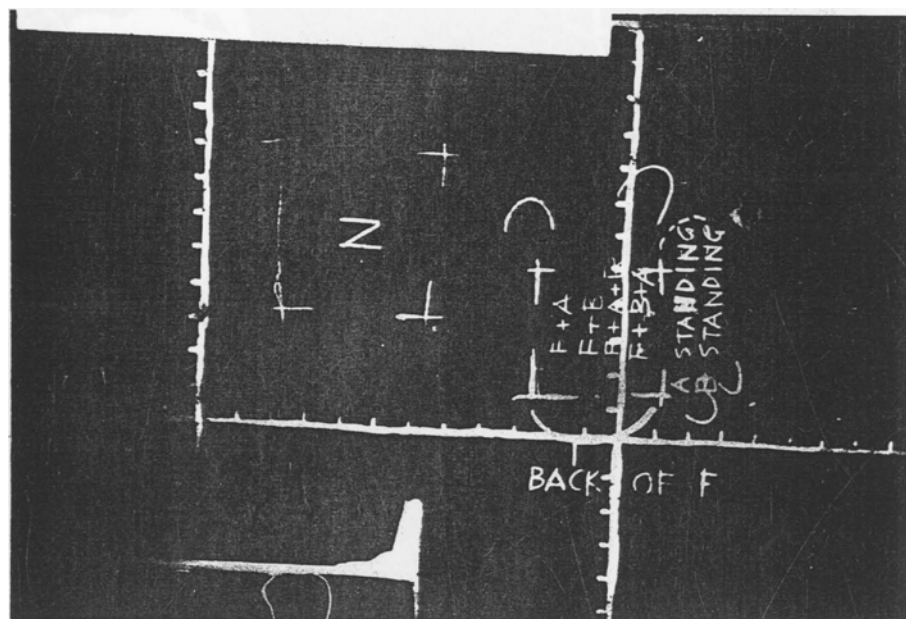
*Testing the height of an uZcer bench -
hand held camera.*



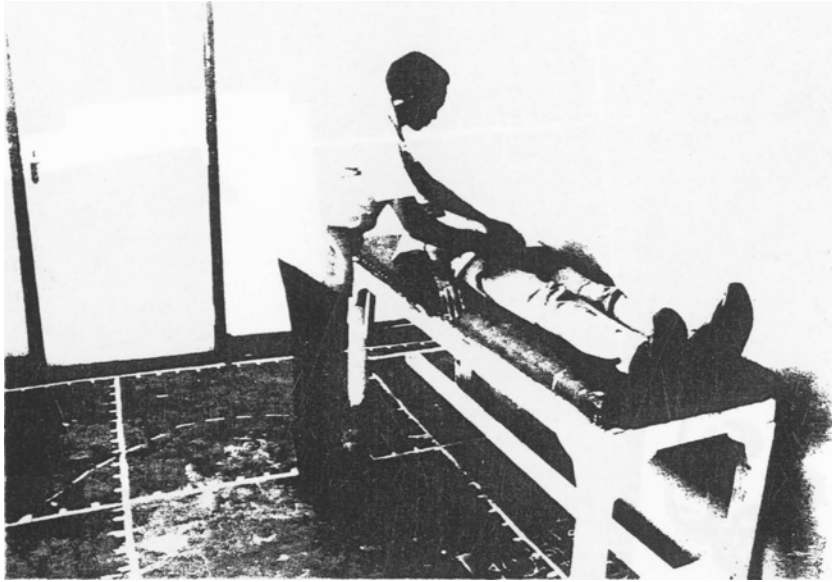
*Testing the height of an uZcer bench -
roof camera.*



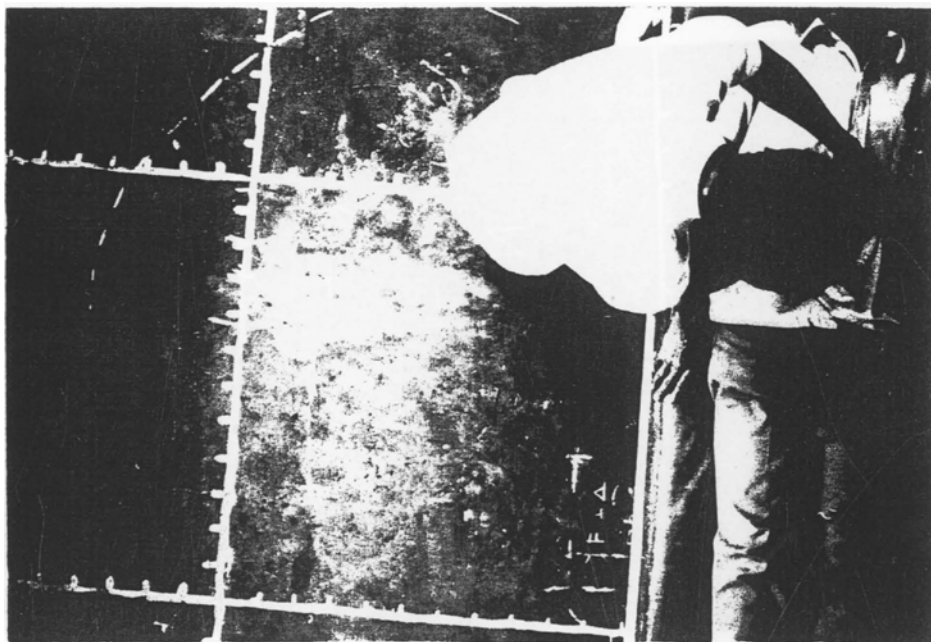
The footmarks of the nurse after working at the ulcer bench.



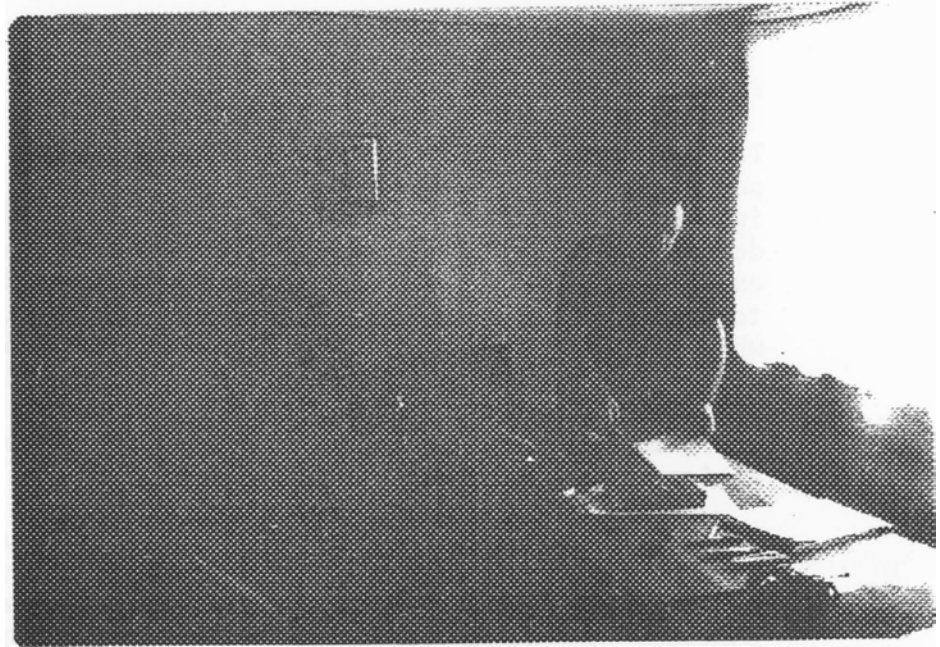
Chalk marks on the floor indicate the space needed by patient and nurse during a certain treatment.



Measuring the space needed around the couch.



Determining the space needed by the nurses when attending a patient on the couch.



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1.2.3.25

PARALLEL TESTS: SIMULATION AND FEEDBACK

The combination of simulation and feedback in parallel tests constitutes a new design method. It is because of this that we wish to explain in some detail how these tests were conducted. This method, especially used for the treatment rooms, proved to be a swift way of adjusting design shortcomings which normally cannot be detected before the space has been built and used for a considerable period. It seems that the experiences from this programme might prove to be useful in a great number of different design situations.

The OPD in Kiambu has from its first day been used for operational research and these activities have for the staff and patients become a part of the clinic routine. The observation that staff and patient reaction to the test would be minimal was of great importance because it would increase the reliability of the full scale tests. Moreover, precautions were taken so that the tests activities would not interfere with the normal patient flow through the clinic and cause interruptions in the treatment. It was very fortunate that within the building some space was found to conduct detailed tests of certain work sequences and space relations, which could take place without disturbing the patient treatment. After elaborate observations and registrations in the clinic, it was now possible to test alternative solutions in a "mock up" situation. These experiments constituted simulations - a term we will use from now on to indicate full scale tests in a mock up where employed test persons act as patients and as clinic staff and which aim at achieving an optimum design. The simulations do in effect the same work as an architect does for his sketch design, but instead of drawing and redrawing on paper, people, equipment and walls are moved about until a solution is found. Simulations are not, however, a disorderly process. In this project a fairly standardised procedure was followed. The different factors determining the room, its use and dimensions had first to be studied during the observation phase in the clinic. Time and space analyses based on observations and photographs gave the basic data to be used in the simulations.

There were observations about staff movements, patient flow, equipment needs, etc. and as a result all movements and work sequences were listed and selected for simulation. The first step would be a separate list series on each isolated sequence, e.g., a patient entering the door and handing his card to the clerk or a patient placing a child on her back in a sling prior to leaving the room.

This sequence would then be tested in the simulation room. Test persons would act out the sequence and relate their experiences to the observer. At the same time vertical and diagonal cameras would registrate the sequence. Then one of the mounted walls on sliding rods would move inwards and reduce the space a few centimetres and thereafter the same sequence would be repeated. In this way the optimum and minimum dimension would very quickly be determined. After testing all the critical equipment positions and working sequences one by one a layout proposal combining all the observations would put together in "mock up" form. Having constructed a full scale room based on the critical dimensions and proper special relations the fully integrated room function would be tested in full scale. Still working with test persons acting different patient and staff roles the full range of functions in the room would be acted out. With observers and registration equipment the whole process could then be studied and here again under conditions of changing space dimensions.

After each sequence one of the two movable walls would be moved inwards and then the same sequence would be repeated. The process would go on until the reduced space would hamper the proper execution of the functions. After having determined the test layout, the clinic staff would be called in. The first step would be to record their reactions to the new room, without asking them any questions.

The second step was then to act out the work sequence again, but this time using the staff to perform their normal duties. These two steps frequently led to minor adjustments in the layout of the test room. When finally all involved agreed that an optimum solution had been reached, the results were then to be tested in reality. Over the weekend the room concerned in the clinic would be dimensioned and equipped according to the simulation findings. This change is from here on called the feedback:

The application of the simulation results in the real clinic situation. From here the whole process started from the beginning again. After the weekend the staff and patients would use the new room, while observers from their hidden cubicle would register and photograph the use of the space. Minor adjustment would be discussed with the staff and directly tested in their presence in the simulation room whereupon the same day these changes could be made in the feedback situation.

The whole process of observation, detailed simulation, integrated simulation, feedback and adjustment proved to be very effective in finding errors in design. It was found that in situations where many different people would use the room, quite unpredictable behaviour which effected the layout would occur. With the possibility of simulation such behaviour could be analysed and the layout of the room could be adjusted. It is especially in situations where many people interact that the relationship between function and space are difficult to determine. It is here that the method of simulation and feedback has the most to offer.

2.0.0.

WAITING AREAS AND PATIENT FLOW

2.1.

WAITING FOR MEDICAL CARE

To have to wait for something can be both pleasant and unpleasant. The degree of pleasure depends on the situation of the waiting person, what he is waiting for and the physical surroundings.

A patient waiting for medical care could be in a rather bad condition, the expectations of the treatment could be frightening, and the waiting area could be a very hot, odourous and dirty place with not enough space to sit down. This would certainly make the waiting time most unpleasant. On the other hand, most patients are not very sick, they sometimes even appreciate an injection because they know the curing effect it has, and finally the waiting areas could provide comfortable relaxed waiting, or possibilities for other activities in a pleasant surrounding.

The condition of the patients, as well as the expectations of the treatment, is something we have to know about but cannot change when we do our planning. But the organization of the waiting and the physical surroundings are things that are subject to the planning of a medical institution.

The organization of the waiting as part of the whole organizational and administrative layout has been studied by the KNEPOROS team at Kiambu over a long time, and many improvements have proved successful in order to increase the efficiency of the OPD. The aim for this study is to follow up their achievements on the architectural side and to provide proper space for the required functions.

The strategy of this study will be to, after studying the KNEPOROS system and results, observe the situation in the waiting areas and state the problems that occur. After analysing the problem proposals for solving problems that are connected with the physical layout will be made.

Some of the proposals will be made in the real situation, and the effect will be evaluated. Finally, we will make design proposals for waiting areas as well as for the whole OPD or Health Centre layout. We will also make a layout proposal for the Kiambu OPD, which in the near future is supposed to be provided with permanent walls.

2.0.0.

WAITING AREAS AND PATIENT FLO:\-J

2.1.1.1.

THE MAIN WAITING AREA IN THE OPD

The main waiting area under the new system in Kiambu is based on the filtering system. The MCH and general OPD are separated in two different parts of the building. All OPD patients are screened by a CO (clinical officer) who filters out all recurring patients and all easily diagnosed cases. These patients are directly referred to the treatment sections. The bulk of the patients however will enter the main waiting area to be seen by one of the three clinical officers for examination.

The traffic in this area is directed by an attendant (askari). As the filtering CO easily copes with arriving patients there is only a short line waiting in front of his office.

The infiltrated patients are many and form a long line towards the three examination rooms. The waiting line consists of a long row of wooden benches laid out in a serpentine fashion. A buzzer _ announces when a CO can see a new patient and the first in line is then directed by the askari to enter that cubicle.

The general waiting area is thus divided into two parts: the first area taking all new patients and the second area taking the patients selected for more thorough examination. The filtering system reduces the queue in two respects:

Firstly, easily diagnosed patients can be filtered out, and proceed to the treatment rooms; and,

Secondly, recurring patients can bypass the waiting area.

This system reduces the waiting line and enables the second echelon COs to examine patients more carefully.

The waiting area can hold several hundred people for several hours. Therefore, the design of this space deserves attention of the architect.

2.1.1

SPACE FOR WAITING

Waiting for medical treatment is an unpleasant experience, but it is unavoidable.

Even if arrival patterns of patients can be controlled, as in the case with private doctors, waiting and queueing are created by the irregularities in treatment time. If arrival patterns are uncontrollable and if the number of patients becomes very large, waiting can become a pressure on patients and staff alike. But it is not just the loss of time and the discomfort which the patient is exposed to but also the presence of a large number of waiting patients who can also complicate the efficient execution of the clinical work.

In Kenya one cannot fail to notice the great demand for treatment as demonstrated by the great number of patients each dispensary and OPD has to handle.

The tiny two room dispensary of Kajulu handled in 1970 2000 patients a month (7). The Ahero Health Centre noted at the same time almost 4000 patient visits (7). The work-loads in the hospital OPDs are even greater:

Kisumu 1970: 650 patients per day(7)
Machakos 1970: 5400 patients per week
Kiambu 1970: 800 patients per d (12).

Even with three or four examining medical or clinical officers on duty, long queues and short diagnosis time are unavoidable. Examinations take only one to four minutes per patient, and similarly treatment time is insignificant: waiting is the dominating activity in an OPD.

From the survey of the improved set up at Kia.mbu, one can draw the conclusion that an average patient during a busy day may spend 138 minutes in the outpatient department, and at least 130 minutes of this time is waiting. (12)

The majority of the people in an OPD are the waiting patients and in terms of space this function requires far more area than all the service rooms combined. The KNEPOROS team observed (12) that the Kia.mbu clinic would need a seating capacity in the waiting rooms for 430 patients, whereas maybe 20 patients would be attended in the treatment rooms.

One of the reasons for the large capacity which is needed in the central waiting room is the irregular arrival pattern of patients in an OPD, as the KNEPOROS team noted. (12)

The patients flow rapidly builds up during the first two hours that the clinic is open and then drops sharply. Mein (9) points out that patients often come by public transport and will arrive in batches. Zwart (6) notes that the number of patients is lower on rainy days.

The KNEPOROS report of September 1975 (12) also notes that arrival patterns seem to be stable, but that rainy weather greatly reduces clinic attendance. Zwart describes the mechanism as follows:

"The normal procedure for examining and treating patients 'first come, first served.' There is a natural tendency for patients to arrive early to ensure attention, which results in overcrowding in the waiting spaces." (6)

The crowds in the waiting areas build up in correspondence to the arrival pattern:

"The majority of patients arrived early in the morning and early in the afternoon and, because of delays caused by the differential rate of arrival and admission, the numbers increased considerably at these times." (6)

It is therefore not the total number of patients per day nor the average waiting time which determines the waiting space, but the occurrence of peaks which inevitably build up in the absence of an appointment system.

It is also obvious that the patients arriving at the height of the peak or shortly thereafter will have a considerably longer waiting period than what the averages tell us.

The KNEPOROS report pointed out that architects erroneously tend to underestimate the waiting space for places where service time is short. This explains much of the congestion one can observe in front of the injection room in many OPDs.

The flow of patients determines to a large extent the efficiency of an out-patient Department and much of the literature on OPD planning concentrates on this organizational question. And, indeed, without a clear concept of the patient flow it is not possible to design a satisfactory OPD.

The waiting areas are needed to ensure a regular flow of patients through all the service rooms, because the diagnostic service does not have the same rhythm as the treatment functions further down the line. The diagnostic function is no doubt the bottleneck in the flow and various systems have been devised to optimize the diagnostic capacity. An important step has been the separation of administrative tasks from the diagnostic tasks. Other methods have concentrated on various filtering systems.

In the case of the Kiambu studies both measures have been taken - as described before, to reduce the bottleneck effect.

It is obvious that such an organizational set up greatly determines the layout and dimensions of the waiting area.

A major question is whether waiting takes place in a moving line or through a number of systems. Other questions concern the seating capacity, registration systems and the desire to have educational activities.

Although few authors have given the waiting space any significant attention, its importance to the patients seems to justify a more elaborate discussion of planning factors.

2.1.11

THE MOVING QUEUE

A moving line of patients is from the organizational point of view the easiest solution. The flow of patients is seen as a stream of objects and in a rather orderly fashion the flow can be absorbed by the service units. The next patient waits in the line ready to enter as soon as the service unit is vacant, and on the sound of a buzzer he enters the service room without any confusion about who is first.

From the point of view of the patient it is a tiresome, torturous and sometimes degrading system. The patient has constantly to shift and guard his place in the line, and is often pushed by his impatient neighbour. It is boring because it makes practically all useful activities impossible and waiting time is wasted time to the patient.

It is true - the moving patient line creates the least trouble for the staff and is very helpful in producing a smooth flow - and indeed the available literature concentrates on the aspects of staff efficiency rather than on patient comfort.

The most common system is the moving queue using fixed benches, crowd control barriers and traffic supervisors as the usual means of perfecting the smooth patient intake.

2.1.12

THE CALL SYSTEM

In Europe waiting and registration is usually combined and in most cases it is based on an appointment system. Patients are called by name after a relatively short waiting period. The system works well especially since the number of patients is far less than in most LDC's.

A call system based on issued queue numbers exists both in industrialized and in less developed countries. This system has the advantage that the patients are free to move about and that the special arrangements in the waiting room do not have to be arranged in such a rigid way.

The very fact however that patients can sit in one and the same seat or can move around, eliminates much of the tension which is so obvious in the moving queue. A drawback is that certain confusions are difficult to avoid, when patients lose their number, or leave the waiting room and fail to turn up in time.

In large central waiting rooms the two systems can be combined, with lowest ten or so numbers called to sit in a moving queue and the others waiting anywhere in a general waiting space.

The mass character of the outpatient service reduces easily the respect which the staff and the planners show for the patients and reinforces their feelings of superiority. In a racist society as South Africa these feelings are expressed in defence of the moving queue system:

"However, as the Bantu patient at present has little concept of time or obligation, it is felt that an appointment system would not work satisfactorily." (6)

At the 1974 Nairobi WHO-UIA conference on Health Facility Planning a participant rejected the number-card system out of hand.

"It doesn't work. Patients cannot be made to keep their number cards"*

One cannot fail to sense something of the same disregard in such remark.

It is certainly easy to lose perspective of the patients feelings and comfort in all the talk about flow and efficiency. It seems to us however that there need not be any contradiction between patient comfort and OPD productivity.

*) Mrs. Goldfinch, a British midwife at the WliO-UIA conference on "Health Facilities Under Conditions of Limited Resources."

COMFORT PROBLEMS IN WAITING ROOM

The great number of people which can gather in a waiting room can cause great discomfort especially if the space has not been designed properly.

"The most obvious problem in this whole field is noise" (4)

This is especially true for the Mother-Child Health (MCH) clinics, where uncomfortable temperatures and the crying of other babies can induce the others to join the cacophony.

"The noise level rises as the number of patients increases, gangways are filled and blocked, and staff and patient circulation impeded." (6)

An enclosed, bare walled waiting space can then create accoustically unbearable situations. Noise levels will become less disturbing if the design is relatively open and if the use of hard and smooth surfaces is avoided.

The organizational conditions have certainly a great effect on noise levels. An unclear queueing system and little supervision will create confusion and frustration and therefore also produce extra noise. If the system is clear and supervision is effective, there is little reason for excessive commotion. Cammack noted in British Health Centres that an

"Environmental problem is the control of heating and ventilation in reception area. Some of these were most uncomfortable places in which to work." (4)

The same can be noticed in the Health Centres in the LDC's. Large waiting areas in enclosed spaces give noticeable discomforts in the tropics and except for extremely cold highland regions, enclosed areas should be avoided. The air soon becomes both hot and stuffy and a long waiting time turns into agony.

The long waiting periods can be very tiresome for the patients and the quality of the chairs or benches is therefore of importance. Without fixed benches it is difficult to maintain safe and orderly conditions: if two hundred patients start to shift chairs around then a total congestion can soon be expected.

But the use of fixed benches does not need to create a disagreeable atmosphere. By grouping the seats in smaller units and by subdividing the space with half partitions one can create more agreeable spaces. Benches with high backs or fixed against half partitions can offer better comfort and create pleasant special subdivisions, giving a sense of privacy in the smaller group.

The use of plants can contribute to a nice atmosphere and educational displays can have the double effect of offering information and distraction.

2.1.13

SUPERVISION

The situation in the central waiting room in the Kiambu OPD depends to a considerable extent on the effectiveness of the attendant (askari).

Directing people to their place in the queue, summoning them to the examination room, keeping order, easing up quarrels, and regulating the traffic, he is a constantly active guardian of the room. We were impressed by his kind and polite attitude and the clear authority he exerted.

Supervision is a necessary function in a large waiting room because of the great crowd of people assembled and because of the many questions the patients want to ask. The receptionist should meet the arriving patients immediately and remove any doubts about where to go. The receptionist should therefore be an active attendant moving throughout the waiting area and not a clerk behind a glass window.

2.1.14

SURVEY PROGRAM WAITING AREA

The design problem in a waiting area does not concern the minimum space requirements of the waiting function, because these are well known data. The design brief needs to have information concerning factors effecting ones physical and psychological well-being.

The survey concentrated therefore on observation of behavior and photographic illustration thereof.

The following factors were noticed by mobile observers:

- Movement patterns
 - at the end of the line
 - crossing passages
 - interruptions (standing up)
 - reaction to observstions
 - queue discipline (e.g. toilet visits)

Social activities:

- conversations
- conflicts
- reactions to music posters
- food consumption smoking
- stress and fatigue

Comfort

- temperature
- noise
- ventilation
- **light** conditions
- **general hygiene**

Structure and furniture:

- doormats and mud scrapers
- partitions decorations
- windows
- minimum bench intervals

2.1.2

THE KNEPOROS ORGANIZATION

2.1.21

THE FLOW SYSTEM

The layout of the Kiambu OPD is mainly based on the flow system, as introduced by KNEPOROS. This means that the layout of the whole building as well as the single rooms are made in such a way that this is a continuous flow of patients that starts up at one end of the building and ends up at the other. Crossing flows and back-flows should not occur in order to avoid interference and delays.

This system, when working, provides an unbroken and fast stream of patients into the service rooms. The next patient is called into the service room already before the former patient has left through the exit door. This is much quicker than the usual system where the treated patient is calling the next patient when leaving the service room. Many conflicts in the door-passage, which take time, are also avoided.

2.1.22

THE FILTERING SYSTEM

To reduce the waiting times for new patients, KNEPOROS has introduced a filter system. One of the clinical officers (CO) is screening all new patients who can easily be diagnosed. This CO is supposed to spend only a short time on each patient and those he cannot safely diagnose in this time he will send for further examination at second line CO's. The filtered-out patients, who will amount to more than 80% of all new patients, can go directly to the treatment stations, and their waiting time is reduced compared to the old system, where all patients have to wait for the normal examination.

2.1.23

REGISTRATION OF PATIENTS

In order to reduce the workload of the Clinical Officers, most of their administrative tasks have been taken over by two clerks. The CO only writes down the diagnosis and treatment in code on the patient card, and then the patient continues to the clerk who makes the registration.

This means that the CO can concentrate on and spend more time for the medical task. The clerks also take part in the task of directing the patients.

2.1.24

DISPENSING OF DRUGS

As most of the prescriptions to the pharmacy in the KNEPOROS system should be for coded drugs, these drugs can be kept prepacked and prebottled at the pharmacy. Thus the pharmacy in the OPD has one counter where all coded drugs are dispensed, and as the patients do not know whether their prescriptions are for coded or un-coded drugs, all patients are supposed to visit this counter first. Patients with un-coded prescriptions are then referred to a second counter, where the patients will have to wait until their drugs have been prepared.

With this system the dispensing of coded drugs, which are about 75% of all drugs, can be made very fast with the dispenser spending on average less than three-fourths minute per patient.

2.1.3

KNEPOROS RESULTS

2.1.31

NUMBER OF PATIENTS

From the KNEPOROS report of September, 1975 we will find the number of patients who visit at the Kiambu OPD during their survey week 12.

Filter CO:	1474 patients
Second line CO's:	1580 patients
Injection room:	1383 patients
Dressing room:	668 patients
Pharmacy:	2362 patients
Laboratory:	367 patients
Whole OPD:	350 patients

2.1.32

ARRIVAL PATTERNS

From the same report we can also find some data about when the patients arrive at the OPD.

From 7:00 in the morning, when the OPD opens, up to 9:45, 50% of the daily amount of patients arrive with a peak around 9:00 am. Before noon, 80% of the total number of arrivals is rather low through the rest of the day, except for after lunch when the number increases slightly.

2.1.33

LENGTH OF QUEUES

The same report also gives us the length of queues, at the maximum as well as the mean queue length, at various stations.

Station	Mean	Max	Average Maximum
Filter	44	101	55
CO	107	217	140
IR	12	38	10
DR	5	27	
PH	21	66	35
LAB	13		25
MO	6		

For the other stations the mean queue length is less than 5 persons, even if the maximum queue length can be somewhat bigger.

2.1.34

WAITING TIMES

KNEPOROS have also measured the mean waiting times for patients to the different stations.

Station	Minutes
CO	73.3
IR	18.7
DR	15.7
PH	21.3
LB	85.3
MO	72.1
OPD TOTAL	112.6

As can be seen, the main waiting occurs in the central waiting room except for the medical officer's, who spend most of their time outside the OPD. These figures should be compared with the total examination and treatment time, which normally is less than 5 minutes.

2.1.35

SEATING CAPACITY

From all the collected data, KNEPOROS has also figured out the necessary seating capacity that will be sufficient during 95% of the time. The table also shows the seating capacity as per November 1975, when this study was undertaken. As can be seen, many of the waiting areas have a bigger capacity than necessary.

Station	Seating Capacity Patients	
	Necessary 95%	Actual November 1975
Filter Co	90	90
CO	190	220
IR	30	25
DR	18	25
PH	50	50 + 15
LAB	30	40
MO	15	25 + 25

As a conclusion from the KNEPOROS team they suggest that the rule-of-thumb, which says that space for 20% of the daily attendance should be available in the central waiting room, is a rather low estimate and that 30% should be more adequate. On the other hand, they consider that for the treatment stations, the figure* does not include escorts, who may amount to about 30% of the patients. This must be taken into consideration when dimensioning the rooms.

*should be closer to 10%. As are these figures.

2.1.4

FUNCTIONAL DEMANDS ON WAITING AREAS

2.1.41

SPACE REQUIREMENTS

The dimensions of the waiting areas have to be based on the expected number of patients plus escorts, and the space which is needed per sitting person including communication areas.

From the waiting areas in Kiambu OPD we can figure out the floor area per seat, and with the estimated necessary seating capacity we can figure out the number of seats provided for escorts, and finally the floor area per patient. The suggested figure for space per seat is derived from alternative layouts of different waiting rooms at Kiambu OPD.

Source	M2 per seat	Escort Seats per patient	M2 per patient
OPD Kiambu present CWR	0.85	10%	0.95
OPD " " IR	0.55	0	0.55
OPD " " DR	0.65	40%	0.9
OPD " " PH	0.8	30%	1.0
OPD " " LAB	0.5	30%	0.7
SPRI *)		50%	1.2-1.4
NUEFERT			
Suggested CWR	0.7	25%	0.9
Other waiting room	0.7	10%	0.75

The space requirements vary widely as can be seen in the table; as well as the percentage of seats **provided** for escorts. This last figure should be rather high in areas where waiting takes a long time as in the CWR, but can be reduced where the waiting time is shorter. As can also be seen, the space need is much bigger according to SPRI, where different waiting systems are used and completely different furniture is included.

*Swedish Social Care Bureau

2.1.5

OBSERVATIONS AT KIAMBU OPD

2.1.51

PHYSICAL ENVIRONMENT

Within the large concrete structure of the OPD, the central waiting room (CWR) occupies roughly 260m². After entering the building one will meet a large empty area, from where one will turn right to enter the CWR. It is surrounded by outside walls on two sides, and timber partition walls of different heights on the other two sides.

The outside walls are plastered concrete block walls with high windows equally spaced out along the walls. The partition walls are made of timber posts with high or low infilling panels and doors. The posts span between the floor and the ceiling, while the panels start 25 cm above floor level and reach to 125 and 225 cm over floor level respectively.

At the entrance to the CWR there is a filter room made of timber partitions, and in one corner there are toilets, surrounded by block walls, with entrances from the outside. A single door from the waiting room to the ladies toilet is not in use. In the concrete ceiling there are 2 roof-lights with fixed glass louvers covering the central part of the room. The roof lights are facing north and give good sun-protection, while the normal windows have no protection. Electrical outlets in the ceiling and water/drainage points in the floor are laid out along a grid system.

The concrete floor is cast in sections, in a red brown colour, with concrete covers over the water drainage points.

The ceiling and the walls are painted white, only the timber posts outstanding with their natural brown colour, and the painted doors. The block walls and the ceiling though rather rough are in good condition.

The condition of the partition walls is partly acceptable, but the walls are collapsing at some places. A few posts are completely loose, others are bent, and some panels are cracking or falling out. The maintenance of the walls is very unsatisfactory.

— LOW PARTITION
TOTAL AREA 0PO rv1030m2

The floor condition is very bad. The surface itself is very uneven and rough, and there are many big cracks around the water/drainage points. Even many of the covers are broken.

For the other parts of the OPD there are a number of smaller waiting bays. The three main ones are the Injection Waiting Room (IWR) roughly 16 m², the Dressing Waiting Room (DWR), with the same size and the Pharmacy Waiting Room (PHWR) of about 51 m². Then there is the waiting bay for the Medical Officers' room (MOWR) of 23m², the Laboratory Waiting Room (LWR) of 21m², and finally the Casualty Waiting Room (CYWR) of the same size.

For these waiting rooms the situation is the same, only that they mostly are surrounded by low partition walls on three sides, and that the only daylight comes from the roof-lights.

2.2.

THE WAITING SYSTEM

2.2.1.

THE CENTRAL WAITING ROOM

When a patient enters the room he has first to cross the queue to the filter room before choosing where to go. A supervisor is sitting at the entrance to direct the patients. New patients line up in the queue to the filter room, while real re-attendants line up for the examination rooms. Patients for continued treatment line up for, or go directly to (if there is no queue) the clerk for registration. Patients who are seeking care for their eyes line up for the eye examination room. Hence, there are four main queues in the room and when the new patients have been to the filter room, they are directed to any of the other three queues.

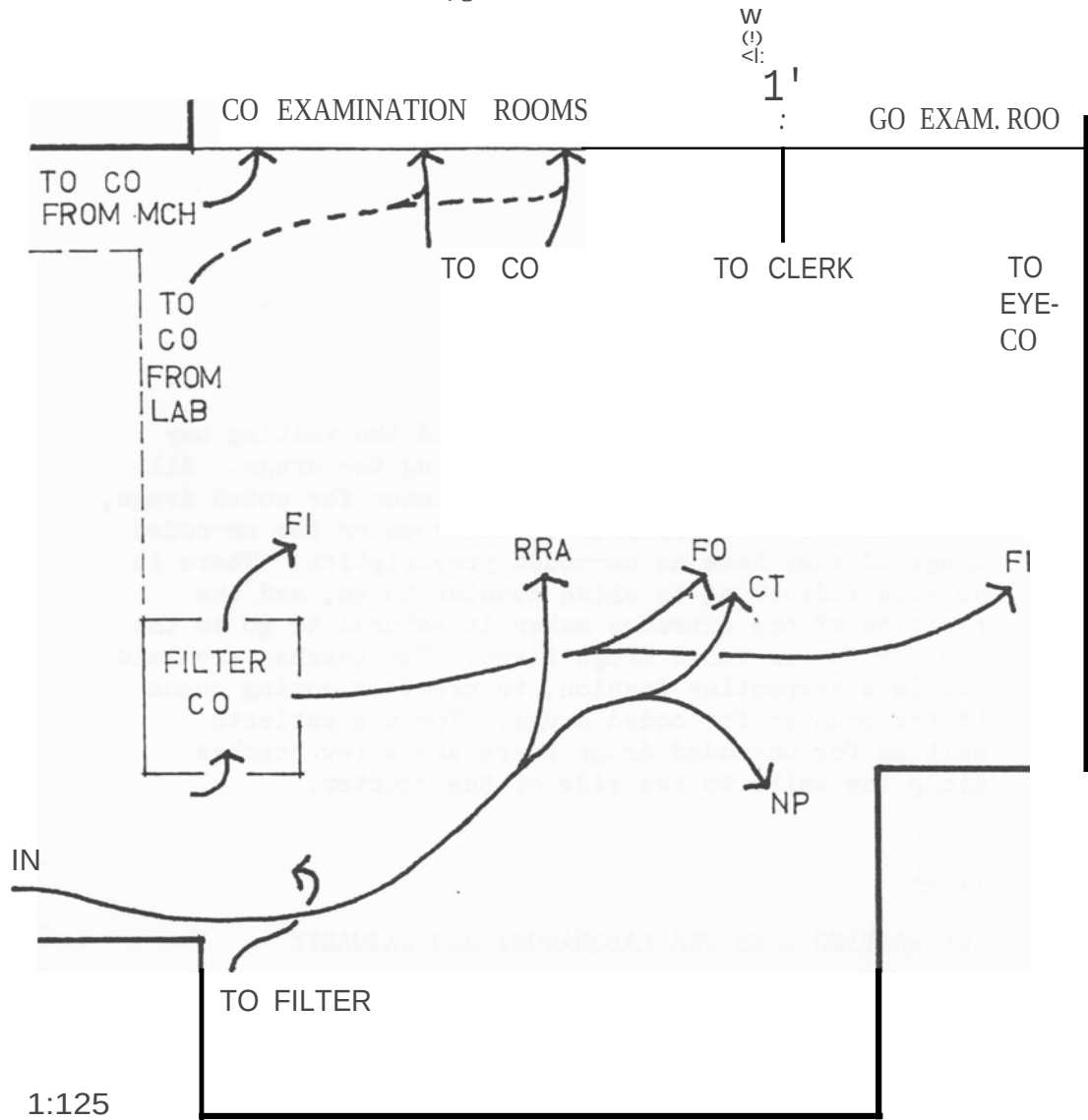
Patients returning from the laboratory to re-visit the examination rooms form a separate queue in order to enter before the other patients. The far left examination room is normally used for patients referred from the MCH-clinic, and these patients form a queue coming in from the left up to the door.

From the central waiting room the patient flow goes either via the examination rooms or directly to the clerks and then further on to the waiting bays for treatment, pharmacy or MO.

2.2.2

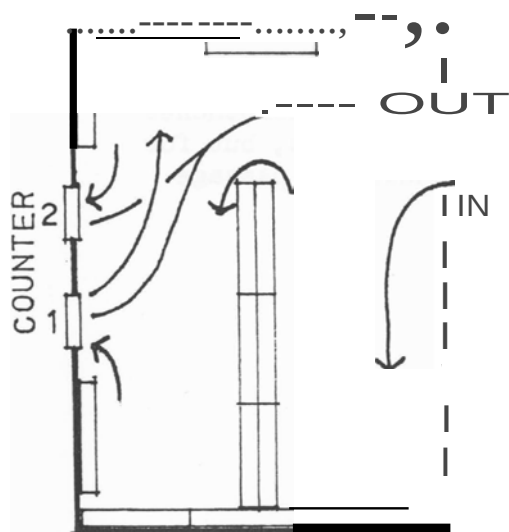
THE WAITING BAYS FOR THE TREATMENT ROOMS

The waiting bays for the injection room and the dressing room both use the same queue system and are of the same size. The patient lines up at the end of the queue and moves forward until as first in line he is called to enter the treatment room.

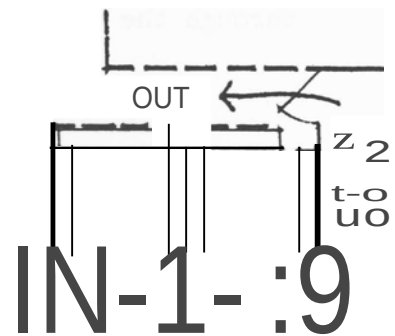


EXISTING LAYOUT CWR

---LOW PARTITION
 ---} PATIENT FLOW
 WAITING ZONE
 :=:BENCH



PHARMACY WAITING ROOM



INJECTION W. R.

EXISTING ROOM LAYOUTS

2.2.3

THE WAITING BAY FOR THE PHARMACY

In the wall between the pharmacy and the waiting bay there are two counters for dispensing the drugs. All patients should first visit the counter for coded drugs, and then they are referred to the counter for un-coded drugs if they have an un-coded prescription. There is no sign indicating to which counter to go, and the position of the entrance makes it natural to go to the counter for un-coded drugs first. The benches are laid out in a serpentine fashion, to create a moving queue to the counter for coded drugs. For the patients waiting for un-coded drugs there are a few benches along the walls to the side of the counter.

2.2.4

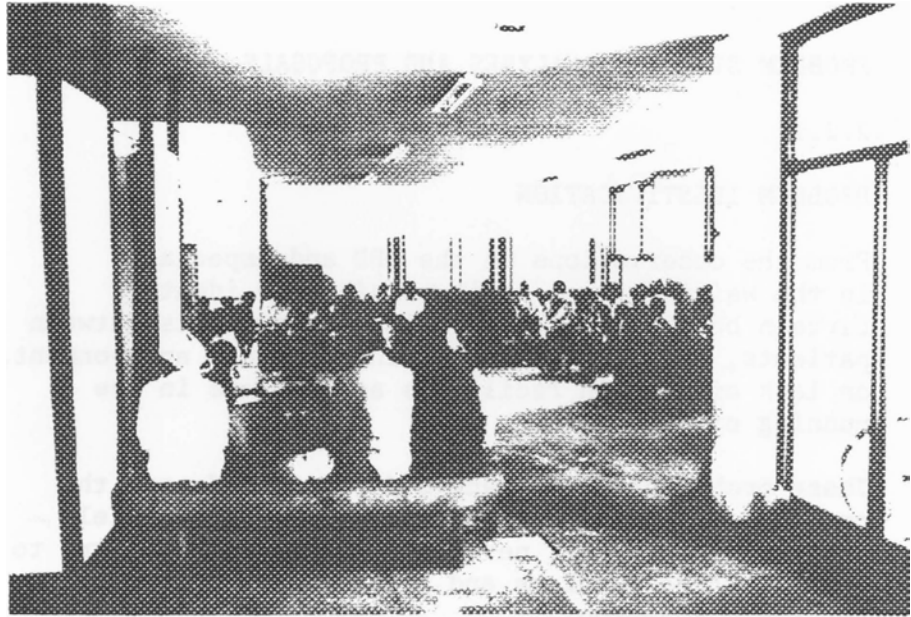
THE WAITING BAYS FOR LABORATORY AND CASUALTY

For the laboratory and the casualty there is no moving queue system. The only need is a space for the patients to sit down until they are called. Hence the benches are equally spaced out in the waiting-bay, with a direct passage through to the service room.

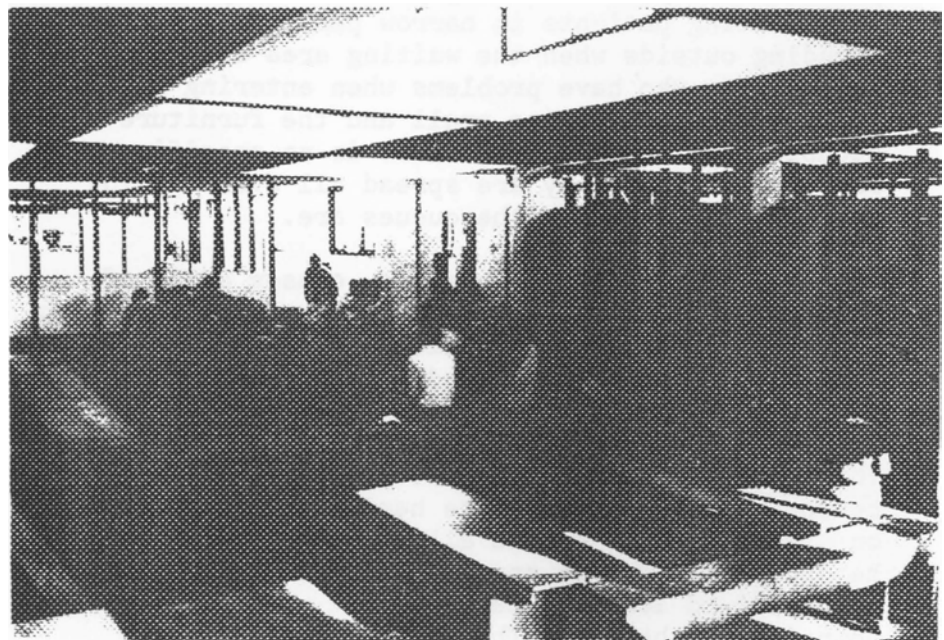
2.2.5

THE WAITING-BAYS FOR MEDICAL OFFICERS AND MINOR THEATRE

For services in these rooms the patients come on appointments or are called by a nurse. The benches are equally spaced out in the waiting-bays, but for one of the MO-rooms there is no indicated passage through the waiting bay.



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2.3

PROBLEM STATING ANALYSES AND PROPOSALS

2.3.1

PROBLEM IDENTIFICATION

From the observations in the OPD and especially in the waiting areas it is possible to identify certain behaviour of the patients, conflicts between patients, certain aspects of the physical environment, or lack of certain facilities as problems in the running of the clinic.

These problems are of many different kinds and the reasons are sometimes far outside the normal field of architecture, but nevertheless we will here try to analyse these problems and possibly give proposals for their solution.

A great of the problems are connected with the queueing. Some patients don't care about queuing, others prefer to stand instead of sitting in a moving queue, mothers with children cannot always move when the queue moves and are by-passed by impatient neighbours.

Other problems are connected with the layout of the rooms. Patients looking for the way, choosing wrong doors, entering through back-doors - etc., usually just trying to find the way. Then there are problems of space. Passing patients bumping into sitting patients in narrow passages, patients standing outside when the waiting area is too small or patients who have problems when entering a room because the room is too small and the furniture occupies too much space. There is no specific space for escorts, and they are spread all over causing confusion about where the queues are.

The hygiene, or lack of hygiene, causes a lot of problems. The floor is always dirty, sometimes with big pools of water, the walls are dirty and collect dust, the toilets are incredibly unclean and smell evilly.

There are problems of comfort in general. The benches are too narrow, one has to keep a pressure on the neighbour behind all the time, otherwise he occupies too much space. One gets tired without something to lean the back against when there is no neighbour behind. The constant moving is

irritating, at least when one is far behind in the queue. To move children and bags at the same time is not easy. The noise level becomes very high when a child starts crying and then a telephone starts ringing at the other end of the building.

Another thing is that many patients regard the waiting time as wasted time, as there are very few opportunities for activities and it is impossible to leave the queue other than for short periods.

2.3.2

CATEGORIZATION OF PROBLEMS

In order to come to an understanding of the problems it is necessary to divide them into different groups depending on the nature of the problem. Then we will find problems caused by:

- a) the human behaviour of staff or patients
- b) the organizational/administrative pattern
- c) the physical environment

In the following analyses we will use these three categories when we look into the problems.

2.3.3

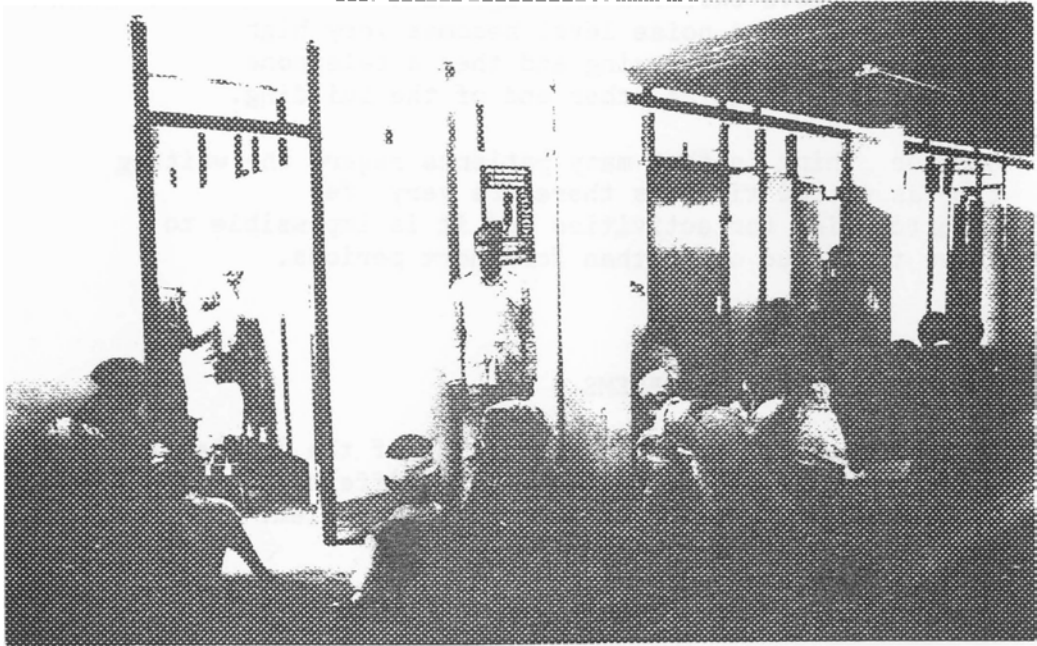
PROBLEM ANALYSIS

2.3.31

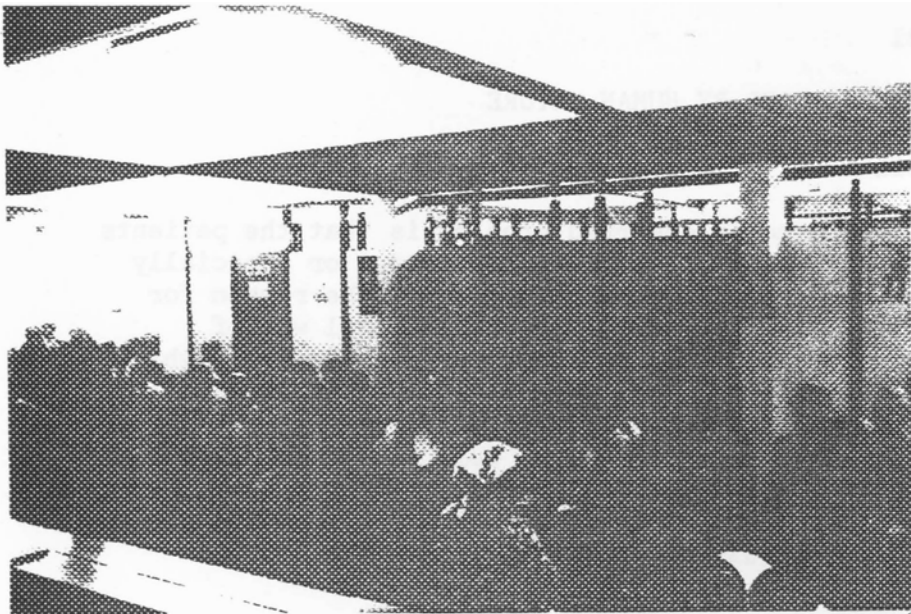
PROBLEMS CAUSED BY HUMAN NATURE

2.3.311

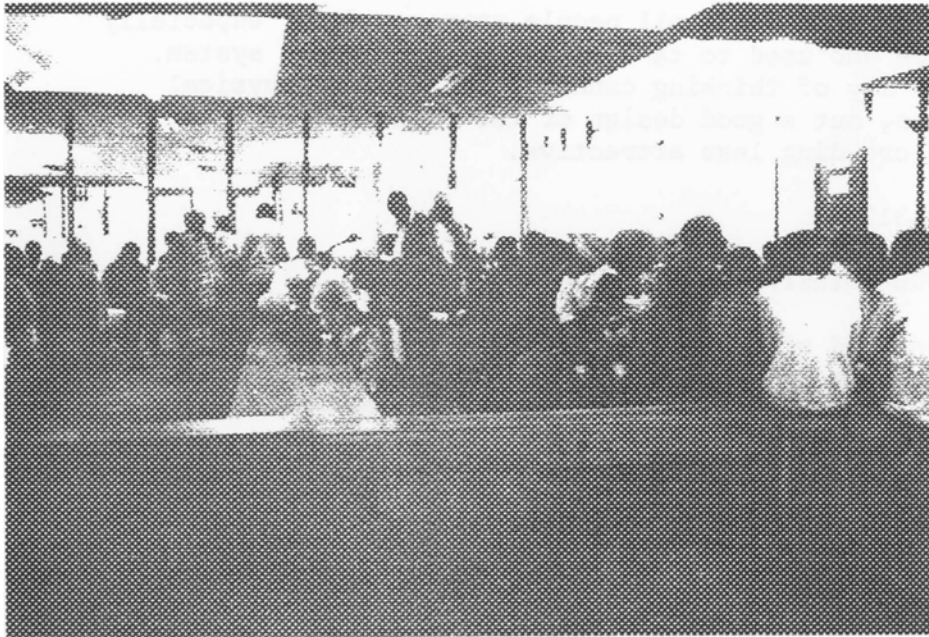
A rather commonly observed problem is that the patients often crowd around a clerk, an entrance or especially around the counters at the pharmacy. The reason for this is that this was the old traditional way of getting service. All persons try to claim the right to be served first, but the most influential, the strongest and the most loud-speaking will certainly be served first, as well as any friends or relatives to the person in charge of the service. The principle of "first come - first served" and the queue as a result of this is a rather novel idea



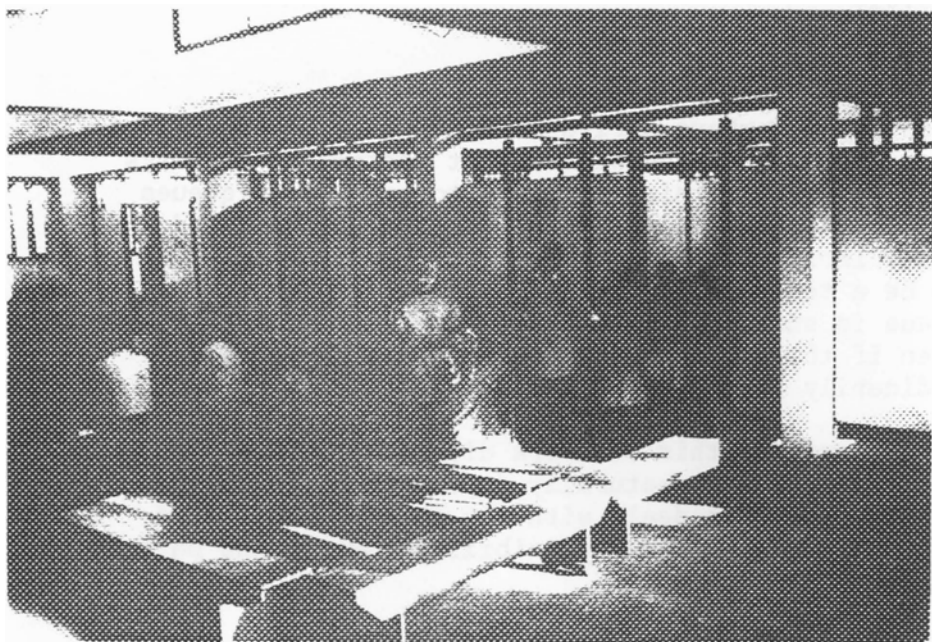
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Crowding and confusion in CWR.



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in Kenya, and not all people approve of it, especially those who used to take advantage of the old system. This way of thinking cannot be changed by physical means, but a good design of the rooms can make the crowding less attractive.

2.3.312

QUEUE DISCIPLINE

Connected with the above-mentioned problem is the low discipline some patients show in the queue. If there happens to be a gap in the queue somewhere, one can be sure that someone from behind will try to take the position.

Somebody might leave for the toilet and when he comes back there is no seat for him; either the whole queue has moved forward or somebody has just taken the seat. The returning patient will then have to wait standing till the queue moves forward again, or he will try to squeeze down on the already crowded bench with force.

Friends and relatives to the staff and influential people will always by-pass a queue, usually with little reaction from the queuing patients, and this cannot be prevented even if a good layout can make the by-passing less easy.

2.3.313

BAD STAFF DISCIPLINE

When staff members arrive late at work, or take extra long breaks, or otherwise do not perform their tasks as they should, this will lead to extra long queues and increased waiting times for the patients and cause irritation among them. There also seems to be a tendency among staff-members that when the queue is short, they can stop working for a while even if the patients then have to wait an extraordinarily long time.

The reason for this bad work discipline which has been observed, is naturally depending on human nature but it has to be dealt with by the superior staff to create a greater responsibility towards the patients.

2.3.32

PROBLEMS CAUSED BY ORGANIZATIONAL ADMINISTRATIVE PATTERNS

2.3.321

The system of the whole sitting queue moving forward for every patient that is entering a service room is by far the most simple and efficient way to provide a continuous flow of patients from the view of the staff. From the patients view, it is a tiresome, stressing and perhaps degrading system, as they are not able to leave their seat, except for short periods, sometimes for many hours. This is time otherwise could have been used for other activities outside the hospital.

Other queue systems, for example a queue number system or a call system, are in this respect far better for the patients. They can sit down at one place during the whole waiting time, or they can estimate how long a time they will have to wait and then use their waiting time for other activities. But these systems have their limits in other respects. The call system, for instance an appointment system, requires a different administrative system than the KNEPOROS proposals. The queue-number system requires that all patients can read and add numbers and, at present, this is not the situation in Kenya. Even if this system when applied normally uses mechanical signboards, which are likely to fail on occasion, the system could be rather simple without any significant costs; for example, large metal plates, with pressed-in numbers, could be used.

The patient would collect one when entering, and when his turn finally comes up he hangs the number-plate on a clearly visible point before entering the service room.

But as long as these above-mentioned obstacles for other systems remain, the moving queue system is likely to remain.

2.3.322

DISTURBANCES IN THE FLOW

There are some conflicts arising from back-flowing patients, or patients who return for a second visit to the examination room from the laboratory or the X-ray. These patients have to see the same narrow passage as the queue to the registration clerk is using and the conflict is obvious when the queuing patients almost fill the whole space.

When the laboratory and X-ray patients return for their second visit to the CO, they are not supposed to wait in the ordinary queue, but from a separate queue and go in before the other patients. This system very often causes conflicts among patients who do not know the reason and the attendant is needed to explain and supervise. At the pharmacy, a back-flow occurs when a patient is requested to clean his empty bottle properly. First the patient has to return back against the queue and then when returning he has to by-pass the whole queue to regain his position. Other patients, who do not know the reason will perhaps try to stop this patient or follow the patient up to the front and both cases cause conflict between patients.

2.3.33

PROBLEMS CAUSED BY THE PHYSICAL ENVIRONMENT

2.3.331

ORIENTATION PROBLEMS

Many patients, especially new patients, children etc do not know where to go. There are only few signs, and as most patients cannot read, they are not helped by such signs.

The different queues in the CWR are sometimes floating into each other, causing uncertainty about which one to choose. The passage from the CWR to the treatment stations is very badly defined as it is a former examination room.

2.3.332

UNCOMFORTABLE FURNITURE

The benches, 180 x 30 cm in size, are not especially comfortable for sitting for a long period. The benches are often placed together, so that the patients sit

back to back and push or press i jo each other when moving. The narrow seat forces the patient to sit up-right, which is rather tiresome for long periods.

2.3.333

NOISE

The noise level in the CWR, as well as in the whole OPD, is usually rather high. The most-disturbing sounds are those that come from other parts of the building, when one cannot see the source. Loud cries from small children are usual disturbances, telephone signals, street noise and call buzzers add up the noise level. The two reasons for this are primarily the lack of sound insulation between the different parts of the building, and secondly the bad sound absorption caused by the flat concrete ceiling.

2.3.334

SMELLING TOILETS

There are toilets for both males and females situated in the four corners of the building.. The two corners with public toilets transmit a veri bad smell to the surrounding areas. This is especially bad in the CWR, where patients have to sit and wait in this smell-zone. It is quite obvious that doors from public toilets should lead to the open and not to any inside rooms.

2.3.335

CLEANLINESS AND HYGIENE

In dry weather, the red dust comes in through every opening and can be found everywhere. On rainy days the mud that sticks to feet and shoes will be taken around the whole building and leave thick layers of soil on the floors.

There have been arrangements for cleaning feet outside the entrance, but as the taps for water e not working, nobody can use this. There are no foot-scr pers, where patients with shoes can get rid of mud and dirt. The cleaning of the floor is a rather simple business. The benches are_piled up in heaps, one person is flushing the floor with a hose while three or four others shovel the dirty water towards the entrance with long brushes.

Pools of water are often left on the floor after the cleaning patrol has finished and it is needless to say that the degree of cleanliness is not very high. Considering that more than 10% of all wounds occur on the feet, and that many patients are bare-footed, the risk of getting or spreading infections is very big on the wet floor.

The hygienic standard of the toilets is very low, causing both the embarrassing smell as well as the risk of spreading infections. There is no proper place where a parent can lay down a small child while cleaning and changing the child.

2.3.4

PROPOSALS FOR PROBLEMS SOLVING

2.3.41

PROBLEMS CAUSED BY HUMAN NATURE

The problems in this group are naturally very essential, but they are mainly beyond the field which can be covered by this study. As mentioned above, crowding and by-passing the queue can only be made less attractive by the physical layout, and this has to be considered in the design proposals. With barriers or low partition walls that creates a narrow passage up to the service unit, by-passing and crowding will be very uncomfortable. The dimensioning of such channels has to be studied so that it will not make the queuing for the normal patient uncomfortable, but only prevent others from by-passing.

2.3.42

PROBLEMS CAUSED BY ORGANIZATIONAL/ADMINISTRATIVE PATTERNS

As discussed under 3.321, the possibility of changing the moving queue system is not likely with the present organisation of the work at Kiambu OPD. The changes that can be made within the system to make the queuing more comfortable are mainly to improve the furniture, as we will see below.

Back-flowing of patients from laboratory and X-ray can be avoided by having patient cards collected by the clerk, who brings the cards to the respective CO. The CO will then call the patient from the back door when he is free. This system will avoid the conflicts of patients jumping the queue, and it can also insure that the patients re-visit the same CO, which should be an advantage.

A special waiting space for these patients has to be provided, which in the present layout would create no problems.

The back-flow created by patients who have to clean their bottles at the pharmacy could be avoided by providing a sink at the entrance of the pharmacy waiting room.

2.3.43

PROBLEMS CAUSED BY THE PHYSICAL ENVIRONMENT

2.3.431

The whole layout of the CWR should be re-arranged, with the filter room moved away from the entrance. The different waiting zones should be more clearly defined, possibly end up in a kind of channel close to the service unit. There should be separate space for escorts, in case they do not accompany the patient in the queue.

The passage to the rear part of the OPD should be made wider, so that two patients can meet without conflict. The filter cubicle should have 3 exits, one for each of the following waiting zones, so the route is clear for the patient. The routes to different stations should be marked with lines on the floor in different colours. Simple symbols in different colours should be used on doors etc. to explain the function of the rooms.

2.3.4.32

UNCOMFORTABLE FURNITURE

The benches should be wider, at least 40 cm. They should be provided with a solid back to lean against. There should be two variants, single and double, where the double share a common back. The length of the benches should fit into the building module, and be suitable for 4 to 5 persons, to make them easy to handle.

2.3.4.33

NOISE LEVEL

In a permanent solution, the walls should reach up to the ceiling, with louvres to provide necessary ventilation and light on top. Also some partitions should have compact walls to the ceiling, to create good sound barriers. The walls in the waiting areas should have a hollow or soft surface to improve the sound absorption.

2.3.4.34

SMELLING TOILETS

The entrances to the public toilets should be changed to face the outside. The unused door in the CWR should be closed with a permanent block wall.

2.3.4.35

CLEANLINESS AND HYGIENE

The floor has to be re-made with a smooth layer of cement screed, and in some rooms with terrazzo or some similar substance, to enable proper cleaning. The existing covers over water/drainage points should be changed to cast iron metal grids to drain away the water when flushing the floor.

Footscrapers should be provided outside the entrance, the existing foot wash-basins should be made good, and a tap for drinking and washing hands should be provided. A small concrete bench for cleaning small children should be provided in connection with the water-tap.

2.4

TESTING OF PROPOSALS AND EVALUATION

2.4.1

SELECTION OF PROPOSALS FOR TESTING

The solutions that are feasible to test during this study are all connected to the physical layout. The layout of the CWR will be changed in three stages, the passage to the rear part of the OPD will be altered, the pharmacy waiting room will also be changed in three stages, and finally the MO waiting room will be slightly altered.

The limitations of the test are for reasons of time, economy, and capacity and quality of the team. Also the aim of the project, building functional studies indicates that it is mainly the physical aspects we should deal with, even if the problems connected with waiting areas and patient flow are to a large extent depending on other factors. A simple simulation for estimating the need of space per person in the waiting areas will also be done.

2.4.2

TESTING OF PROPOSALS

2.4.21

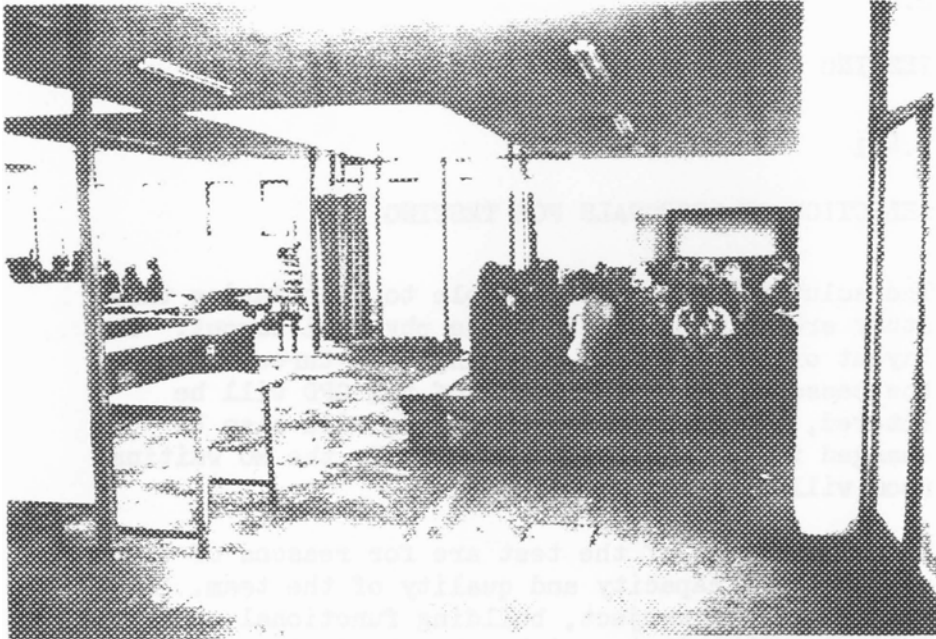
THE CENTRAL WAITING ROOM

The proposal was first presented verbally to concerned staff members. A rough sketch was also shown to illustrate the changes. The proposal was met positively.

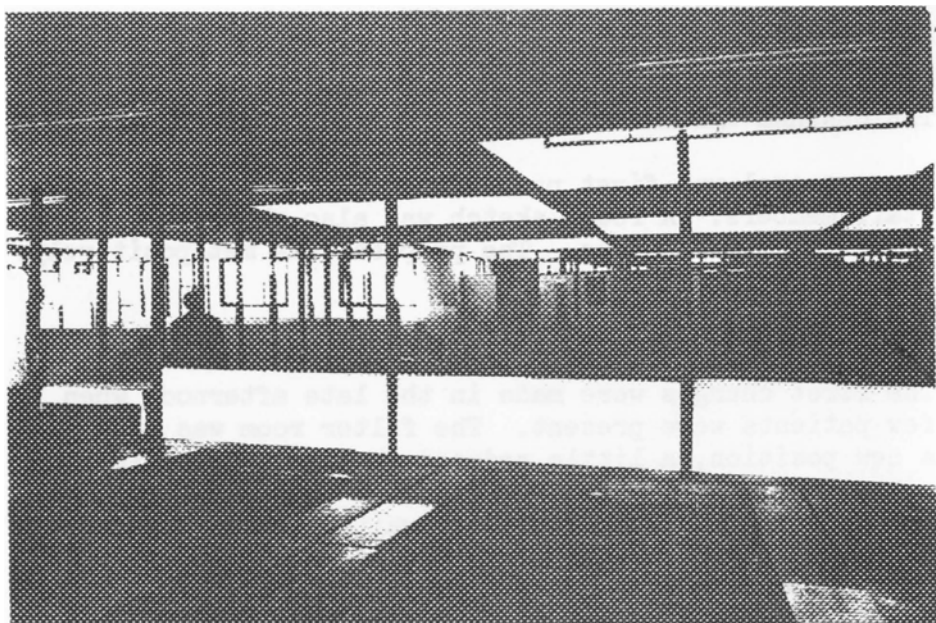
2.4.21.1

The first changes were made in the late afternoon when few patients were present. The filter room was moved to a new position, a little reduced in size and provided with 4 openings instead of 3. The 3 exits now provided are facing the 3 main secondary waiting zones in the CWR. The attendant was provided with a table and a chair, and took the former filter position. The benches were re-arranged in the filter waiting zone to fit the new situation.

The reactions of patients and staff were observed during the following day.



The first change in CWR. Filter room moved to new position at table to the left.



The second change in the CWR, with a two-partition system and separate N2 and other patients.

The number of patients turning to the attendant for questions, showing their patient cards, was much greater than at earlier observations mainly because of the very clear position of the attendant, who during earlier observations had no fixed place but was moving around freely in the room.

The attendant was very satisfied with the new arrangement especially his own position from where the whole room could be overlooked, One of the CO's expressed satisfaction with the fact that the waiting patients now were unable to look directly into the filter room,

The benches in the filter waiting zone, with the new layout, were also supposed to act as a barrier to the other zones, This proved to be less successful as patients easily climbed over these benches, Also the layout gradually was changed by the cleaning staff when replacing the benches after cleaning, probably because they found the benches too much in their way. The position of the benches along a wall seem to be more satisfying, also for the patients who prefer a wall to lean against if possible.

2.4.21.2

The second change was to alter the position of the passage and eye-examination room, The passage was then made wider, from door width to about 1.30:cm wide. The clerk was positioned at the entrance to the passage, The queue-zones were altered to fit this change,

After one day the clerk moved his position back to the other end of the passage, The reason was that he should also direct the patients to the different stations after the registration and that was easier to do from the backwards position.

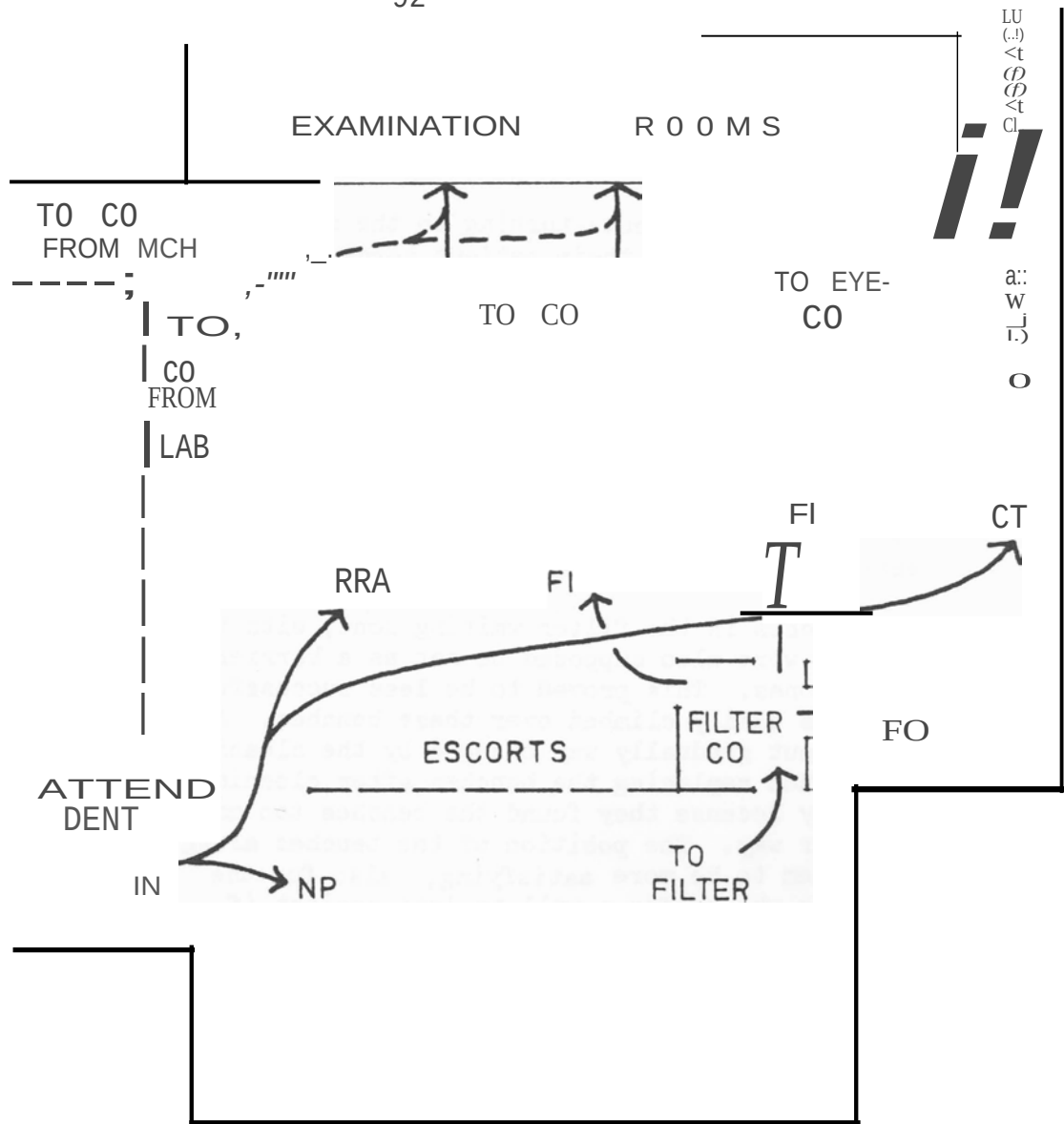
2.4.21.3

The third change was to put up a low partition wall, 1.05 cm over floor level between the filter waiting zone and the other parts. The waiting zones were much more clearly defined, and as all patients now would be passing close to the attendant, he was very satisfied. Benches for escorts were provided along the partition wall, with good view over the room,

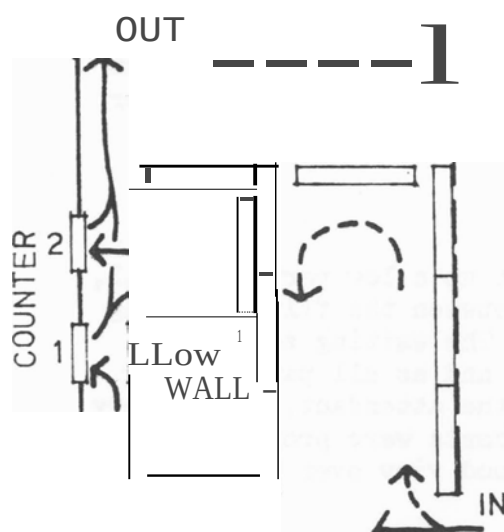
2,4.22

CHANGING THE PASSAGE

This change, as mentioned above, was made by moving the position of the eye-examination to the former passage.



CHANGED LAYOUT CWR



1:125

- LOW PARTITION
- ..C- PATIENT FLOW
- WAITING ZONE
- BENCH

NEW LAYOUT PHAR/VJACY WR.

In the same alteration, the eye-examination room was provided with a special dark room for close-up eye-examinations, which earlier had caused some problems. The examination room was also improved with a call buzzer, of the same type as the other examination rooms. With this the back-flow of patients that had been the problem before could be avoided and the patients did not have to queue again for the registration.

2.4.23

THE PHARMACY WAITING ROOM

After the ideas had been discussed with the pharmacy staff, who very much approved of anything that could improve the situation, the first change was made.

2.4.23.1

A new entrance was made, and the old opening was made a bit smaller to serve only as an exit. The benches were lined up to form a channel up to the first counter, with the first patients in line facing the counter side.

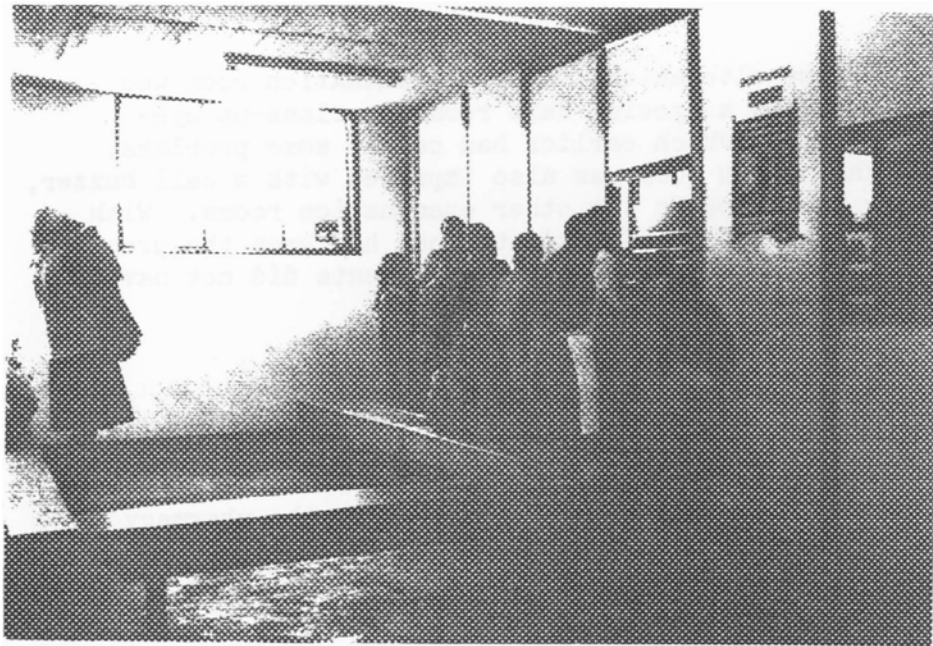
Too many patients were used to the old entrance, and continued to use this way, especially as it provided a more direct route to the counters. The benches acting as barriers were not successful, as the patients easily climbed over and went directly to the counter in front of the queue.

2.4.23.2

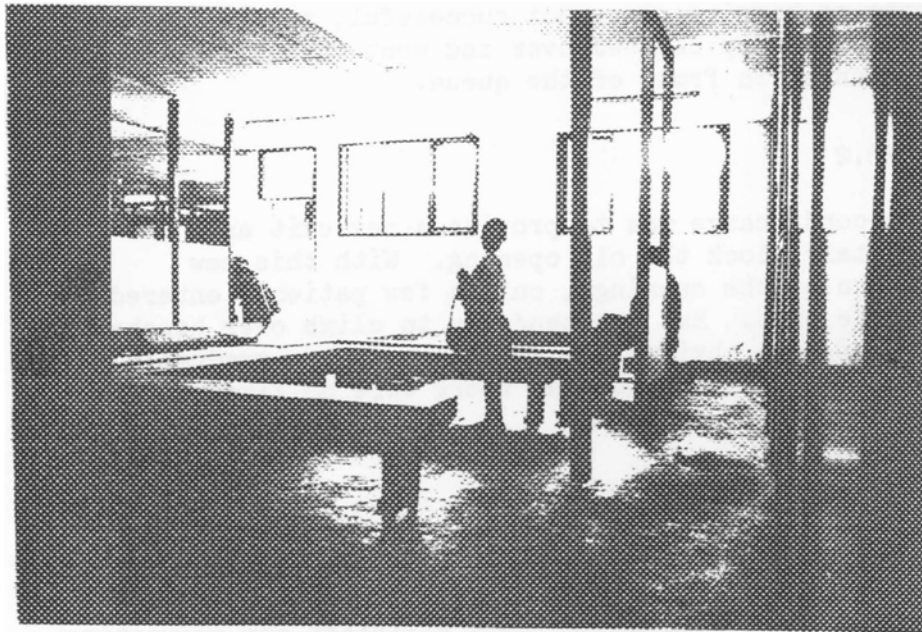
The second change was to provide a new exit and completely block the old opening. With this new position of the openings, only a few patients entered from the exit. But the tendency to climb over benches was even more obvious and the benches were gradually moved around in the room as there were no fixed points for starting or ending.

2.4.23.3

The third change was to provide a low partition in front of the first counter, at a distance of 80 cm from the counter. This wall seemed very efficient for preventing crowding at the counter which up to now had occurred from time to time. The whole situation became more clear and the patients seemed to accept the queuing in order to get served.



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2.4.23.4

THE MO WAITING ROOM

The two MO's examination rooms were sharing a common waiting room with the entrance in a corner. With the layout of the benches, there was no passage to the second examination room but patients as well as staff had to squeeze in between the sitting patients in order to reach the room. The solution was simply to provide an additional entrance in front of the second examination room, while the other entrance was made slightly smaller to provide more wall to line up the benches against.

2.4.3

EVALUATION OF THE ALTERATIONS

The value of the changes that were made will of course partly be the benefits that the Kiambu OPD could gain, and from the reactions of the staff it seems that the changes were improving the situation. But the general conclusions are very valuable for the planning of new waiting areas. The flow patterns should be natural and distinct and the waiting zones clearly defined. The position of supervising staff, attendants be led into narrow channels in order to avoid crowding and congestion outside a service-point. Low partitions, not necessarily walls, are very helpful in creating zones and channels, while benches without backs are not enough for the same purpose.

DESIGN PROPOSALS

GENERALLY

The design of the waiting areas, as well as the whole medical clinic, depends on the prevailing climatic zone. For most parts of Kenya the climate is such that open, well-ventilated solutions are preferable. For the waiting areas it means that a light-weight roof, completed with half-walls where the wind tends to be strong, would provide the necessary building shell. The floor should be a smooth cement screed, with provisions for drainage with slopes and outlets. The walls should be with rough surface, for example unplastered brick or concrete-block walls. Close to the entrance of the waiting area should be provisions for washing hands and feet, and also for removing dirt from shoes. Toilets should be within sight from the waiting area, but in a direction so that the prevailing wind moves any smells away from it.

When a patient enters the waiting area, he should be met by an attendant to direct him, or by a clerk who will also register him. The different waiting zones could be divided by railings, flower beds or low walls, making the divisions clear without preventing patients flow should be painted in different colours on the floor. Simple symbols should be used on doors, etc. to explain the functions.

Benches with backs, both single and double, should be the main furniture. Along walls fixed benches could be used. The layout of the furniture depends on the

waiting system that is used.

The flow of patients has to be carefully studied with main streams of patients given priority over more occasional flows. From a filter the main flow goes via the clerk to the treatment stations, but the flow to the second line CO's is also important. From the clerk the connections to injection room, dressing room and pharmacy should have priority over other connections. From the examination rooms, the connection to the laboratory, and vice versa, has to be good.

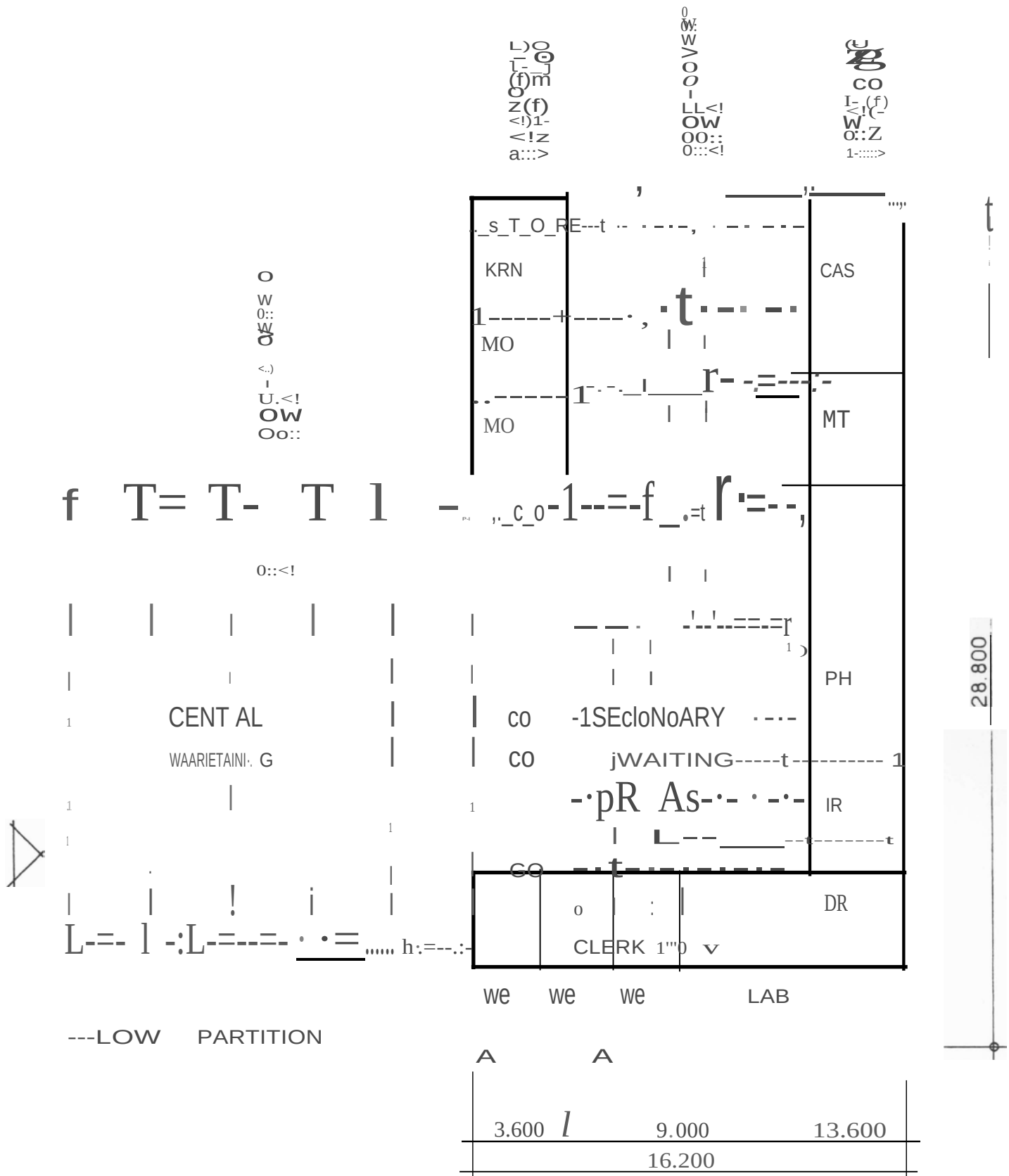
The waiting areas should be divided in two zones, one for patients waiting for examination, and one for patients waiting for treatment.

Through this a certain flexibility can be achieved between the different waiting areas, and adaptations to changes in the demands can be more easily done. This kind of zoning will also make the total layout of the institution more simple, as the demands on the building are different for examination rooms, treatment rooms and waiting areas.

2.5.2

PROPOSED BUILDING LAYOUT FOR AN OPD

To illustrate how a simple OPD-building layout can provide a satisfying patient flow, we have done the following sketch plan. The layout can also be made as two parallel buildings with walls at both ends. The lengths of the blocks can be adjusted to the needs and future additions can be made. The treatment block can have staff and goods entrances from the outside to avoid **interference with the** patients.



LAYOUT PROPOSAL
FOR AN OPD 1:200

PROPOSALS FOR LAYOUT OF KIAMBU OPD

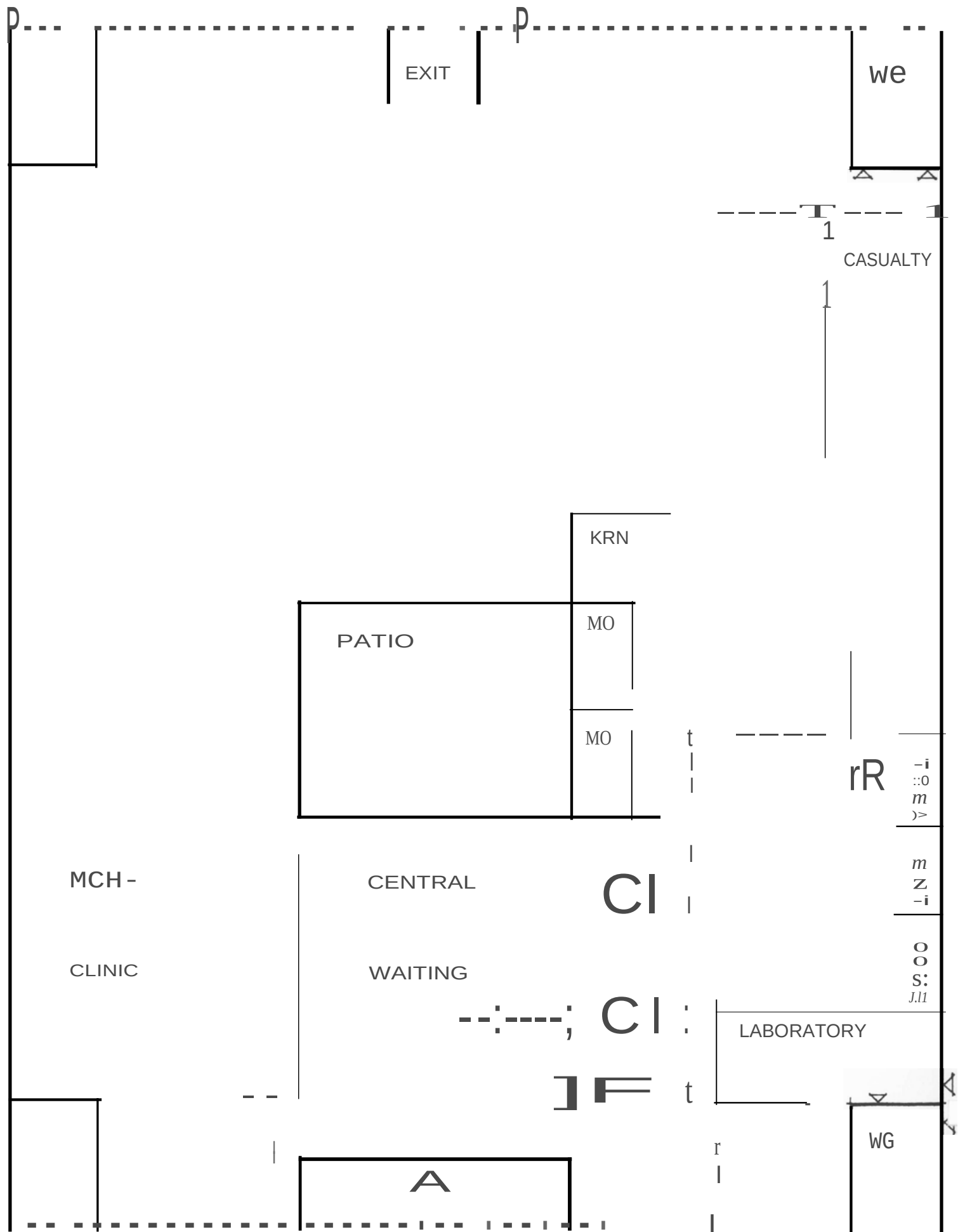
The layout of the Kiambu OPD **can be done either as an** adaption of the suggested general layout or as a modification of the existing layout.

In the first case, an adaption of an "ideal" layout to the existing building leads to some difficulties in achieving the necessary spaces, due to the location of the patio. On the other hand, it gives a very clear layout and very simple installations of water and drainage. The staff and supply traffic to pharmacy and laboratory could be arranged on the outside of the building, but the distances would be somewhat longer than today. If the patio is to be removed and the space utilized as has been discussed, then this principle probably would be preferred.

In the second case, a modification of the existing layout, a much easier change to the permanent situation would be achieved. The new walls can be put up one by one while the clinic is still running. Even though all rooms and waiting area have been increased or kept the same as in the existing situation, a reduction of about 25% in the total OPD area will be achieved. The staff communication and the patient flow will be satisfying. For supply to the pharmacy, a special entrance could be made from the outside, and also other rooms can have their own outside entrance if needed.

For both alternatives, there are some general remarks about the design and use of materials. Due to the very differing amounts of daylight that reach the inner parts of the building, the partition walls should generally be provided with glass from above door level. To satisfy the need for ventilation, this could be made as fixed or adjustable glass louvres. Around certain rooms, where the noise level tends to be high, fixed glasses should be installed.

To improve the sound absorption in the waiting areas, the surrounding walls could be made of unplastered hollow bricks or concrete blocks. This surface will also keep up much better over long time than the usual plaster wall.



LAYOUT PROPOSAL I

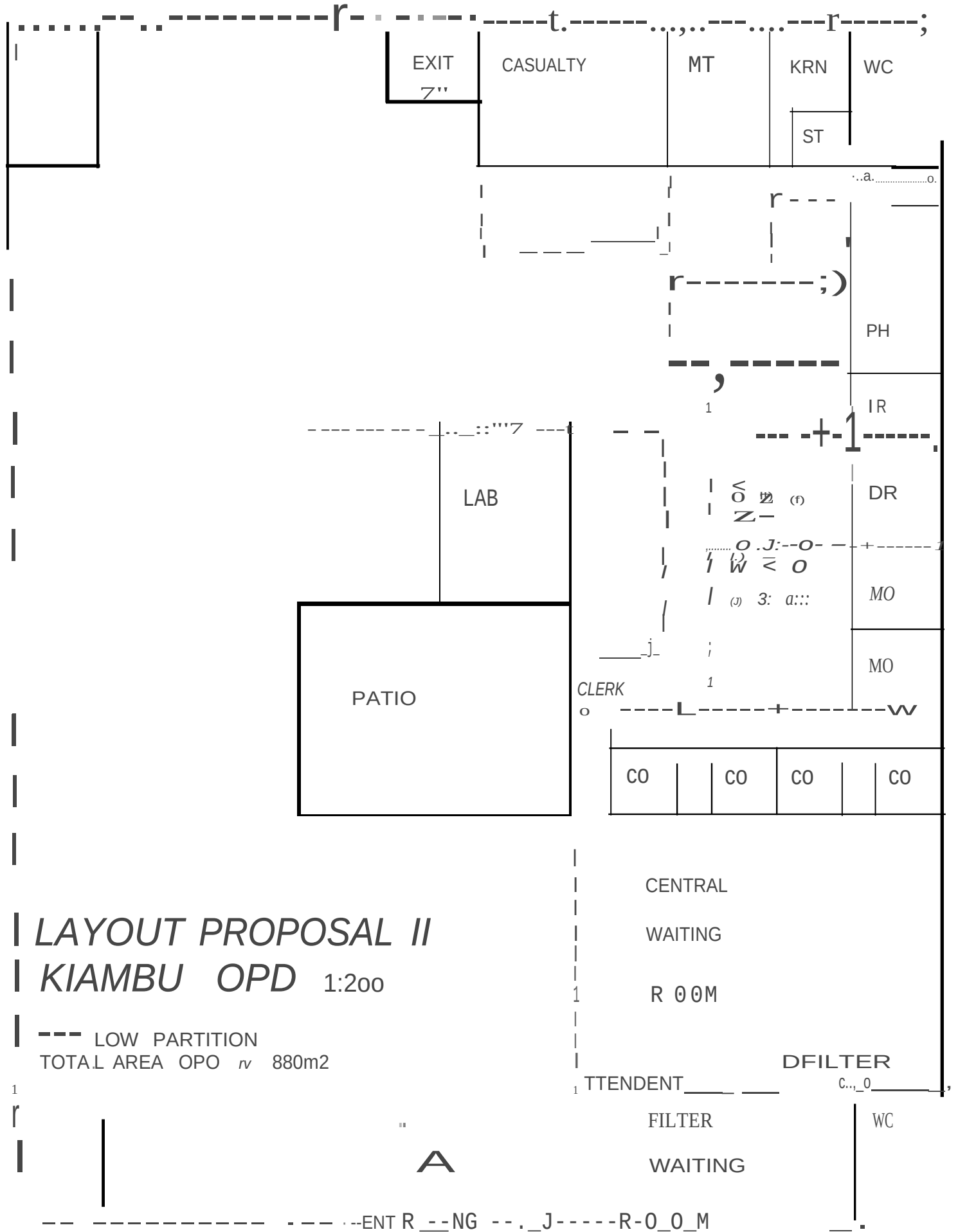
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TOTAL AREA n P n

WAITING ZONE

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3.0.0

DIAGNOSIS AND TREATMENT

3.1.0

DICAL CARE IN THE OPD

3.1.0

MEDICAL CARE IN THE OPD

The medical care given to patients in an Out Patient Department (OPD) consists of three phases which can be rendered by one and the same staff member or by several specialised persons. In a small clinic, a doctor or a clinical officer can do all the aspects of the work whereas a large Out Patient Department will have a division of labour so that the patient will have several stations to receive different parts of the treatment. In Less Developed Countries (LDC's), medical care is faced with the dilemma of great demand and limited resources, especially as far as professional staff is concerned. Consequently, a policy of effective staff use has been developed with the principle of "always using the least qualified person capable to execute a certain task." A clear example is to let a clerk register all medical and personnel data of the patient in a ledger and to enable the nurse to concentrate on medical tasks.

The three main phases of the curative care in the out-patient department are:

Firstly, consultations
Secondly, examination and diagnosis
Thirdly, treatment.

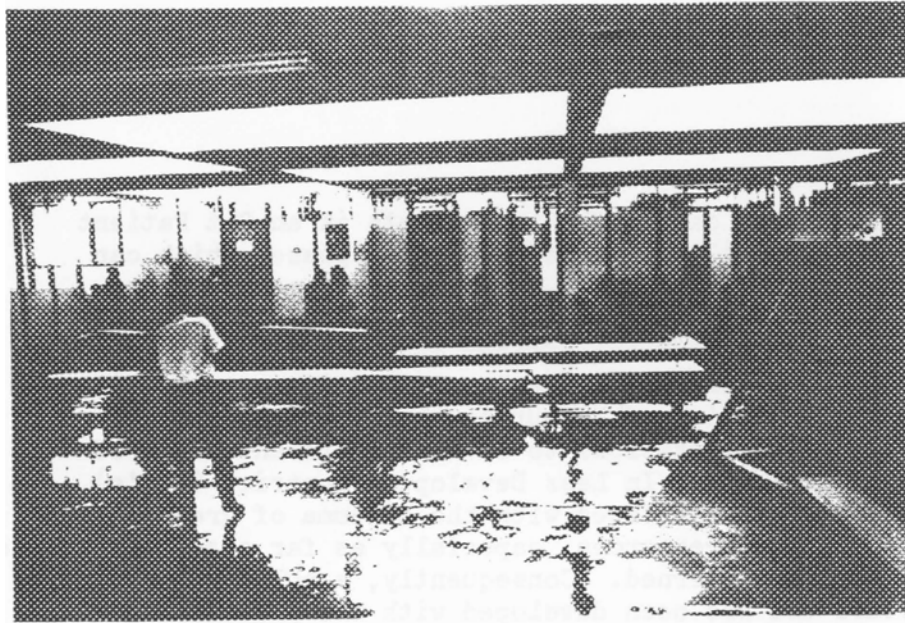
In the first two cases, the patient has to be attended by a clinical officer or a doctor, whereas in the third case treatment can be given by a nurse.

Consultation does not involve any manipulation of the patient and the only furniture required is chairs for the patient and the clinical officer and a desk.

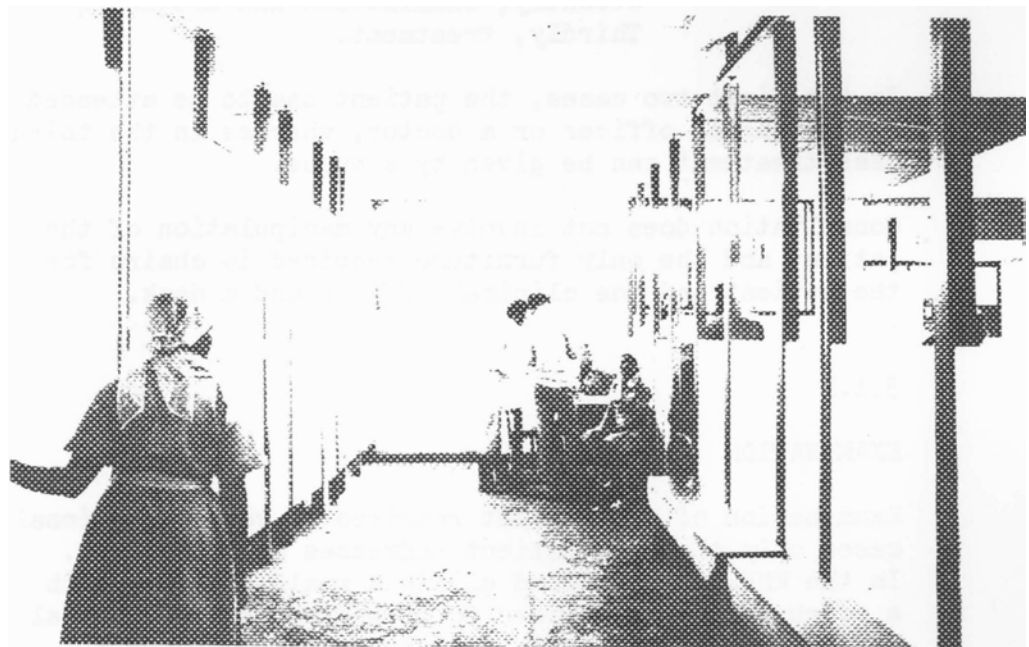
3.1.1

EXAMINATION

Examination of the patient requires in very exceptional cases only that the patient undresses and lies down. In the KNEPOROS designed clinic a small cubicle, with a couch has been provided to be shared by two clinical officers. But the cubicle is seldom used indeed - the bulk of the examinations take place while the patient sits on a stool in front of the clinical officer.



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The examination room.



It is noteworthy that in all observations, the examined patients were seated close to the clinical officer, almost between his knees, and never behind the table. In Europe, a greater physical distance between doctor and patient is kept. Instruments used during examinations are mainly a stethoscope and blood pressure meter. For diagnosis, the clinical officer needs a desk and sometimes reference books. Although the spacial requirements for these first activities are extremely limited, the design and position of the examination rooms is quite crucial. As all patients will have to pass here, there is an enormous pressure on the unit which often becomes the bottleneck in the OPD production flow.

3.1.2

TREATMENT

The following activities, where the actual treatment is administered, are far more complicated and require quite elaborate room arrangements. The actual treatment consists of administering injections and of general treatment. The two functions are usually separated and executed in two rooms. As a very large proportion of the patients receive injections and it is desirable to keep a high hygienic standard here, it is justified to separate this function from the other types of treatment. In the dressing room a large range of different treatments are given. Some of these are cleaning of wounds, removal of bandages, application of ointments, etc. All this makes it very difficult to maintain the same high level of cleanliness as is required in the injection area all the time.

The treatment itself also requires different spatial arrangement for the two types of treatment and this is another factor why separate rooms for each of these functions are desirable. Therefore, most clinics organise the medical treatment into three separate rooms: examination room, injection room and dressing room. In very large Out Patient Departments, as is the case in regional hospitals, even more subdivisions can be justified. But in most other OPD's, these three spaces are accepted as essential elements.

The three described units form the heart of any OPD, be it in a district hospital, a health centre or a dispensary. The actual work load of the OPD may vary widely and necessitate a far greater capacity in one unit compared to the other, but the functions and the work routine in each of these units are well defined. We will address ourselves to the problems of capacity and flexibility later and first review what some publications have stated on this subject.

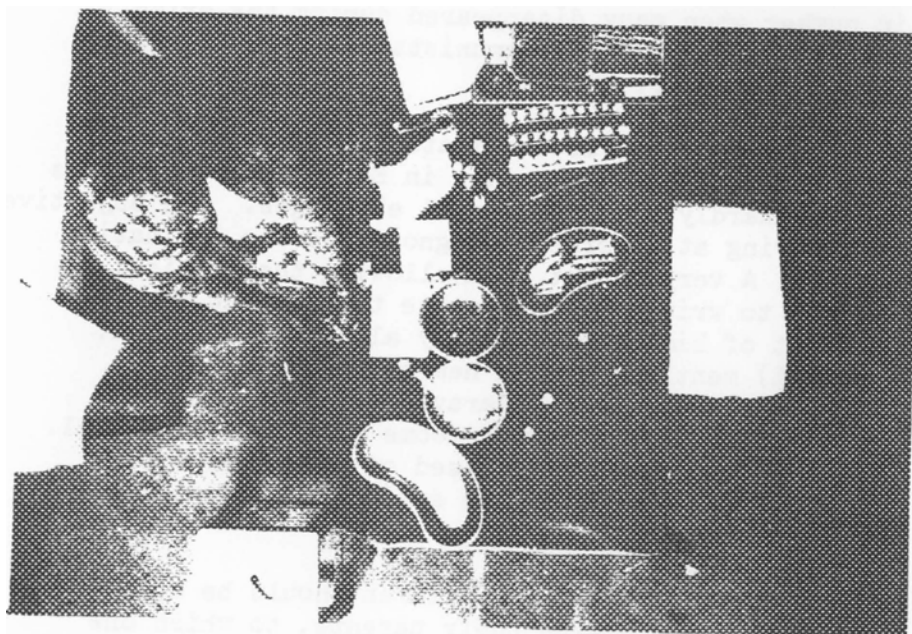
Cavaredo (13) noted in Latin America a consultation examination time was 10 - 15 minutes per person whereas Cammack reports this to be 3 - 10 minutes in Britain. Our own observations in Indonesia (1966- 1971), Ethiopia (7) (1969) and Kenya (8) (1970 and 1976) suggest that the consultation examination time is much less than that. In district hospitals the OPD's are in these countries receiving between 600 and 1000 patients a day and the average time is therefore reduced to 2 - 3 minutes per patient. It was interesting to note that the number of patients in the district hospitals in Indonesia dropped dramatically between 1966 and 1971 when free treatment was abolished. Examination time was however found to be largely the same as before. An explanation that was given to us argued that the rural medical staff had been reduced in number when many disappeared during the drive against socialist and communists when the military regime took over.

It is obvious that if examination time is so drastically reduced as is the case in East Africa that this time is hardly used for social exchanges. The objective of arriving at a correct diagnosis is the dominating motive. A very modest room allowing the clinical officer to write and to examine the patient sitting in front of him is practically all that is needed. King (11) mentions that a nearby couch is needed even if seldomly used. Cavaredo (13) argues that all consulting/examination rooms should be identical. The KNEPOROS proposal is based on pre-examination and filtering in which case a simplified examination room would suffice.

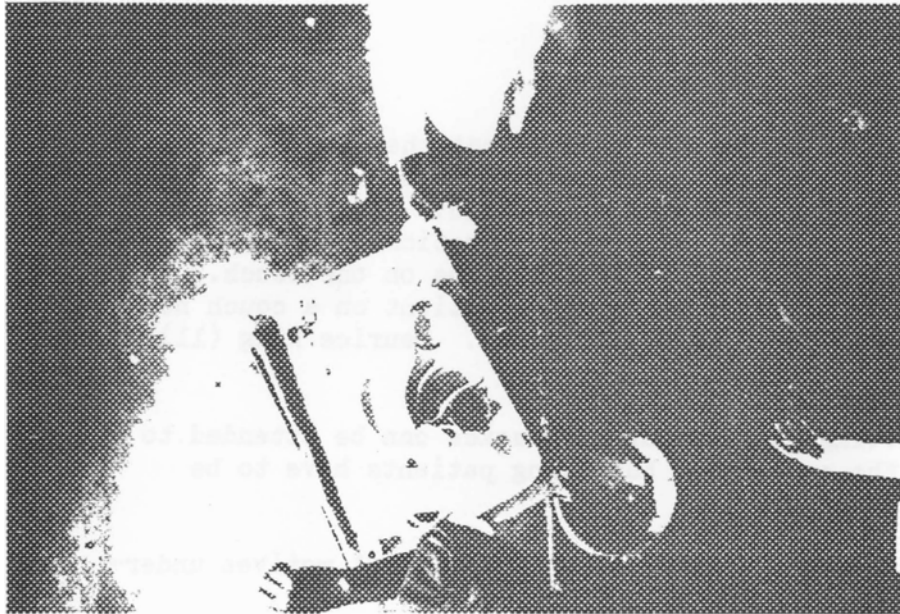
Mein (9) points out that children should be allowed to enter the room with their parents, to which one readily should agree.



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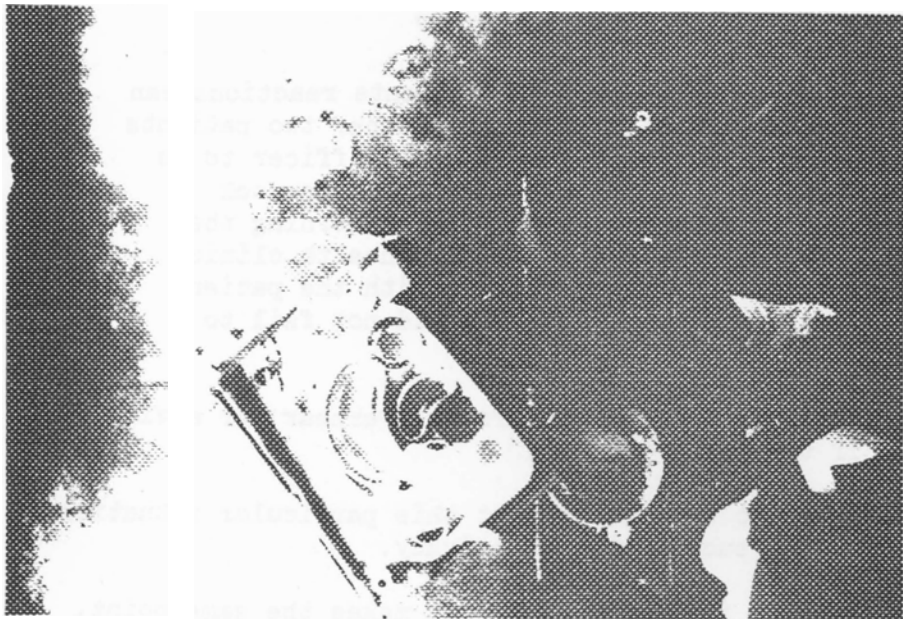


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The KNEPOROS dressing room:

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The KNEPOROS dressing room:

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It can, however, be argued that the room should be kept small to make it difficult for other patients to crowd the room before they are called. Cammack stresses the need for privacy during examinations especially in connection with the examinations on the couch. Several authors seem to feel that a patient on a couch needs to be shielded from observations. Maurice King (11) states that:

"Sitting patients of both sexes can be attended to in the same room, but lying patients have to be separated."

He does not elaborate on the cultural motives underlying this statement.

The question of privacy has concerned many authors and arguments against elaborate arrangements to assure privacy can sometimes be found. Svart (6) seems to argue that efficiency is more important than privacy:

"As ailments are usually of a minor nature, the patients do not object to being overheard" and he explains further on:

" the normal procedure is to have two patients at the desk simultaneously"

One can question whether the patients reactions can be assessed as easily and also whether two patients at the same time helps the clinical officer to be more productive in his examinations. Cammack mentioned an interesting opinion concerning the consultations in a mother - child health clinic. A nurse made a point of talking with the patient in such a manner that others could not fail to hear:

"She wanted the other mothers to overhear her advice even if they were too shy."

It is easy to understand that this particular situation can justify such breach of privacy.

David Morlye in King's book (11) makes the same point, relating it to Under-fives Clinics in Nigeria.

In a general OPD, however, the patients are likely to resent such attitudes and Cammack agrees that here the subjects are of a more individual nature and that **privacy is a justified need and that arrangements** be made:

"..... such that medical consultations cannot be overheard"

Moss and Anderson report that:

"..... the West Middlesex and Mayfield investigations recommended the abolition of changing cubicles and in principle they both supported unbroken consultation and examination." (14)

And indeed, given the heavy workload and short examination time, there is little need for arrangements with changing cubicles when few patients are examined so elaborately as to require undressing.

Most literature agrees that handwashing facilities in the examination room are required.

KNEPOROS concluded its series of operational studies with the general principle of a continuous patient flow through the rooms and tried to prevent a backflow. Mein (9) also points out that:

"the doors should open into the room and not into the waiting crowd."

A through flow does, however, only function if there is an effective call system. KNEPOROS installed buzzers, but still needed sometimes a guard to prevent more than one patient from entering the room. It seems indisputable that a through flow as applied by KNEPOROS can increase efficiency considerably.

The observation of colour changes in different parts of the body gives vital indications for diagnosis. Light conditions are therefore important.

Cammack points out that the patients must face the light and indeed we have found that light conditions have not always been taken into consideration in the layout of examination rooms.

In spacial and physical terms, the requirements of the examination room are thus very modest. There is however one principle which applied to all the treatment rooms, and which should be observed here as well: the zoning of different types of activities.

Cammack argues that three types of areas should be distinguished:

- a) public area (staff will not enter)
- b) staff area (patients have no access)
- c) clinical area (staff meets patients)

As we will see later in this report, much confusion in the treatment rooms could be traced to a lack of respect for such zoning. It is important that the principles of zoning physically are expressed so clearly that convenience will restrict the staff and patients within their respective zones.

Although this study addresses itself to the internal layout of treatment rooms, the question of zoning and patient flow is of such importance that the links with other parts of an OPD have to be considered. The study contains, therefore, a chapter on waiting and queueing.

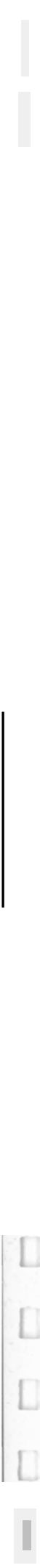
Other elements of the OPD which the patient might have to visit are the pharmacy and the laboratory. Not all clinics have a laboratory and the study of this function could for reasons of time and resources not be included in this project. It should be noted, however, that the examination of stool, urine and blood samples constitute an important part of a detailed examination. The patient should therefore easily find his way from the examination room to the laboratory, where he should find a toilet to produce faeces or urine samples.

Likewise the patient should pass the pharmacy on his way out and find waiting facilities as not all prescriptions can be dispensed immediately.

The pharmacy has been included in this study because of the successful system of standardisation and pre-packing which KNEPOROS system with coded prepacked drugs seems to have many advantages and is eminently suitable for health centres and dispensaries. The great use of low qualified staff in this system makes it especially attractive in the rural areas where staff shortages hamper many health institutions.

3.2.0

THE EXAMINATION ROOM



3.2.0

THE EXAMINATION ROOM

The examination room is the place where the patient is interviewed and examined to receive a diagnosis. The whole treatment of the patient is determined by this diagnosis and examination is therefore the most crucial step in the treatment process.

In a normal outpatient department in basic health institutions - dispensary, clinic, health centre and district hospital - this examination determines easily identifiable conditions only. More difficult examinations are usually made higher up in the referral system by more qualified, specialized and better equipped medical staff. In relatively few cases a more than superficial physical examination is made at the basic health level and from time to time a patient is asked to come back for a final diagnosis after laboratory tests have been made. Tests can be stool or blood examinations but bacteriological tests are practically never made at this level.

Examination is usually more than anything else the activity which determines the capacity of the Outpatient Department. All patients have to pass this section and here one finds the most qualified staff.

Although the process of examination differs very little in the outpatient departments around the world, it can be organised in many different ways. Each system will thus adapt its spatial arrangement, e.g. the examination room in a different way. The organisational work in the examination room will determine its shape and equipment.

Diagnosis consists of one or several of the following steps:

- a short interrogation
- pulse taking
- ocular examination of parts of the body
- manual examination of skin or organs
- measuring blood pressure

One of the important conclusions of the Machakos study (3) was that the very qualified staff in the examination room was spending a major part of its time doing little qualified work. Indeed simple clerical work prevented the clinical officers and physicians to be effective in the diagnostic work and it was reported that almost 70% of their time was devoted to administrative tasks.

The Kneporos project sought to utilize these findings in a different organisation of the diagnostic department.

There was in the first place the separation of administrative and diagnostic tasks which was achieved by employing a clerk.

Secondly, two measures were introduced to facilitate the organisation of the diagnosis itself; by coding the most common diseases and the treatment and by a filter system which separated patients in need of close examination from very obvious cases and from patients returning for continued treatment.

The filter system constituted a very swift first selection and reduced the pressure on the real examination room.

In the filter station recurring patients, very light and very serious cases are filtered out from the patient queue so that the second line of examination would have a much reduced workload.

The patients who are filtered out will be referred either directly to the treatment stations or for qualified diagnosis to a medical officer e.g. a qualified doctor. The very swift examination in the filter station is usually restricted to asking a few questions and does not include a physical examination.

The real examination then takes place in the second line where a group of clinical officers is ready to deal with the much reduced flow of patients. In spite of this reduced pressure, consultations proved to be very short indeed, the

average for several series of observations was 2.2 minutes per examination. In 14% of the cases the patient would not even sit down and a full third of all the consultations would last less than one minute. During several consultation days it was noted that not a single patient was asked to lie down on the examination bench in the cubicle.

The diagnosis and treatment.. prescription are directly noted in coded form on the patient card and this is later registered in a ledger by a clerk who awaits the patient in the next room. This separation of administrating and diagnostic tasks is one of the important changes introduced in the KNEPOROS project.

The KNEPOROS system seemed to be working satisfactorily and the quality of **diagnosis** proved to stand well under the higher speed and efficiency. Repeated treatment and diagnosis evaluations within the KNEPOROS project showed encouraging results in this respect.

The examination rooms in the KNEPOROS project were dramatically reduced in size and equipment compared with the facilities of any other known outpatient department.

The room itself is based on a through-flow design. Patients are called by a buzzer signal, enter and face the clinical **offieer** who is at a table. The patient is usually asked to sit right next to him and often the questions start before the patient is seated. The 4.8m² room has a small book-shelf and a hand basin; a 2.8m² cubicle with a couch is shared by two examination rooms but is only infrequently used. After receiving the card with the prescription again the patient leaves the room through the opposite door.

The size of the examination room was thus in total only 6.2m². In existing health buildings as well as in national recommendations the size of examination rooms varies between 12m² and 20m². In European O.P.D's much larger dimensions are common, with only two examination rooms combined with a doctor's office, which only functions as consultation room.

From frequent observations in O.P.D.'s in L.D.C.'s, it is, however obvious that only a small space is needed for the examination as such and that increases in the room size often lead to difficulties in patient flow control. It is also clear that the presence of other patients in the room is a distracting factor and effects the diagnostic work negatively. The physical separation of the administrative and the medical part of the diagnostic work increased not only efficiency in the KNEPOROS project but contributed also to greatly improved attention for the patient.

3.2.1.

METHODS

The examination and consulting function in the O.P.D. requires little space and involves few people: usually the clinical officer and the patient only. As we have seen above, there are very few activities taking place and very little equipment is used. The spacial relations and requirements are therefore much simpler than in the other departments which our study took up. Still because of the importance of the examination itself and the bottleneck-effect it has on the whole patient flow, it justifies close observation.

And indeed our previous surveys of O.P.D.'s had shown that the confusion caused in and around the examination process was often right at the very heart of the operational difficulties of the entire department.

From the methodological point of view we noted at an early stage that full scale studies and simulations would be of limited value in the examination room. The spacial relations and the patterns of movement are few and all quite simple in the examination room.

Observations presented themselves as an important method and combined with the study of the basic dimensions for the activities, most of the needed information could be acquired in this way. The full scale study was therefore very limited

in its ambitions and the short series of simulations had a limited value. It was interesting however that in the examination room and the filter station the functional dimensions did not determine the optimum design. As the series of simulations took place in a gradually reduced room it was found that psychological reactions limited the further decrease of the space before the functional needs did. When these rooms are tightly shaped around the smallest needed space for the activities, very small cells are a result which easily provoke claustrophobic reactions from both staff and patients.

The study consisted of a review of existing designs from various countries, long series of observations, including camera registration and time taking, measuring of space needs for each activity and interviews.

3.2.2.

EXISTING DESIGNS

The problem of capacity has been the leading motive in most examination room designs.

The need to see as many patients as possible per day has led to various solutions, which usually reflect simultaneously the level of economic development as well as the society's attitude towards the individual.

At the one extreme, one finds the "Bantu" polyclinics in South Africa where it is "general practice to examine more than one patient in the consulting room at the time." (6)

The efficiency of the doctor is so highly priced here that: "The normal procedure is to have two patients at the desk simultaneously ... and depending on the number of couches available, one or two patients awaiting physical examination"

(6) At the other extreme, one can see many European systems where one doctor can receive one patient in a consultation room while in two adjacent examination rooms other patients undress and await physical examination (14) with all privacy and comfort.

In these solutions the doctors' suites cover 25-35m² and here the organisational set up has avoided all patient flow problems by an individual call system.

Most LDC's have tried to find solutions in between the two and to combine consultation and examination in one room.

Only one patient at the time is planned for, although flow control often proves to be insufficient. The normal area for the consulting room is 12-18m² as can be seen from the table below.

EXAMINATION ROOMS IN DIFFERENT DESIGNS

	Floor areas	Separate Consultation	Through flow	Several patients served at once
ROYAL TROPICAL INSTITUTE	35	yes	--	yes
KNEPOROS 1971	20	yes	yes	yes
Ethiopia 1969 (Nimpuno)	18	--	--	--
Hospitals in Developing countries	17		--	--
Sharon, Israel		--	--	--
Kenya 1970 (Nimpuno)	16	--	--	--
Mein (Kenya) 1975	15	--	yes	--
Centrala Sjukwards Beredningen 1966	15	--	--	--
SPRI 1973	13	--	--	--
Tanzania (Cornworks) 1974	13	--	--	--
White Arkitekter 1974	12	--	--	--
KNEPOROS: Filter room (1976)	7	--	--	--
KNEPOROS: Consultation (1976)	5	yes	yes	--
KNEPOROS: Examination Cubicle (1976)	3	yes	yes	--

* Studies referred to in the table have directly or indirectly contributed to the preparations for the KNEPOROS and k)r our tests in Kiarnbu.

In all the studied examples, the examination room was equipped with a desk, a hand basin, a cupboard and a couch, sometimes in a cubicle. All reports mention that the couch very seldom is needed, but should be there. In most of the existing O.P.D.'s it was found that occasionally several patients could be in the examination room against the intention of the design. The bigger the room, the more people would be likely to press themselves inside, but minimum dimensions would be no guarantee for a total flow control. Indeed even in a five square meter cubicle in the KNEPOROS clinic we found one day six adult patients crowding around the clinical officer.

A smaller room will usually make patients somewhat reluctant to enter before their turn. The examination routines are so simple and the patient is constantly under so much supervision that there is little need for zoning between service and patient areas. Mein (9) is alone in this preference for a "restricted" staff area in the examination room.

The separation of consultation and examination in the European solution presupposes a frequent use of the couch; in L.D.C's at the other hand there is no time for such thorough examination; the diagnosis can usually already be reached during the consultation.

The two functions are thus combined in one room, the patient flow is increased, and only a few cases are taken to the couch. This observation led to the conclusion of the KNEPOROS team that one couch could be shared by two clinical officers and as a result the separation of consultation and examination was re-introduced.

But where the European plans show one consultation room with two examination rooms, for Kenya the Kneporos team allowed two consultation rooms to share one examination cubicle. Our previous surveys in several L.D.C's showed indeed that the couch seldom is used in the O.P.D. ' and observations in Kiambu revealed that the normal diagnosis routine only exceptionally would include its use.

The removal of the couch from the room then changed its layout drastically and allowed for a remarkable reduction in floor area.

3.2.3

FUNCTIONS AND DIMENSIONS

As we have seen in the first section (3.2.0) of this chapter, there are only a few activities in the examination room which determine the minimum dimensions of the consultation and examination rooms. We have also remarked that the strictly functional space requirements would give such small rooms that the users start rejecting the space on other grounds.

In the KNEPOROS project the room was gradually reduced in the course of the frequent lay out changes, as it was discovered that even smaller rooms would be functional.

It is, however, useful to review the space requirements for the most basic activities as studied in Sweden, Peru and at Kiambu. These are in the first place the activities of the clinical officer alone: writing, and washing hands. Then, there are the interactions between him and the patient: Interrogation, pulse taking, measuring blood pressure, ocular and manual examination. The first activities take place at the consultation table and the latter activity on the examination couch.

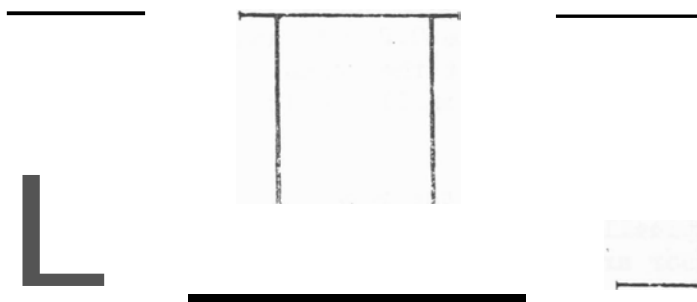
2. 60

The KNEPOROS Filter Station



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2.....0



The KNEPOROS Examination Unit:

Two consultation rooms sharing one examination cubicle.

SPACE REQUIREMENTS

Minimum Areas for Basic Activities

Activity	Peru/ Caravedo (a)	Sweden/ Nimpuno (b)	Kiambu/ Nimpuno (c)
Using Hand Basin	40 em x 90 em	65 em x 90 em	65 em x 80 em
Writing at desk	60 em x 90 em	10 em x 120 em	60 em x 90 em
Consultation at table	130 em x 120 em	140 em x 110 em	120 em x 110 em
Patient examination couch	135 em x 180 em	115 em x 180 em	130 em x 170 em

- a) The Caravedo study was executed at the Medical Architecture Research Unit (M.A.R.U), Northern Polytechnic- London, as a feasibility study for Health Facilities in Peru.
- b) The Swedish study concerned conference facilities in Sweden and covered a survey of Swedish human dimension publications as well as direct human studies at the Building Function Laboratory in Lund.
- c) The Kiambu figures are the dimensions measured in full scale test at the research facility in Kiambu as a part of this study.

The question of the need of a couch for examination now becomes important because the elimination of the couch in the room would drastically reduce its dimension.

The process of diagnosis in Outpatient Departments in L.D.C.'s, as virtually all authors agree, - given at the one hand the volume of wcr : and at the other hand the limited professional scope of the para medical staff*, excludes any comprehensive medical examination in the OPD. In all cases, if such an examination is necessary, the patient will be referred to more specialised levels in the medical care system. In the examination room most diagnosis are made on the basis of consultation and a quick "feel" of the concerned part of the body. Physical examination in the sense of surveying various complementary indications rarely takes place.

*Variously called Health Officer (Ethiopia), Medical Assistant (Tanzania and Uganda) and Clinical Officers (Kenya).

At the same time all agree that certain patients have to be examined, even if they are exceptions.

In many designs (Ethiopia, Kenya, Mein, Tanzania, White, from the table on page 118) attempts were made to place the couch in a separate zone of the examination room.

Where the European solutions reflect the frequent use of the couch because of the quite comprehensive examination routine, the O.P.D. 's in the L.D.C. 's are faced with the opposite situation. The European solutions provide, therefore, several examination spaces for each consultation room. In the L.D.C. 's it is justified for two consulting rooms to share one examination space.

The design constituted a radical change in the design of the examination rooms of the OPD which greatly simplified the room layout and reduced the dimension of the composite units. The result is a remarkable net saving in floor area. The combined area of an examination cubicle and a consultation room of (8 m²) is much less than the economic designs of Comworks/Tanzania (13m²) and White/Kenya (12m²). But since the examination cubicle is shared by two consultation units, the real floor area is 12.5 m² or less than 6.5 m² for one unit.

Recognising that these dimensions are very small indeed, various attempts were made to test both functional effects and staff reactions to increased or reduced rooms. In a series of gradually reduced rooms we were unable to find any indication that the KNEPOROS layout of the examination unit was under dimensioned.

A possible argument for a further reduction of room size in order to control the patient flow more easily could be made. But the observations of a long series of consultations led us to the belief that other factors than the room dimensions would cause such patient "pile up".

A faulty buzzer, the occurrence of back flow or the absence of the waiting room attendant would usually be the direct reason for such irregularities.

As a result, the conclusion could be drawn that the examination rooms were well dimensioned and that the filter station could be reduced if necessary, but that a spacious filter cubicle might have psychological advantages.

Survey : EXAMINATION ROOM

1. Calculation of minimum dimension for

- sitting CO
- standing and sitting patient
- couch cubicle
- patient circulation

2. Room qualities: (observation/registration)

light conditions ventilation
wall and floor finishes noise
privacy

3. Furniture and equipment (measuring)

Simulation can take place in existing space, no special arrangements needed.

3.3.0

THE INJECTION ROOM

3.3.0

THE INJECTION ROOM

Injectons are an important treatment in the OPD's in the LDC's because the treatment is given by professionals, assuring that the drugs really get into the patient's system. Tablets and mixtures which the patient has to take without supervision are less reliable in this respect. The instructions are not always well understood and the necessary discipline for the use of the drugs is another uncertain fact. An additional consideration is the patients positive attitude toward injections, which not seldom are regarded as the true form of western medicine.

Therefore, injections have become a predominant form of medication in East Africa. In the Machakos studies it was found that 282 injections per 1000 patients were given (14) whereas the KNEPOROS team recorded the figure of 138 injections per 134 patients (12).

Different from the practice in the dressing room, in the injection room all patients and their treatment has to be recorded, a procedure which used to take a considerable portion of the nurses total working time.

In the KNEPOROS project this was changed with the presence of a clerk in the injection room to do all administrative work connected with patient treatment. The employment of the clerk was wholly in line with the aforementioned principle of executing each job by the least qualified person capable to do the work and thus freeing more qualified persons to do the more qualified work.

The number of different types of injections can be quite large.

There are many different drugs on the market covering the same health conditions. Maurice King agreed (11) ten years ago that standardised medication would simplify OPD work without reducing the standard of health care. The administering of one injection of 0.25 MU Tri plopen instead of five injections of 0.04 MU of PP7 would have the same effect.

Such simplification would not only reduce the workload in the OPD but also reduce the treatment costs from shs 1.25 to shs 0.55 per patient. (14)

In addition to these, other vials with drugs are kept to administer noncoded injections for the less usual conditions. The nurses sit or stand at the table with the drugs and administer the injection to the patients who are brought to them.

All the vials are on the table, together with bowls with clean syringes and needles. After each injection, the syringes are emptied and the used syringes and needles are dropped into kidney dishes to be sterilised later. Sterilisation takes place continuously in the same room with an electrical steriliser. The drugs and hypodermic syringes are taken to the casualty department after the day's end and brought back the next morning. Practically all injections are given in the buttocks. Adult patients take them when standing behind a curtain, small children standing with their mother or lying on their mother's lap. In some clinics the patients are lined up in batches of five at the line (as preferred by Dr. Jorgensen of the Flying Doctors) in other clinics they are entering in a continuous line. The injection room has almost always a heavy workload and in all the OPD's we have visited there was a tendency among the patients to crowd into the room long before they were due to be attended to. This would, in many cases, make it very difficult to keep acceptable working conditions. Crowd control, or flow control, is therefore a pressing need in injection rooms, not in the least because of the difficulties in keeping instruments sterile and to maintain a good general cleanliness in the room.

The present working methods in the injection room leave little scope for radical changes in the work routine and by consequence for the special requirements. It is hardly conceivable that the work will become mechanized in the future. Two developments which might occur is firstly the use of injection guns instead of hypodermic syringes and secondly the storage of the drugs within the injection room in lockable refrigerators, neither of which would alter the room requirements to any noticeable extent.

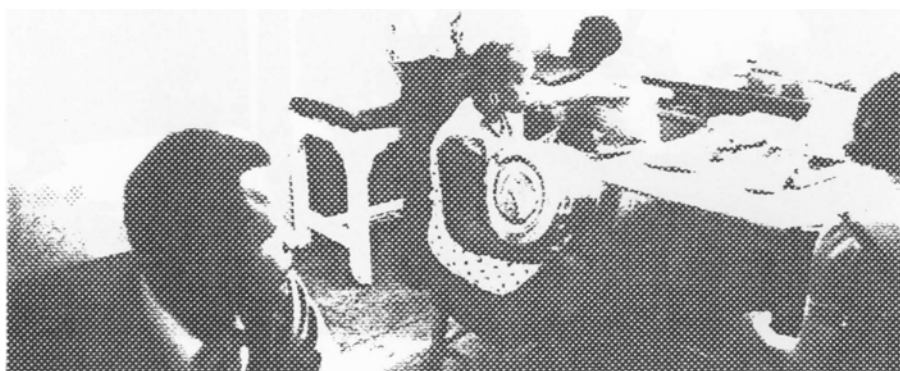
The principle of traffic separation - that is staff areas and treatment areas - a clear circulation pattern, and hygienic finishing of walls, floor and furniture are three factors of importance. The patients should be helped in a well lit area and adequate ventilation is necessary.



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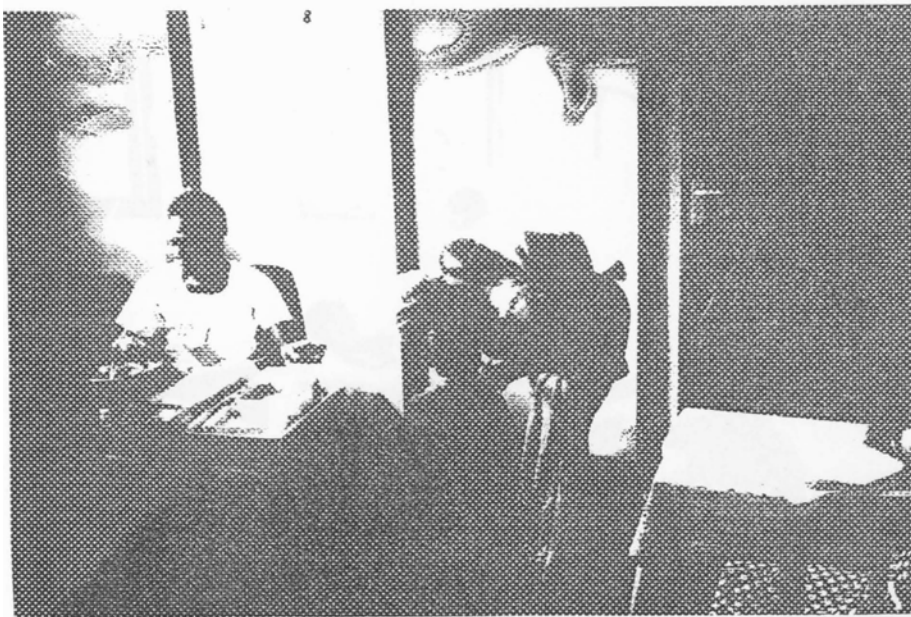
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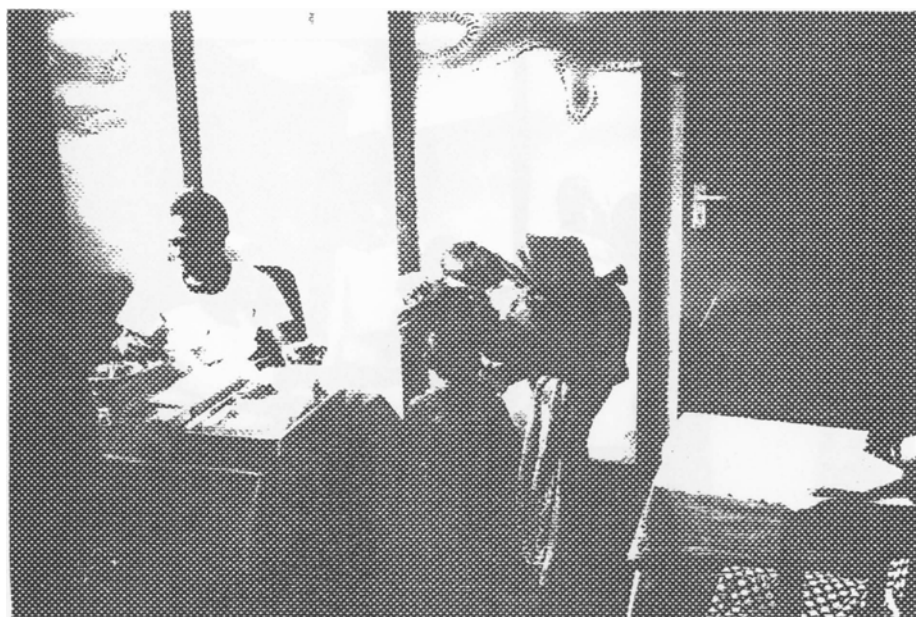
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the third after-nai,le of the infection room: in
 circulation.
 Circulation the clock table: in a space of .90 K 80 cm
 five adults and a child could be standing.



the XNEPOROS injection, room -

The patient is lying on the table while the nurse is
 to inject a child lying over her mother's knees. Adult
 patients will be behind the curtain and then the nurse
 will give the injection through the patient in the chair.

3.3.1

THE KNEPOROS INJECTION ROOM

The injection room measures 4.40 x 4.40 *em* giving a flow space of 19.4 m².

The staff desks are positioned next to a couch with a curtain around it and the patients circulate through the room around the staff. Adults pass a clerk and enter the couch cubicle to receive an injection through a split in the curtain while children move around the tables. The arrangement allows for the simultaneous treatment of two patients with the next and third patient already in the room submitting his card for registration. Both the nurses have the drugs and syringes within reach and can treat patients on either side without having to leave their chair. They have no administrative tasks and only need move from the table when using the steriliser and the sink.

The great disadvantage of the lay out is the lack of zoning. There are no clear staff, patient or treatment areas and the mixing of these functions creates confusion. The most important features of the KNEPOROS system is the introduction of prescription codes, the registration of the perscriptions by a clerk and the standardisation of drugs.

The organisational principles of the KNEPOROS injection room had been based on the studies in Machakos by Vogel and Dissevelt (3), considering:

- (a) The long waiting time (over 40 minutes) for the patients;
- (b) The prescriptions which were given without considering the workload in the injection room or the injection costs;
- (c) The complicated registration procedures taking much of the nurses' time.

The question of waiting for injections relates to different factors. In the first place, it seems that the capacity of the injection room in terms of staff organisation and space often is not in balance with the workload. Secondly, the workload is determined by the diagnosing officers with little consideration for the conditions in injection rooms. This is quite common in Out Patient services. Our earlier observations in Indonesia showed lack of coordination between prescription and treatment implementation.

The question of organisation of the work and space is also of vital importance. In an injection room there are a great number of patients with a very stereotyped treatment. Nowhere in the OPD can the principles of a continuous patient treatment be so effectively applied and will be so beneficial for patients and staff alike. But the "batch" system as studied by Vogel in Machakos is still quite common in East Africa. A dozen patients are admitted into the injection room at the same time and then treated. New hypodermics are thereafter prepared for a new batch of patients who, in the meantime, wait for their call. It seems obvious that little consideration is given to privacy. One of the reasons for this system is the different types of work, e.g., administration and treatment the staff has to fulfil.

The KNEPOROS system has used several methods to simplify the work in the injection room, and holds several advantages over the "batch" system.

Firstly, there is the separation of administration and treatment by assigning a clerk to the injection room who will do all the registration work. This is fully in line with the policy of letting each task be performed by the least qualified person able to do the work. This allows the nurse to concentrate on medical tasks and to work more continuously.

Secondly, by giving preference to standard medication and reducing the number of prescriptions. The use of codes again reduces the writing work.

Thirdly, as a consequence of these two improvements the replacement of the batchsystem with a continuous patient flow. The consequences for the room organisation are considerable and although the KNEPOROS team had no designer, the IR design became much more effective and economic than previous designs.

The layout of the room and the organisation of the work makes the patient move and allows the nurses to stay in one place. Almost all they need is within reach and they can therefore sit at the table instead of standing during the injection as is the case in most injection rooms in Kenya.

The public reacted strongly against this plan and even sent a protest to the President because it was taken as a sign of laziness and carelessness of the staff than they were working while sitting.

It took some time before it was generally understood that the smoother KNEPOROS system was advantageous for all.

The following sections will show, however, that the physical arrangements did not fully utilize the organisational improvements of the KNEPOROS system.

The flow of patients was found to be far from smooth. The light conditions in the KNEPOROS lay out were found to be less than satisfactory.

The lack of zoning constituted a serious drawback and made it difficult to maintain a desirable hygienic standard.

The height of the sink is unsuitable. The sterilizer is too high for the staff to be handled according to instructions.

These and other shortcomings were observed during the first phase of the studies and the test programme was used to study all the disharmonies between the organisational intentions and the physical arrangements. As will be seen here, functional design stands in contradiction to flexibility and in spaces with a well defined use, a detailed study of movements, dimensions and flow can give a design that is both more economic and more effective.

3.3.11

DESCRIPTION OF THE TREATMENT IN THE KNEPOROS INJECTION ROOM

The lay out stresses 3 principles:

- a) The smooth flow of patients through the room
- b) The possibility for two nurses to work symmetrically*
- c) The possibility for the first nurse to register patients in the clerk ledger without moving from the stool when the clerk is absent.

Two categories of patients are distinguished in the injection room:-

- a) Adult patients
- b) Children of 10 years and less, mostly accompanied by relatives.

These two categories are proceeding into the injection room in the same queue until they are registered by a clerk (or when the clerk is absent, by a nurse). After registration (a) and (b) proceed to treatment in different ways.

Adults are directed behind a curtain where they mostly stand to receive the injection through a split in the curtain. Sometimes adults are asked to lay down on a couch (also where fainting patients are laid down). After injection adults will leave the room through the exit door.

Children are directed towards a stool in front of the nurse. Almost all patients of category (b) **are accompanied** by a relative who holds the child on their knees, sitting on the stool, to prevent the child from making sudden movements when the injection is given. After injection, the child leaves the room through the exit door.

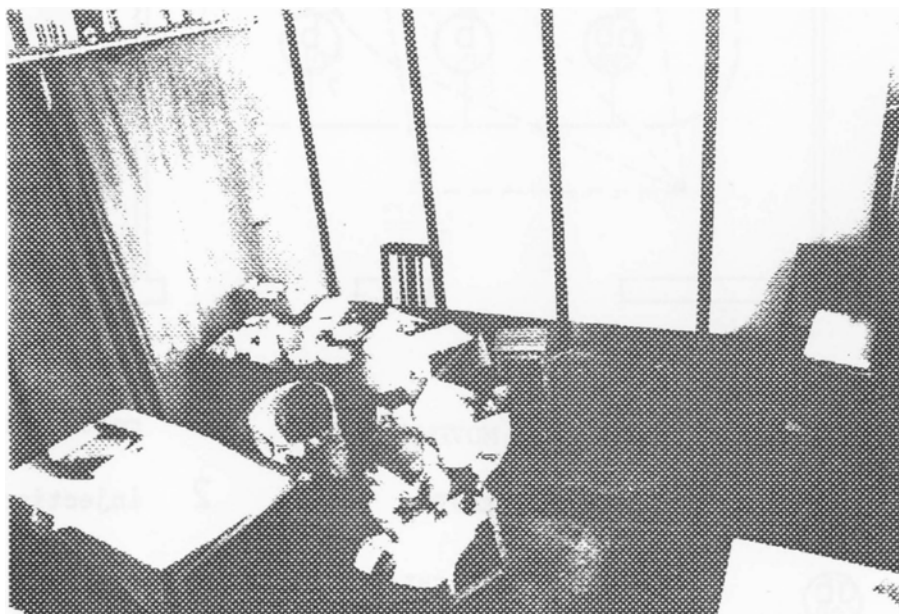
*Symmetrically here means: To do the same work simultaneously.

*The KNEEPORE Injection
Room:*

*1.21; //1'e8 'D) r-cf-r i;217.T -;:
-4-lr; 0/1 -r...l'ed
behind the curtain
and children (b)
treated on the chair
next to the nurse.*

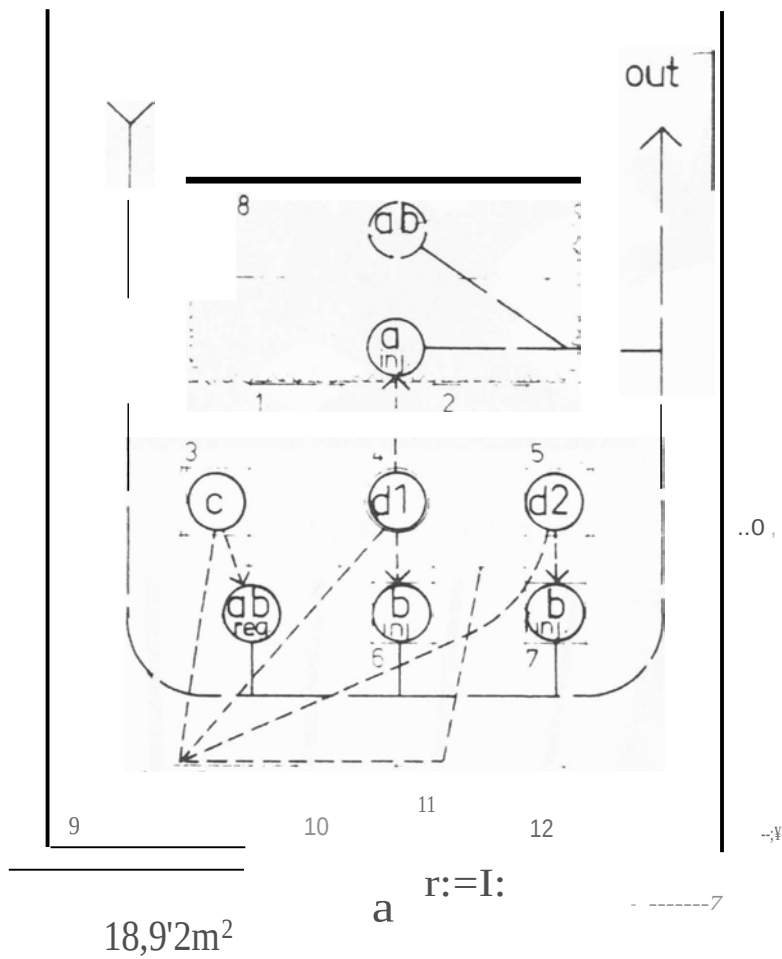


Injection to patient category A



Injection to patient category B





	PATIENT'S MOVEMENTS	1	registration table
	STAFF MOVEMENTS	2	injection table
@	both patient categories: registration	3	chair
Ⓡ	injection place for adults	4	revolving stool
Ⓡ	injection place for child	5	chair
Ⓡ	clerk	6	stool
		7	stool
Ⓡ	rst nurse	8	couch
Ⓡ	II nurse	9	sink
		10	cabinet
		11	sterilizer
		12	cabinet

3.3.13

THE STAFF OF THE INJECTION ROOM

The following persons are working in the injection room:-

- c) The clerk
- d.1) The first nurse (permanently on duty)
- d.2) The mobile nurse (working actually in the casualty room but often assisting in the injection room due to the fact that the work load in the casualty room is irregular).

The clerk is sitting on a chair at the registration table with his back turned at the patients' queue. Patients are passing behind him and will stop at his right side, where the patient's card is put on the table. The clerk will copy the patients data and prescription in the ledger. The clerk is also supposed to control the flow of patients to the injection place.

The first nurse waits the patient seated on a stool at the injection table. She receives the patient's card from the patient himself or she will turn around and collect the patient's card from the clerk's desk. Then she places the patient's card on the injection table, reads the prescription and selects the right drug. When the injection is ready the card is returned to the patient (sometimes the card will remain on the injection table until the injection is administered, at other times the nurse turns around and reads the prescription directly on the clerk's desk). The nurse then picks up a clean syringe and a clean needle from a kidney dish, collects the prescribed drug, fills the syringe, takes some disinfected cotton from a metal bowl on the injection table and administer the injection to adults on her left side behind the curtain or children on her right side.

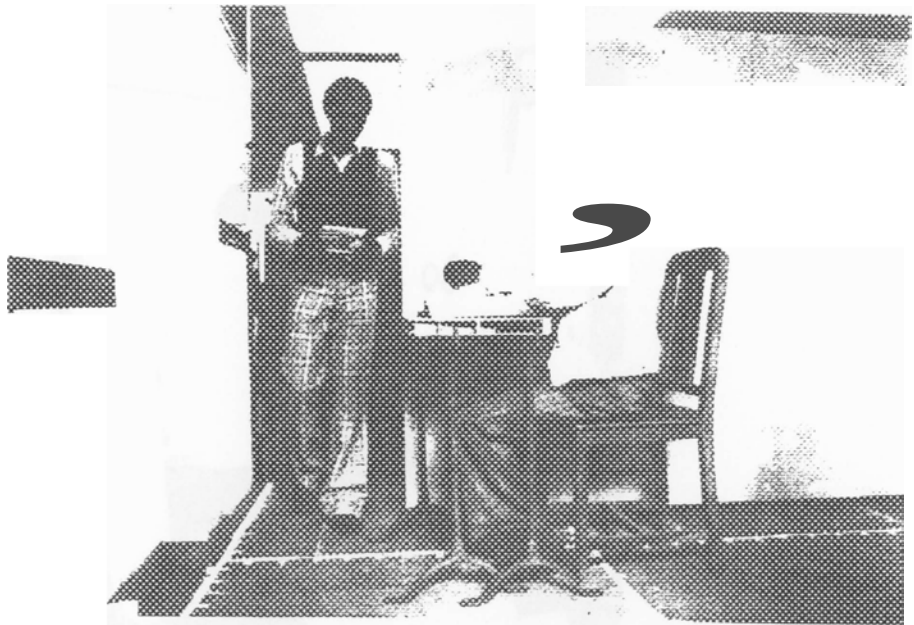
After this, the nurse will clean the syringe by filling it with water from a kidney dish. She then empties the syringe in a basket placed **under the table** and puts the syringe in a kidney dish. From time to time the nurse uses the steriliser. She takes out clean syringes and re-fills it with used ones. Then the nurse lifts out the strainer. She will let some water run off, puts the strainer on the table, and places the sterile syringes in a kidney dish.

After this, the nurse collects the dirty syringes and injection needles, rinses them in the sink with water and places them in the sterilizer.

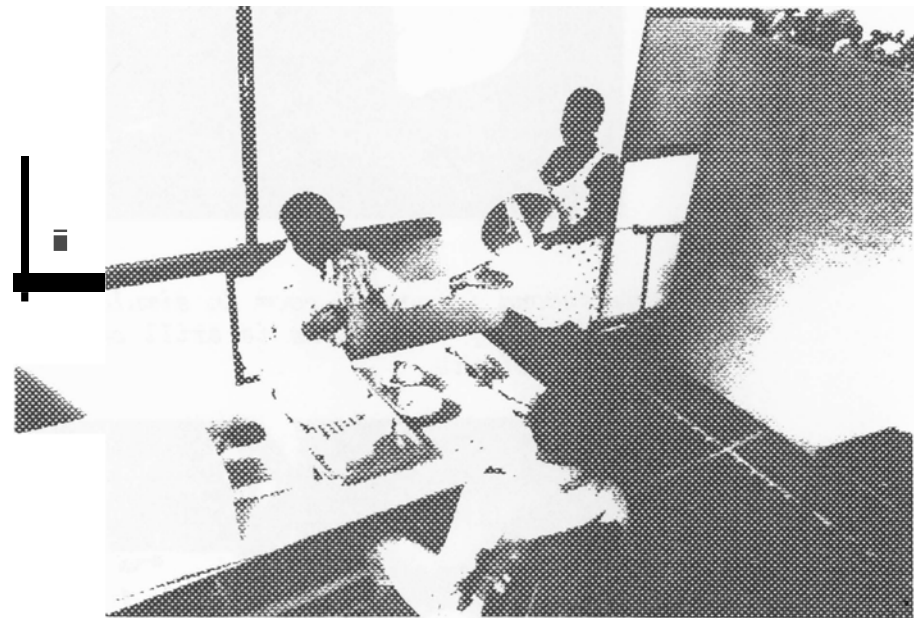
The mobile nurse is supposed to work mostly in the Casualty Department. But since patient pressure on this department is low and there are periods of inactivity, the mobile nurse is to assist the permanent nurse during these periods. (d.2 is sitting in front of d.1.) She does almost the same work as the first nurse but she can only inject patients of category(b).

In the morning, before patients are admitted in the injection room, d.1 and d.2 are assisted by two other nurses in filling ampullas with diluent. The four nurses gather around the injection table.

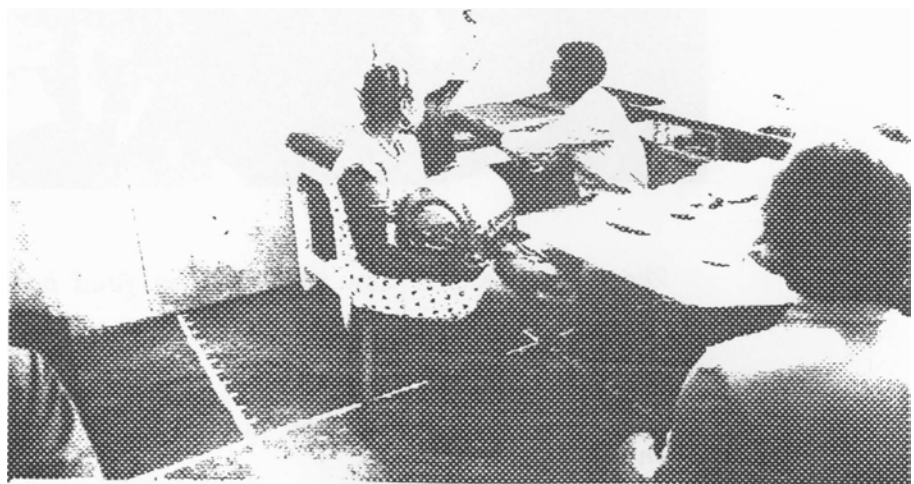
simulations of
the injection
room.



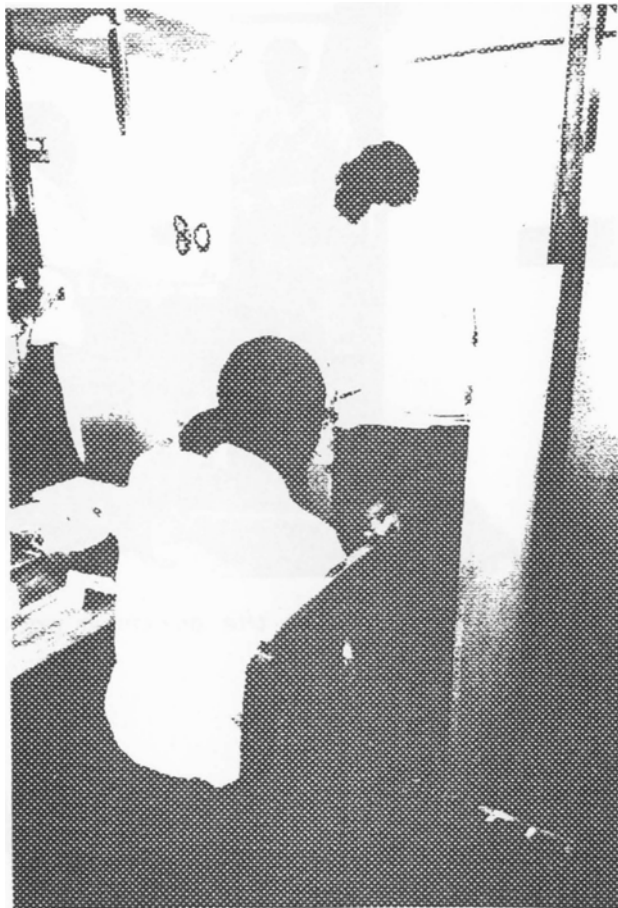
Clerk registering the entering patient



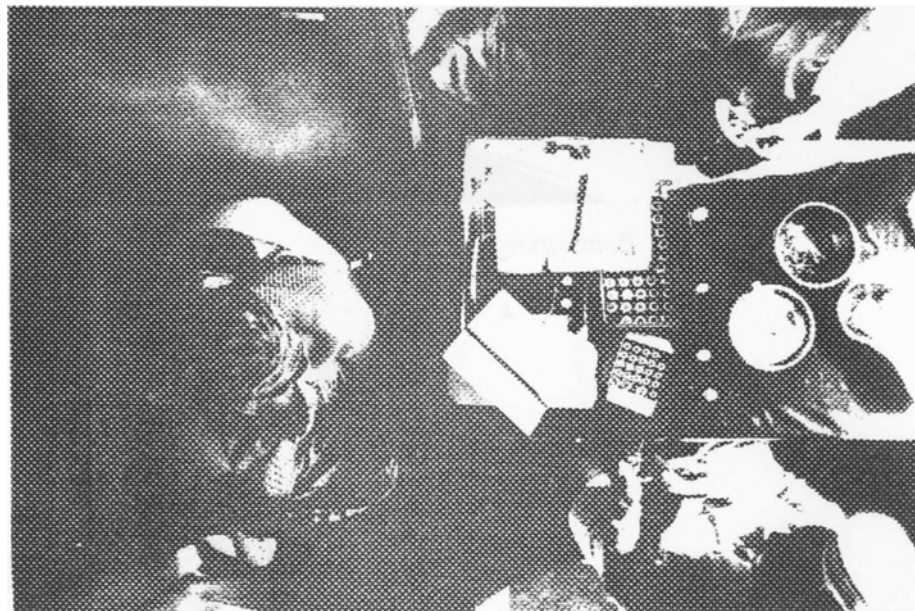
Receiving patient.



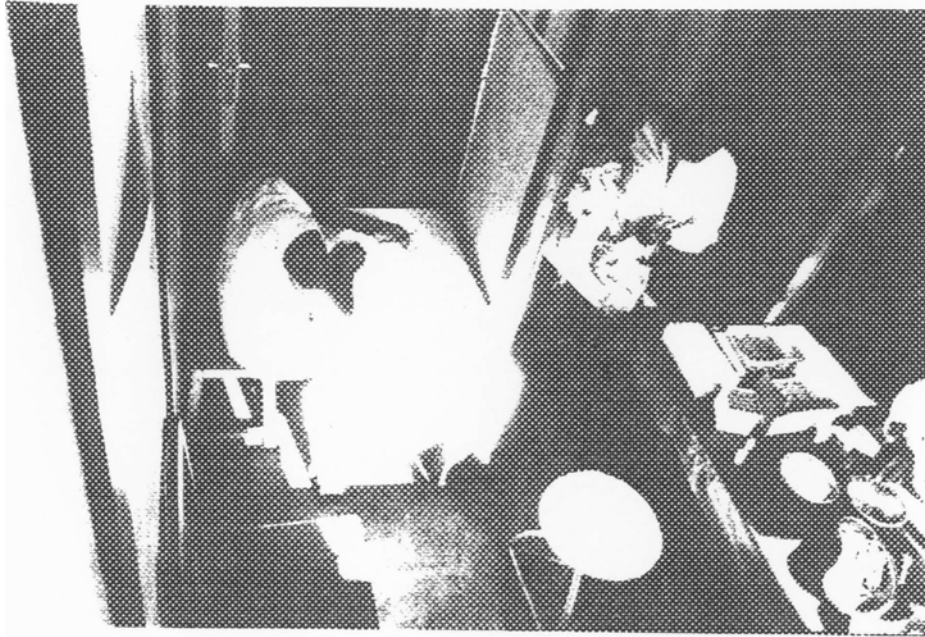
Nurse with adult patient while mother and child
(here drum) await their turn.



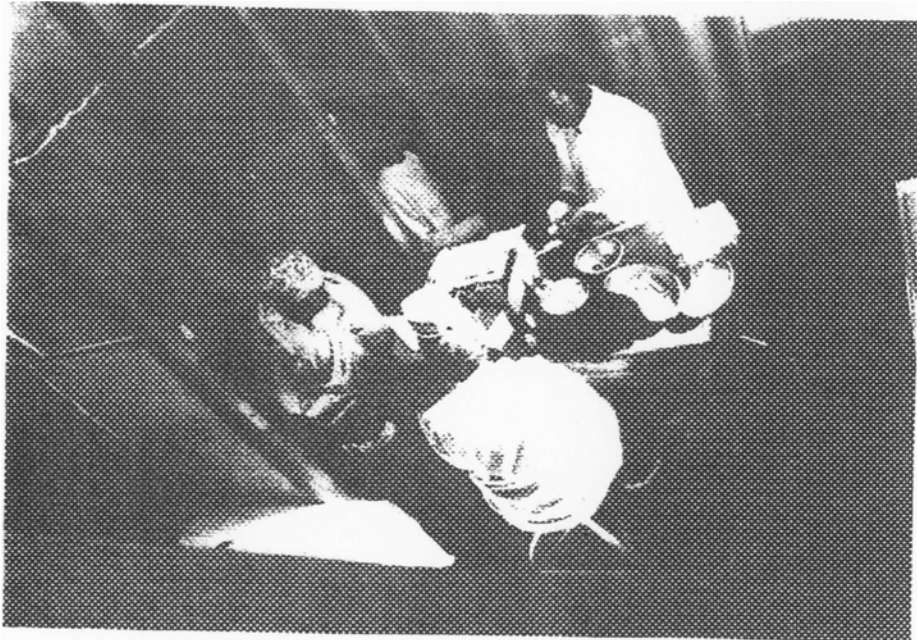
The second injection room during fuel pack ready
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The second injection room during fuel pack ready
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Alternative II (in) 39 X 36 satisfies most
criteria. The clerk's space is, however,
minimal.



The room could be increased somewhat in both
length and width, better passage space (Z.1
the sin7< (-g}z_t) ,1.3 rrrr.=l-e rtloc)iii at the (Jfer k 's
r;az, Ze Zc:ft /;,,,; z_YJJ)



The second injection room test in simulation:

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 } ft;,,3 f: z,,? t-:iY'e JI'>C::Y!! I?-gh1; l;Q z-?,vüi: i_-;2 thi:Ef:
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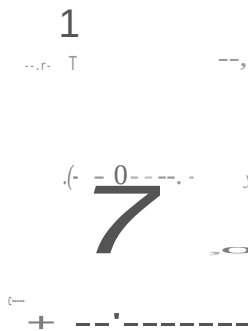


*The second injection room in feed back. The table
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 tc_ rec.cl?. tYte B'L-rk. fi"hort Zy -tj=i.e.y; t,,i-... P'r...!tur;;: 2:is
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 thr; sink to allow passage, but then the space for
 the patients became too small.*

3.3.14

FURNITURE AND EQUIPMENT IN THE INJECTION ROOM

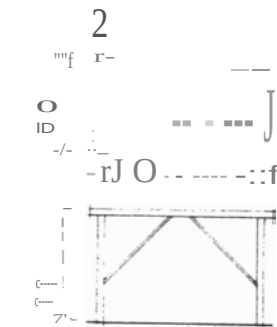
The following furniture and equipment is found in the injection room:



- Clerk's Table with a registration ledger.

60 x 120, H = 77

- Clerk's Chair



- Injection Table on which two kidney dishes, two metal bowl, two cartons with drugs 10 x 15 x 30 CM, 2 cartons with drugs 15 x 15 x 15 CM, and
 - 1 metal tray 7 x 25 x 35 CM with ampules are placed on the table in the morning and then drugs are prepared. Other cartons with drugs are on the table namely:
 Two cartons 10 x 15 x 30 CM
 Two cartons 10 x 15 x 30 CM
 One carton 15 x 15 x 15 CM and
 Two cartons 18 x 18 x 10 CM
 One carton 5 x 15 x 30 CM

60 x 120, H = 77

(These are kept during the day in a cabinet)



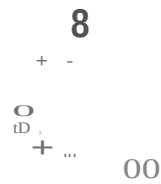
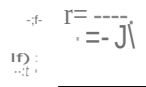
- Chair for d.2



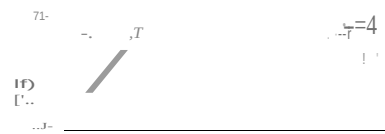
- Revolving stool for d.1



- Patient stool



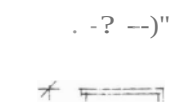
- Couch



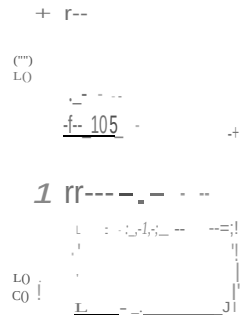
- One sink with one wash basin



- One cabinet with three shelves



11



- 1 cabinet with

Two shutters and

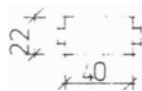
two drawers in which

one roll of cotton is

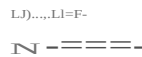
kept plus some cartons

with drugs (see injection table).

12



- 1 sterilizer



3.3.15

DAYLIGHT AND ACOUSTICS

- The clerk sits with window - at his right handside.
- d.1 and d.2 injects patients (a)with her back turned to the window, while (b)is between d.1/d.2 and the window then receiving injection.
- The couch receives no direct day light since it is placed along the wall parallel to the window wall and surrounded by a curtain H 200 am.
- The noise level is very high due to the gaps between the partition walls and the ceiling and floor. It was therefore decided that no acoustics study could be carried out because of this unusual aspect of the special building in Kiambu.

3.3.16

RELATION OF INJECTION ROOM TO CASUALTY ROOM CLEANING

The equipment, materials and drugs from the injection room (except the sterilize are brought in to the casualty room at 4:15 pm, when work in the injection room is stopped.

In the morning at 8:00 am everything is carried back. After having placed the equipment on the top of the cabinet, the nurses start cleaning the room (except the floor) before admitting the patients. The injection table and the sink are cleaned with a wet rag and soap and the steriliser is emptied. It is then lifted to the sink and cleaned with steel wool and water.

A cleaner cleans the floor with a wet floor rag before the arrival of the nurses.

3.3.17

OTHER ROOM QUALITIES

- Wastes as well as the liquids from the syringes are disposed in a basket on the floor.
- There is no exhaust from the steriliser.
- The cabinet and the shelves are made of unpainted wood. The sink is pressed stainless steel on a tabular iron stand.
- There is one cold water tap.

There is one electrical outlet.

3.3.2

IDENTIFICATION OF PROBLEMS

3.3.21

PROBLEM CATEGORIES

Three groups of problems are derived from 1.1

a) Control of patients' flow

i) Patient's queue

ii) Position of Clerk

b) Difficulties of d.1/d.2 when carrying out work

i) Position

ii) Day light

iii) Space

iv) Cleaning

c) Conflicts caused by patients' flow crossing area of staff service activities.

i) Use of steriliser

ii) Use of sink

d) Difficulties caused by furniture's design

i) Unsuitable working - Height

ii) Many items difficult to keep clean

iii) Choice of materials

e) Difficulties caused by lack of privacy for patients

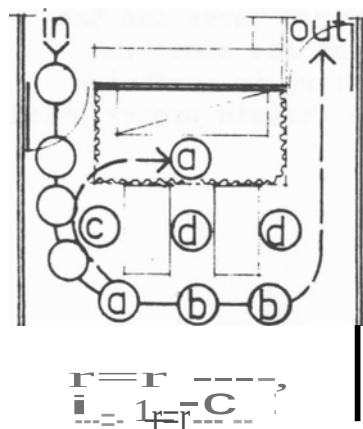
3.3.22

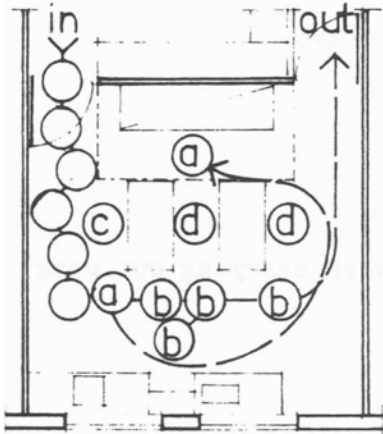
CONTROL OF PATIENTS' FLOW

The different problems related to the flow of patients through the room are depending on the degree of crowding in the room.

a) Few patients

b) Small queue





c) Double queue

- a) When few patients are in the room there is no real difficulty for them to find their way to the injection station. The prescribed flow through the room is not observed. Patients leave the room from nearest door.
- b) When a small queue forms between the entrance and the clerk then patients of category (a) have to flow to the back to reach the injection place (behind the curtain) from the registration place. No problems for patients of category (b) except for a few patients who will go back to collect bags that they have left near the entrance before receiving injection. It is impossible to leave the room through entrance door because of crowd.
- c) A double queue forms at some times when one addition to the queue between the entrance and the registration place and a number of patients queue up in another line. Between the registration station and the nurse, back flow becomes then impossible for patients of category (a) who will have difficulty finding their way behind the curtain by passing behind both nurses. For all patients right following becomes compulsory.

3.3.23

POSITION OF THE CLERK

The clerk has difficulty in controlling the entrance of patients into the room since she has her back turned to the queue. She is not able to observe the patients before they stand at her right hand side. It was observed that sometimes both the first nurse and the clerk are reading patient's cards at the same time (once as many as four cards) resulting in confusion about who should be administered a certain prescription.

4 .0 .0

THE PHARMACY

4.0.0

THE PHARMACY

The distribution of drugs in Kenya is organized in a centralised system with the main pharmacy at Kenyatta National Hospital as the National centre and small dispensaries at the periphery.

The district hospitals have central pharmacies, which function as the subcentre at the district level and draw their supplies from the pharmacy in Kenyatta National Hospital. These district pharmacies distribute drugs to health centres and dispensaries in the district and serve both inpatient and outpatient departments within the hospitals.

The wards draw their daily needs from here, whereas the O.P.D. runs its own sub-pharmacy. In this whole network of distribution very little drugs are produced, but medicines are diluted and packed in smaller quantities for smaller outlets or for distribution to patients.

The pharmacy is a quite independent body within the hospital or health centre. The staff has a quite long and different training compared to the other medical workers and tends to regard itself somewhat as an elite.

Although the technicians have been trained in the preparation of drugs, only dilution, packing and distribution of drugs takes place. Much of the work is therefore routine and tends itself to a systematic analysis to form the basis of the design of the space.

In spite of the absence of drug preparation among the daily tasks the work is still demanding and consists of many different jobs. There is the preparation of mixtures, dilution of drugs, the packing of the right quantities, the dispensing and the administrative work.

The medical treatment in a district O.P.D. is not specialised and all patients in need of specialist attention are referred to the larger hospitals. The vast majority of the diagnoses falls therefore with a very small range and can be treated with a very limited number of drugs.

The ten most common diseases

malaria	15.1%
Bronchitis	12.0%
Skin Ulcer	8.4%
Common cold	5.4%
Diarrhoea	4.5%
Scabies	3.9%
Other skin diseases	3.3%
Stomach ache	3.2%
Pneumonia	3.0%
Conjunctivitis	2.5%
	61.30%

Haraldson, S - (llli0 - Advisor)

Health Centres and dispensaries in Kenya, Nairobi 1967

The organization of the district O.P.D. 's included originally a fairly all round pharmacy, but it became soon apparent that such was not quite efficient.

Vogel and Dissevelt (3) observed that of all the tablets dispensed in the O.P.D. pharmacy as far as ten drugs covered 90% of all the tablets issued.

They also noted that many drugs given in the form of mixtures could be replaced by tablets. The Machakos and Kiambu studies pursued the subject further and a quick radical standardisation of drugs was finally achieved. From these it was a small step to introduce the coding of the prescriptions already from the moment of examination. This simplified administration and changed much of the work in the pharmacy because it opened the way to prepacking and bulk preparation of the standard coded drugs.

It also opened the way to a division of labour and made it possible that much work could be done by attendants with a minimal training.

For the odd prescriptions and for dispensing dangerous drugs a fully trained technician would still be needed, but the attendants could take over the prepacking and dispensing of coded standard drugs.

The main activities in an O.P.D. pharmacy are: storing, preparing and dispensing of drugs administrative work. These four tasks require different spaces and are the natural basis for zoning the pharmacy rooms.

The actual space requirement for a pharmacies are not very well studied and one can find a wide range of areas in different designs.

The pharmacy for Health centres takes 13 m² in Tanzania (Comworks) 18 m² in Kenya (Simonh) Mein (9) and Nimpuno (7) proposed 16 m² whereas Bouwcentrum calculated an needed area of 36m².

Much of the differences can be traced to the organizational set up and the zoning of the work in the pharmacy. The Bouwcentrum design for instance includes a pharmacy room, a large sluice and a store and there seems to be little relation between the frequency of the activity and the space allocation in the proposal.

The rationalisation of the work as tested by the KNEPOROS team however opened the way to a better zoning in the pharmacy. The standardisation of bottles for mixtures, the separation of coded and uncoded drugs and the system of prepacking, all contributed to the possibilities of simplifying the space.

The clear separation between patients and pharmacy helped to analyse the production and a full scale mock up proved to be a satisfactory form of simulation. It was therefore not deemed necessary to arrange for dynamic space tests such as were executed for the other parts of the O.P.D.

4.0.1

THE OPD PHARMACY AT KIAMBU DISTRICT HOSPITAL

The OPD pharmacy is separated from the main pharmacy and is serving both the OPD and the MCH.

The main pharmacy is serving all the district at Kiambu. It is located in the hospital building at a distance of about 90 metres from the OPD pharmacy.

The main pharmacy supplies the OPD-PH with all drugs which they are dispensing, both un-coded drugs and the raw material for the coded drugs. If there is a demand for a drug which is not kept in the OPD-PH, the patients are directed to the main pharmacy.

The system with coded and un-coded drugs has worked now for years. The list of coded tablets comprises 10 different kinds which include all different doses and makes 22 variants to be pre-packed. The coded mixtures are 5 but including the different doses there are 8 different kinds to be prebottled. The list of coded drugs has been changed during the research period in order to correspond more to what are actually the most dispensed drugs. Still there are some mixtures (about 10) which are prebottled. These mixtures are mostly for external use, like liniment and skin lotions, but also some of the syrups.

The drugs are dispensed through two counters next to each other, one counter for the coded drugs and one for the non-coded. The patients first call at the coded counter. When the dispenser there sees a non-coded drug prescribed, he passes the prescription inside the window to the dispenser of non-coded drugs while the patient is told to go to the second counter to receive there his non-coded drugs.

If the patient has a prescription with both coded and un-coded drugs he is given the coded drugs at the first window and the un-coded at the second. At the second counter there is no queuing system while the patients are called for one by one by the dispenser in the order he gets the prescriptions from the first dispenser.



Patients line up at the long first counter in the pharmacy.



The queue tends to become more of a standing crowd.



*Fat, ...YL-; S cv_ril#:'i:J to the first counter in the
p,ir,(J-;Jla. 'I/ o;-:t i;:?? room.*



The queue tends to become more of a standing crowd.

With this system the OPD pharmacy can easily handle a workload of about 470 patients a day with a proportion of coded and un-coded drugs of about 75% to 25%.

The PH is the only treatment station for about 45% of the patients and about 68% of all patients passed the PH on an average day in September, 1975.

According to KNEPOROS the pharmacy should be staffed with four persons: two technicians and two attendants, One technician at each counter and one attendant prepacking and the other prebottling. During the study time in November, 1975 the number of staff varied between 5 and 7. When there were five, two worked at the counters, one prebottled and two prepacked. The reason for two prepacking was 'probably that they did not have the ready made envelopes for the pills so they had to make small paper bags themselves. When there were seven people' the pharmacy was too crowded'.

Raw material to the coded tablets and mixtures is fetched from the main pharmacy about once a day, . . .

mostly in the mornings. Sometimes they go there more often when they don't really plan what could be fetched at the same time. The non-coded drugs are fetched about once a week.

The bottles used for all mixtures dispensed are Tusker Export beer bottles. The patient has to bring such a bottle to be dispensed with a mixture. If the patient has forgotten or did not have such a bottle it is possible to buy one just outside the clinic where a couple of young boys have a business selling bottles. The price for one bottle is Shs. 1.00.

4.1.0

DESCRIPTION OF THE ACTIVITIES

4.1.1

FUNCTIONS

The different functions of the OPD-PH are simplified as follows:-

- a) fetching
- b) preparing

- c) storing
- d) dispensing
- e) registration
- f) cleaning
- g) staff activities

These functions broken down to what are actually the different processes going on in the PH can be seen in Table 1. The differentiation of the functions in the second and third line are related to the different sections in the PH observed during the research period (November, 1915).

4.1.2

STAFF

According to KNEPOROS the staff should be four: two technicians and two attendants (see above). The fetching, preparing of coded drugs and cleaning are supposed to be done by the two attendants. The two technicians are supposed to dispense, one at each counter, and to prepare the un-coded drugs. During the research period one attendant, who had long experience, was dispensing all the time at the counter for coded drugs, replacing one technician who mostly helped with the prepacking of tablets.

The attendants (during the research period there were 3-5) also did most of the prebottling of the un-coded mixtures and prepared the ointments.

TABLE 1.

THE FUNCTIONS OF THE OPD-PHARMACY

a) fetching:	coded:	tablets	
		mixtures	
	uncoded:	tablets	
		mixtures	
		ointments	
b) preparing:	coded:	tablets	
		mixtures	
	uncoded:	tablets	
		generally	
		prebottled	
		mixtures	
		ointments	
c) storing:	coded:	tablets: raw material	
		prepacked	
		mixtures: concentrated	
		diluted	
		prebottled	
	uncoded	tablets: generally	
		antibiotics	
		mixtures: generally	
		prebottled	
		ointments: generally	
		prepacked	

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J

	prescriptions:	cleaning up material rubbish cloths empty bottles or tins tea-drinking material
d) dispensing:	coded:	tablet mixtures : generally prebottled ointments: generally prepacked
e) registration:	antibiotics scheduled drugs balancing	
f) cleaning:	floors preparation - surfaces rubbish	
g) staff activities:	undress waste tea drinking	

4.1.3

Places and attributes for functions (see fig. 1 and the special drawings of the furniture)

The preparation of coded mixtures is also done at a table in the inner room (no. 21 fig. 1). The raw material for the mixtures are mostly fetched in a concentrated form so they first have to be diluted. After the diluting which is made at the sink (no. 20 fig. 1) in a big plastic bottle the mixture is shaken and poured into a smaller jar. From the jar the prebottling is made by pouring the mixture with the help of a funnel into the Tusker beer bottle which are fetched in the paper bag (no. 7 fig. 4) beside the counter for coded drugs. These bottles should, according to KNEPOROS, be cleaned by the PH-staff. During the research period the attendant working at the counter for coded drugs looked at the bottle brought by the patients. If he did not think it was clean enough the bottle was given back to the patient who had to go and wash it. The water-tap in the patio just beside the PH was used for that purpose. The dosage is told to the patient while dispensing. According to KNEPOROS the bottles should be labeled, but the labels were no longer available.

The preparing of un-coded tablets and mixtures is done while dispensing at the counter for uncoded drugs except those mixtures which are prebottled on the initiative of the staff themselves like liniment, skin lotions, eye and ear drops and some syrups.

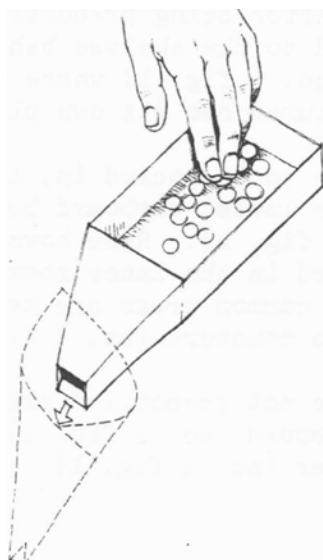
For the preparing of un-coded drugs the same bottles and paper bags as for the coded drugs are used. The preparation is done on the table beside the counter (no. 2 fig. 1) and at the grid on the other side (no. 4 fig. 1).

The ointments which are kept in big tins and which have to be prepared before dispensing are also sometimes packed in advance. That is done on the cupboard beside the counter for coded drugs. (no. 10 fig. 1). Empty tins and paper boxes are used for this purpose. If they have had the special paper boxes which according to KNEPOROS should be used for this purpose, they should pre-pack more of the ointments.

- a) All drugs are fetched from the main pharmacy. (The coded drugs are fetched about once a day and the uncoded once a week- see above). The raw material (some in concentrated form) for the coded mixtures are fetched in big plastic bottles, and the raw-material for coded tablets are fetched in big tins. The un-coded drugs are fetched in ordinary tins and bottles.

This is done in a rational way so that each kind of mixture is prebottled in a larger amount each time. The bottles are closed with a piece of cotton. According to KNEPOROS the bottles should be closed with real corks, but the PH was not supplied with that. The corks were even used to write on.

- b) The preparation of coded tablets is made at a table in the inner room (no. 18 fig. 1). The prepacking is made by putting a larger amount of tablets on a small "metal tray" with a spout to which the paper bag is fixed. From this "metal tray" the different dosages are counted and pushed into the paper bags. The paper bags used during the research period were made by the staff themselves by rolling paper sheets into cones. They were supposed to have ready made envelopes. The dosages are written or stamped on the paper bag.



The prebottling of un-coded mixtures especially those for external use is separated from the pre-bottling of the coded mixtures for internal use. This is done out of fear of mixing them up. The prebottling is made on the cupboard beside the counter for coded drugs (no. 10 fig. 1). Some of the syrups however are prebottled on the same table as the internal mixtures (no. 21 fig. 1). The prebottling of these un-coded mixtures is done in the same way as for the coded ones except that they do not have to be diluted. The mixtures for external use are labeled with a sign which says "for external use only". For the prebottling of eye ear and nose drops small bottles which originally contained injections are used.

- c) The raw-materials for the coded tablets are stored in a locked cupboard beside the labels used for prepacking (no. 17 fig. 1).

After being prepacked, medicine is put in the drawers of the same cupboard. From the drawers they are moved to the specially made grid in the dispensing room (no. 14 fig. 1) from which they finally are moved to the pigeon-holes beside the counter (no. 8 fig. 1). These pigeon-holes are not big enough so two paper boxes are used (no. 9 fig. 1).

The concentrated and ready-to-use raw material for the coded mixtures are together with the diluted mixtures stored at the same table at which they are prebottled (no. 21 fig. 1). After being prebottled the mixtures are at once moved to the shelves behind the counter for coded drugs (no. 6 fig. 1) where each of the different kinds of mixtures has its own place.

The uncoded tablets which have to be locked in, like antibiotics, are stored in the locked cupboard beside the entrance to the PH (no. 1 fig. 1). Some however are kept in the locked cupboard in the inner room (no. 17 fig. 1). The uncoded common drugs are kept in the grid in between the two counters (no. 4 fig. 1).

The uncoded mixtures which are not prebottled are kept either in the locked cupboard (no. 1 fig. 1) or at the table beside the counter (no. 2 fig. 1).

The raw materials for the uncoded mixtures which are prebottled are stored in many different places. The syrups are kept back on the table together with the internal mixtures (no. 21 fig. 1) and in a cupboard in the dispensing room (no. 15 fig. 1). The eye ear and nose drops are kept on top of the part of the grid for coded tablets (no. 14 fig. 1). The liniment and skin lotions are stored at a table in the dispensing room (no. 13 fig. 1).

After being prebottled the liniment and some of the syrups are stored in the shelves. Others are put on the cupboard beside the counter for coded drugs (no. 10 fig. 1), in the cupboard towards the counter (no. 10a, fig. 1) or on the table under the grid (no. 4b, fig. 1).

The ointments which are kept in lighting and which have to be prepared before dispensing are kept in the cupboard beside the counter for coded drugs (no. 10b fig. 1).

When prepacked, they are kept on top of the same cupboard. The other ointments are kept together with the antibiotics in the locked cupboard (no. 1 fig. 1).

The prescriptions which are counter signed by a M.O. have to be kept for a couple of years. These prescriptions are only dispensed at the counter for uncoded drugs. The prescriptions are first kept in a paper box at the table beside the counter (no. 2 fig. 1) and then about once a month stored in the cupboard in one corner of the dispensing room (no. 12 fig. 1).

Cleaning up materials like brushes etc. are kept under the sink in the **inner** room (no. 20, fig. 1).

Rubbish is also kept under the sink in two buckets.

Clothes are either kept in a cupboard in the inner room (no. 16 fig. 1) rolled and put on the shelves, or hung on the walls in the inner room.

Empty bottles and tins are kept all over the place. In every cupboard which is not used for any special purpose there are empty bottles, tins and boxes (see fig. of the furniture).

Cups and spoons, tea leaves and sugar are kept in a cupboard in the inner room (no. 19 fig. 1). The spirit stove for boiling water stands at the end of the sink (no. 20 fig. 1).

- d) The dispensing of coded drugs always takes place at the counter for coded drugs (no. 3b fig. 1). Uncoded tablets (not prebottled uncoded mixtures and ointments which don't have to be prepared) are dispensed at the counter for uncoded drugs (no. 3a fig. 1). The prebottled uncoded mixtures and the ointments which have to be prepared are mostly dispensed at the counter for coded drugs.
- e) The registration of the antibiotics and the scheduled drugs e.g. those drugs which are contrasigned by a M.O. is done in two different ledgers on the table beside the counter for un-coded drugs (no. 2 fig. 1). This is done continuously while dispensing. The balancing of the books is done every morning at the same table.
- f) The cleaning of the preparation surfaces and tables is done every morning by the attendants. Cleaning floors and throwing away the rubbish is done every morning by special cleaning Staff.
- g) The staff changes every morning and puts on white coats. They have tea every morning at about 10 o'clock. During the research period there were sometimes 10-12 persons having tea together while the PH-staff were joined by other staff members of the OPH. During this tea drinking period, almost every visitor helped roll the paper bags for the coded tablets.

FIG. 1

LAYOUT OF THE EXISTING PHARMACY

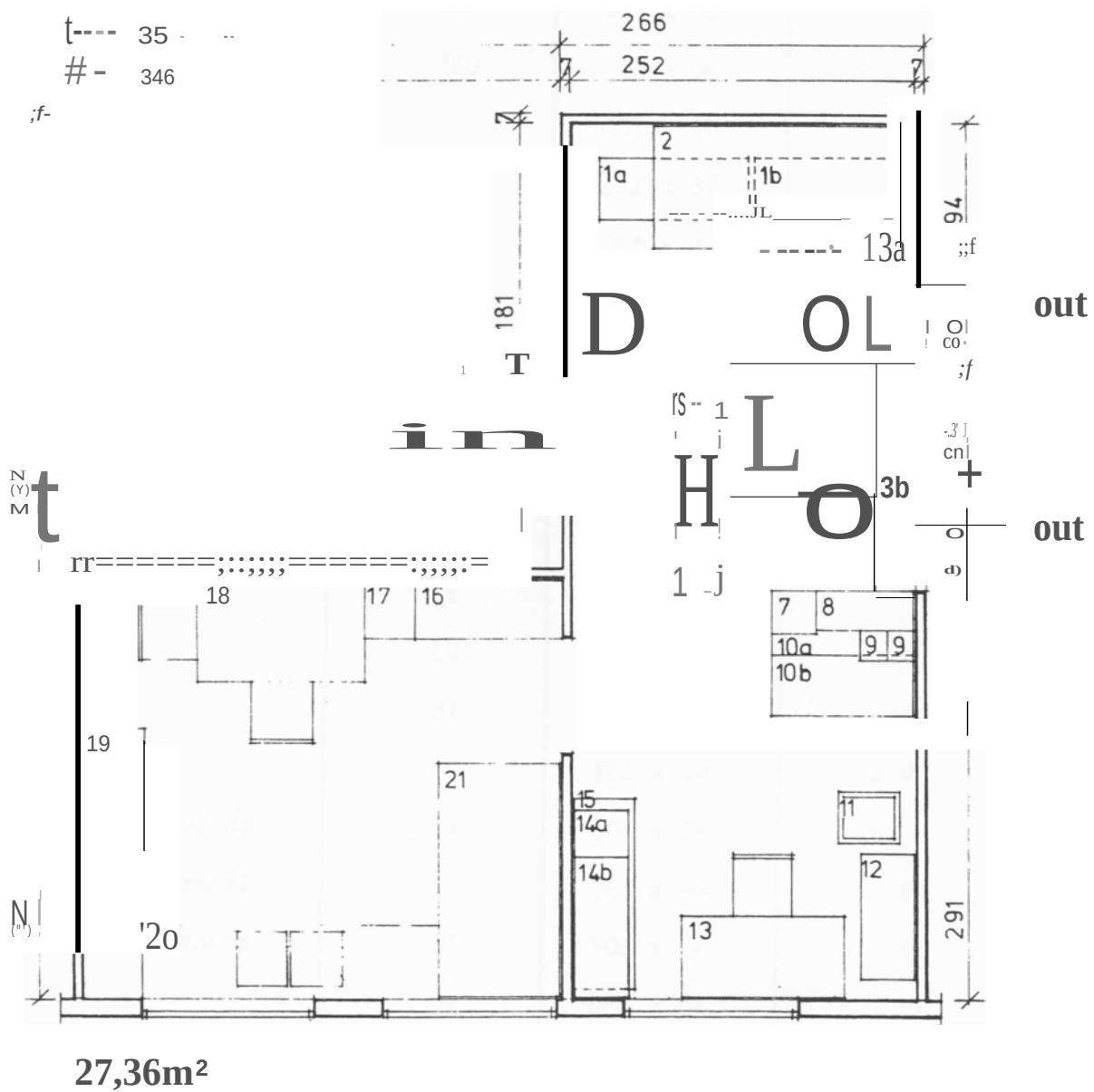


Table 2

FURNITURE MEASUREMENTS

LIT	SURFACE	HEIGHT	NOTES
1 a, b	44 x 107	90	
2	90 x 181	97	over 1
3 a, b	30 x 96	108	inside height
4 a	80 x 100	5	stands on
b	76 x 123	76	
5	29 x 52	79	
6	32 x 92	162	7 shelves
7	32 x 32	30	stands on 10
8	30 x 70	15	"
9	20 x 20	16	" , 2 pes
10 a, b	44 x 106	90	
11	44 x 38	94	
12	41 x 91	183	
13	61 x 122	76	
14 a	41 x 137	44	
b	41 x 103	43	on top of 14 a
15	44 x 137	90	14 stands on 15
16	45 x 107	90	stands on 17
17	45 x 136	90	
18	76 x 121	76	
19	44 x 108	91	
20	53 x 215	96	
21	90 x 180	96	

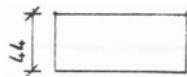
1a

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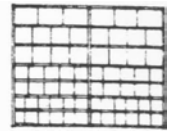
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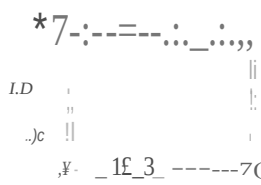
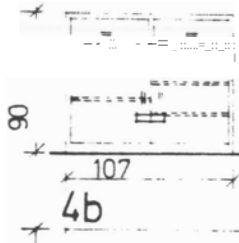
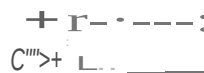
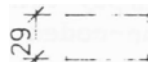
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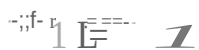
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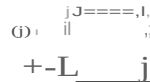


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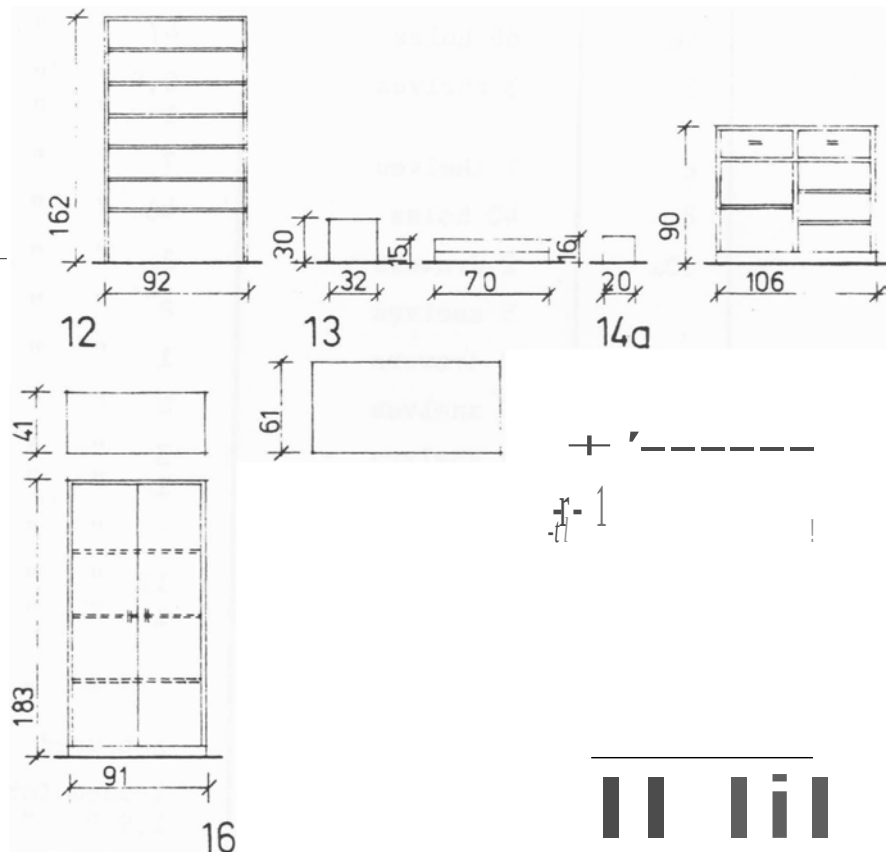


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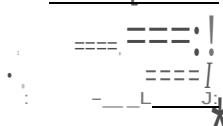
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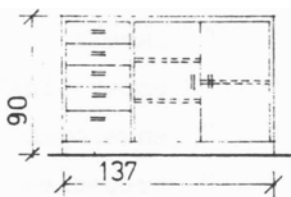


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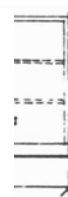
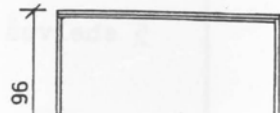
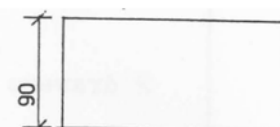
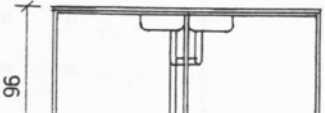
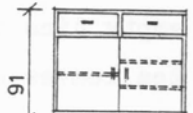
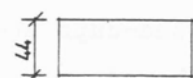
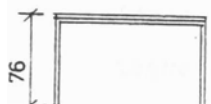


TABLE 3

ACTUAL STORING CAPACITY AND DEGREE OF UTILIZATION
(MEMBERS OF THE FURNITURE SEE FIG. 1)

	STORING CAPACIT	UTILIZATION
1a	2 drawers	1 used for papers
	5 shelves	3,5 " " uncoded drugs
1b	2 drawers	1 " " papers
		1 " " empty tins
	5 shelves	2 " " empty tins
		0,5 " " un-coded tablets
2	table	" " un-coded liquid drugs
4a	66 holes	47 " " un-coded tablets
5	3 shelves	0,5 " " empty paper-bags
		1 " " empty tins
6	7 shelves	7 " " prebottled mixtures
8	40 holes	40 " " prepacked coded tablets
10a	2 drawers	1 " " papers
	5 shelves	2 " " prebottled uncoded mixtures
10b	2 drawers	1 " " labels
	5 shelves	2 " " ointments to be prepared
12	4 shelves	3 " " old
		prescriptions 1 " "
		empty tins
13	table	" " storing liniment and lotions
14	21 holes	11 " " prepacked coded
		tablets 1 " " empty
		injection-bottles
	"shelf" on top of 14a	" " storing eye ear and nose drops
15	5 drawers	not used
	5 shelves	1 used for empty tins and bottles
		1,5 " " syrups
16	2 drawers	not used
	5 shelves	1 used for free samples of drugs
		2,5 " " clothes
		0,5 " " labels
		0,5 " " empty tins
17	5 drawers	1 " " envelopes
		4 " " prepacked coded tablets
	5 shelves	4 " " coded tablets to be
		prepacked 0,5 " " un-coded
		drugs
19	2 drawers	1 " " tea-cups etc.
		1 " " bread

5 shelves

1,5 " " empty tins and bottles

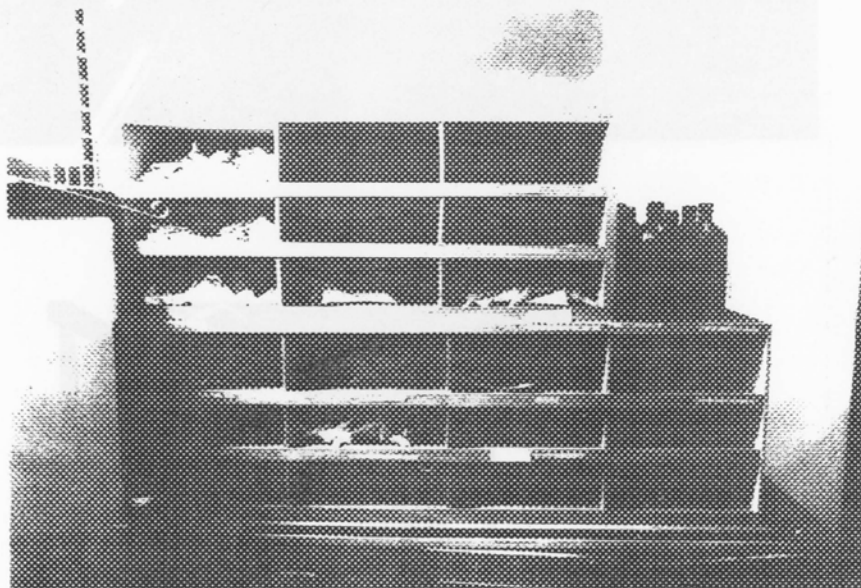
0,5 " " tea leaves and sugar

1

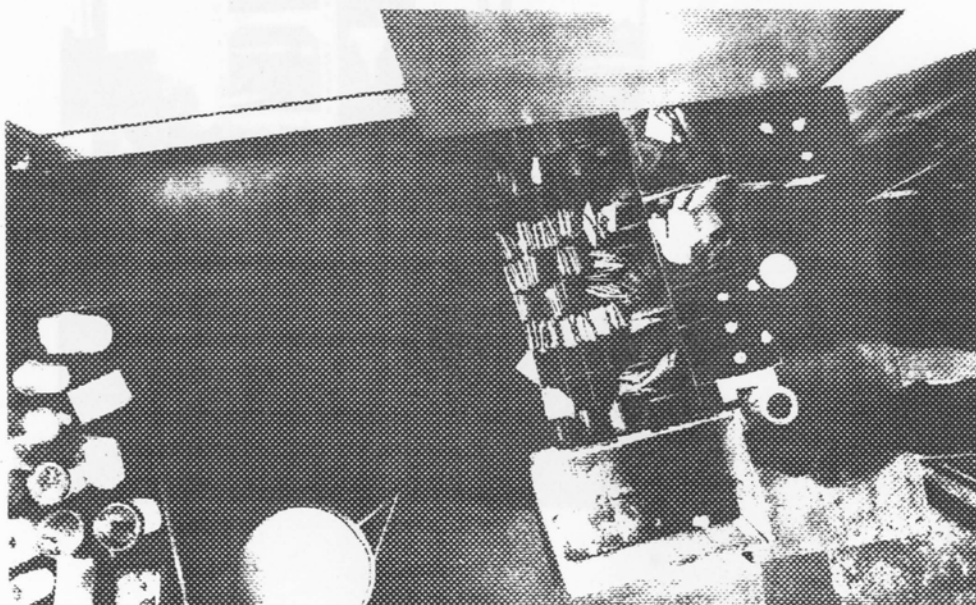
120
Preparing and storing of coded tablets.



Filling the paper bags.

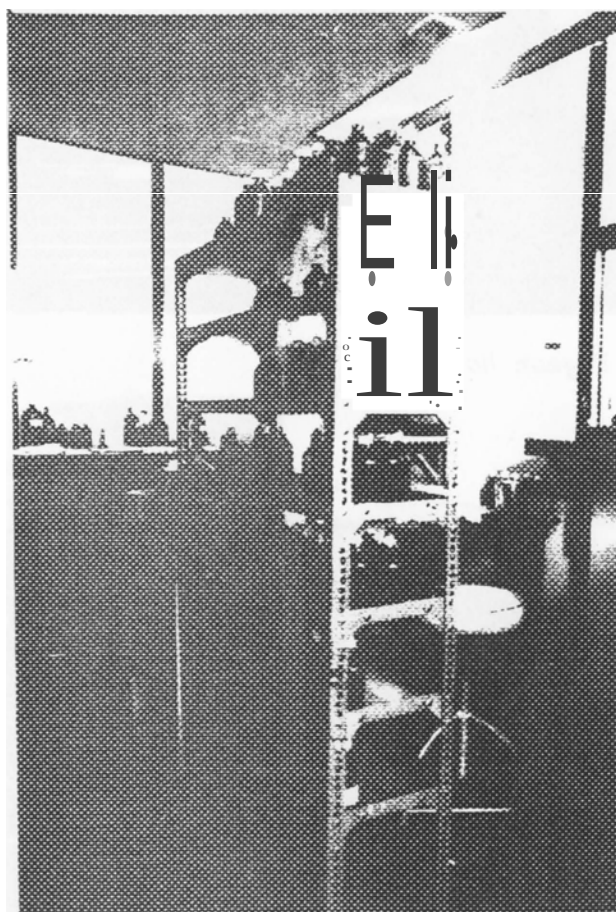


Pigeon hole rack.



Mr. ... with ... on the table

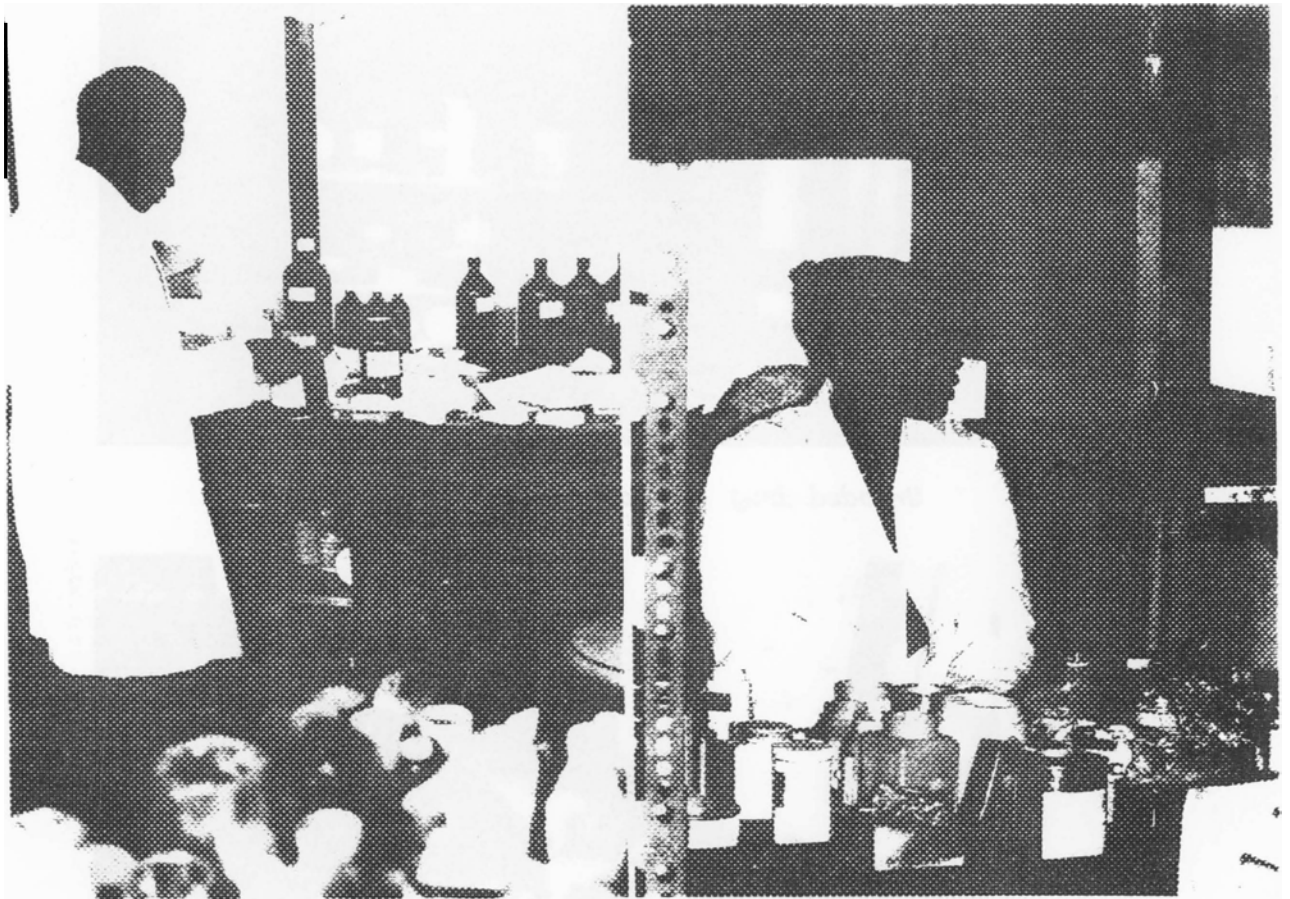
Preparing anri storing of coded mixtures.



PREPARING:

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Ointments



STORING:

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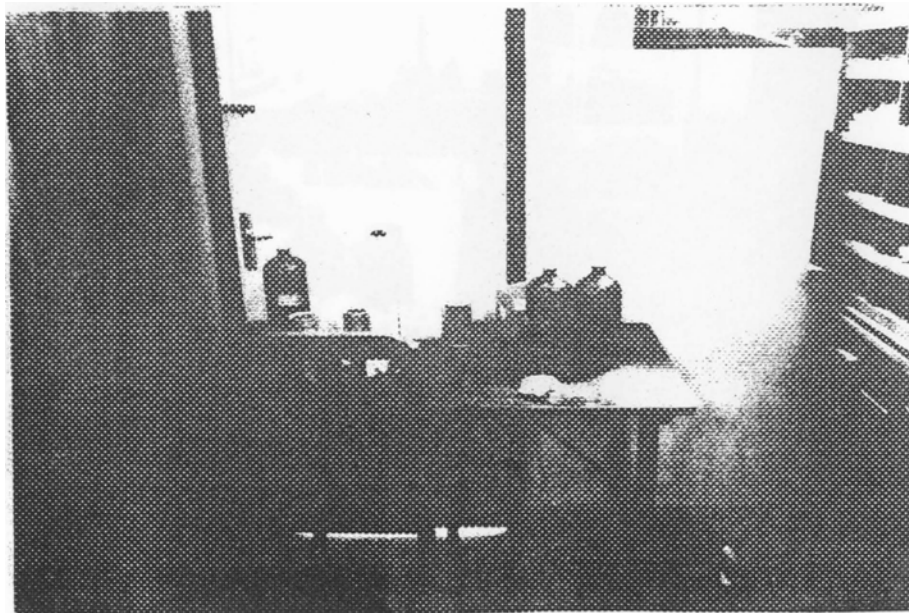
uncoded drugs (to be locked in)



Uncoded drug (common).



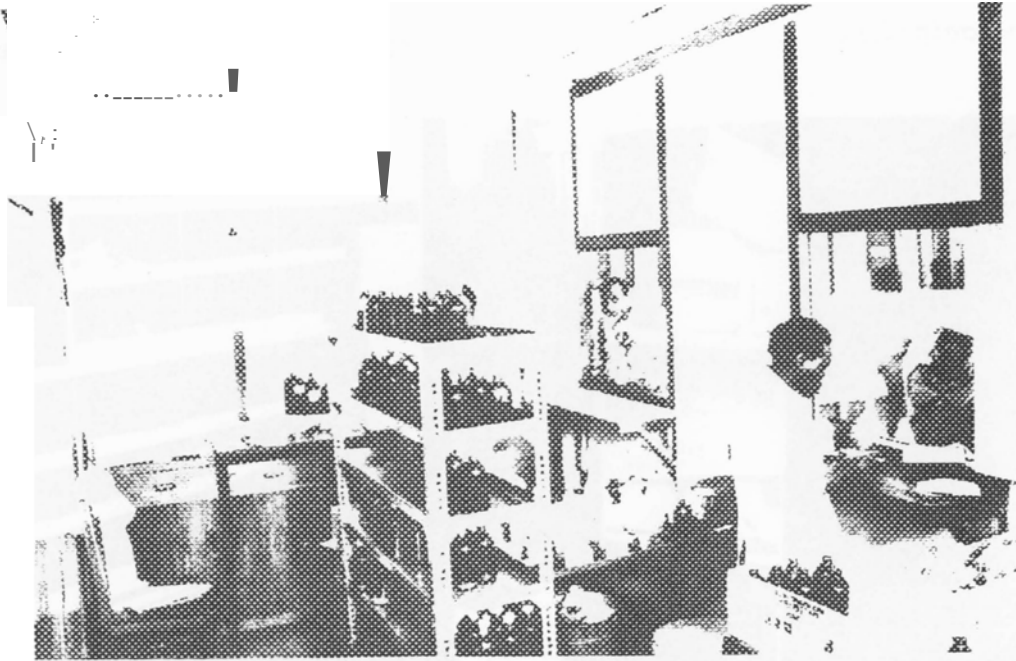
Liniment and lotions.



DISPENSING:

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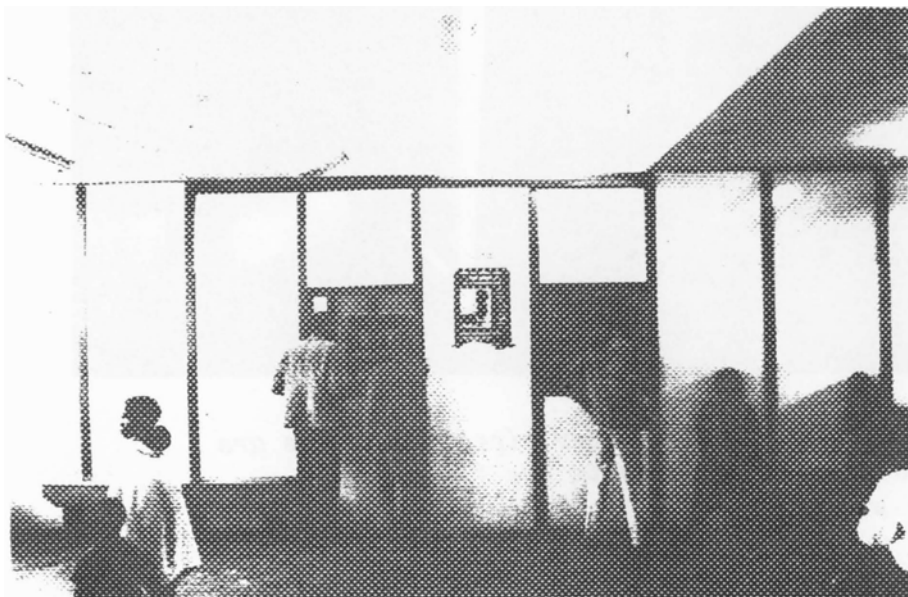
Loaded drugs, dispenser at the window.



Uncoded drugs, dispenser at second window



The two counters from outside



STAFF ACTIVITIES:

tea drinking
(storing of clothes)



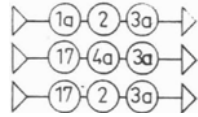
Storing of equipment for tea-drinking



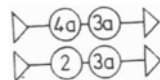
Flows of the drugs from coming into the PH to be dispensed

(see fig. 2 and the special drawings of the furniture)

1. UNCODED TABLETS



to be locked in
)



common

2. UNCODED MIXTURES

(to be locked in 0
common
)

liniment

t>---R-R@-{->

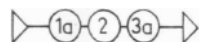
!syrups

prebottled

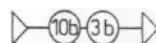
t>---R-@-@-@-{-> drops

I>---@-@-R--t> J- lotions

3. OINTMENTS

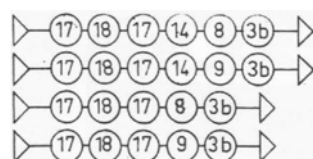


common



to be prepared

4. CODED TABLETS

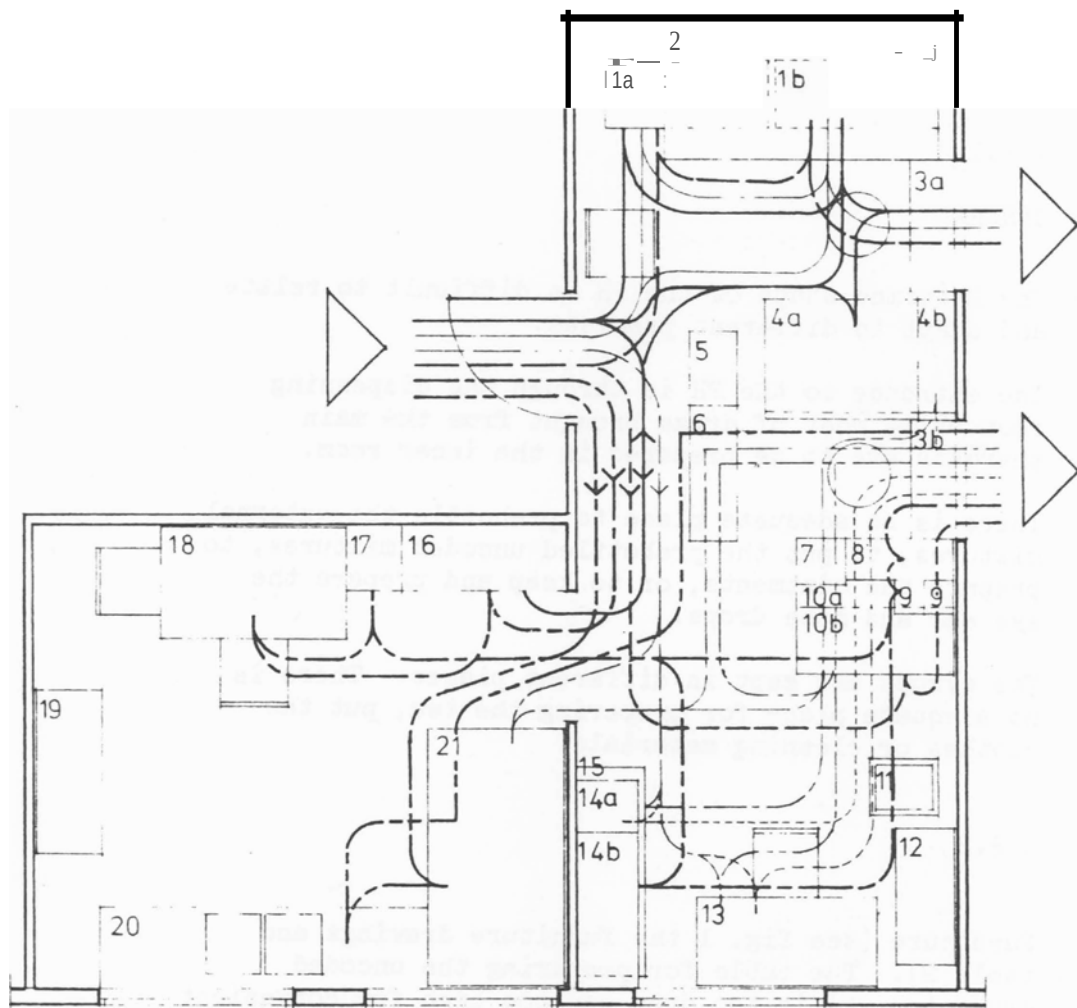


5. CODED MIXTURES



FIG. 2

FLOWS OF THE DRUGS



- | | |
|--------------|------------------------------|
| 1 ————— | UNCODED TABLETS |
| 2a- - - - - | COMMON UNCODED MIXTURES |
| 2b- - - - - | PREBOTTLED UNCODED MIXTURES |
| | LINIMENT |
| | SYRUPS |
| | EYE - EAR - AND NOSE - DROPS |
| | SKIN LOTIONS |
| 3c- - - - - | COMMON OINTMENTS |
| 3b- - - - - | OINTMENTS TO BE PREPARED |
| L, - - - - - | CODED TABLETS |
| 5 - - - - - | CODED MIXTURES |

4.2

IDENTIFICATION OF PROBLEMS

4.2.1

GENERAL

The L-formed shape of the PH is difficult to relate and adapt to different premises.

The entrance to the PH is through the dispensing room while most of drugs brought from the main pharmacy are to be prepared in the inner room.

There is no adequate place to prebottle the external mixtures, to put the prebottled uncoded mixtures, to prepare the ointments, or to keep and prepare the eye ear and nose drops.

The syrups are kept in different places. There is no adequate place for preparing the tea, put the clothes or cleaning materials.

4.2.2

Furniture (see fig. 1 the furniture drawings and table 2). The table for preparing the uncoded drugs (no. 2) is too deep and too high for convenient working position. 1*

The grid for the common un-coded drugs (no. 4a) is too deep which makes it difficult to reach the drugs on the end of the grid.

The shelves for the coded mixtures (no. 6) are too far away from the counter to be easy to reach without moving. The highest shelf is difficult to reach.

The paper box for empty bottles (no.7) is weak and difficult to carry.

The pigeon holes for coded tablets (no. 8) are too small so two paper boxes (no. 9) are added. Even then there are not enough places for the different kinds of tablets.

The sink (no. 11) is not often used but it is too high.

The cupboard for prescriptions (no. 12) is impossible to open without moving the table (no. 13).

*1 The locked cupboard for antibiotics etc. (no. 1a) is difficult to open and it is difficult to reach the drugs when it is pushed in too far under the table (no. 2).

The grid for coded tablets (no. 14) is too high. The table for preparing coded tablets (no. 18) is too small, always very crowded and must also serve for having tea.

The sink (no. 20) is high for convenient working position especially when there are heavy items to be lifted.

The table for preparing coded mixtures (no. 21) is too high and too deep for convenient working position, especially when there are heavy items to be lifted.

There are many cupboards in the PH which are not used or just filled with some empty tins, boxes and bottles. The ones used for adequate storing are often not filled. (see the furniture drawings).

4.2.3

MOVEMENTS

As can be studied from the flow diagram (fig. 2) there are many conflicts in the moving pattern, the coded drugs are often to be carried long distances from preparation to storing and dispensing.

The position of the entrance also causes long transport which is a problem for the heavy coded mixtures.

The flow of the coded tablets is complicated because there are too many storing stations.

The dispensing of coded drugs conflicts with the preparation of un-coded mixtures and ointments.

4.2.4

DISPENSING

The dispensing of coded drugs at one counter and the uncoded at the other counter is mixed up partly as a result of the prebottling of uncoded mixtures and the preparing of ointments beside the counter for coded drugs.

There is no place to put the prescriptions which are given inside the counters from the coded window to the dispenser at the uncoded window.

4.2.5

ORGANISATIONAL PROBLEMS

The PH is not supplied with adequate packages for different drugs like envelopes for the coded tablets, and bottles for the ointments. Neither are they supplied with books and tablets for the mixtures.

The PH-staff don't wash the bottles themselves; rather, they ask the patients to do it and that is considered adequate.

One attendant is always dispensing at one counter. The PH is overstaffed according to KNEPOROS.

4.3

PROBLEM ANALYSIS

4.3.1

GENERALLY

The form of the OPD-PH should be easy to adopt to different premises and with a span which can easily be used for different construction and layouts.

The entrance of the PH should be placed in such a way that the transport doesn't conflict with the dispensing.

There should be an adequate place to prebottle the external mixtures.

There should be an adequate place to store the prebottled uncoded mixtures before dispensing.

There should be an adequate place to prepare the ointments. There should be an adequate place to keep and prepare the eye ear and nose drops.

The different kinds of syrups could be kept together. There should be adequate places to prepare tea, put the clothes and keep the cleaning materials.

4.3.2

FURNITURE

Table no. 2 should have measures more convenient for working both in sitting and standing positions.

The cupboard no. 1a should be placed in line with the desk above so it is easy to open and reach the drugs.

The shelves no. 6 should be put close to the counter and made lower to make it easy to reach all bottles.

The paper box no. 1 should be made in a better material and should be easy to carry.

The pigeon holes no. 8 should be bigger so that all different kinds of tablets have their own adequate space.

The sink no. 11 should be lowered.

The cupboard no. 12 shall be placed in such a way that it is easy to open.

The grid no. 14 should be lowered so it is easy to reach all the tablets.

The table no. 18 should be bigger so that everything has its place and so that it is easier to keep order (and so that it is possible to have tea without cleaning up all the table before).

The sink no. 20 should be made lower so it is easier to handle especially the heavy plastic bottles with mixtures.

The table no. 21 should have measures more convenient for the work done there involving heavy lifting.

The overcapacity of cupboards should be reduced.

4.3.3

MOVEMENTS

The different functions, should be organised so the work routine can be simplified. The different functions should also be organised in such a way that the distances to carry, especially the more frequent and heavy ones, are minimised e.g. the flows are concentrated and shortened.

The entrance should be placed in such a way that it doesn't interfere with the working routines and so the most frequent transports are simplified.

The many storing stations for the coded tablets ought to be reduced.

The prebottling of uncoded mixtures, especially those for external use, and the preparing of ointments should have their own specific places for being handled so that they don't conflict with the dispensing.

4.3.4

DISPENSING

The prebottled uncoded mixtures should be stored on the shelves in such a way that they can be reached from both counters to make them easy to dispense, or the prebottled uncoded mixtures should be considered as coded and dispensed only at the counter for coded drugs.

The ointments which take some time to prepare should be placed close to the counter for uncoded drugs in order to be dispensed there so the dispensing of coded drugs is not delayed.

There should be a place in between the two counters where the prescriptions for uncoded drugs could be placed before being dispensed at the counter for uncoded drugs.

4.3.5

ORGANISATIONAL PROBLEMS

These problems are not analysed.

4.4.0

SELECTION OF PROBLEMS FOR FURTHER STUDIES

Some problems are connected with the staff. For example, the prebottling of uncoded mixtures and the dispensing of them at both counters; however, most are dispensed at the counter for coded drugs. This problem is accepted and should be taken into consideration.

The suggestion from the staff to differentiate mixtures for external use is also accepted as being very reasonable. The staff having tea in the PH is also accepted but it is not taken into consideration that there sometimes are many more than the staff of the PH themselves. That problem must be solved in another way than giving space in the PH itself.

Other organisational problems connected with the staff and with the PH not being supplied with adequate packages are not taken into consideration neither has the problem with the PH being overstaffed.

The problems selected for further studies are those connected with furniture, the working routines as they have been studied during the research period, the movements, the flows and the room layout as a whole.

4.5

PROBLEM SOLVING - THE DESIGN PROCESS

4.5.1

THE FUNCTIONAL STATION FOR THE DIFFERENT DRUGS

To be able to study the functional stations of the different categories of drugs must be analysed.

- A. The uncoded drugs to be locked in.
- B. The common uncoded tablets.
- C. The common uncoded liquids.
- D. The prebottled uncoded mixtures for internal use.
- E. The prebottled uncoded mixtures for external use.
- F. The ointments to be prepared (prepacked).
- G. The coded tablets.
- H. The coded mixtures.

All these different categories of drugs must after coming to the PH have functional places in continuous order for storing and preparation and for the prepacked and prebottled drugs restoring again before being dispensed.

Some of these different categories of drugs can be combined on certain stations thinking of the types of drugs and of the functional stations in a room.

So can for example D and H be combined while it is all mixtures for internal use. Even E and F can be combined as far as preparation is concerned being drugs only for external use. A, B and C can also be combined as far as preparation is concerned. D, E and H can be combined as far as restoring is concerned (with special arrangements see below).

The different functional stations for the different categories of drugs:

A. Uncoded drugs to be locked in:	storing	1	
	preparation	2	
B. Common uncoded tablets:	storing	3	J
	preparation	2	
C. Common uncoded mixtures:	storing	4	
	preparation	2	
D. Uncoded prebottled mixtures for internal use	storing	5	
	preparation	6	
	restoring	7	
E. Uncoded prebottled mixtures for external use:	storing	8	
	preparation	9	
	restoring	7	J

F. Ointments to be prepared (prepacked):	storing	10
	preparation	9
	restoring	11
G. Coded tablets:	storing	12
	preparation	13
	restoring	14
H. Coded mixtures:	storing	5
	preparation	6
	restoring	7

Table 4. Functional stations (combined where possible)

		FUNCTIONAL STATIONS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
CATEGORIES OF DRUGS	A	0	0												
	B		0	0											
	C		0		0										
	D					0	0	0							
	E							0	0	0					
	F									0	0	(0)			
	G												0	0	0
	H					0	0	0							

Suggested type of furniture for the different functional stations.

- 1 cupboard, locked
- 2 desk
- 3 grid and shelves
- 4 shelves
- 5 shelves and desk (for the most heavy mixtures)
- 6 d.esk
- 7 shelves
- 8 shelves
- 9 desk
- 10 cupboard
- 11 shelves
- 12 cupboard locked
- 13 table with chairs
- 14 vertical grid

Other functions than the above mentioned to be considered in a layout are the registration, the staff activities (undressing, tea drinking and washing) the cleaning up and the dispensing.

4.5.2

THE FLOW OF THE DIFFERENT CATEGORIES OF DRUGS

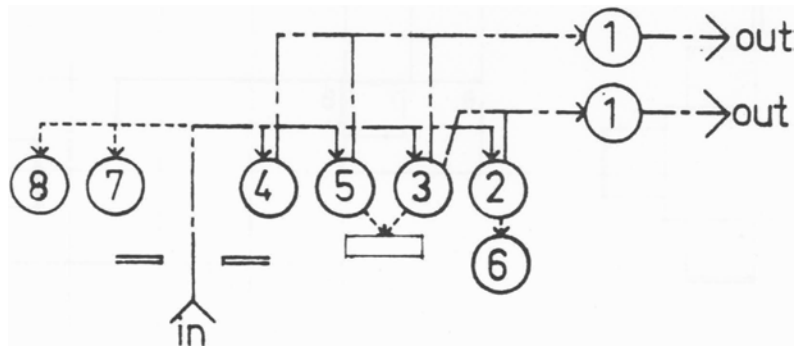
- | | | |
|---|---|--------------------------------------|
| A | [>----00---{> uc | |
| B | t>--<D0---t> uc | UC = Uncoded drugs window |
| C |  | C = Coded drugs window |
| D | f>--(R)-(R)-Q)--t> C or UC | |
| E | f>--(R)-(R)-Q)--t> C or UC | |
| F | C>----(R)@--(> uc | Numbers refer to the above stations. |
| G | [>----@@@----{> c | |
| H | f>--(R)-(R)-Q)--t> c | |

4.5.3

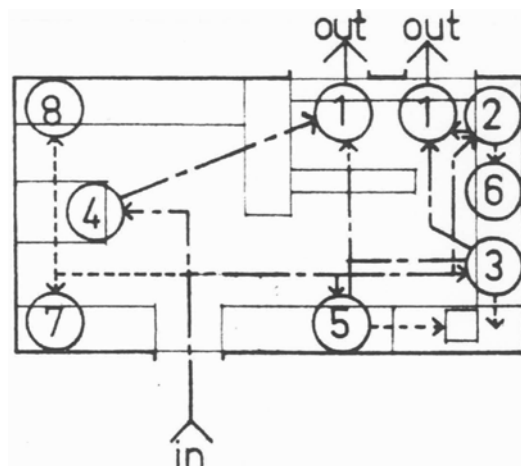
ZONING OF THE ACTIVITIES (FUNCTIONS)

- Zones: 1 dispensing
- 2 preparation and storing of uncoded common drugs
- 3 preparation and storing of external mixtures and ointments
- 4 preparation and storing of coded tablets
- 5 preparation and storing of internal mixtures
- 6 registration and storing of **prescriptions**
- 7 staff activities
- 8 storing of cleaning material

The different zones related to each other:



In this relation scheme the importance of the dispensing zone being in direct connection with the different preparation zones is stressed.

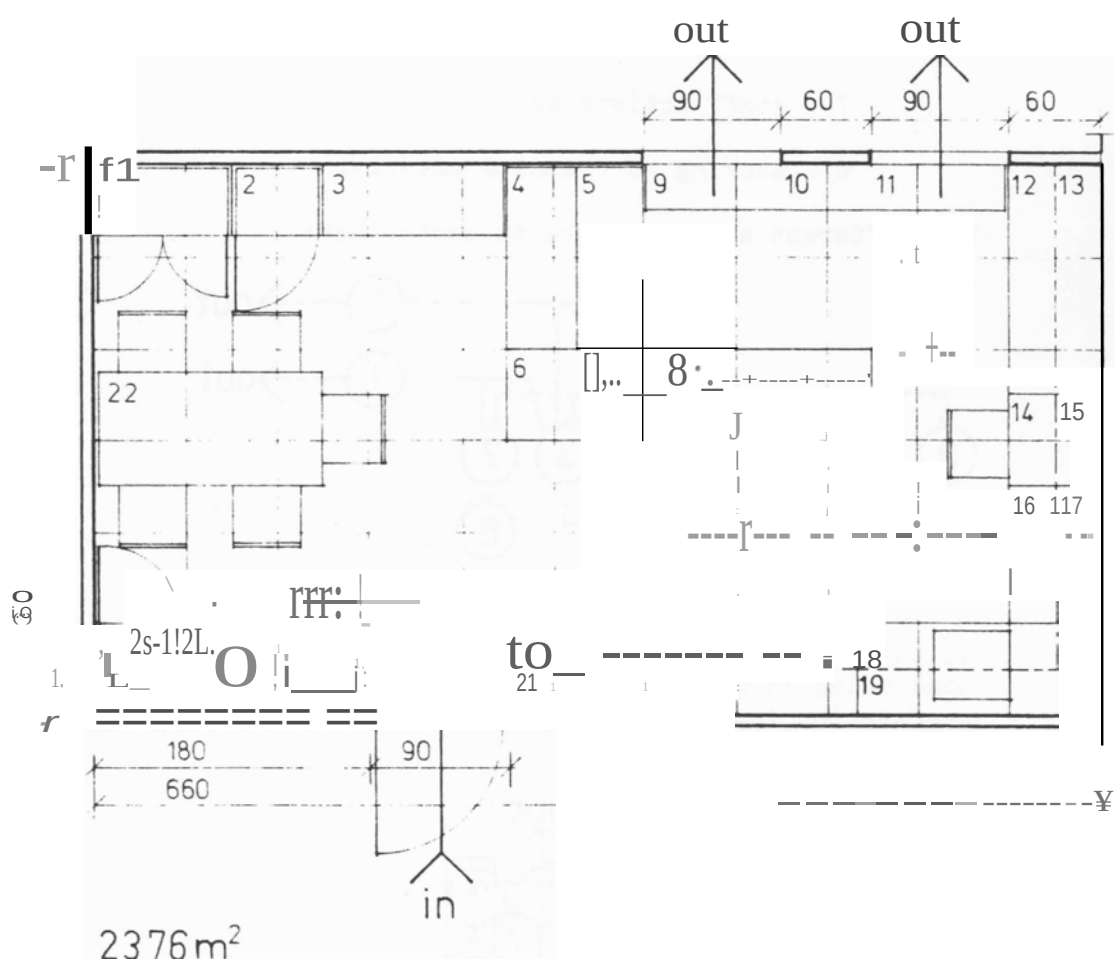


4.5.4

SUGGESTED ROOM LAYOUT

With the study of the functional stations, the flow, the relations between the different zones of activities, the suggested furniture, the span being maximum 4 metres (simplifies the building construction) and the statements under 3, the following room layout was designed.

FIG. 3



FURNITURE CODE

- 1 cupboard for old prescription full height
- 2 cupboards for cleaning material, full height
- 3 cupboards locked for coded tablets, desk height
- 4 grids for prepacked coded tablets
- 5 pigeon holes for prepacked coded tablets
- 6 tables (under 5, 6, 7)
- 7 crates for empty bottles
- 8 shelves for prebottled mixtures
- 9 counters for coded drugs
- 10 place to put prescriptions
- 11 counter for uncoded drugs
- 12 cupboard, locked for uncoded drugs, on top of it
a grid for the most common uncoded drugs and a
place for preparation
- 13 two shelves for common uncoded tablets and mixtures
- 14 writing place for the contrasigned prescriptions
- 15 two shelves for prepacked ointments and the medicine
book
- 16 cupboard for ointments and empty tins and boxes
on top of it placed for preparation of ointments
and external mixtures
- 17 two shelves for external mixtures
- 18 sink for diluting the mixtures and for washing the
jar and the funnel
- 19 one shelf for no special purpose
- 20 desk for prebottling of internal mixtures

- 21 one shelf for the diluted mixtures
- 22 table for prepacking coded tablets and for tea drinking
- 23 sink for washing
- 24 cooking place with cupboard under for cups, tea etc.
- 25 cupboard, full height, for clothes.

The dimensions of furniture and the distances in between which are related to the working conditions are partly taken from Swedish anthropometric studies partly simulated in the mock up room (see below) and partly a result of the observations in the existing pharmacy.

Thus the benches surfaces for preparation are not deeper than 60 cm or higher than 85 cm. The shelves are not wider than 20 cm and the storing cupboards not deeper than 45 cm (see drawings of the suggested furniture).

The storing capacities of the suggested furniture is related to the capacity as a result of the observations in the existing PH.

THE FLOWS OF DRUGS IN THE SUGGESTED ROOM LAYOUT

The flows of the drugs in the suggested room layout are illustrated in fig. 4 in the same manner as for the existing pharmacy.

1 UNCODED TABLETS

$t > \text{---} @ \text{---} \{ >$

to be locked in

common

2 UNCODED : MIXTURES

common

$t > \text{---} \text{R} \text{---} \text{R} \text{---} \text{I} >$ (to be locked in)

prebottled (for external use)

3 OINTMENTS

$C > \text{---} \text{R} \text{---} \text{R} \text{---} t >$

common

to be prepared

4 CODED TABLETS

5 CODED MIXTURES

(including syrups}

$[> \text{---} @ \text{---} \text{R} \text{---} \text{R} \text{---} \text{---} \{ >$

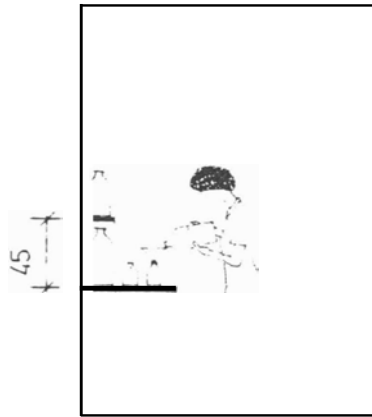
OBSERVATIONS AND SIMULATION IN A MOCK-UP PH

The suggested room layout was mocked up at an unused place of the OPD.

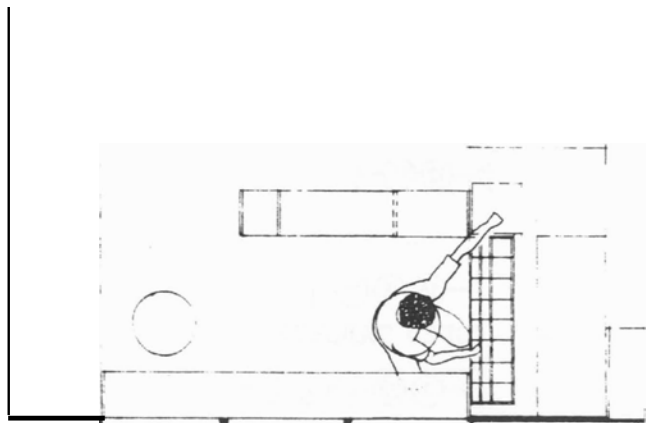
The following simulations were done:-

1. Prebottling mixtures on different heights of the desk (85, 88, 91, 97 cm)

The shelf was fixed to 135 cm length.



2. Dispensing at the counter for coded drugs while moving the shelf into different distances **from** the counter (70, 80, 90 100). The dispenser was mostly sitting (height of chair 65 cm).



3. The dispenser of coded drugs passing behind the dispenser of uncoded drugs.

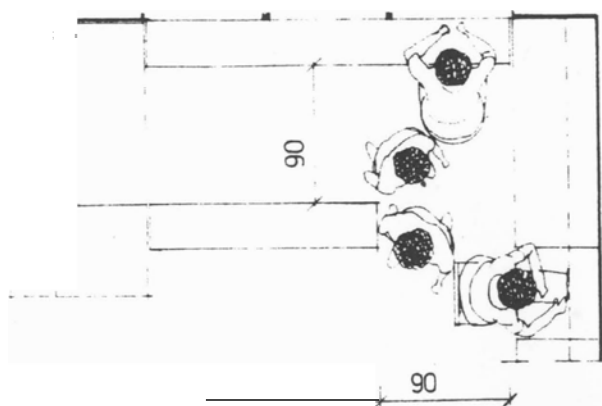
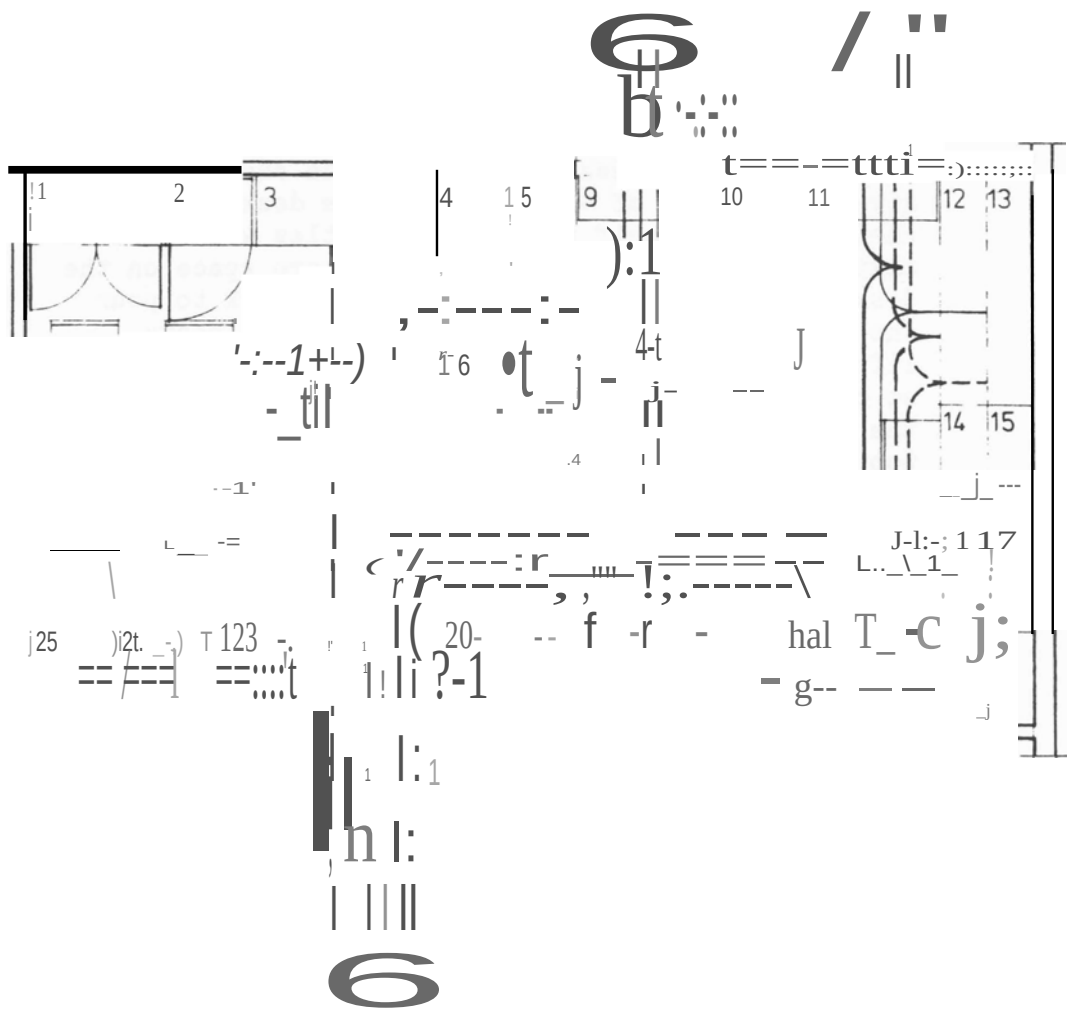


FIG. 4
FLOWS OF THE DRUGS



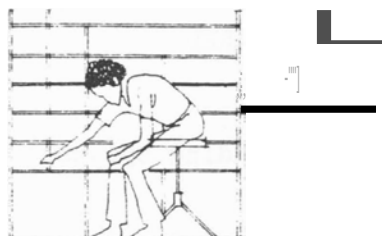
OBSERVATIONS:

1. The prebottling of mixtures is work with heavy lifting. The most heavy bottles are the ones used for the concentrated raw material. These should be placed on the desk itself under the shelf which gives a distance of 45 em between the desk and the shelf. On the shelf the lighter bottles with diluted mixtures ought to be placed to give more space on the desk itself for prebottling. Even the work to pour the diluted mixtures into the jar includes heavy lifts which are easier to do if the desk are lower, so one does not have to lift the arms so high. Even the prebottling itself is easier if the desk is not too high. Taking the diluted mixtures from the shelf is quite an effort if the bottles are filled, and is easier if the shelf is lower. The depth of the desk was considered to be realistic.

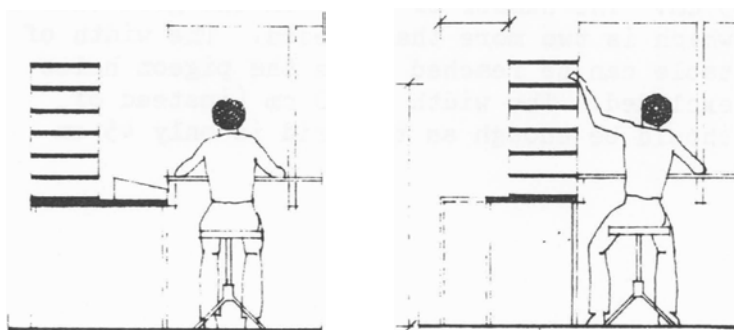
CONCLUSIONS:

The height of the desk should be 85 em and the depth 60 em. The height of the shelf should be $85 + 45 = 130$ em.

2. The dispensing at the counter for coded drugs is quite fast work which could be simplified if everything is easy to reach. In the existing PH the dispenser is always standing while he, of course, is more mobile. However, it ought to be possible for him to reach the most frequent drugs while sitting. The measures of the mocked up shelf was: height 140 em (25 em lower than the existing one) with the lowest shelf at 40 em height, length 150 em and width 30 em. The shelf was made larger than the existing one (90 em) while there was one shelf less and the idea was the uncoded prebottled mixtures should also be put on the shelves.

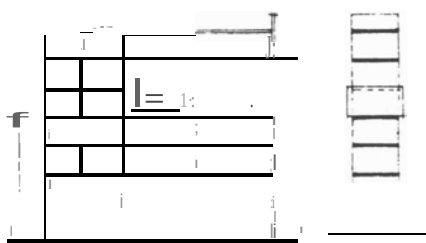


While testing the distances of the shelf, it was evident that it was difficult to reach the bottles at the end of the shelves. It was also clear that the highest shelf could be higher and that the lowest one ought to be higher. The depth of 70 em was apparently too narrow and the depth of 100 em too wide. While simulating the distances of the shelves we also studied the possibilities of reaching the coded tablets on the left hand side of the dispenser and the crate for the empty bottles given by the patients. It was evident that the crate was not easy to reach and that if the grid with coded tablets was put closer the dispenser could take the tablets directly from the grid; excluding the pigeon holes in between and eliminating one station for the coded tablets.



The height of 90 em standing on a table of 90 em height, thus the highest shelf in the grid was 165 em. This height was still a little difficult to reach sitting which means that the highest shelf ought to be lowered a little.

The width of the grid being 120 em and putting it close to the counter makes it impossible to have the crate on the left hand side of the counter. That problem, however, can be solved by putting the crate in the shelves just behind the dispenser where it also is easier to reach. This causes some special arrangements in the shelves while the distance between the shelves is only 20 em.

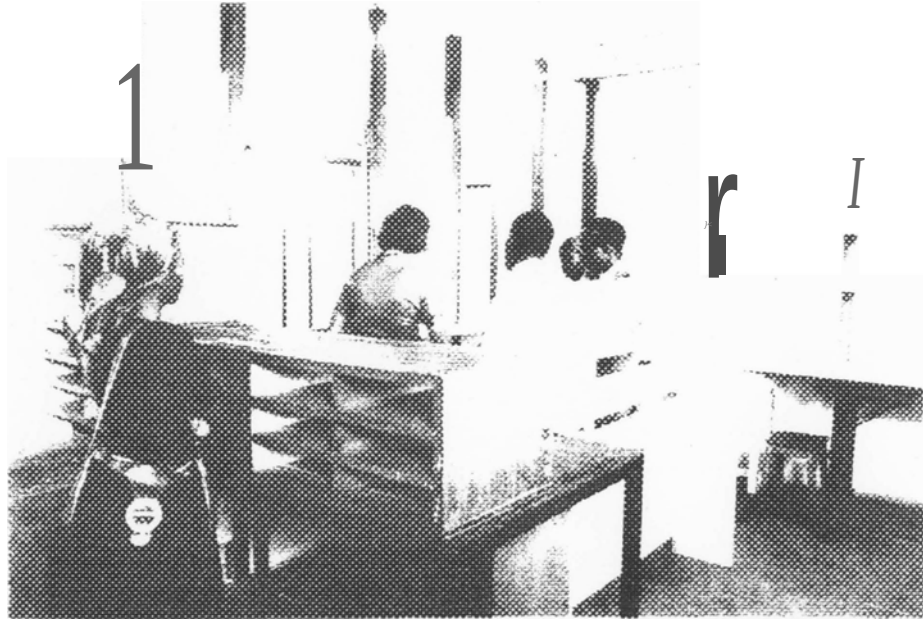


The crate for empty bottles has here been placed in the bottle rack.

CONCLUSIONS:

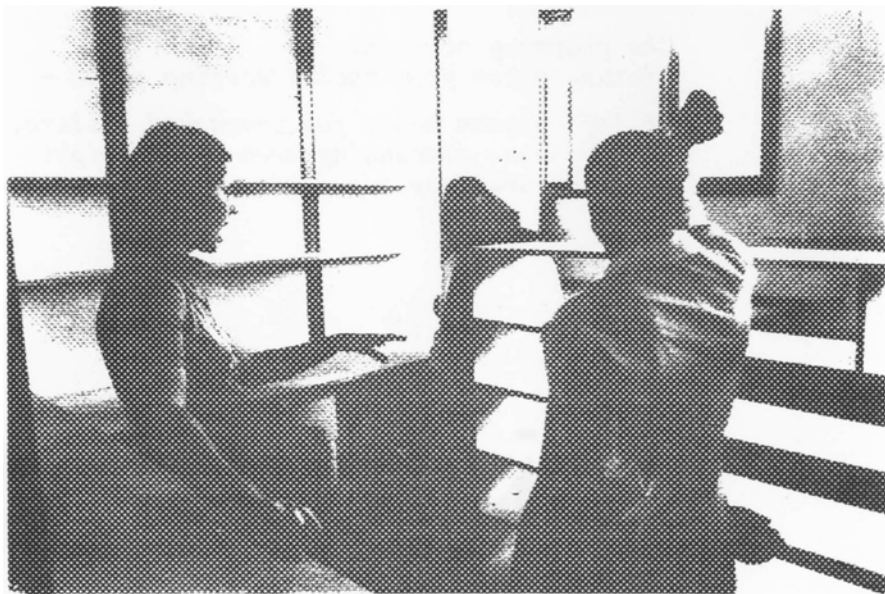
The distance from the counter to the shelves should be 90 em. The height of the shelves should be 145 with the lowest shelf on 45 em. The length of the shelves can be 150 em but then the less frequent mixtures should be put at the end; for example, the prebottled uncoded mixtures which could then even easily be reached from the counter for uncoded drugs. A place for the crate should be built into the shelves. The grid for the coded tablets should be put close to the counter. The counter 30 em wide and the distance between the counter and the shelves being 90 em gives the width of the grid 120 em.

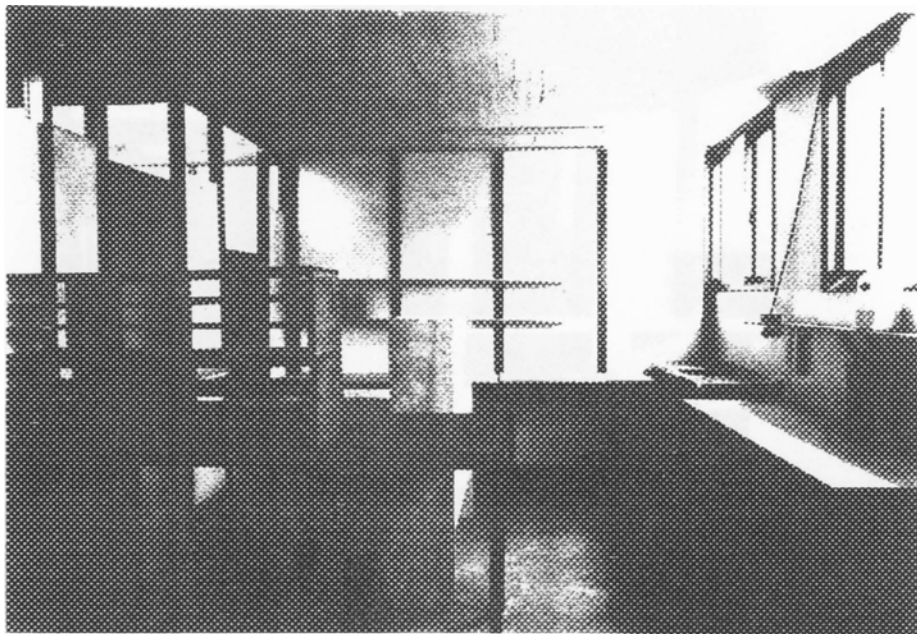
The height of the highest shelf in the grid should be 160 em which gives a height of the table below at 85 em. The number of holes in the grid thus is 24, which is two more than needed. The width of the table can be reached while the pigeon holes are excluded. The width of 60 em (instead of 90) should be enough as the grid is only 45 em deep.



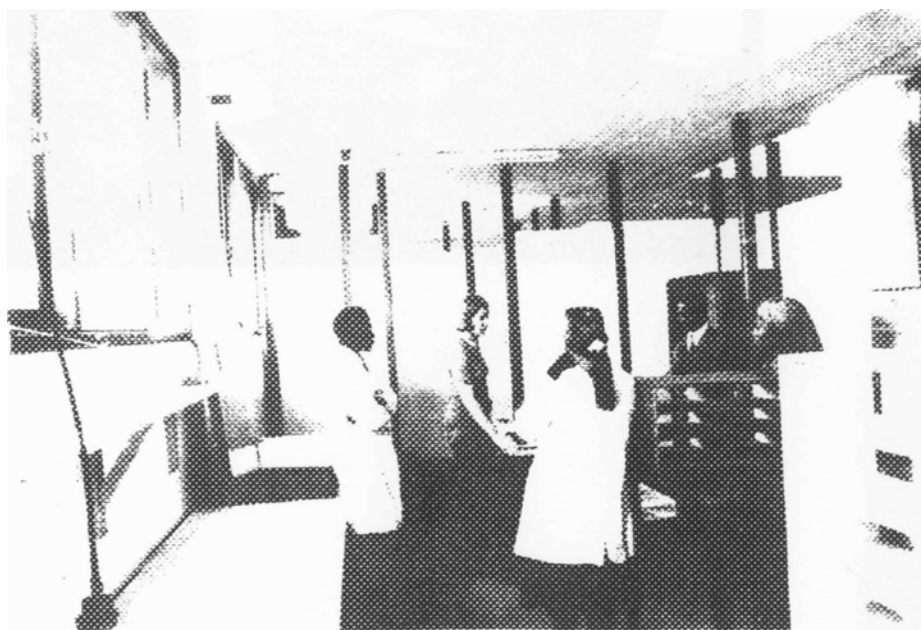
1t.Jj...f. :")...J' [.,1;:: :>]rJ."(>7t"J,C!-f d.:r;(t-A: ---1;Y(.· the space around
i.){n:ZGLN' / >4 f,lJ:?. mo::_) ,: U[;..

The mock up of the pharmacy.





$\{h \mid \exists x \in \mathbb{N} \text{ such that } x \in \text{dom}(h) \text{ and } h(x) = 1\}$
 $2^{\mathbb{N}} = \{f \mid f: \mathbb{N} \rightarrow \{0, 1\}\}$
 $4 \leq t \leq 10, \exists t \in \mathbb{N} \text{ such that } S \text{ is a } t\text{-ary relation}$
 $(\exists c \in \mathbb{N}) (c \in \text{dom}(S) \text{ and } S(c, \dots, c))$
 $z = Jtt! \text{ Er } 0 \text{ } A; U; (I \text{ } \dots \text{ } OC \text{ } \dots) (zC(z \text{ } \dots \text{ } f; 'M' \text{ } \dots))$



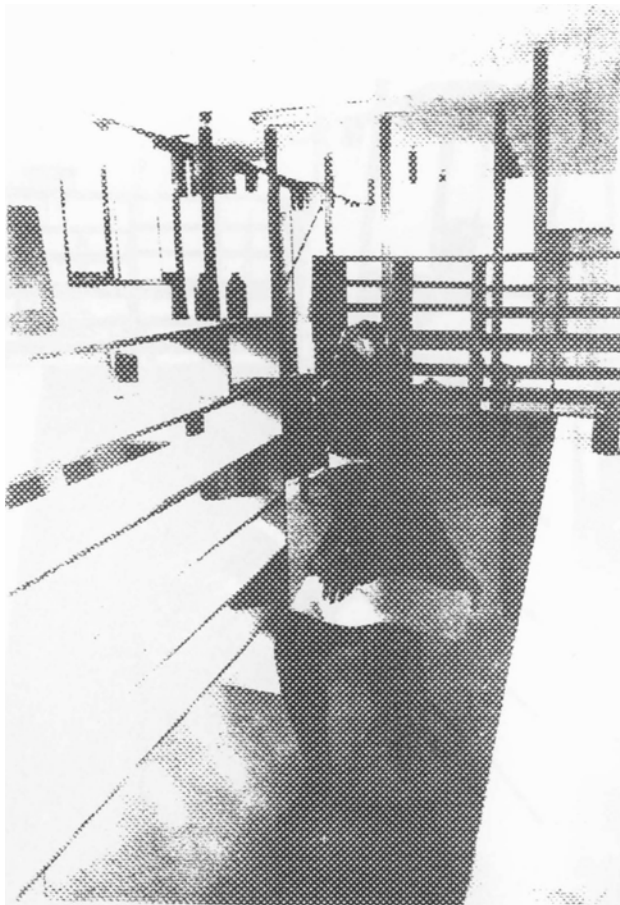
The pharmacy staff is shown the mock up for the first time.



measuring heights and dimensions of furniture while prebottling coded mixtures.



Assessing convenience for the dispenser to reach the crate.



Assessing convenience for the dispenser to reach the crate. shelf m dispense .

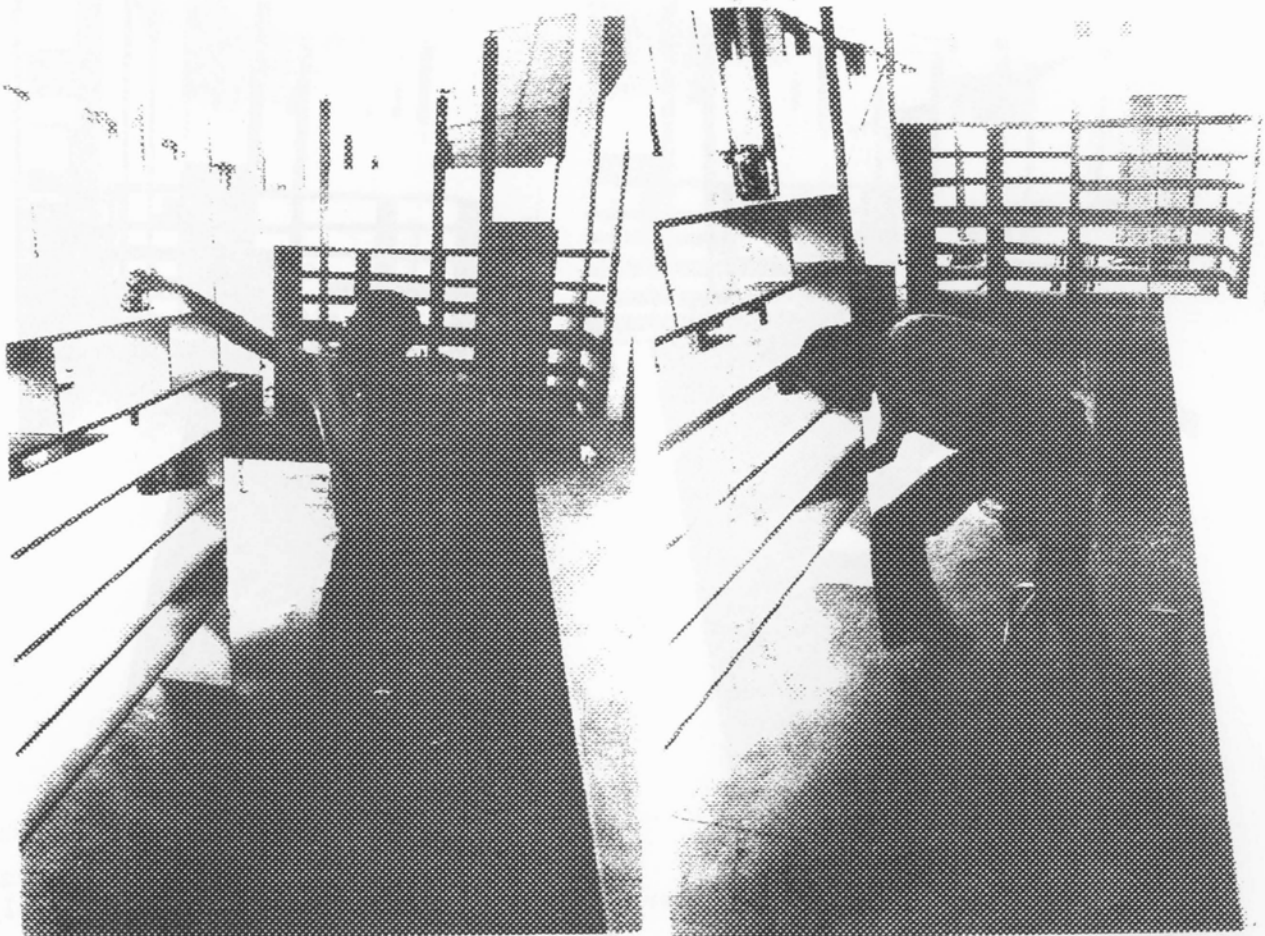
Assessing convenience for the dispenser to reach the prepackaged tablets.



Assessing convenience for the dispenser to reach the prepackaged tablets. be wee Pegiste ing place and shelf.



Assessing space and furniture dimensions at the dispensing area for coded drugs.



4.5.7

DISCUSSIONS WITH THE STAFF OF THE PH IN THE
MOCKED UP ROOM

As a whole the staff liked the mocked up PH and wanted to try it in reality.

Conclusions from the discussions with the staff:

The wish that more than two dispensers could work at the same time ought to be fulfilled by enlarging the window area. There could be three windows, each with a width of 80 cm, all along the counter.

The windows then must open upwards. The wish that the two dispensers usually working at the two counters should be able to help each other when one window is overcrowded and the other is empty is met by avoiding any furniture in between the two main windows.

The storage of empty Tusker Export beer bottles could be arranged by fixing one or two crates as drawers under the desk for prebottling mixtures.

The sink ought to be a double type which also facilitates washing the bottles.

The first day's discussion with the two technicians from the OPD-PH and the head of the main pharmacy, is summarized below -

DISCUSSION:

The antibiotics should be locked up in a place where it is safe - even if they forget to lock the cupboard.

The technicians were afraid that the attendants would take something away. They understood the conflict between easy to reach and the wish to lock it away. One suggestion was to keep the antibiotics in a locked cupboard over the desk for preparing ointments and external drugs.

The storage capacity was considered too small. After we had explained that under almost all desks could be cupboards and that there should be more shelves than was shown they found it enough. They mentioned that the storage capacity as a whole was too small, the mocked up room was smaller than the existing pharmacy.

The table for prepacking and tea drinking was mentioned as too small. After we showed them how big their actual table is they thought the new one was big **enough**. They wanted more than 2 people to be able to work at the counters at the same time. That could be solved by either extending the room or by making a wider window i.e. by taking away the piece of wall in between the two windows.

The wish that many people should be able to dispense at the same time and the wish to have everything within reach while dispensing comes into conflict with the fear for any of the antibiotic drugs being stolen i.e. they should be put away somewhere.

One suggestion was to put the grid with uncoded drugs in between the two counters like it is now. That however, makes it impossible to co-operate while dispensing or to have more than two people dispensing. The reason for putting the grid in between should be to keep the attendant at the coded window away from the antibiotics. This however, shows a conflict with the KNEPOROS routine which has the two counters. Another reason for putting the grid in between the two counters was that the dispenser dispensing coded drugs should be able to dispense some of the uncoded drugs. This also conflicts with the KNEPOROS routine which strictly differentiates between what should be dispensed at each counter.

One of the technicians thought it was alright with the antibiotics placed where we suggested after realising the advantage of having everything within reach.

They wanted to be able to store empty bottles to make the routine of prebottling not depending too much on the patient bringing new bottles.

The sink in between the two tops for internal and external mixtures should be a double one.

The second day discussion with the staff of the OPH-PH:

The two technicians and two other of the staff members (two attendants) came on their own initiative to the mocked up pharmacy to discuss the layout, especially the problem where to put the antibiotics.

The suggestion was after some discussion to put the locked cupboard, under the desk. According to one technician it is not very important that you can

sit and write which would be difficult if you put a cupboard there. Another result would be that the shelves for the mixtures must be shortened to make the passage broader in order to be able to open the doors when someone is passing. According to the staff that would not be a problem since they noticed that the proposed one was much broader than

the one they used now (150- 90).

The shelves should be painted so that each mixture has its own place. With six shelves painted into three divisions there should be place for 18 different kinds of mixtures. (8 coded+ 10 uncoded but prebottled). The divisions could be of different sizes according to the proportion of frequency.

There should be a partition between the writing place and the desk for preparing ointments and external mixtures because it is a "dirty" place which should be separated.

To make it possible for more than two people to dispense at the same time, the window area should

be enlarged. That could be obtained by making three windows all along the counter without enlarging the area. Then the staff could open as many windows at a time as necessary according to the patients flow.

The shelves for prebottled mixtures should be divided into about 18 different partitions so that every mixture has its own place. There should be edges on the shelves like the existing one so that the bottles cannot easily fall off.

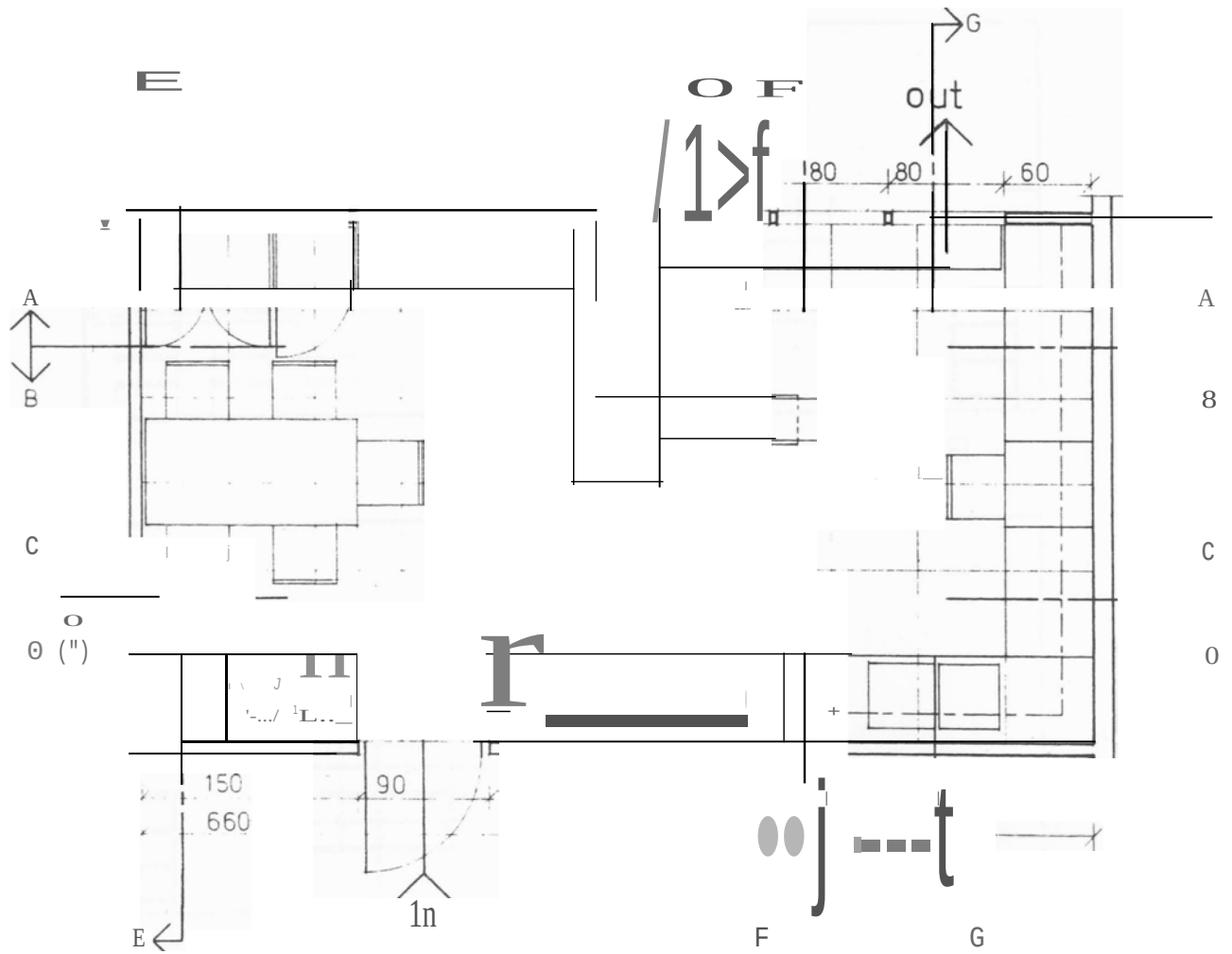
There should be a partition between the table and the desk for preparing ointments and external mixtures.

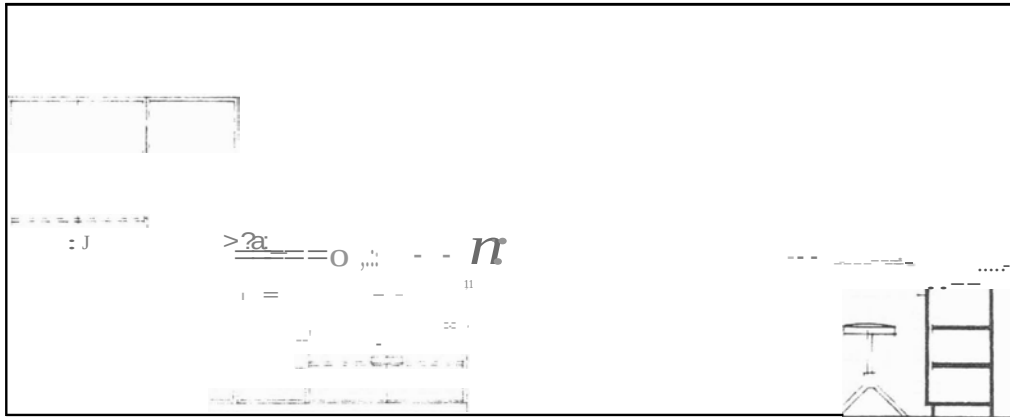
The problem with the antibiotics however is more difficult to solve, because it is mostly a problem of discipline. It doesn't really matter where it is placed if it is not locked. There is actually no place which is easier to supervise than the one just close to the dispenser of antibiotics and no one can pass between him and the cupboard. The suggestion to put the cupboard under the desk conflicts both with the possibility of sitting writing, which they usually do while balancing the books, and the suggestion to enlarge the shelves so they can include locks for prebottled uncoded mixtures and the crate. Actually the suggested place seems to correspond most with the wishes of the staff.

Another way which could partly solve the problem with the antibiotics is to have a selflocking bolt on the cupboard door -

4.5.8

THE REVISED ROOM LAYOUT OF THE PH





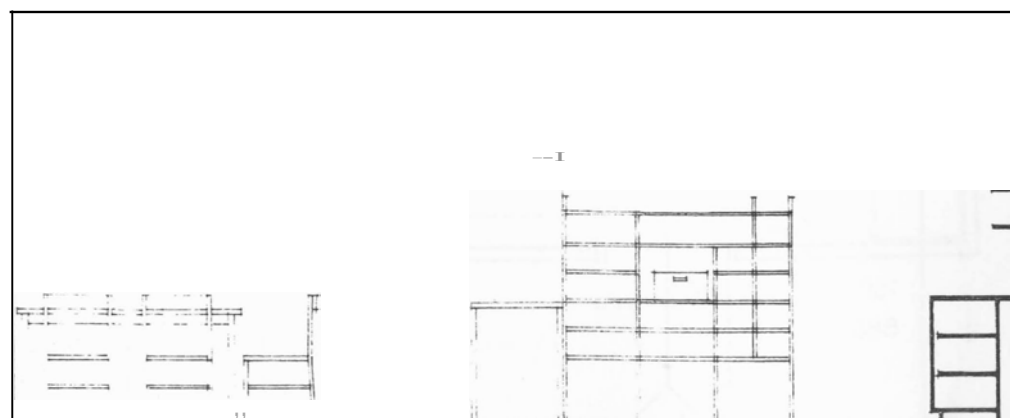
A-A



O-O



8-8



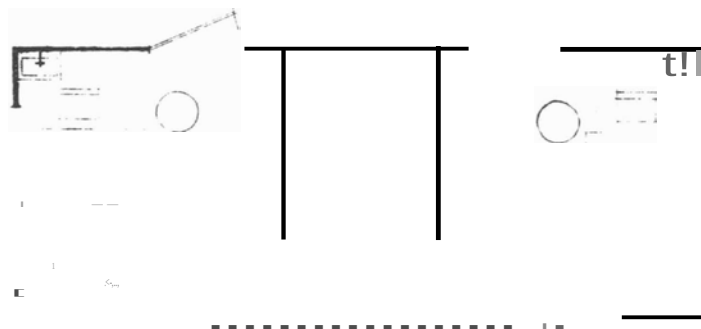
S.O.O.

FINAL DESIGNS

FINAL DESIGN

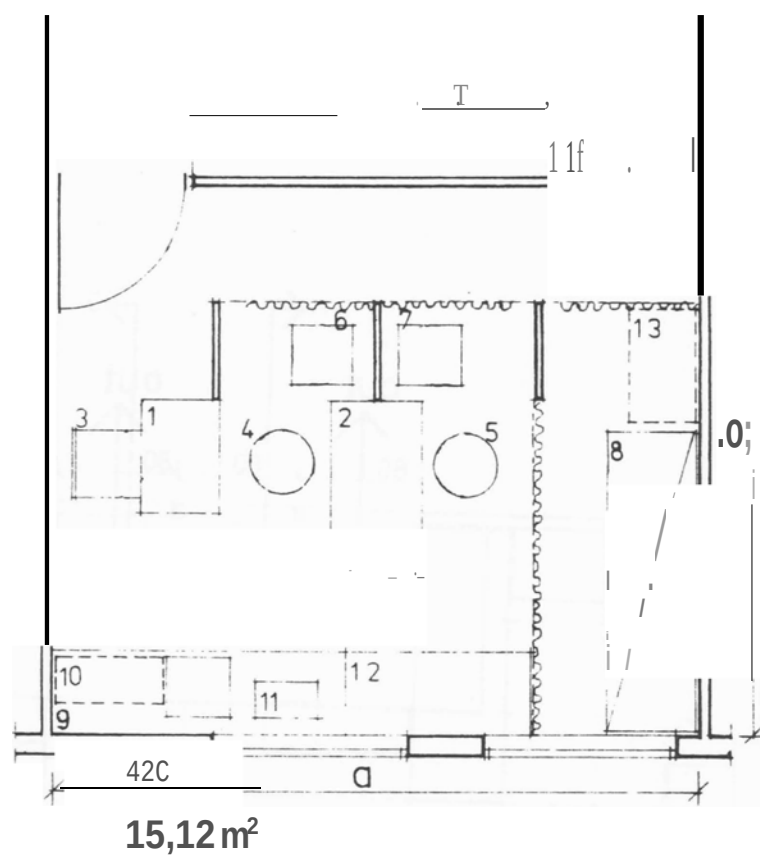


FILTER STATION

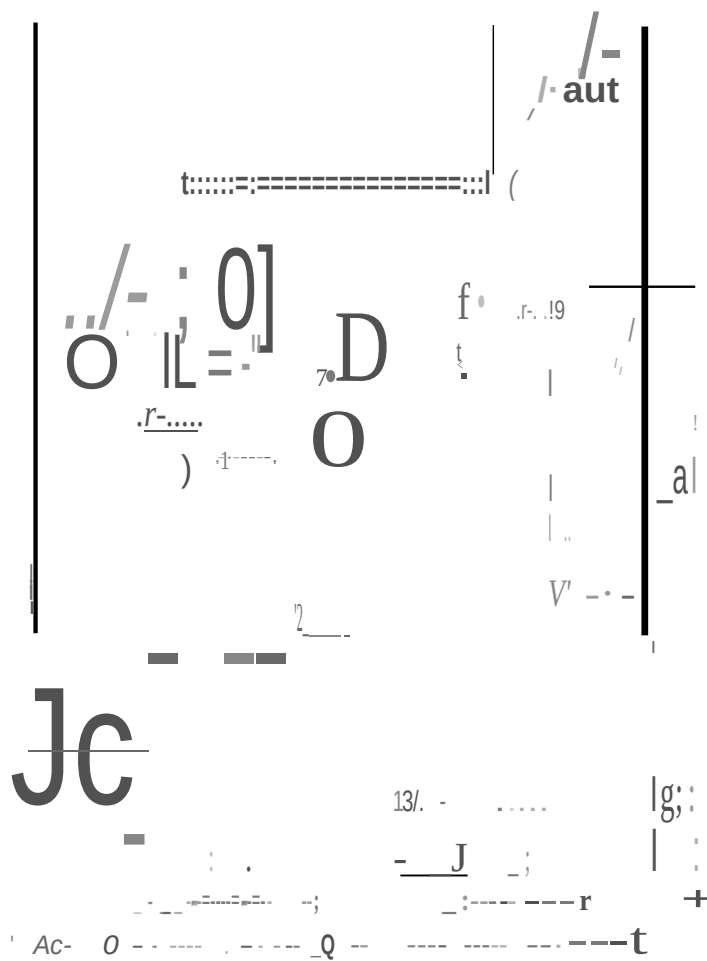


EXAMINATION UNIT

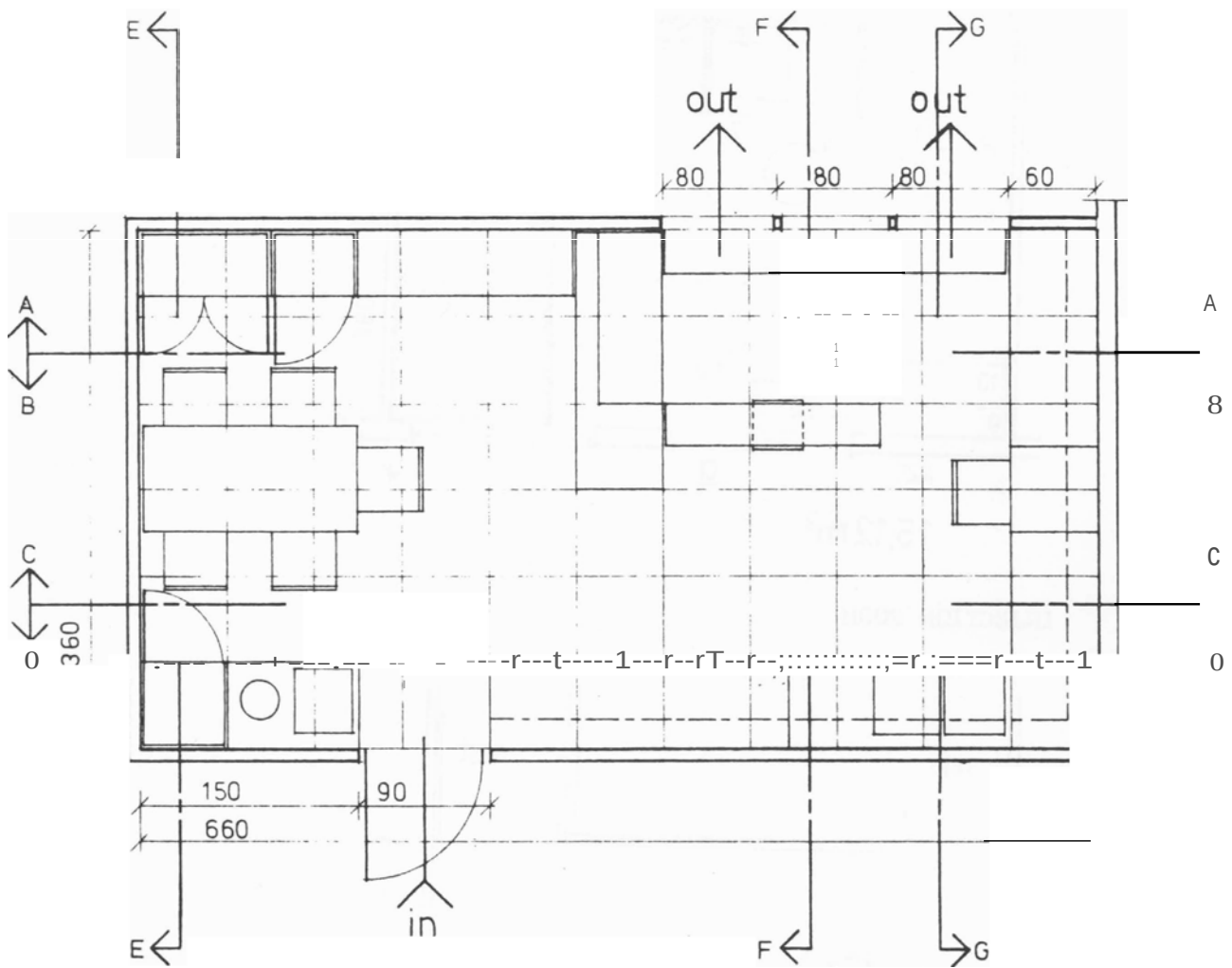
TWO CONSULTATION ROOMS SHARING ONE EXAMINATION CUBICLE.



INJECTION ROOM



FINAL DESIGN



PHARMACY