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AN INVENTORY OF WATERSUPPLY, SANTATION, HEALTH - AND SOCIO-ECONOMIC STATUS IN FOUR COMMUNITIES IN THE MUNICIPALITY OF CAPÃO BONITO, SÃO PAULO STATE, BRAZIL

THESIS

AGRICULTURAL UNIVERSITY OF WAGENINGEN (THE NETHERLANDS)

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WINFRIED OVERBEEK
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PREFACE

During our six-months' practical term in Brazil, there were many people who helped us to make our stay a succesfull one. Here we want to thank our compagnion prof. Santos for his help and encouragement. Further on, we would like to express our thankfulness to people from the library, the computer-centre, Bruno for his statistical analyses, and all other people of CETESB who showed their willingness to help us.

Also we want to thank the people from the ERSA and Adolfo Lutz laboratory in Capão Bonito and especially people of Turvo dos Almeidas, Ana Benta and Capoeira Alta, who were willing to receive us for carrying out our fieldwork. Besides answering our 'research questions' we lived with them and learnt about their habits and ideas. This made our time in the villages to a pleasant and important experience.

We will remember all our friends of São Paulo with whom we had such a good time.

Hennie and Winfried

C.

SUMMARY

This research is about an inventory of water, sanitation, health- and socio-economic status in three villages, within the municipality of Capão Bonito, São Paulo State, Brazil. The research was done in terms of the 'Projeto Saneamento Rural', which aims to assist the rural population of Brazil with clean water and adequate sanitation. The inventory was carried out by the CETESB-institute in São Paulo, with the assistance of two Dutch trainees, Winfried Overbeek and Hennie van Vree.

The methodology of the research was based on the Minimum Evaluation Procedure (MEP) of Schultzberg (1982). This is a relatively cheap and simple method of evaluating water supply and sanitary projects. One of the three villages acted as a control community (Turvo (+)). Its people have been served for four years by a piped water supply, which was built and is operated and maintained by the water agency SABESP. The other part of Turvo dos Almeidas (Turvo (-)) and the other two villages (Capoeira Alta and Ana Benta) acted as project communities where in the near future a SABESP water network will be implemented. So, out of the three villages, four communities were studied.

Both researchers investigated two communities during a period of four weeks. They lived in the villages themselves during the fieldwork period (may-july 1988). Each investigated community consisted of 100-200 people. Information was gathered by means of preliminary questionnaires and household interviews. Latrines and water points were inspected as well. The water quality of these water points was examined (bacteriological and physical-chemical parameters). To get an idea about the prevalence of intestinal diseases, the community was subjected to a stoolexamination. Besides, a diarrhoeal morbidity survey and measurements of weight and height were carried out among children under five years of age.

Regarding to all **socio-economic indicators**, as age, literacy, education, housing, labourforms, the highest and most comparable socio-economic level was encountered in Turvo (+) and Turvo (-). The situation in C.Alta turned out to be the poorest. E.g. percentage of illiteracy here reached up to 13 %, compared to 5 % in Turvo dos Almeidas.

In regard to the **water supply and water facilities** the most urgent situation is present in C.Alta. Not only numbers of users per water point are high (11-23), but also consumed water quantities are the lowest. Still 19 families (108 people) are using river water for drinking and cooking. The water quality is not sufficient for consumption (fecal coliform numbers range from 11-1300/100ml).

In Turvo (-) and A.Benta the water situation is less urgent. All villagers have access to reasonably good water supplies (wells and springs). In all communities, it was observed that families used higher water quantities when they were supplied with more

sophisticated sanitary facilities.

That water quantity and -quality had its influence on health was proved in Ana Benta and Capoeira Alta. Water quantities used in Capoeira Alta were lower than in Ana Benta. A remarkable difference in diarrhoeal morbidity was recorded, probably due to bad hygienic conditions in combination with the poor water quality. During a 14 day survey 13 children had 27 episodes of diarrhoea in C.Alta, compared to 30 children with 9 episodes in A.Benta.

Sanitary conditions appeared to be better in Turvo (+) and Turvo (-) than in Ana Benta and Capoeira Alta. In the first two communities, the majority uses w.c.'s, and latrines have respectively 75 and 40% concrete slabs. Slabs made out of wood and/or earth are more common in A.Benta and C.Alta, where the majority uses latrines.

The prevalence of **excreta-related diseases** appeared to be significantly higher in A.Benta and C.Alta (45.9-47.1%) than in Turvo (+) and Turvo (-). Although sanitary conditions in the last two communities were rather good, still respectively 35.2 and 32.1 % of the population suffered from intestinal parasites. In Turvo (+) and Turvo (-) these parasites were of a fecal-oral origin (E.coli and G.lamblia), whereas in A.Benta and C.Alta, the soil-transmitted helminth Ascaris was most prevalent.

For Turvo dos Almeidas, it was concluded that just implementation of a water supply did not result in improvement of the community health status. Although Turvo (+) has SABESP-water and Turvo (-) lacks this facility, no significant difference was measured in the prevalence rate of intestinal infections, nutritional status of children and diarrhoeal prevalence. Usage of tap water and w.c. or an adequate latrine alone did not guarantee the absence of infectious intestinal diseases. Development of hygienic and sanitary behaviour is strongly required.

In Ana Benta and C.Alta where latrine conditions were relatively more primitive, a significant difference was found in the infection rate of intestinal parasites between people using w.c. and those who were using latrine or bush to defecate.

The **nutritional status** shows to be better in Turvo (+) and Turvo (-) and worse in Ana Benta and C.Alta. In this aspect socio-economic level had its influence. Under the poorest conditions, malnutrition shows to be the worst, including water-, sanitary- and hygienic conditions.

It was suggested that an **intensive extension** campaign on hygiene and latrine usage could do well in terms of improving the health status of the communities. Both ERSA and CETESB could be involved in this type of community development. Not only adults, but children as well should be subject to health education. **Community participation** has to be taken into account as well. For this reason it is preferable that people from the community take

charge of education. Therefore the role of CETESB and ERSA should be one of instructing and educating some selected villagers. The latter will transmit their knowledge to the community itself. The efficiency of health education could even be more amplified, if a health unit could be attended by the community. The ERSA could help in this way to install and arrange health units in Ana Benta and Capoeira Alta.

Improval of latrines, e.g. promotion of concrete slabs, is preferable instead of introduction of e.g. a sanitary unit with w.c., shower and septic tank. A latrine is a well-known system and people can therefore be greatly involved with the improvement works.

Because of the urgent water situation in Capoeira Alta, it is suggested that SABESP-water is preferably implemented in this community.

RESUMO

Esta pesquisa refere-se a um inventário sobre a qualidade de água, saneamento, saúde e sobre o padrão socio-econômico de três localidades situadas dentro do Municipio de Capão Bonito, pertencente ao Estado de São Paulo, Brasil. A pesquisa nomeada de 'Projeto de Saneamento Rural' tem com meta assistir a população rural com água potável e saneamento adequado. O inventário foi desenvolvido através da Companhia de Tecnologia e Saneamento Ambiental (CETESB), São Paulo, com o auxilio de dois estagiários da Universidade da Agricultura de Wageningen da Hollanda.

O método de pesquisa foi baseado no processo mínimo de avaliação (PMA) de Schultzberg (1982). Este é um método relativamente simples e barato de se avaliar o abastecimento de água e projetos sanitários. Uma das quatros comunidades atuou como comunidade de controle, Turvo (+), pois as pessoas dispunham de água encanada fornecida pela SABESP, Companhia de Saneamento Básico do Estado de São Paulo, há mais de quatro anos. A outra parte de Turvo dos Almeidas (Turvo (-)) e as outras duas localidades, Capoeira Alta e Ana Benta, apenas possuem projetos de futuras instalações da rede de água pela SABESP. Deste forma foram estudadas quatro comunidades que fazem parte de três localidades.

Os dois pesquisadores investigaram as duas comunidades durante um período de quatro semanas, período em que permaneceram em campo, de maio a junho de 1988. A comunidade pesquisada consistia de uma população entre 100 e 200 pessoas. As informações foram recolhidas em forma de questionários preliminares e entrevistas domiciliares. As latrinas e os pontos de captação de água foram examinados através de exames com parâmetros bacteriológicos e físico-químicos. Para se ter uma idéa sobre a incidência de doenças intestinais, a comunidade foi sumetida a exames de fezes. Além disso foi feito um levantamento sobre a diarréia e também foram tomadas medidas de peso e altura das crianças de dois meses até cinco anos de idade.

De acordo com os indicadores sócio-econômicos tais como idade, habitação e formas de trabalho a localidade de Turvo (+) e Turvo (-) obtiveram os maiores níveis. A localidade de Capoeira Alta foi tida como a mais pobre, onde o índice de analfabetismo atingiu 13%, comparados com 5% de Turvo dos Almeidas.

A situação parece ser mais grave também a respeito do abastecimento de água em Capoeira Alta. Nao apenas a relação entre o numero de usuarios por ponto de captação é alta (11-23), mas também a quantidade é menor.

Aproximadamente 19 famílias (108 pessoas) ainda estão utilizando a água do rio para consumo. A qualidade desta água não é suficiente para este consumo devido ao alto número de coliformes fecais que variam de 11-1300/100ml.

Em Turvo (-) e em Ana Benta a situação sobre o abastecimento de agua é menos urgente. Todas os habitantes possuem razoavel acesso

a bons pontos de captação de água tais como poços e nascentes, observou-se em todas as comunidades que se estas famílias estivessem sendo supridas com condições sanitárias mais sofisticadas, o consumo de água seria bem maior.

Pode-se provar que a qualidade e quantidade de água estão diretamente relacionadas com a saúde e isto pode ser provado em Ana Benta e Capoeira Alta. A quantidade de água utilizada em Capoeira Alta era menor que em Ana Benta. Uma diferença notável sobre a incidência de diarreia foi regristrada, provalvelmente devido ás condições higiênicas acompanhada ainda da baixa qualidade de agua. Durante um levantamento de 14 dias, 13 crianças tiveram 27 casos de diarréia em Capoeira Alta, comparáveis a 30 crianças com 9 casos em Ana Benta.

As condições sanitárias parecem ser melhores em Turvo (+) e em Turvo (-) do que em Ana Benta e Capoeira Alta. Nas duas primeiras comunidades, a maioria dos banheiros e latrinas utilizados tinham respectivamente 75 e 40 % de paredes de cimento. As paredes feitas de madeira ou de pau-a-pique são mais comum em Ana Benta e Capoeira Alta onde a maioria utiliza latrinas.

A predominância de doenças relacionadas ás fezes aparentam ser significantemente maior em Ana Benta e em Capoeira Alta (45.9-47.1 %) do que em Turvo (+) e Turvo (-). Embora as condições sanitarias das últimas duas comunidades sejam bem melhor, ainda sofrem de parasitas intestinais respectivamente 35.2-32.1 % da população. Em Turvo (+) e em Turvo (-) eram de origin fecal-oral (E.coli e G.Lamblia), enquanto que em Ana Benta e Capoeira Alta, a maior incidência era de Ascaris, transmitada pelo solo.

Para Turvo dos Almeidas foi concluído que apenas a implementação do abastecimento de agua não garantirá a melhoria do padrão de saúde da comunidade. Embora uma parte seja abastecida pela SABESP, Turvo (+) e a outra parte não (Turvo (-)), nenhuma grande diferança foi mensurada na comparação de taxas de incidência de diarréia. Uso de água de torneiras e de banheiros ou de ainda latrinas por si só não garante a ausência de doenças infecciosas.

Em Ana Benta e em Capoeira Alta onde as condições das latrinas eram mais primitivas, encontrou-se uma diferença significativa na taxa da infecções por parasitas intestinais entre as pessoas que utilizavam o banheiro e aquelas que usavam latrinas ou defecavam no mato.

O nível de nutrição apresenteu-se melhor em Turvo (+) e em Turvo(-) e pior em Ana Benta e Capoeira Alta. Este é influenciado pelo aspecto sócio-econômico. Sob condições mais pobres o estado de nutrição apresentou-se pior, além da água e condições sanitárias.

Foi sugerida que uma intensiva campanha de longa duração sobre o uso de banheiros e sobre higiene em geral, poderia ser útil em termos de melhoria de saúde para a comunidade. Tanto a ERSA como a CETESB poderiam desenvolver este aspecto. E tanto os adultos

como as crianças deveriam ser objetos desta educação sanitária. A participação da comunidade deve ser levada em conta também. Por este motivo prefere-se que pessoas que pertençam à comunidade cuidem com esta parte da educação. Neste caso o papel da CETESB e da ERSA seria de instruir e educar estes pessoas. Este seria transmitir seus conhecimentos para as outros pessoas da comunidade. A eficiência da educação da saúde deveria até ser mais ampliada se um Posto de Saúde pudesse atender à comunidade. A ERSA poderia auxiliar deste modo instalando as Unidades Básicas da Saúde (UBS) em Ana Benta e Capoeira Alta.

A melhoria das latrinas, por exemplo a construção de paredes de cimento, deve ter preferência sobre a introdução de uma unidade sanitária com banheiro, chuveiro e pia. A latrina é o melhor sistema conhecido e as pessoas podem então envolver-se com a melhoria delas.

Devido a urgência da situação da água em Capoeira Alta, sugere-se que seja dada preferência na implantação do abastecimento de água pela SABESP nesta comunidade.

CONTENTS

LITERATURE

LIST OF ANNEXES

GLOSSARY

1. INTRODUCTION

This is a report of a field study by CETESB about water supply, sanitation, health and socio-economic status in three villages in the municipality of Capão Bonito, State of São Paulo, Brazil. The investigation was done in the period may-july 1988 by two dutch trainees as a part of their six-months' practical term at CETESB in São Paulo.

The field study was carried out in terms of the 'Projeto Saneamento Rural' which aims to assist the rural population of Brazil with clean water and sanitation. The main objective is to improve the health standard of the rural population. Drinking water and sanitation programmes are essentially health programs, rather than disease programmes. They work more preventively than curatively. Also, safe drinking water and adequate sanitation are essential prerequisites for community development, and ultimately for social and economic development.

This report starts in chapter two with the research proposal and objectives of the research. Chapter three deals with the methodology of the research. In chapter four, general information will be given about Brazil, Capão Bonito and the investigated villages, including information about water, sanitation and health in Brazil and Capão Bonito. Chapter five gives the results of the field study. The four items of interest are socio-economic status, water, sanitation and waste and finally health. At the end of every section the results will be discussed and conclusions will be drawn. Chapter six deals with the main conclusions and gives recommendations for the 'Projeto Saneamento Rural'. The report has already started with a summary and ends with a list of annexes, a literature list and a glossary of abbreviations and portuguese words.

2. RESEARCH PROPOSAL AND OBJECTIVES

Based on the main objective of the WHO's attempt to supply the whole world with water- and sanitation facilities in the decade 1981-1990, the so-called International Drinking Water Supply and Sanitation Decade (IDWSSD), this project was formulated, in terms of the 'Projeto Saneamento Rural'.

The following research proposal was made:

- In the municipality of Capão Bonito in the São Paulo State, three communities will be investigated. An inventory will be made of the actual status of sanitary facilities, watersupply and health of these communities. These communities must be comparable in the way of socio-economic-, health-, watersupply and sanitary conditions. One of the communities (Turvo dos Almeidas) will partially be functioning as a control village wherein already water is supplied by a watercorporation (SABESP). The other two villages (Ana Benta and Capoeira Alta), and the part of Turvo dos Almeidas without a SABESP-watersupply will be considered as project villages, where in the near future a waternet work will be implemented.;

- In all researched communities the socio-economic situation will be evaluated as well. In this respect labourforms, industrial activities, education, infra-structure and community-organization are of interest.

Objectives which can be distilled out of the research proposal are:

* By means of the gathered information about the health status of the community and inventory of the sanitary conditions and water supply it seems to be possible to give an advice for the kind of sanitation system which is suitable for the project villages (implementation by CETESB).;

* The information obtained can be used as a base-line study for a future evaluation (at least 1 year later), to see if there is any improvement in the health status of the community.;

* Not only can the inventory be used for the advice on the most suitable sanitation facilities to be implemented, it may reveal information which is necessary to make the implementation successful (community participation). These days it can not be denied anymore that without the support of the community, the output of a project will be much less than in case of involving the community in an early stage in the planning of a project.;

* Together with the population, CETESB and other institutes can develop activities which will increase the socio-economic status and so the well-being of the community (remember that the provision of a good water supply and sanitation facilities is just one step more in the right direction, but does not guarantee an increase in the mentioned status).;

* After the examination of the feaces of the habitants, they will receive a treatment if necessary (organized by the ERSA).;

* The introduction/initiation of health posts can be stimulated by presenting the report to involved organizations (ERSA, municipality, SABESP).;

* The latter is considered as important for the implementation of a waternetwork in Ana Benta and Capoeira Alta and the part of Turvo dos Almeidas without a water supply.

3. METHODOLOGY

3.1 Introduction

In this chapter the used metodology will be described. The Minimum Evaluation Procedure (MEP) can be found in 3.2, followed by the description of different ways of data-collection in 3.3. Selection of villages is summarized in the next paragraph (3.4).

3.2 Minimum Evaluation Procedure

The main basis of the investigation was the Minimum Evaluation Procedure (MEP) of Schultzberg (1982). The MEP is a relatively cheap and simple method of evaluating water supply and sanitation projects. According to the MEP, the objectives of investments in sanitation and/or water facilities can only be achieved if the facilities are functioning in the correct way and utilized by the community. Only then, the impact can be measured. So it is clear that data need to be collected on functioning of the facilities, utilization of servicesand on possible impacts. These three kinds of data need somewhat different approaches. For evaluation of functioning, utilization and impact, Schultzberg gives indicators for community water supply, sanitation and hygiene education (see annex D).

Measuring the health impact is the most valuable evaluation, but also the most difficult one. Comparison need to be made with either:
- the health of the same people before the sanitation/watersupply-project was implemented (method B), or
- the health of other similar people who are not served by the same project (method C), or
- both the above (method A).

It is all illustrated in the table 3.1.

In this research, Turvo dos Almeidas is partially functioning as the control village. In one part of Turvo dos Almeidas (Turvo (+)) already existed water implementation of SABESP for 4 years. This part therefore was regarded as control village. Because of this watersupply, it was thought that if a health impact could be found it could partly be described to the better watersupply. The other part of Turvo dos Almeidas, which is called Turvo (-) in the rest of the report, together with Ana Benta and Capoeira Alta are the so-called intervention or project villages. Here no project intervention is expected. Lack of sanitation and watersupply would have it's influence on the state of health. In the near future SABESP will install a waternetwork in these projectvillages. Therefore, method 'C' is followed in this investigation. Disadvantage of this method is the lack of baseline data.

Table 3.1: Alternative methodologies for evaluating health impact studies in water- and sanitationprojects.

	Baseline survey before project implementation	Impact survey at least one one year after project implementation
A Project beneficiaries (intervention group)	x	x
Other similar people (control or comparison-group)	x	x
B Project beneficiaries (intervention group)	x	x
Other similar people (control- or comparison-group)		
C Project beneficiaries (intervention group)		x
Other similar people (control- or comparison-group)		x

'X' indicates that data collection is carried out on this group at this time. A group must not be a single community but a large number of households from several communities.

3.3 Data-collection

In the beginning of the research period a time schedule with all main activities was designed (see annex E). In the following all these activities will be shortly described.

3.3.1 Questionnaires

During the investigation period in the villages, two different types of questionnaires were applied. One was a so-called preliminary questionnaire. This included general questions about composition of the family, age, education and some general additional questions about housing, landownership etc. Labourforms were questioned as well, even as the salaries people were earning. For a total listing see annex F. Preliminary interviews took 10-15 minutes. The other questionnaire was called "the household interview". Householdinterviews could take up more then 20-30 minutes. This checklist (annex G) was more detailed and revealed information about waterusage, sanitary facilities, waste disposal and general health information of the families.

The collection of information of general health needs to be commented. To obtain an idea of the whole spectrum of diseases, it was choosen to review a period of three months of the inhabitants. They were asked from which diseases they had been suffering from the last three months. According to the researchers' opinion this three months period should work out as not too short (which would record not enough diseases) and not too long (which would have interference with lost health information).

Before applying the questionnaires in the communities, they were both pretested in comparable villages (200-300 habitants, simple sanitary- and watersupply facilities, same municipal Capäo Bonito). After pretesting questions were renewed if neccessary. During the first visit of the preliminary questionnaires, the researchers were accompanied by one person of the village. This was to make the introduction in the community a little more easy and also to gain confidence of the community. It was common that women were questioned, because of the fact men were mostly out working . Because the difference in sex (male-interviewers and female responders) it was also necessary to have a person of the community to accompany. Only in Ana Benta the researcher had a companion during the household interviews as well. In Turvo (-) and (+) and Capoeira Alta they were accompanied only during preliminary questioning.

In the first days in the community, a selection was made of the houses to be interviewed. Some 30-40 were selected (150-200 people). These were the houses in the centre of the bairro. More distant house were not included because of practical reasons and because more dispersed locations were not of interest by SABESP.

People who live and eat in one house forms the household. This always appeared to be a family. So in the following, the household and family are used to mention the persons who occupy the house. Some 150-200 people were selected according to the capacity of the Aldolfo Lutz Laboratory, which carries out the feaces-examinations.

3.3.2 Waterquality

A selected number of watersources in each community was examined bacteriological and physical-chemical. For this purpose personal of the Water Research Laboratory of CETESB came over to take watersamples. Analyses were based on the 16th edition of "Standard methods for the examination of water and waste-water (APHA-AWWA-WPCF). Some bacteriological samples were taken out of buckets and storage vessels inside the houses. This to determine contamination by transport or storage. Bacteriologically spoken, fecal- and totalcoliforms and Total Count Plates were analyzed. Physical-chemical parameters were temperature, pH, chlorids, bicarbonates, iron and nitrates.

3.3.3 Collection and examination of feaces

The common gut nematodes are indicators of special interest in the evaluation of sanitation projects. High prevelance in the community indicates bad sanitary facilities or a lack of health education and behaviour . "Changes in watersupply are most unlikely to affect transmission of these worms but improvements in excreta disposal should reduce transmission of Ascaris, Trichuris and the hookworms " (MEP).

In all the communities, a selected group of people was submitted to a stool-examination. The researchers had contacted the nearest laboratory of Aldolfo Lutz (part of department of Health) in Capäo Bonito and organized that they could analyze all samples with a capacity of 40-50 per day. The researchers themselves took care of distribution and collection of the trays. In the late afternoon trays (latinhas) were distributed. The families were visited between 16-19.00 hrs. This to make it possible to meet husbands as well, for they seemed to be very reluctant to collaborate with this type of examination. Men found intestinal infections just a disease for women and specially children. In their opinion men don't suffer from these infections. Inside the house, the researchers with help of the companions explained how to use the trays. Every individual received a tray with a written name, age and a housenumber code. To collect some feaces in the trays, also spatulas were supplied. Feaces as fresh as possible were collected. The morning after distributing between 8.30 and 10.00 hrs. the trays were collected, ordened and transported to Capäo Bonito (15-20 km depending on the community), with bus or car. All days the stools samples were brought in before 12 o'clock at the laboratory.

It happens that not everyday determinants of intestinal diseases as e.g. eggs are excreted in feaces. Therefore it is adviced to subject individuals to a second examination after first being considered negative. This collection was done without the presence of the researchers. In Turvo the woman of the health post took care of the organization. In Ana Benta 2 people involved in public health in the village organized the feaces collection. In Capoeira Alta one car-owner was responsible for collection and transportation of the trays to Capäo Bonito.

After the first examination personal of the ERSA visited the villages to distribute medicine for people suffering from an intestinal disease. Treated were Ascaris, Giardia, Taenia, Ancylostomedia, Strongyloides and Trichurius (see annex A and B).

Methodology of the Aldolfo Lutz laboratory was based on two types of investigations. One was a direct examination of fresh feaces under the miscroscope as soon as the trays were brought in (method of Kato). The other was based on sedimentation. A sample of feaces was sieved and diluted in a fixed quanity of water. After 15-20 houres, a sample was taken of sedimented material. This was examined under a microscope (method of Hoffman). With under twelve years old children, only the method of Hoffman was

applied. With elder children and adults, both methods were applied.

3.3.4 Nutritional status of children

To reveal information about the nutritional status of children in the age group 2 months-5 years, weight and height were measured.

- The MEP method

The MEP(1982) mentions that the association between diarrhoea and nutritional status can be used as an indicator of the health impact of investments in water supply, sanitation and hygiene education.

In terms of this investigation, interest existed in the actual nutritional status of children in the age group of 2 months - 5 years. The nutritional status is influenced by water, sanitary and hygienic conditions but also by the socio-economic level.

The MEP gives two indexes which can be measured. The first one is a nutritional index and is called 'weight-for-height'. It is used for assessment of acute malnutrition, related to diarrhoea. The child's weight is compared with the reference weight for a child of the same height. The reference, which was used during the investigation, are graphs, based on investigations in a suburb of the Greater São Paulo with children of a high economic class (see annex I). The "Brazilian graph" method is discussed below. If the weight of a child is less than 80% of the expected weight, the child is defined as 'wasted'. If it is less than 70%, the wasting is 'severe'.

The other index 'height-for-age' is assessed with long-term or chronic undernutrition. A child whose length is less than 90% of the expected height for age is defined as 'stunted'. If it is less than 85% of expected, the stunting is 'severe'. Stunting is largely a result of adaptation to adverse environmental and nutritional factors. Because stunting is more of a permanent feature, it is not recommended to be used for the evaluation of the impact of water supply, sanitation and hygiene education investments.

- The "Brazilian graphs" method

Most women in the villages take their children from time to time, at the most once a month, to a health unit to measure weight and height. At the health post, the Brazilian graphs are used as a reference (see annex I). If a child has a weight and/or height under the p-10 line in the graphs, milk is normally distributed.

3.3.5 Diarrhoeal morbidity

Diarrhoeal diseases are a major cause of illness and death among children in the age group 2 months-5 years, in all poor communities throughout the world. Most diarrhoeal diseases are

caused by infections of the intestine by viruses, bacterias and/or protozoas. These agents of diarrhoea are transmitted from feaces to mouth by various routes (via hands, via food, via water) and this transmission should reduce as a result of a successfull watersupply, sanitation- and education project. Diarrhoeal diseases constitute the most universal appropiate indicator of the health impact of watersupply and sanitation projects. According to the MEP, measuring diarrhoeal morbidity is prefered rather then -mortality.

It was choosen to use the so-called diary-assisted-recall method. For each child in the range 2 months-5 years,the mother received a form to note down daily during a period of 14 days, whether the child suffered or not suffered from diarrhoea. No definition was given of diarrhoea. After 2-4 days the mothers were revisited to resolve problems if there were any. After 14 days all forms were collected and the number of episodes per child per year could be calculated. One episode is a periode during which a child has diarrhoea, it can be one or more successive days. Schultzberg mentions that normally children have 2.2 episodes of diarrhoea/ year. An example of the form can be found in annex J.

3.3.6 Inspection of waterpoints and latrines

At the end of the household interviews (3.3.1) waterpoints and latrines were inspected. According to Pacey (1981), latrines have to meet certain requirements. A list of inspection-criteria was put together (see annex K and L). Both researchers tried to interpret the criteria in the same way. For example a slab was considered dirty when rest of feaces or urine could be seen on the slab. When it was obvious cleaning wasn't done properly the latrine was marked as unclean. Results of these inspections were used to describe all waterpoints and sanitary systems (5.3 and 5.4).

3.4 Selection of villages

In an early stage of the preparation period, Capão Bonito (municipality and town as well) was visited. This to get an idea about local circumstances and to pretest the questionnaires (3.3.1). At the same time this visit was used to select the communities to be surveyed. Staff people of the ERSA and of the Adolfo Lutz laboratory helped with making up a list of villages of interest. This list was combined with one of the SABESP-watercorporation.

The latter had a listing of communities (5) being candidates for the implementation of a waternetwork of SABESP. Criteria of SABESP: - communities with maximally 500 inhabitants;
- distances between houses less than 40 metres.

In the last phase of analysing, it was decided that Turvo dos Almeidas, Ana Benta and Capoeira Alta should be the communities for investigations. Important criteria in the decision-making were:

- size of population;
- infra-structure;
- socio-economic level of community;
- existence of health post in the community;
- type of watersupply-systems;
- type of sanitary facilities;
- labourforms and landownership;
- geographic situation;
- priority of SABESP to implement a waternetwork;
- interest of ERSA to treat people with intestinal diseases;
- priority of municipality to introduce a public health post in the community.

Turvo dos Almeidas was divided into two parts:
- Turvo (+), which already had a connection of the SABESP-watercorporation during 4 years;
- Turvo (-), which had no connection to the water of SABESP.

Turvo (-), Ana Benta and Capoeira Alta should be the projectvillages, Turvo (+) should be the intervention community.

According to the followed method C of the MEP (see 3.2), no baseline data were available and therefore it is important that the control villages and project villages are comparable, in socio-economic terms. In this way differences in health status can be attributed to the lack of watersupply and/or sanitary facilities. It was found that Turvo (+) was the only village in the municipality of Capão Bonito which had a watersupply already more than one year (4 years), so health impacts were to be expected here. It must be known that totally comparable villages within the list of SABESP were not available, and therefore, the researchers mention that this should be reminded when the collected health data are to be interpreted.

4. GENERAL INFORMATION

4.1 Brazil

4.1.1 General

Brazil is a country with an enormous area of 8.511.965 km² (see annex M). Now it has about 140 million inhabitants. The climate is basically tropical with great differences between northern and southern regions. Great differences also occur in the annual rainfall which ranges from 1050 mm to 4500 mm (CETESB, 1988).

The country is divided in 23 states, 3 territories and one Federal District. The states are divided in municipalities. The majority of the population lives along the Atlantic coast line which has a length of 7400 km. Some 72% of the people live in urban areas, whereas 28% in rural areas (IBGE, 1986).

The State of São Paulo is the most industrialized one. São Paulo City is the biggest town in the country (9.800.000 inhabitants). It forms with 37 municipalities the so-called Greater São Paulo. Here, more than 10% of the country's population is situated in only 0,10% of the area of Brazil.

Brazilian National government is divided in the legislative, executive and juridical power. The president and 23 ministeries form the executive power whereas the legislative power is composed by the federal Senate and the Chamber of Deputies.

The Brazilian State government is composed by several secretaries. The corporation which is in charge of water and sanitation is generally connected to the Secretary of Public Works. According to the Federal Government Law, there is one corporation of this kind in each state.

4.1.2 Water and sanitation

According to the Brazilian Constitution, each municipality is responsible for its water and sanitation activities. The municipality can make an agreement with the state water- and sewage corporation, which means they join the National Sanitation Plan (PLANASA). This plan receives funds of the National Saving Bank (CEF), that also finances other public facilities like transport and electricity. The goals of PLANASA for 1990 are the following:

- public water facilities for 90% of the urban population;
- sewerage systems for 65% of the urban population (CETESB, 1988).

Table 4.1 gives the water and sanitation situation in 1986. It shows that the water situation is rather good, coming near to the goal which is set for 1990. Only 33,8% of the urban population is served with a sewerage system which is far beyond the goal which is set for 1990. Great differences exist between the several

regions with the highest percentages of supplies in the south-east (São Paulo). In general, the conditions in the rural areas are still worse in comparison with the urban areas.

Table 4.1: Percentage of the Brazilian population with water supply and sewerage system (ABES, 1986).

TYPE OF SYSTEM	WATERSUPPLY SYSTEM		SEWERAGE SYSTEM	
LOCATION	TOT.POPUL %	URBAN POP %	TOT.POPUL %	URBAN POP %
NORTH	40.9	70.4	1.9	3.2
NORTH-EAST	37.8	70.4	5.7	10.6
CENTRE-WEST	53.5	72.9	21.3	29.0
SOUTH-EAST	74.3	86.2	45.4	52.7
SOUTH	54.4	81.9	10.5	15.8
BRAZIL	57.0	80.4	24.0	33.8

Municipalities which do not make an agreement with a state corporation are free to make their own water and sanitation plan, and act in this way independent. In the State of São Paulo there are 572 municipalities among which 296 established an agreement with the state corporation (CETESB, 1988). This is SABESP in the São Paulo State.

SABESP provides water for 16 million inhabitants and sewage is collected from some 9,6 million inhabitants. Water supply and sewage collection are charged monthly, according to water consumption. The average price of the supplied water is US $ 0,30 per cubic metre (march, 1988). Table 4.2 shows that piped water and sewerage are strongly limited to the urban population. In the rural areas people mostly use water from springs or wells and use the pit latrine as a sanitary facility.

Table 4.2: Percentage of the population of the State of São Paulo with water and sanitation systems (SEADE, 1986).

TYPE OF SYSTEM	URBAN POP %	RURAL.POP %	TOTAL %
PIPED WATER	96.1	23.9	89.7
WELL OR SPRING	3.2	75.5	9.6
OTHER	0.7	0.6	0.7
SEWERAGE	64.3	7.0	59.2
SEPTIC TANK	14.4	13.9	14.4
PIT LATRINE	16.4	62.1	20.5
OTHER	4.1	8.2	4.5
NOTHING	0.7	8.9	1.4

Most of the sewage which is collected in the urban areas, is drained off to rivers and streams without treatment. Sewage treatment facilities are not sufficient in capacity and quality, but efforts are being made to improve the situation. Water pollution control is a task of CETESB, also an organization of the State Government. CETESB established a sampling system which permanently checks the water quality in places of interest. CETESB also develops different projects in this area.

4.1.3 Health

On a central level in Brazil, there are no morbidity data available. Secretaries of Health do publish mortality data for their states, but these data are only 75% of the total (verbal information). From these 75%, some 20% are causes of death which are badly defined. The published data show a delay of four years.

Some 10-12% of the causes of death are infectious and parasitical diseases, the so-called DIP-diseases. The division within this group is the following:

- intestinal infectious diseases	56 %
- arthropoid-born diseases	11 %
- other bacterial diseases (e.g. hansemiases)	13 %
- tuberculosis	11 %
- other	9 %

The two first-mentioned groups of diseases, 67%, can be greatly diminished if there are adequate water and sanitary facilities available, which can stop the transmission of pathogenic agents.

Some 90% of the causes of death, due to DIP-diseases, occur in under five years old children. This number can be as much as three times lesser in urban areas, and as much as three times higher in rural areas. In the rural areas of Brazil, people often lack the presence of medical services and adequate water and sanitary facilities.

The mean infant mortality in Brazil as a whole was 80 per 1000 in 1980. To compare with a developed country, this number was 12 per 1000 in the USA in the same year (Berghuizen et al, 1987).

4.1.4 The 'Projeto Saneamento Rural'

The 'Projeto Saneamento Rural' is a national program, which will be executed per state. The project aims to assist the population in rural areas. The goal of the program is the one which was set by the World Health Organization at the beginning of the International Water and Sanitation Decade (1980-1990): 'clean water and adequate sanitation for all by the year 1990'. Exactly in the rural areas of Brazil, people lack the presence of these facilities (see table 4.1 and 4.2). Main objective of the 'Projeto' is to improve the health standard of the rural population. The specific objectives are to improve the quality of the consumed water and to impede contact between the water and

human faeces. An adequate disposal of human faeces has to be provided (Berghuizen et al, 1987).

Within the São Paulo State, the project is a co-operation of:

- Secretary of Public Works and Sanitation (DAEE, SABESP);
- Secretary of Environment (CETESB);
- Secretary of Health;
- municipality;
- local community.

In the State of São Paulo, the project has just started. Last year, a detailed diagnosis of the water, sanitation and health situation was made in Apiaí-Mirim and Ferreira dos Matos, two 'bairros' in the municipality of Capão Bonito. The investigation was done by CETESB in co-operation with the regional health secretary (ERSA). Afterwards, piped water was implemented by SABESP in Apiaí-Mirim. This year, SABESP will assist Ferreira dos Matos. The kind of sanitation system which is going to be implemented is still under study by CETESB. CETESB makes studies about so-called low-cost sanitation technology. Low-cost is especially of interest for poor rural communities. In communication with the local community, such systems will be implemented as a project by CETESB. Financial resources have to come from the municipality and the State Government. Further on, the ERSA is involved in hygiene education and control of health indicators, when water is getting implemented.

4.2 Capão Bonito

4.2.1 General

The three villages where the investigation was done, are situated in the municipality of Capão Bonito, some 250 km south-west from the Greater São Paulo (see annex M and N). Capão Bonito is also the name of the main town in the municipality. For the reason of distinction, Capão will be used to mention the town, C.B. to mention the municipality. The town-council is located in Capão, which is part of the administrative region of Sorocabe.

C.B. is situated some 700 metres above sea-level. The landscape north of Capão is rather hilly, becoming even more hilly south of Capão. The mean annual temperature is 18-19°C, being 14-15°C in wintertime and 21-22°C in summertime. The annual rainfall is 1100-1200 mm, with a little peak in january, the warm season (Assef Sallit et al, 1987b).

The total area of the municipality is 1925 km². C.B. had in 1986 some 57300 inhabitants. Figure 4.1 shows the relative evolution of the population in C.B.. It shows that in 1940, the majority of the people lived in rural areas, but from there on, the pattern has been changed. Now, 55% of the people live in Capão (Assef Sallit et al, 1987a).

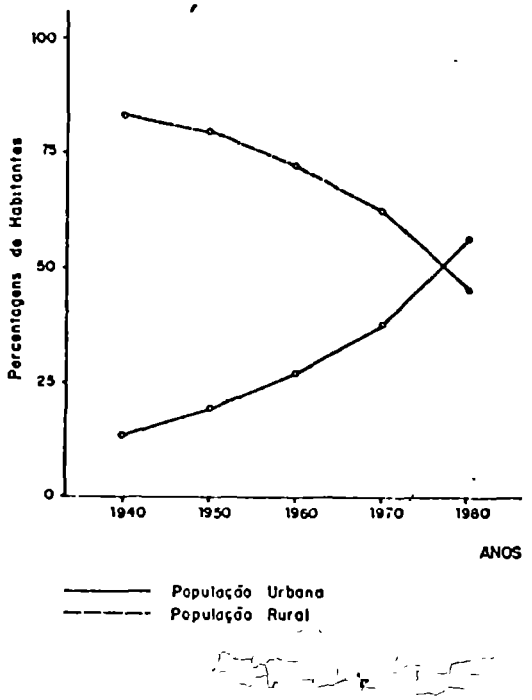


Figure 4.1 : Relative evolution of the rural and urban population in Capão Bonito.

In the whole state of São Paulo, some 90% of the people live in urban areas, the major part in the Greater São Paulo. For this reason, most people in the entire state work in industry and in the service sector, as table 4.3 shows. On the contrary, in C.B. most people earn a living in agriculture. There is little industry and mainly traditional: timber, food processing and stone industry (Berghuizen et al, 1987).

Table 4.3 : Earnings of living in Capão Bonito (M) and in the State of São Paulo in percentages (1987).

LOCATION	PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR
CAPAO BONITO	40.9	70.4	1.9
SAO PAULO	53.5	72.9	21.3

In former days, there was an important trade route from São Paulo to Paraná which passed C.B.. The 'tropeiros', drivers of pack animals, needed food and little communities in the region provided them. When this trade route disappeared in the last century, people changed to subsistence agriculture. The agriculture as a whole continued till today as an agriculture,

based on small properties. Almost each of these properties give work to a maximum of 10 persons. This is shown in table 4.4. Great 'fazendas' are rare in the region.

Table 4.4 : Establishment per number of employees in the municipality of Capão Bonito (SEPLAN, 1985).

LOCATION	% NUM.PROPERTIES 10 WORKERS	% NUM.PROPERTIES 10-50 WORKERS	% NUM.PROPERTIES 50-100 WORKERS	% NUM.PROPERTIES 100 WORKERS
CAPAO BONITO	94.49	4.99	0.31	0.21

The region of Capão Bonito is one of the poorest in the State of São Paulo. This is expressed in table 4.5, which shows the family incomes in C.B. and in the whole state. The table shows that in C.B., most families earn a living up to 2,5 minimal salaries, while in the whole state, most families earn more than 5 minimal salaries.

Table 4.5: Family incomes in Capão Bonito (M) and in the State of São Paulo (SEPLAN, 1985).

LOCATION	TOTAL OF FAMILIES	% OF FAMILIES WITH INCOME		
		UP TO 2.5 MIN.SAL.	2-5 MIN.SAL.	>5 MIN.SAL.
CAPAO BONITO	10.109	51.93	32.06	16,01
ESTADO S.P.	6.148.186	20.94	37.22	41.83

The instruction level is low. Table 4.6 shows that most people in C.B. in 1980 had 1-4 years instruction. In that year, 36,24% did not have any form of instruction at all. Only few percents of people continue studying. This pattern is changing slowly towards more instruction, comparing the percentages of 1970 and 1980 (Galvão et al, 1987).

Table 4.6: Years of study of persons of 5 and more years old in Capão Bonito for 1970 and 1980 (IBGE).

LOCATION	CAPAO BONITO			
YEARS OF INSTRUCTION	NUMBER	Z	NUMBER	Z
NO INSTRUCTION	11.899	46.61	13.921	36.24
1-4	11.769	46.10	19.896	51.80
5-8	1.092	4.28	2.744	7.15
9-12	586	2.30	1.318	3.43
>13	180	0.70	525	1.37
NO DATA	-	-	3	0.00

4.2.2 Water and sanitation

Table 4.7 shows that less than half of the houses in C.B. are served with a piped water supply, compared with the percentage in the whole state. At this moment, Capão is served with piped water, as well as Riberão Grande (5000 inhabitants), 10 km south of Capão. Also part of Turvo dos Almeidas is served with piped water, as is the 'bairro' Apiaí-Mirim. In the rural areas of C.B., people draw water from wells, sources and rivers.

Table 4.7 : Percentages of the houses in Capão Bonito (M) and the State of São Paulo with a water system (IBGE, 1983b).

	WITH HOUSE-PIPING		NO HOUSE-PIPING		TOTAL	
TYPE OF SUPPLY	CAPAO B.	SAO PAULO	CAPAO B.	SAO PAULO	CAPAO B.	SAO PAULO
PIPED WATER	43.1	75.3	20.1	7.0	54.2	82.3
WELL OR SPRING	7.6	6.5	30.6	9.1	38.2	15.6
OTHER	0.7	0.3	6.9	1.7	7.6	2.0

Table 4.8 shows the different types of sanitation systems, expressed as percentages of houses in C.B. and in the whole state, that have such a system. For 1983 only Capão is partly served with a sewage system. This percentage for the whole state is almost two times bigger. The percentage for C.B. must be bigger now, according to the plan of enlargement of the sewage system between 1980 and 1986 from 10718 metres up to 82000 metres (Galvão et al, 1987). The sewage system in Capão is not connected with a purifying plant. In the rural areas, the pit latrine is most commonly used.

Table 4.8 : Percentages of the houses in Capão Bonito (M) and in the State of São Paulo with a sanitation system (IBGE, 1983b).

	PRIVAT		COMMUNAL	
TYPE OF SUPPLY	CAPAO B.	SAO PAULO	CAPAO B.	SAO PAULO
SEWERAGE	27.1	50.8	0.8	4.7
SEPTIC TANK	6.3	13.2	0.2	2.9
PIT LATRINE	45.2	16.4	5.6	4.6

4.2.3 Health

4.2.3.1 Existent services

In Capão, there is a municipal health centre. The centre is attended by eight doctors and disposes of a pharmacy. All the treatments and medicine are free. Connected to the health centre, there is a laboratory of the Adolfo Lutz Institute, which is doing clinical analyses of e.g. faeces and urine.

Further on, there exists an hospital with 129 beds. Also there is a regional secretary of health (ERSA), which is involved in the coordination and planning of health activities in six municipalities among which that of C.B.. The ERSA is involved in the 'Projeto Saneamento Rural'.

Besides the mentioned services which are part of the municipality, there exist also particular health services. These services are only payable for the better-off in Capão.

In the rural area of C.B., there are two health units with assistance of a doctor, and seven units which are attended by villagers (see 4.3.2). The great majority of the some 50-60 villages in C.B. are only attended in the case of vaccination campaigns, organized by the ERSA.

In the villages of C.B. still exist a lot of informal leaders, who practice the so-called popular medical science. There exists

a good relation between these leaders and the people of the health services in Capão. There are periodical lessons, during which these leaders learn about the formal medical science and transmit their own knowledge, based on the usage of natural products (Galvão et al, 1987).

4.2.3.2 The basic health unit (UBS)

In C.B., there are some seven health units in different 'bairros', e.g. in Turvo dos Almeidas since one year. An UBS gives local medical assistance and tries to do as much as possible without the need of a doctor.

Before a health unit can be opened, one or two people of the village need to join a one-year training in Capão to be able to run such a health unit. In Turvo, one woman joined this training and since a little time, she has assistance of another woman. After the request for an UBS has been approved by the municipality, materials are supplied by the same municipality and the villagers themselves can start to construct their UBS.

The health post consists of a consultary room, a treatment room, a storage room for medicine, a room to prepare medicine and a toilet. The UBS is opened every day for mostly simple medical assistance. Annex U shows the activities of the UBS in Turvo in the period of 2-27 may 1988, almost a one-month period.

Besides the activities which are listed in annex U, vaccinations are provided as against polio, diphteria, measles and tuberculosis. Also height and weight is being measured with under five years old children, at most once a month. Milk is provided by certain units for children with a weight or length which is too low.

4.2.3.3 Health data

Table 4.9 shows the mortality data of C.B. and São Paulo State as a percentage per age group.

Table 4.9: Mortality data as a percentage per age group (São Paulo, 1987 and Brasil, 1987).

AGE	CAPAO BONITO (M)	SAO PAULO (S)
0-1	25	16.7
1-4	5.5	2.2
5-19	3.5	3.4
20-49	21	20.5
>50	45	57.0

Comparing the percentages in table 4.8, relatively more deaths occur in the 0-1 age group in C.B. than in the whole state. Most important causes of death in C.B. are:

- infectious diseases, tuberculosis, hanseniasis;
- respiratory diseases;
- birth complications;
- accidents;
- undefined causes.

Exact morbidity data are not available. To have an idea of the health problems, annex U gives an overview of the principal causes of internation in the hospital of Capão during 1986. The annex shows that childbirths, diseases of the respiratory and digestive system, badly defined causes and infectious intestinal diseases are the main reasons of internation.

4.3 Description of the villages

4.3.1 General

The investigation was done in three 'bairros'. A 'bairro' is a district of the municipality and it mostly has one centre or more centres of houses, a village or villages. A 'bairro' mostly has some informal leaders but almost every 'bairro' has an 'inspetor de quarterão'. His activities have to do with health, municipal affairs and religion. Concerning health, the 'inspetor' has contacts with the hospital, arranges medicine if no UBS is present and arranges an ambulance if necessary. Concerning municipal affairs, the 'inspetor' is involved in the development of the 'bairro'. From time to time, the 'inspetores' reunate in Capão to discuss new and running activities. Concerning religion, he organizes meetings and can maintain contacts with the priest in Capão.

Religion is very important in village life. Almost everybody is catholic and every village has its church, which is mostly attended once every three months by one of the two priests in Capão. Besides, the people organize prayers' themselves. The church reunates the people and is the logical entry to organize the people.

The municipality develops few activities in the rural area. A rural development program does not exist. On the contrary, the people in the villages themselves have to go to the municipal leaders to get things done. The UBS in Turvo was requested in this way.

Houses within the village are constructed out of bricks, wood or 'pau-a-pique'. The last type of house consists of a frame out of bamboo with walls which are constructed out of mud or mud with a little cement. The better-off in the villages can afford to construct a house out of bricks with concrete floors, whereas the poorer families live in houses out of wood or 'pau-a-pique', always with earthen floors.

Village life is greatly concerned with agriculture. Almost all men work in agriculture and male children mostly start working at the age of 12-14 with helping their father. Women and female children do all the household activities, but are working too in the field in harvest times. Female children are often working full-time on the land.

There are five agricultural labour forms which exist in the region. They are described here in the range of income. A landowner can earn the best living, whereas a 'camarada' earns the littlest income.

- Proprietário: landowner.
- Arrendatário: he rents the land of a landowner and has an agreement about the rent, e.g. a part of the harvest. The 'arrendatário' himself has to buy the agricultural implements.
- Meeiro: he rents a piece of land from the landowner or 'arrendatário', to whom he pays half of the harvest as a way of rent. The other part of the harvest is his. All the agricultural implements are delivered by e.g. the landowner, and just used by the 'meeiro'.
- Mensalista: he works for any person, e.g. a landowner and earns a monthly wage.
- Camarada: he works in the same way as a 'mensalista' but he only earns a daily wage. So if there is no work available, he does not earn anything. If he has a whole month work, he can earn one minimal salary (about 50 dollars).

People who work as a 'camarada' often still have a little piece of land for their own consumption and sometimes also to sell a bit. They mostly plant rice, beans and corn. In the case of beans and corn, a drying-machine can be necessary when there is rain or to gain a better price when the products are being sold. Therefore, in many 'bairros' there exists an 'associação' which is a cooperation of agricultural workers. The cooperation owns a building with inside a drying-machine. At the beginning, the municipality pays for the building materials and the drying-machine. At that moment, an arrangement is being made about how to pay a part of the costs back to the municipality, e.g. by means of a quantity of beans. The members of the cooperation pay a monthly amount of money for maintenance and energy usage of the drying-machine. Besides of the church, the 'associação' can be a means to organize the people of the 'bairro'.

The majority of the people spend their whole life in the 'bairro'. People marry mostly within the village, and so half the village is family, one from another. People have little chance to get out, because their education is low, and the only option is the work in a factory. In spite of the better payment in the factory, many people prefer the calmness of village life.

4.3.2 Turvo dos Almeidas

- Location

Turvo dos Almeidas is situated in the municipality of C.B., 23 km north-east of Capão (see annex N). The whole village consists of some 200 houses and the village area is separated by the highway Capão-Itapetininga. On one side of the road, the two centres of houses are situated where the research was done (see figure 4.2)

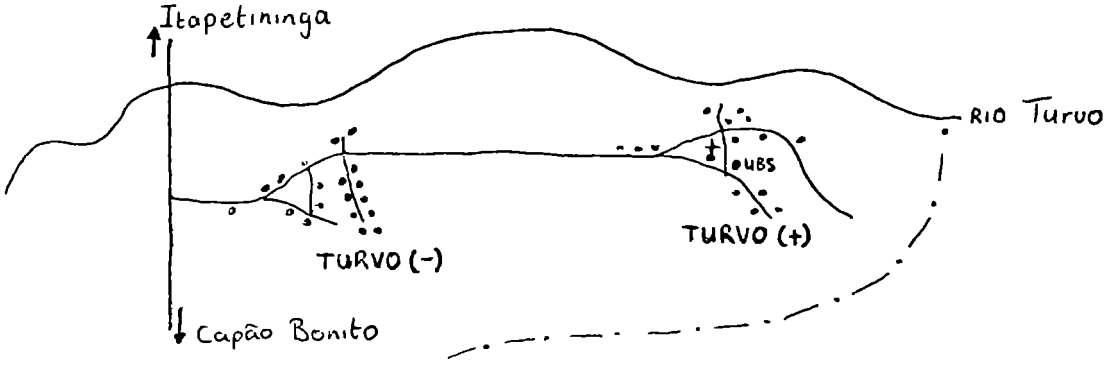


Figure 4.2 : Location of Turvo dos Almeidas.

One centre, Turvo (+), consists of the church, the UBS, a grocery/pub and a school. There are some 30 houses. Turvo (+) is the part of Turvo which uses SABESP-water. Turvo (-), the part without SABESP-water, has two schools and a grocery/bar. In this centre, there are about 60 houses.

The geographic situation is rather plain. One frontier of the village is the river from which the area goes uphill in the direction of Turvo (+) and Turvo (-). Almost all the houses are served with electricity. There is no telephone in the 'bairro'. There are regular buses, almost every hour, to Capão and Itapetininga (100000 inhabitants). Many people take a bus to go to town for shopping. The highway is an asphalt-road. Within the 'bairro' itself there are sandy roads.

- Organization

There are six leaders in the village who reunate from time to time. All important decisions are taken by them. One of them has a chance to be choosen in the town-council of Capão with the elections in november. This could be a good thing for the people of Turvo. Maybe then, requests for e.g. a telephone and an ambulance at the health post could be honoured.

- Education

There are three schools in Turvo. Two schools for the first three years and one school for the fourth year. A minority of the children continue studying in Gramadão (2 km) after the first four years in Turvo.

- Health

There is an UBS in Turvo (see 4.3.2). Not all the people attend the health post in Turvo. They go to Gramadão (2 km), which is further away, but which possesses a health post which is attended by a doctor. The nearest by hospital and health centre are located in Capão (23 km).

- Activities

The majority of the people in Turvo work in agriculture. Most important crop is beans. Besides corn, potatoes, onions and some rice and grapes are planted. There is a Japanese in Turvo who possesses a lot of land and many people work for him. Many people too are working outside of Turvo, leaving in the early morning and coming back in the afternoon or at night. Some people have a few cows, which give milk, only for consuming. In the morning you can meet women, who are fetching milk at another house, e.g. a family-member.

4.3.3 Ana Benta

- Location

Some 14 km southly of Capão, Ana Benta is situated (see annex N). An asphalt road (10km) to Guapiara runs into the direction of Ana Benta. The last 4 km a sandy road is leading to the village. Ana Benta itself, is stretched out and hilly. It is crossed by two rivers. On the main hill the church and the 'salaö parochial' are located. Some 80 houses were counted. The part of Ana Benta around the brickfactory and the church was involved in the investigation (53 houses). All houses are served by electricity. At this moment there is no telephone, but people are working on a connection of TELESP (telephone compagny of Saö Paulo). There is one school (up to the 4th serie), two groceries/bars and an association.

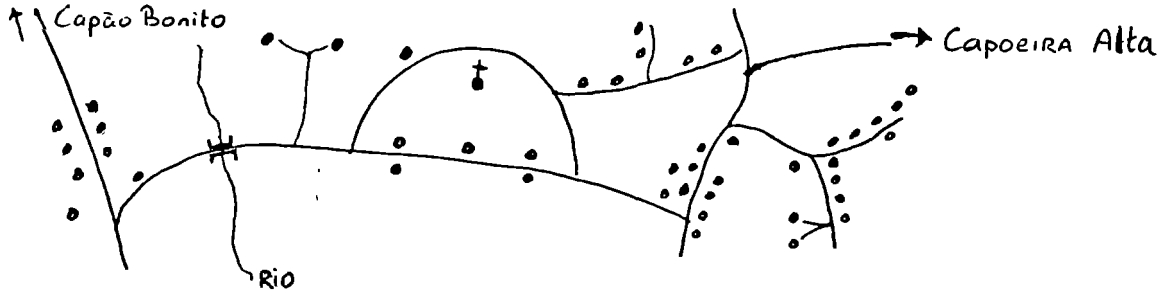


Figure 4.3: Location of Ana Benta.

- Organization

Like in C. Alta, the organization in Ana Benta is based on the church and the association. Religious activities consist of organizing masses and preparing children for their first communion. Weekly prayers are normal as well. Almost all farmers

(meeiros and camaradas and propariatários) are member of this association. Besides being owner of a drying machine, the association is involved in buying agro-chemicals, fertilizers and doing field-analysis for fertility-tests.

- Education

There is one school up to the fourth serie in Ana Benta. In the morning children attend classes. If the weather is bad, lessons are cancelled, because the teacher is not able to come over from Capão (bad roads). After 4 years of attending school, the majority of the children start to work. However they have the opportunity to continue education in Capão. Because of the badly organized transport, lack of money or interest, they don't take further education.

- Health

There are plans to install an UBS in Ana Benta. Two people already have been selected to follow a course in Capão to run a public health post. Untill now the community is not sure when this implementation is going to happen. For medical treatment, villagers have to travel to Capão to obtain these services.

- Activities

Main source of activities is agriculture. Rice, beans, corn, potatoes, onions and tomatoes are grown. Two families work together. This means the father owns the land and the sons may it. Yields are divided as are costs. There is one Japanese owning a lot of land. Many work for him as 'meeiro' or 'camarada'. Cows are common for milkproduction. Production is not sufficient for to supply all people with milk.

4.3.4 Capoeira Alta

- Location

Capoeira Alta is situated, some 15 km south of Capão (see annex N). The bairro consists of two centres of houses. One centre is called Capoeira Alta, in the following: C. Alta. It consists of some 45 houses and here the investigation was done. The other centre is called Lima and consists of some 40 houses (see figure 4.3)

There is a road of asphalt from Capão till Riberão Grande (10 km) and from there on a sandy road which passes Lima and reaches the village C. Alta after 5 km from R. Grande. For this reason, C. Alta is sometimes hard to reach in the case of rainfall.

The geographic situation is rather hilly. There is a river on both sides of the village. From there on, steep hills go to the village centre where a school, a bar, a grocery, a church and the 'associação'-building are located. This is 40-50 metres above river level.

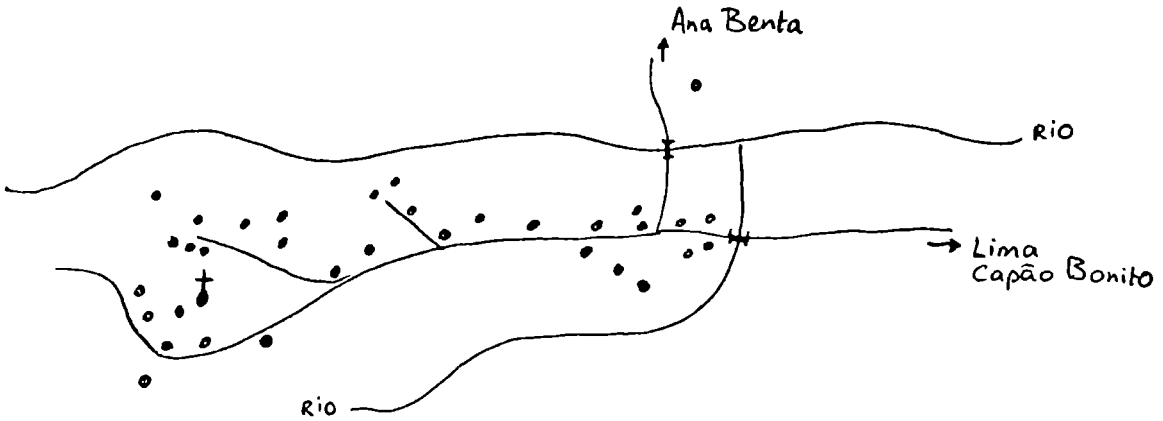


Figure 4.3: Location of Capoeira Alta.

Almost all the houses are served with electricity. There is no telephone. The nearest by bus service to Capão is in R. Grande. Besides, there is a taxi service to Capão, run by a villager.

- Organization

Organization in C. Alta is based on the church and the 'associação'. The association exists since three years and has some 35 members, from whom some 15 are active members. Besides the church reunates the people and there is also an 'inspetor de quarterão'. The last person is at the moment involved in the creation of a crèche, which was the initiative of some women in the village.

- Education

There is one school in C. Alta with two classes, one for the first three years and one for the fourth year. All the children attend this school during the morning. Sometimes when there is rain, the school is closed because then, the village is not accessible for the two teachers who have to come every day from Capão. After this school, children can study four years more in R. Grande, but only few really go. This happens mostly because the parents of the children do not force their children to do so. After the school in R. Grande, children return to C. Alta and do not continue studying, because lack of interest or money or because their labour force is needed by the family.

There are some 10 young male people who left C. Alta to work mostly in a factory in Sorocabe, some 130 km from C. Alta. In C. Alta there is little future for a great group of young people.

- Health

The nearest by health post is situated in R. Grande. There, also a doctor can be attended. Further medical services are to be obtained in Capão.

- Activities

All people work in agriculture. Rice, beans, corn, potatoes, onions and tomatoes are planted. There are a few Japanese with a lot of land. Besides, there is one 'arrendatório' who gives work to some 10-15 'meeiros' and some 'camaradas'. The majority of the people are 'camaradas' who still possess a bit of land and who are members of the association. Few people have cows and so no milk is available for the majority of the people, especially the poorer families.

5. RESULTS AND DISCUSSION

5.1 Introduction

In this chapter the results of the field investigation will be presented. Section 5.2 gives general results of the researched villages. This will be followed by the results of the investigation of the watersupply and -activities (5.3). Section 5.4 is about sanitation and waste, followed by section 5.5 which describes the results of the health investigation. At the end every section will be discussed and conclusions will be drawn.

5.2 General results of researched villages

The researchers visited a family several times. The first visit included the prelimineray questionnaire. General questions were asked,to obtain an idea about the socio-economic status. In the following part results will be described.

5.2.1 Age distribution

The next figure visualizes the data about age distribution of the selected group in the village.

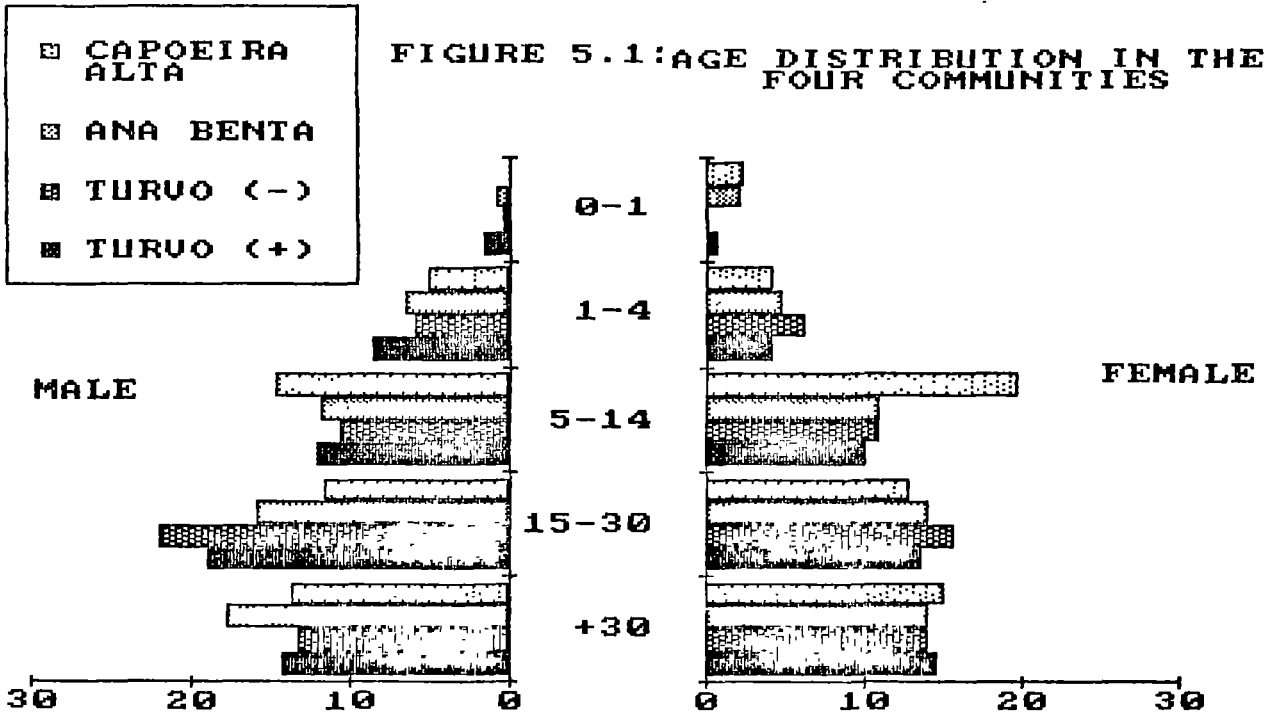


FIGURE 5.1: AGE DISTRIBUTION IN THE FOUR COMMUNITIES

(percent in each age class)

The figure showes that the youngest age groups (0-1 year) in Turvo (-), is relatively small. However the 1-4 years old groups of people are distributed equally among the different populations (total of males and females). In Capoeira Alta the 5 up to 14 years old group is relatively greater (34.6%) compared to the same age group in the other populations (21-23.1%). This can be

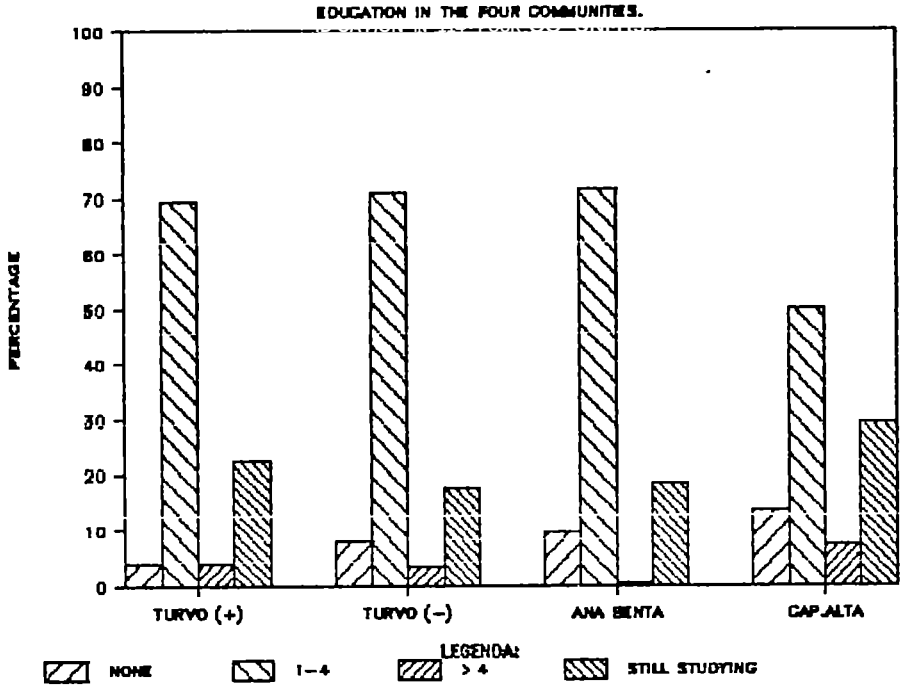
attributed to the higher number of females (73) in this group, compared to only 42 males in the same age group. The age distribution was statistically tested (see annex W). Male and female numbers were compared in the villages, no significant difference was found (X^2_{12}=14.46 and X^2_{12}=15.09, respectively).

In the age group 15 up to 30, in Turvo (-) is a slight increase of the distribution. Male numbers (56) are higher in this group than female numbers (40). The oldest age group shows an equal distribution (27-30%) among the villages. Exact number can be found in annex R.

5.2.2 Education

Education is an important indicator to describe the social-economic status of the community. Therefore it was asked how many years the people studied or still are studying. The next table represents the results.

FIGURE 5.2:



About education in the four areas, the following remarks can be made (see annex S). From the researched group older than 5 years 4.1-9.7% didn't have any education at all in Turvo dos Almeidas and Ana Benta. In Capoeira Alta this number is even higher (13.5%). In the group which received 1-4 years education, again the situation in Capoeira Alta is the worst. Only 50% of the population went 1-4 years to school. In Turvo and Ana Benta this percentage was 69.3-71.5. Because of the fact the age group of 5 up to 14 is very big in Capoeira Alta, this introduces interference in the education group ( )4 years and still studying). The percentage in this group was 36.5 compared to 18.8-26.6 in the other areas. Distribution of education was found to be statistically significant (X^2_9=34.58, see annex W).

As can be withdrawn out of the following table, literacy percentages vary from 91.9 to 95.9 in Turvo(+) and (-). In Ana Benta this number was 90.3. Capoeira Alta has the highest percentage of illiteracy: 13.4%. Illiteracy was tested statistically, but was not found to be significant (X^2_3=7.24, annex W).

Table 5.1 : Illiteracy among the four communities.

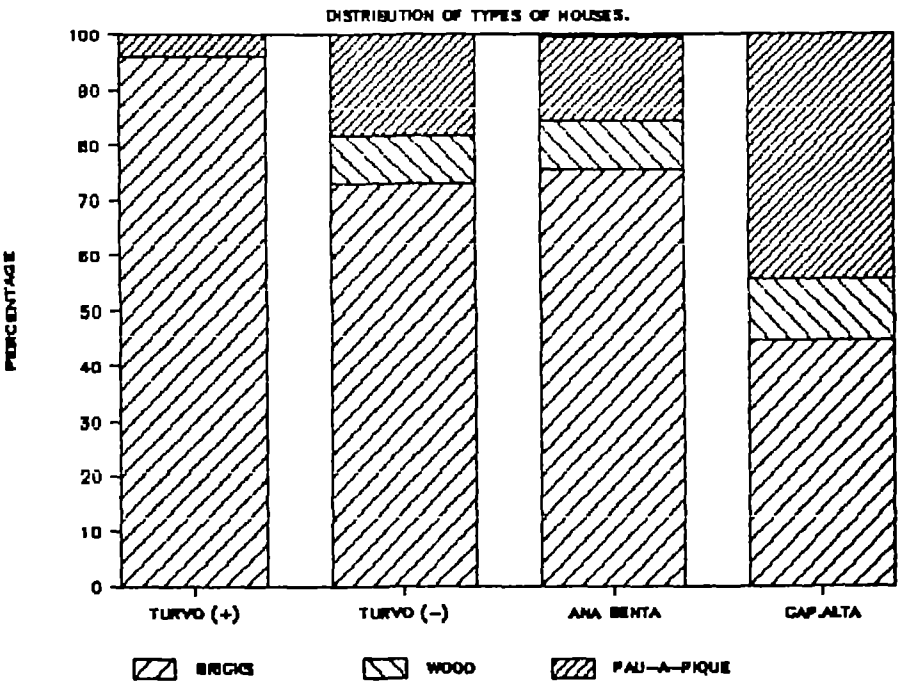
LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
LITERATE	94	95.9	203	91.1	168	90.3	161	86.6
ILLITERATE	4	4.1	18	8.1	18	9.7	25	13.4
TOTAL	98	100.0	221	100.0	186	100.0	186	100.0

Because the villages are isolated, transport is a problem. The first big town (Capão Bonito) is 13-25 km away. For this reason people only go to school in the village itself. However only instruction can be followed to the 4th serie. If they want to receive higher education, a journey out of the community is a must. This explains partly the high number of people with education up to 4 years in the villages. Also lack of money and interest are inportant factors here.

5.2.3 Housing

Another social-economic indicator is housing. It was calculated (of an asselect number of houses) how many houses were made out of bricks, wood or pau-a-pique.

FIGURE 5.3:



Houses of bricks are the common type of housing in Turvo (+). In Ana Benta and Turvo (-) the situation is about the same: an equal distribution of the different types of houses. Houses of bricks exist in 72-76 % of the cases. Houses "de pau-a-pique" also exist here (15-18%), followed by houses from wood (9%). In Capoeira Alta, the housing situation is the most primitive. Only 44.5% of the researched group lived in houses of brickes. Pau-a-pique was seen regularly as well (44.4%). Distribution of houses of wood are about the same in Ana Benta and Turvo (-) (see annex T).

5.2.4 Luxury goods

Distribution of luxury goods says something about social-economic status of the populations. The next table displays the results.

Table 5.2 : Distribution of luxury goods in the communites.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
LUXURY GOOD	NUMBER	Z *)	NUMBER	Z *)	NUMBER	Z *)	NUMBER	Z *)
TELEVISION	22	88.0	37	67.2	32	69.6	21	58.3
RADIO	21	84.0	49	89.1	39	84.7	27	75.0
ELECTRICAL GOODS **)	17	68.0	27	49.1	33	71.7	8	22.2
TRATOR	8	32.0	12	21.8	6	13.0	1	2.8
CARS	10	40	10	18.2	6	13.0	2	5.6
NOTHING	-	-	2	3.6	1	2.1	8	22.2
TOTALS	n=25		n=55		n=46		n=36	

*)% expressed per household
**) refrigerator, blender, iron etc.

Luxury goods are not distributed equally among the different population groups. Also in this case in Capoeira Alta the situation is the poorest. Television, radio and especially electric goods are not very common as they were in the other villages. Ownership of tractors and cars is the highest in Turvo (+). Ana Benta and Turvo (-) are comparable but numbers of tractors and cars in Capoeira Alta are very low. Households which don't have anything at all of these indicators are frequently seen in Capoeira Alta (22.2%).

5.2.5 Labourforms

General

The region of Capão Bonito is famous for its great bean production. About 70% of the total beans consumed in the state of São Paulo are produced here. Therefore most labourforms in the villages have some connection with agriculture (for a description of different labourforms see 4.4.1).

People were asked about their labourforms and their income. When a family had more than 1 person employed these were registered as well. Frequently the children helped their father with agricultural duties.

A classification was made on different types of labourforms. It was categorized into the primary, secondary and tertiary sector. As can be seen out of table 5.5, the primary sector is much larger in Ana Benta and Capoeira Alta. Turvo (-) and (+) are comparable in all sectors. The economy of Ana Benta and Capoeira Alta does more lean on agricultural activities. The secondary sector is most developed in Turvo (+) and (-). In Capoeira Alta this sector hardly exists. Also the tertiary sector is small here.

Table 5.3 : Labourforms in the villages.
(divided in primary-, secondary- and tertiary-sector)

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	Z
PRIMARY SECTOR	24	68.6	45	63.4	35	74.5	60	95.2
SECONDARY SECTOR	7	20.0	16	22.5	4	8.5	1	1.6
TERTIARY SECTOR *)	4	11.4	10	14.1	8	17.0	2	3.2
TOTALS	35	100.0	71	100.0	47	100.0	63	100.0

*) INCLUDING PENSIONERS AND PEOPLE DESEMPLOYED

Agricultural sector

In this part the agricultural sector will be more worked out. In Turvo dos Almeidas labourforms where just divided into proprietário, meeiro and camarada. This was because of the lack of information about other existing types of labour. In Ana Benta and Capoeira Alta this division was made with more indicators (see 4.4.1 for more types of agricultural labour forms). Salaries are expressed in OTN (reference salary used in Brasil), because of the high inflation rate (300% a year). The next table was withdrawn out of the results.

Table 5.4 : Agricultural sector in the villages.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA		SALARIES	
LABOURFORMS	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	RANGE OTN
I. PROPRIETARIO	10	41.7	13	28.9	6	17.6	1	1.8	15	10-)20
II. ARENDATARIO + MEEIRO	3	12.5	5	11.1	24 (5+19)	70.6	10 (2+8)	18.2	21 2	5-15 (5
III. MENSALISTA + CAMARADA	11	45.8	27	60.0	4 (1+3)	11.8	44 (1+43)	80.0	8 68	(5 5-15
TOTALS	24	100.0	45	100.0	34	100.0	55	100.0	114	-

It can be concluded that in Turvo dos Almeidas (+) it is more common people own land (41.7%). In Turvo (-) there are less landowners. Landownership does raise the income of the household as is proved. Proprietários earn more than 10->20 OTN's. Differences between meeiros, mensalista and camaradas are less clear. They all seemed to have same access to economic goods. Arrendatários however, do possess more economic goods (e.g. tractors) as do meeiros, mensalistas and camaradas. This is due to the fact the landowner doesn't supply them with these goods. The arrendatário has to buy all inputs by himself.

In Ana Benta agricultural labourforms are not divided equally among all catergories. As can be seen a relatively high number of category II is prevalent here. This is probably due to the presence of a Japanese landowner who is hiring land to meeiros. In Ana Benta 19 out of 34 agricultural workers worked as meeiros.

People out of the second category earn less then the proprietário's (21 earn 5-15 OTN, 2 less than 5 OTN). The third category earns the least: 68 people 5-15 OTN. Speaking about differences in the way of living and economic advantages, there is almost no distinction between meeiros, mensalistas and camaradas considered housing, social status, watersupply and sanitary facilities. Over the last three categories all these indicators are distributed equally.

None-agricultural activities

Labourforms other then in the agricultural sector, do allow to conclude the following:

- Jobs as constructionworkers (including bricklayers), electricians, tractor drivers are considered to be the better jobs. Not only people earn more money executing the jobs, but they have more possibilities to work in other villages and cities as well. E.g. electricians easily gain >10-15 OTN/month. Constructionworkers earn about 10-20 OTN.;

- Pensioners earn very little. They receive a monthly payment of 5 OTN. Regular pensioners lived together with other familymembers. Because of low income they were forced to join the family of one of the children.

5.2.6 Discussion

Out of the section of general results the following remarks can be made:

Age

Age is distributed equally among the different communities. Only in Capoeira Alta the age group 5-14 year is relatively greater (statistically not significant).

Education

It was proved that the level of education is not distributed equally among the communities (annex W). Probably because of the isolated position of the bairros, education of more than 4 years is not layed aside for the majority of the population. A better infra-structure and regular bus connections to Capaõ Bonito can do good in this respect. In all communities more than 87% of the population is litterated. The most pinched situation exists in Capoeira Alta (13.4% illiterated).

Housing

Turvo (+) has the highest percentage of houses made out of bricks. Turvo (-) and Ana Benta are comparable. Here houses of wood are common as well (9%). 'Pau-a-pique' is seen in 15-18% of the cases. In Capoeira Alta the housing is situation is poorer. Only 44% owns a house of bricks and the same percentage has a house of 'pau-a-pique'.

Luxury goods

Talking about the distribution of luxury goods, in Capoeira Alta it is made clear that in this community in all categories, luxury goods are under-represented. For households possession of television and radio is more important than the presence of a refrigerator or another electric good (blender, iron etc.). Indicators as cars and tractors declare the best economic situation in Turvo (+), followed by Turvo (-) and Ana Benta.

Labour forms

As is a consequence of being an agricultural region the economies of all researched communities do heavily rely on agriculture. From here it is logical to understand that other activities as agricultural, hardly are developed in the villages. This can easily be concluded out of the distribution of labourforms (table 5.5). All activities are concentrated on the primary sector. The secondary- and tertiary sector are under-represented. Turvo (+) and Turvo (-) are most comparable in all sectors. In Capoeira Alta the primary sector is the greatest, followed by this sector in Ana Benta.

It was proved as well that landownership does raise the income of the people (10->20 OTN). In Turvo (+) the number of landowners is the highest. Labourforms other than proprietário and arrendatários as meeiro, camarada or mensalista doesn't change much the economic status of the inhabitants. Probably due to low salaries and lack of interest it seemed to be hard to improve the existing situation. People who work as camarada or meeiro are in a dependent role, therefore it turnes out to be difficult for them to improve their economic situation. In this aspect people are also dependent on other factors as infra-structure, community-organization and education.

Socio-economic situation

In terms of comparison of the socio-economic situation the most equal situation exist in Turvo (+) and Turvo (-). Not only in the agricultural-, secondary- and tertiary sector this comparability is the highest, also the other indicators as housing, age, education etc. are divided equally among these two communities.

Overall it can be concluded that in Capoeira Alta the socio-economic level is the lowest out of the four researched communities. All used indicators are pointing into this direction. No wonder that some villagers do give up their jobs and move out of Capoeira Alta to find a better living situation somewhere else.

Compared to Capoeira Alta the situation in Ana Benta is a little more better. The infra-structure makes it able to have more frequent contacts with Capão Bonito, although the travel still is time consuming. Also the housing- and education situation is a little better as in Capoeira Alta.

It was observed inhabitants who attended higher education (more than 4 years) had more opportunities to establish themselves. It was more easy for them to develope economic-higher services. All together, better educated people have access to better economic-earning labourforms.

5.3 Water.

5.3.1 Introduction.

This part of the report describes waterusage, functioning and utilization of waterpoints and the results of the bacteriological and chemical-physical waterexamines. A description of waterpoints is included as well, even as habits of fetching water. The discussion can be found in the last paragraph.

5.3.2 Description of waterpoints.

In this paragraph all types of waterpoints (wells, springs and rivers) will be described, which are being used in Turvo dos Almeidas, Ana Benta and Capoeira Alta. Results of the inspection of waterpoints is used to describe these waterpoints (see annex O).

5.3.2.1 Wells

Construction and situation

During the household interviews wells were inspected. Normally a family (household) has an individual well (poço). However some households used water of the well of the neighbours. In most cases this was a member of the family (aunt, uncle). All wells were dug by the people themselves. Average depth was 5-8 meters and the diameter amounted 1-1.5 meters. Daily 200-500 liters are taken up. During rainfall the waterlevel of the wells is varying. However people tell wells never dry up in the dry season. The wells are situated in the direct surrounding of the house (5-25m).

In **Turvo dos Almeidas** there was no problem of finding a specific area to dig a well. Groundwater was present everywhere. Geographically spoken Turvo was plane with only a few slight slopes. In **Ana Benta** the geographical situation is different. The church is situated on top of a hill, as are some houses. Here no wells could be driven because of the very deep groundwaterlevel. Families on top of this mountain are using water from wells at the bottom. In **Capoeira Alta** only 3 wells exist which are all situated downhill, rather close to the river. The majority of the houses are situated uphill where there is no way to dig a well (groundwaterlevel). Digging does cost a lot of money, some 60.000 cz$ (200$), one villager told during the fieldwork. This is about a half years wage for a "camarada", the common type of work in Capoeira Alta.

All wells have enough water during the whole year. They never dry up in the dryseason (may-august). Even there was no problem with the waterinput of the wells. Wells don't have foundation to the bottom. Sometimes only a part is reinforced with bricks or concrete up to 2 m under groundlevel. The part above groundlevel is made out of bricks, sometimes layered with concrete to prohibit entry of rainfall water.

People who own a well with a pump, say the system only fails when the electricity is cut down. This happens about once a month taking up 2-6 houres to restart again. Because many households have a reservoir (caixa), this doesn't seem to introduce problems.

Lid.

If a well has a lid, this is made out of wood, or out of concrete. Lids of woods have the disadvantage of leaking rainfall water, leaves and sand into the well. In this aspect concrete lids are better. Frequently small gaps are spared in the lids to allow that a small horse pipe can enter into the well to take water up with a pump (bomba). Rainfall water and other pollutants can enter the well in this way.

Installations for water taking up.

Two main systems exist to take water up out of wells. First there is a system which uses an electrical pump. This pump is installed right at the bottom of the well. A horse-pipe and an electrical cabel are connected up to the pump and make it able to fetch water. The rubber tube normally goes to a waterreservoir. This reservoir (250-1000l) is installed 3-4 m above groundlevel, sometimes in the houses themselves, sometimes outside on a specially constructed framework. The well itself doesn't need any special maintenance. Sometimes replacement of the pump or a slight deepening are sufficient (after some years of usage).

The second way to fetch water is to use bucket and rope. The bucket is of galvanized iron, so erosion is not a problem. Via a pulley and a rope or chain, the water is brought up. For transport into the house a special bucket is used, normally rinsed out before usage. Indoors sometimes a lid (tampa) is used to protect contamination. In the case of rope and bucket system, noone uses a reservoir.

Surrounding of the wells.

None of the wells has protection to prohibit infiltration of rainfall water. No extra concrete slab for protection was seen for this. In some cases in the direct surroundings of the well uphill, there are latrines (10-15 meters). In this respect contamination may occur. Small cattle (chickens, pigs and goats) could freely enter close to the well. Urine and feaces were observed in the direct surroundings. Some wells are protected in such a way that they have a little roof-construction. This makes it impossible to allow entering of rainwater.

5.3.2.2 Springs.

Construction and situation.

Springs were used as a watersource as well in the surveyed villages. A spring consists of a built construction where in appearing water is being collected. Some springs (minas) have a concrete underground-construction, others only have an overground construction. This can be an apron of concrete or bricks. If the spring has a lid, this is made out of concrete. The surroundings of the springs normally is very muddy. In Turvo dos Almeidas 2 springs can be entered by cattle (cows were seen). Springs were 2-3 meters deepened and distances to the houses amounted 100-500 meters. The water is transported to the users by way of a rubber tube (borracha). Diameter 2- 3 centimeters. Repairs are done by the users themselves as is installation and construction. No other activities are undertaken close to the minas, e.g. no cloth washing.

5.3.2.3 Rivers

In Ana Benta and Capoeira Alta riverwater is being used for consumption or washing clothes and irrigation. In Turvo dos Almeidas the only activity with riverwater is irrigation. For washing clothes special places exist nearby the rivers. Planks (wood) are installed and make it able for the women to wash the clothes (see 5.3.4). After heavy rainfall the water becomes very turbid (clay particles). Women wait with fetching until the water is clear again.

In Ana Benta only 1 riverstream crossed the village. Along the riversides were only 2 washing places. Also here families take water for bathing. In Capoeira Alta 2 streams can be distinguished. After rainfall the water turns into a turbid yellow-brown coloured stream, unsuitable to fetch for consumption. If there was rain at night, which wasn't that heavy, the other day in the afternoon the water becomes clear again.

In Capoeira Alta, people who use water of the river (rio) fetch water in the early morning because animals haven't entered the water yet at that time. Feacal contamination is diminished this way and washing clothes hasn't started yet. Fetched water is being used for all kind of household activities, including drinking and cooking. Normally a place for washing clothes and utensils (kitchen) is situated close to the spot of taking in drinking water. Only the last is situated a little more upstream. However there do exist more places as described along the river. This means that polluting activities, as cloth washing with soap and washing kitchen utensils, will have its influence on the waterquality more downstream, where other people are taking in drinking water.

In Capoeira Alta some people who live long away from the river have installed an electrical pump to bring the water up. Some villagers told they had the intention to install a proper well,

but rejected because of the lack of financial resources. In this way, they are kept dependent on the sometimes dirty riverwater, which had to be carried uphill. This is 15-20l of water, sometimes 4 times a day.

Riverwater and well water is fetched in tins or plastic drums, containing 15-20 l. Women told they cleaned the drums every day with soap (Capoeira Alta). Fetching water is a typical job for women and female children. In some households everybody helps with fetching water. For well water people have to walk 5-25 meters, for fetching riverwater this distance goes up to 50-200 meters. This doesn't seem to be very much, however the area is very steep.

5.3.2.4 Water of SABESP

In Turvo dos Almeidas one part of the village already had a connection to the water of the State São Paulo Water Cooperation (SABESP). People pay a monthly rate of 100-200 cz$ (0.5-2$) depending on the quantity of spent water. Minimum rate to be paid is about 100 cz$/month. For this amount up to 9 m^3/month can be used. Normally SABESP is supplying water during the whole year. If the system fails (e.g. defect pump) it takes 2-3 days at the most untill the water is redistributed again. For the majority of the people who have a connection to SABESP-water, this is not a problem. The majority command over a waterreservoir (150-1000l). The reservoir is not needed for maintaining waterpressure, just for spare. At this moment the users of the SABESP-water are satisfied, although in the beginning the new taste (chlorine is used for desinfection) was perceived as strange and untasty.

5.3.2.5 Rainfall water

In Capoeira Alta 11 households are using rainfall water. All these houses are dependent on riverwater. When the riverwater is dirty (heavy rainfall), one solution is to start using rainfall water. Quantities vary in the range of 10-20 l/d. Hardly no information was obtained about the usage of this water. In Turvo and Ana Benta no-one uses this type of water.

5.3.3 Utilization and preference of facilities

Utilization

An inventory was made on how many people were using the different waterfacilities. When someone had a well or spring it was asked if this was for individual- or communal usage. In this way it was calculated what was the average number of users/facility. Table 5.5 resumes the results.

As can been seen out of this table in Turvo (-) and Ana Benta the majority of the population uses water out of wells. Number of users/well varies here between 4.5-4.8 per well. It is observed that in Turvo (-) out of the total wells 54% is used individually per household. In Ana Benta only 6 out of 39 wells are individual

(15%). Springs are observed to be more for communal usage. In all villages numbers of people using spring water are lower than the number using well water; probably because wells can be installed more close to the houses. Springs need a horse-pipe for transport and this seemed to be a problem. In Capoeira Alta in total 102 people use water of wells and springs. The rest of the researched group (108) uses river water. As can be concluded out of the density of used facilities in Capoeira Alta, number of users/facility are all higher compared to Ana Benta and Turvo(-). In the last area, the number of users/facility varies from 4.1-4.8. However in Capoeira Alta these numbers are much higher (11.7-22.6). This is an indication of the poor watersupply. Or there are no other possibilities to construct (lack of good well construction land) or lack of financial support or lack of people's interest. In Turvo (+) the main watersupply is water of the SABESP watercorporation (118 users). For this reason no other used facilities were of interest in this area.

Table 5.5 : Utilization of used watersources for cooking and drinking.

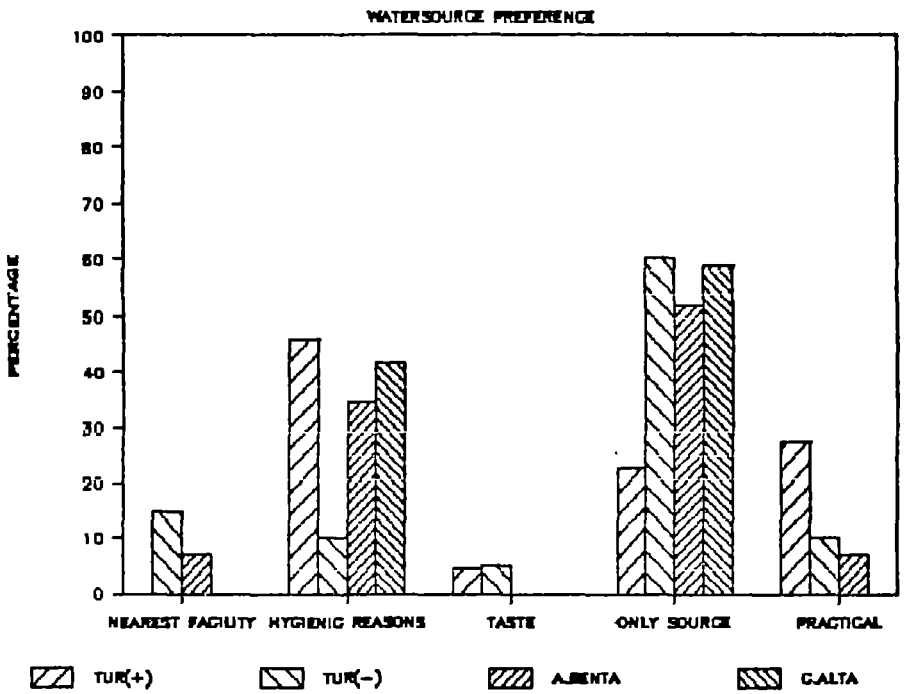
LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	INDIVIDUEL	COMMUNABLE	INDIVIDUEL	COMMUNABLE	INDIVIDUEL	COMMUNABLE	INDIVIDUEL	COMMUNABLE
WELLS			24	20	6	33	1	2
NUMBER OF PEOPLE			200		186		67	
USERS/WELL			4.5		4.8		22.6	
SPRINGS			1	10	1	7	1	2
NUMBER OF PEOPLE			53		33		35	
USERS/SPRING			4.8		4.1		11.7	
RIVER								2
NUMBER OF PEOPLE							108	
USERS/RIVER							54	
SABESP	-	-						
NUMBER OF PEOPLE	-	118						
USERS/CONNECTION	-	54						

Watersource preference

It was considered important to reveal why people gave preference to a certain watersource. Out of all data the next figure could be constructed.

It can be concluded that in Turvo (+) the people are much more aware of the hygienic necessity of used water. Out of 22 investigated households 45.5% answer this is the main reason why they are using SABESP water. In Turvo (-) only 10% thinks this is important. In Capoeira Alta the watersituation is bad. However the community is aware of this lack of good watersupply. Except Turvo (+), in the other parts more than 51% answered they are prefering that facility because it is the only source which is usable. Arguments as "taste" and "most practical" are not considered to be of significant interest.

FIGURE 5.4:



5.3.4 Wateractivities

Water is being used for rather varying types of activities. All of them will be discussed shortly.

Personal hygiene

People who have a w.c.(banheiro) inside the house, including a shower (chuveira) with hot water, say to take a bath everyday. Children as well as adults. Baths are mostly taken in the late afternoon or just before dinnertime (16-19.00 h.).

The shower apparatus itself consist of an iron arm with a shower-bowl at the end. In this bowl an electric heating element is installed (110 V). However some electrical connections are badly isolated and dangerous situations have been seen.

Families without a shower usually wash themselves using a small washing-bowl (bassia), containing 2-10 l. People who don't have streaming water inside the houses normally clean themselves this way. The majority of the people uses soap, shampoo and water. Only families with a low income economize on cleaning material.

In Capoeira Alta people without a banheiro were used to take a bath in the river. In the period the research was done, it was wintertime and the temperature dropped sharply, so if the weather was dry and warm, people went to the river. In summertime taking a bath in the river, was mostly common for men and many times also for women.

Cooking and drinking

Cooking seemed to be an activity just for the women alone. None of the men ever cooks. In the morning a small breakfast is taken (café de manhã), which consist of some plane slices of bread with magarine, crackers or cake (bolo) and coffee (normally very sweet). Lunch and dinner are both served with rice (arroz) and beans (feijão) with a piece of meat, fried cornmeal pudding (polenta). Cabage, french beanch, tomates, salad and potatoes are common as well. For preparing all vegetables are washed in water. Washing the dishes is normally done in cold water and some detergent. The cooking itself is done inside the houses on a proper cooking-range using gas, or on specially constructed open fire places situated in one of the corners.

Cloth washing

For washing clothes women do have two options. First they may use a sink outside the house. The water comes from a reservoir (installed 2-4 meters above groundlevel to maintain waterpressure). They all wash by hand. Just a few households in Ana Benta had a primitive washing machine. This is a wooden barrel with an electrical stirring installation. After 10-15 minutes of stirring, clothes are taken out and rinsed by hand further in the outdoor sink. Women say to use a lot of water for rinsing and washing in general. Almost everyday they wash clothes.

Secondly women use the river for washing clothes (see 5.3.2.2). Special installed places at the riverbanks make it possible to squat and wash and rinse the clothes.

Cleaning

Depending on the type of construction of the house, the people clean the floor regularly, with water and detergent. Everyday 1-2 times the floor is swept. In rainy periods the floor is cleaned with water as well because of muddy shoes of the men returning from the fieldwork. Houses which don't have a concrete floor are just being swept.

Gardening

Crops planted in the near surroundings of the house were sometimes sprinkled with water. Fields more far away were irrigated with proper sprinkler installations including pumps and pipelines. This last option only applies for landowners. No data on waterusage were gathered.

Other activities

For flushing the toilet 7-10 liters was used every time. In big families the amount of water spent on flushing could go up to more than 100 l/day.

In some cases special drinking trunks for animals where seen. People filled these up with well or spring water to allow animals to drink it.

5.3.5 Waterquantities

It was calculated how much water people spent per member of the household (annex P). Out of these results figure 5.5 was composed. A distinction was made between what kind of water facilities people use and the type of sanitary facilities in the houses. Sanitary facilities could be divided into:

I) people who have a latrine or go to the bush to defecate and wash themselves either inside the house using a washing-bowl or take a bath in the river;
II) people who have a latrine or go to the bush to defecate and wash themselves indoors using a shower (chuveira);
III) people who have a w.c. and wash themselves indoors using a proper shower.

In this way the used quantities of water were calculated. Waterusage for washing clothes was excluded, because it turned out to be extremely difficult to estimate used waterquantities. Activities which are included are: water used for preparing food, cooking, washing the dishes, cleaning of the house, gardening and flushing the toilet (if they had one).

The following main conclusions can be drawn (see figure 5.5):
- People who use water out of the river for drinking and cooking and have simple sanitary facilities (I) use up to 5-25 l/head.day. (Capoeira Alta). When they have a shower and w.c. inside the house, the used quantities raise to 21-75 l/head.day.;

- The more difficulty the people have with fetching water, the less they spent during the day. People fetching water out of a well and carrying it to the house consume 3-30 l/day, in case of having simple sanitary facilities (I). Having a shower in the house does raise the consumption with +/- 40 l/day up to 65 l/day (average).;

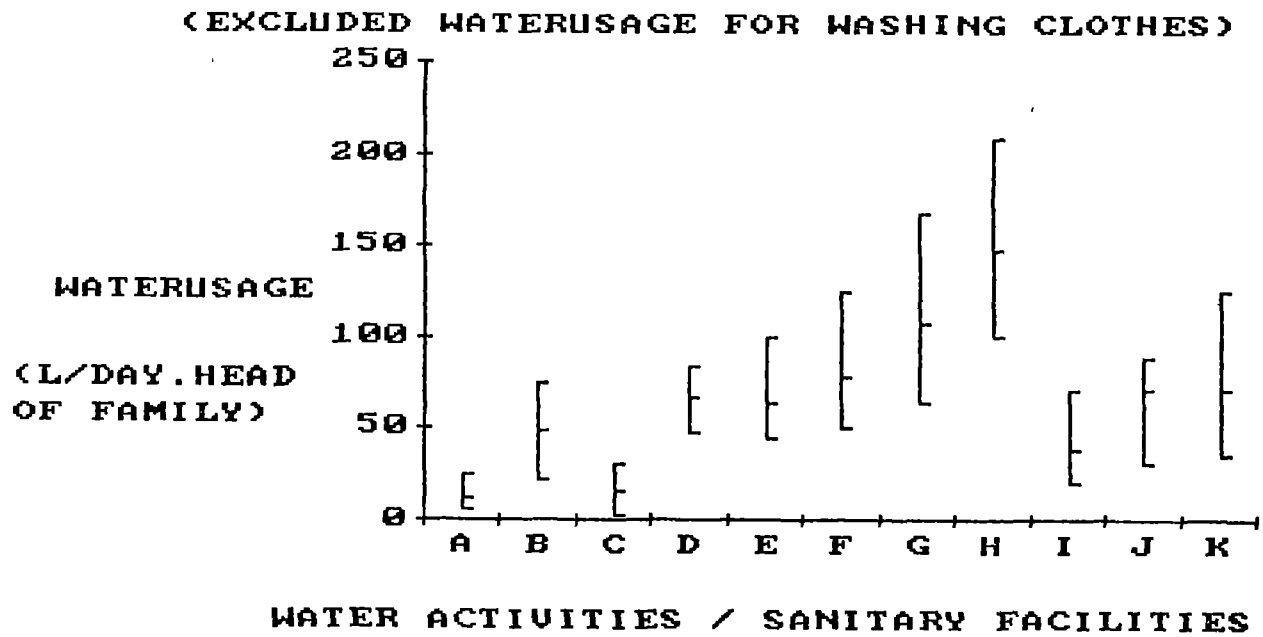
- For households having a well and pump and reservoir there is hardly no restriction on waterconsumption. For this reason they use higher quantities. Families with simple sanitary facilities (I) are using 44-100 l/d in Turvo and Ana Benta. If they have a shower indoors (II), the amount goes up to 50-125 l/day. The highest consumption is registered for w.c. and shower (III), namely 62-167 l/day.;

- People having water out of a spring and using a reservoir are comparable to the last in the consumption rate. They are spending 100-218 l/d.;

- Households with a SABESP-waterconnection, have a consumptionrate of about 20-70l/d for simple sanitary facilities (I), 30-88l/d for more luxurous systems (II) and 35-125 l/d for w.c. and shower inside the house (III).;

The overall conclusion can be formulated as follows: if households have more sophisticated watersupplies (e.g. well with pump and reservoir) the daily rate of waterconsumption increasing depending on advanced sanitary facilities.

FIGURE 5.5: WATERQUANTITIES USED IN THE FOUR VILLAGES



Legenda:
A: River (I), directly, n=12, (5-25), 11
B: River + pump (II + III), n=6, (21-75), 48
C: Well, fetching (I), directly, n=12, (3-30), 15.2
D: Well, fetching (II), directly, n=2, (47-83), 65
E: Well+ reservoir (I), Ana Benta and Turvo (-), n=9,(44-100),63
F: Well + reservoir (II), n=6, (50-125), 77
G: Well + reservoir (III), Ana B. + Turvo (-),n=21,(62-167), 106
H: Spring + reservoir (III),Ana B. + Turvo (-),n=3,(100-218),147
I: SABESP (I), Turvo (+), n=4, (20-70),37
J: SABESP (II), Turvo (+), n= 5, (30-88),66
K: SABESP (III), Turvo (+), n=10,(35-125),66
Location,(type of sanitary facilities), # of observations,range and average waterusage l/day.head of family.

5.3.6 Waterquality

Watersamples were taken in all three villages. It was organized that people of the CETESB-laboratory passed in Turvo dos Almeidas in the beginning of the second week, in Ana Benta and Capoeira Alta this was in the last week (fourth) of the fieldperiods. Total time of research in each village was 4 weeks. During the prequestionnaire and householdinterviews all data about watercollection where gathered. An inventory was made and decided where were interesting places of taking samples. The decision-making reckoned not only with watersources for drinking but for places for washing clothes and taking water for a bath as well.

5.3.6.1 Bacteriological waterquality

Annex Q resumes all results of the bacteriological waterquality. In total 48 samples were taken in all 4 research areas. According to the WHO Bacteriological Quality Guidelines values for unpiped watersupplies are 10 total coliforms per 100 ml and 0 fecal coliforms per 100 ml. In respect to fecal coliforms, out of 48 samples only 22 meet this requirement.

Turvo dos Almeidas

Samples here were taken after two days of heavy rainfall. The waterquality in Turvo dos Almeidas is by far the best. This can be attributed to the waternetwork of SABESP. People who use this type of water are insured that water is treated before being distributed. The other 5 investigated wells in Turvo (+) don't show any fecal coliforms, although total coliforms numbers reach up to 280/100 ml.

The bacteriological waterquality in the other part of Turvo (-) is comparable. Out of 13 samples 11 require the WHO fecal coliform standard. Total coliform numbers are higher (up to 1600/100 ml.) There is no direct indication that the quality of the water is runed to ruin because of transport or storage in reservoirs (caixa) or buckets or storage vessels inside the house.

Some households can improve the waterquality if they use a lid to cover the bucket or vessel. In this part of Turvo (-), the 4 investigated springs were all badly protected from cattle or entering feces of animals. In 2 cases no fence was observed and cattle could come very close to the watersource. However the waterquality is not ruined by fecal coliforms. Total coliform counts go up from 0-350/ 100 ml. WHO standards are not reached. All users of these springs are sure their waterquality is very good. Some households have a connection to a spring as a well as well. In this case they use the water of the well just for washing. Springwater is used for consumption and cooking.

In Turvo (-) 5 other wells were examined. Three showed no fecal coliforms, the other two 6-34 fecal coliforms/ 100 ml. Total coliforms and total plate count numbers were higher as well (2-

>1600 ml.). Talking about recommandations of watersources in Turvo dos Almeidas, only 4 inspected waterpoints were observed as sufficient.

Capoeira Alta

In Capoeira Alta the samples were taken after 9 days of heavy rainfall. In Capoeira Alta the watersituation is even more urgent. None of the 14 samples reached WHO standards. Wells closer to the river show higher numbers of fecal coliforms and total coliforms. Only in 2 cases no fecal coliforms could be detected. In Capoeira Alta people use water of the river for drinking as well. This water is of a bad quality. Stream up and stream down exist washing places and places for water taking in. Also cattle has free entry close to the river. Waterquality is not changed after transport or storage inside the houses.

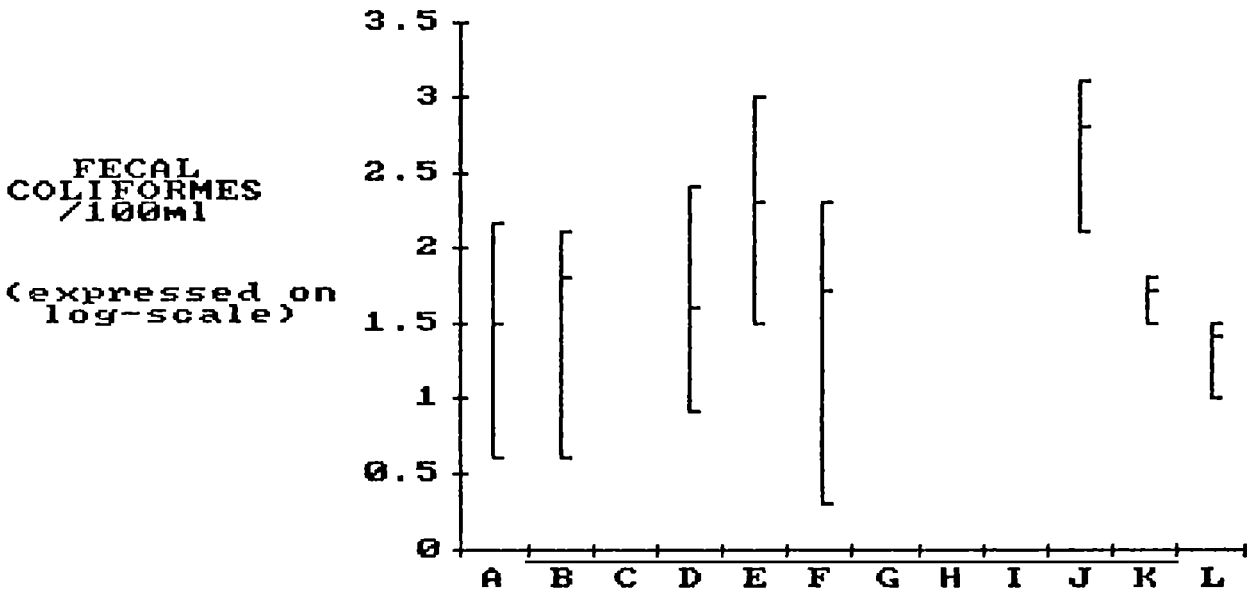
Ana Benta

Samples in Ana Benta were taken after 8 days of heavy rainfall. In Ana Benta one river flows through the village. Where the river enters the village some houses are located which don't have any soakage pit facilities. Feaces straight enters the rivers via a tube. For this reason the waterquality of the river is extremly bad. Downstream women are washing clothes.

Also in Ana Benta none of the total number of the samples (13) reached WHO standards. Wells situated downhill produce water of a bad quality (fecal coliforms 4-140/100ml), wells located a little bit higher have lower numbers (absent-8/100 ml.), but combined with total coliforms still not sufficient for human consumption. Storage and transportation doesn't change recommondation (WHO standards are not achieved).

Figure 5.6 visualizes all results of bacteriological examines. For this, watersupplies of the different communities are grouped and the ranges of Feacal coliform contaminations are visualized. Number of bacteries are expressed in (log number of bacteria/100ml). Also numbers of samples with absence of f.c. are resumed. It is made clear that the quality of well water is worse than the quality of the springs. None of the springs showed fecal pollution (n=8). In the case of wells , out of 25 samples 15 are fecal coliform free (60.0%). SABESP-water is free of f.c. as well. Quality of riverwater is bad, not sufficient for human consumption. Generally speaking, water of springs can be prefered above wellwater. SABESP-water is treated and therefore, risks of contamination are minimalized.

FIGURE 5.6: BACTERIOLOGICAL WATERQUALITY



Legenda:
A: Well without pump, directly,n=6,(4-140),29, 3x absent
B: Well without pump + reservoir,n=2,(4-110),58, no absent
C: Well without pump + bucket,n=2,(0),0,2x absent
D: Well with pump directly,n=7,(8-280),42,4x absent
E: Well with pump + reservoir,n=5,(34-1000),186,3x absent
F: Well with pump and tap,n=5,(2-200),46,2x absent
G: Spring with/without pump, directly,n=6,(0),0,6x absent
H: Spring + reservoir + tap,n=2,(0),0,2x absent
I: SABESP,n=3,(0),0,3x absent
J: River,directly,n=5,(130-1300),680,no absent
K: River + reservoir + tap,n=2,(30-70),50,no absent
L: River + bucket,n=2,(11-34),23,no absent
Location and description,# of observations,(range of # of bacteria), average number of bacteria, number of no fecal coliforms in sample.

5.3.5.2 Physical-chemical waterquality

As can be seen out of table 5.6, pH's of wells and springs range from 4.9-8.2. According to the physical-chemical parameters as chlorids, total carbonates, bicarbonates, iron, no hazardous situation exists. No conclusion could be drawn out of higher numbers of nitrates and the location in respect of contamination of groundwater by animals or badly localized latrines. Still nitrate numbers do obey requirements of set values.

Tabel 5.6 : Physical-chemical waterquality in the four communites.

PARAMETER	pH	CHLORIDS	TOT.CaCO3	Fe	NITRATES	NITRITES	BICARB.	# OF
LOCATION		[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	SAMPLES
WELLS								
TURVO DOS ALMEIDAS	4.9-6.5	1.0-6.0	3.0-7.5	0.01-0.08	0.1-2.46	-	2-6	10
ANA BENTA	5.3-8.2	4.5-12.5	-	0.01-0.06	0.44-7.1	0.005	3-50	2
CAPOEIRA ALTA	4.9-5.1	4.0-13.0	-	0.01-0.13	5.0-7.9	0.01	7-14	2
SPRINGS								
TURVO DOS ALMEIDAS	5.9-6.2	1.0-1.5	4.8-7.0	0.01-0.1	0.02-0.1	-	2-4	4
ANA BENTA	5.9-6.3	-	-	0.02	1.5-2.2	-	10-21.5	7
CAPOEIRA ALTA	6.9	-	-	-	0.22	-	46	1
RIVERS								
CAPOEIRA ALTA	6.6-7.8	2.0-4.0	-	0.3-3.1	0.04-8.7	-	36-79	3

5.3.7 Discussion

At the end of the section about water the following remarks can be made:

Utilization and functioning

In Turvo (-), Turvo (+) and Ana Benta all habitants have access to a type of watersupply for drinking and cooking. In all cases this is or a well (poço), or a spring (mina) or a waterconnection of SABESP (Turvo (+)). It was observed that inhabintants out of higher economic classes were supplied with the better sanitary facilities (banheiro and chuveira) and better constructed wells and springs. More frequently, they had the possession of a reservoir to store the water and a pump to take the water up.

In Capoeira Alta the watersituation is more urgent. One part (102 people) use water out of wells or springs, however 108 people are being forced to use river water for drinking and cooking. These inhabitants use the river for washing their clothes as well. Often locations for taking water in for consumption are close to the washing places.

Waterquality

Combined with the waterquality this last mentioned option in Capoeira Alta is not prefered and need to be improved. Speaking about waterqualilty, springs in Turvo (-), Turvo (+) and Ana Benta are considered as supplying water of a reasonable quality (no fecal coliforms, total coliforms-numbers are still too high). However water doesn't reach WHO's watersupply standards. Wells located close to the river produce water of lesser quality, probably because of groundwater interference with the precense of latrines in the direction of the waterpoints. SABESP water is desinfected, no fecal coliforms were measured.

People could improve the quality of there watersupply (well + spring) if they were disinfecting and cleaning their supplies in a better way. Special watereservoirs are subject of neglection.

Waterquantity

All well and spring water is present in sufficient quantities. Even in the dry season none of the supllies ever dries up. It was concluded that households which have simple sanitary facilities (use latrines or bush to defecate and wash in river or use washing-bowl) depending on location and type of watersupply, use less water than people who have access to more sophisticated types of watersupplies (well, spring all with or without pumps) depending on sanitary facilities.

Overall, people with a SABESP-water connection also can be classified by the type of sanitary facilities. Households which have a shower and proper w.c. are using more water (see 5.3.4 for exact numbers). Important to realize is the observation that if people have water of SABESP or a reservoir or a pump there's no limit on used waterquantities. Only people fetching directly out of well or river and who have to transport the water to the house in buckets economize on waterusage.

General observations

As was already seen in 5.3.3 (Utilization and watersource preference), it is of major importance to realize that the most urgent situation exist in Capoeira Alta. Not only numbers of users/facility are very high here (11.7-22.6), but also used waterquantities are lower than in the other communities. Too low waterquantities can induce water-related diseases as diahrroea. Considering 19 families (108 people) still are using riverwater for drinking and cooking it is made clear that the watersupply in Capoeira Alta needs to be improved.

The latter argument gets even more amplified when the bacteriological waterquality is taken into account as well. High numbers of feacal coliforms do not longer allow the usage of riverwater for drinking and consumption. The population here is more concerned with a good watersupply. A major part was aware of the fact that they were using water of a doubtfull quality (see waterpreference, 5.3.3). They are keeping on using the existing facilities because it was the only source they have entry to.

In Turvo (-) and Ana Benta the situation is less urgent. All inhabitants have access to reasonable good watersupplies, or have the opportunity to improve the quality of used water by using water of the neighbours (having a better watersupply) or to select a better watersource (e.g. springwater instead of wellwater).

5.4 Sanitation and waste

5.4.1 Introduction

The people in the villages which were investigated, have different solutions to dispose their excreta. There are families which have a w.c. (the pot itself), inside or close to their houses. Others have a pit latrine outside. There are also households that do not have any type of facility and use the latrine of their neighbours or the bush to defecate.

The following table 5.7 shows the distribution of the different excreta disposal solutions among the four population groups which were investigated.

Table 5.7 : Distribution of w.c.'s, pit latrines and bush (no facility) among the number of households and persons in Turvo (+), Turvo (-), A. Benta and C. Alta.

LOCATION	TURVO (+)			TURVO (-)			ANA BENTA			CAPOEIRA ALTA		
		PERSONS			PERSONS			PERSONS			PERSONS	
DESCRIPTION	# HOUSEH.	n	%	# HOUSEH.	n	%	# HOUSEH.	n	%	# HOUSEH.	n	%
W.C	14	77	65.3	19	85	55.9	15	59	26.9	4	39	18.9
LATRINE	10	39	33.0	10	57	37.5	27	128	58.5	29	157	76.2
BUSH	1	2	1.7	2	10	6.6	5	32	14.6	2	10	4.9

As can be seen in the table above, the majority of the people in Turvo (+) and Turvo (-) uses the w.c. to defecate. But in A. Benta and C. Alta, the majority uses the pit latrine. In the four population groups, a rather small number of people use the bush to defecate. The highest percentage (14,6 %) was found in Ana Benta.

Now, the w.c. and the pit latrine will be discussed more in detail. Then, functioning and utilization of latrines will be described, followed by a section about waste. Finally, the results will be discussed.

5.4.2 The w.c.

The w.c. is situated in the bath-room or rarely in another cabin, inside or outside the house. The bath-room often includes a shower and a wash-basin with a tap. The w.c. needs a certain quantity of water which must be available. For this reason, a w.c. is only found in the houses of the better-off, who can afford a water reservoir and a pump. The construction costs of a pit latrine are lower and a latrine does not have water use.

The sewage of the bath-room goes normally to a soakage pit by means of a tube. The soakage pit receives exclusively the waste-water of the bath-room. The waste-water of the sink goes to any place: in front of the house, the garden or the street. Some four households in A. Benta did not have a soakage pit for their sewage, but drained off their sewage into the river.

The soakage pit itself is situated some 5-20 metres from the house. It is just a hole in the ground with a slab out of wood and earth or sometimes out of concrete. The pit has a diameter of 1-2 metres and a depth of 2-5 metres and is in use by a household for a period of 4-8 years. When it is filled up, a new pit is dug in another place. Inside the soakage pit, digestion of organic matter takes place and the liquid can infiltrate into the soil. Some soakage pits have a tube for escape of produced gases.

Families which use a w.c. are common to use toilet paper as a cleaning material. The used toilet paper is collected separately and mostly burned. It is not flushed away with excreta to prevent stoppage of the tube. People say to clean the w.c. or bath-room in general with water and detergent.

5.4.3 The pit latrine

The pit latrine is located outside the house within a distance of 5-30 metres. It consists of the pit, the squatting plate or slab and the superstructure (see annex V).

The pit itself has a typical size of 1*1*2-4 metres. The pit is just a hole in the ground and is filled up after a 1-10 years' period. The length of the period depends on household size and pit capacity. According to Pacey (1981), a pit latrine of a family with 5 persons and a pit size of 5 m^3, can be used for a 3-4 years' period. But e.g. in places near the river with a high groundwater table, pit capacities were lower, and households could only use their pit for one year. This was recorded in C. Alta and A. Benta. After the pit has been filled up nearly, it is covered with sand, and a new pit is constructed. This is normally done by the male head of the family. Distances between pits and wells were also observed (see 5.3.2).

The squatting plate is constructed out of concrete, wood, wood and earth or only earth. Concrete is the most expensive slab material because the cement has to be bought. Wood is always locally available. The slab itself has a hole which is sometimes covered with a roofing-tile or plank.

The superstructure consists of bricks, wood, pau-a-pique or plastic. Of these materials, only bricks are not locally available and have to be bought. They are therefore the most expensive solution. The roof is constructed out of roofing-tiles, plastic or a type of asbestos. The door is mostly constructed out of wood. Some latrines do not have doors or roofs at all.

Inside the latrine, there are no windows, and it is therefore rather dark. This is done for reasons of privacy, but the isolation also keeps insects outside.

Table 5.8 shows the distribution of the different construction and slab materials among the latrines in the villages. The type of material is a socio-economic criterion, according to the criteria of Pacey (1981) (see annex L).

Table 5.8 : Division of construction and slab material over pit latrines (%).

LOCATION	TURVO (+)	TURVO (-)	ANA BENTA	C.ALTA
# LATRINES INSPECTED	8	10	11	22
CONSTRUCTION MATERIAL	%	%	%	%
BRICK	88	40	9	-
WOOD	-	20	91	41
PAU-A-PIQUE	12	40	-	54
OTHER	-	-	-	5
SLAB MATERIAL	%	%	%	%
CONCRETE	75	40	9	-
WOOD	25	10	-	59
EARTH OR EARTH/WOOD	-	50	91	41

According to construction and slab material, the socio-economic situation is the best in Turvo (+). There, 88% of the latrines are constructed out of bricks, while 75% of the latrines have a slab out of concrete. The situation in Turvo (-) is worse, although rather good in comparison with C. Alta and A. Benta. In the two last-mentioned villages, latrines are commonly constructed out of wood or pau-a-pique with wooden and/or earthen slabs.

5.4.4 Functioning and utilization of the latrines

5.4.4.1 General

During an household interview, information was obtained about latrine usage, e.g. hygiene. Besides, after every interview, the latrine was inspected by one of the investigators. The results of these inspections are therefore results which express the opinion of the researchers, who tried to maintain the same criteria. A list of criteria was made, according to Pacey (1981) who gives some health- and socio-economic criteria for a range of sanitation techniques (see annex L). Results of the inspection and the household survey are listed in table 5.9. Information about cleaning and used cleaning material was obtained by means of the interview. The rest of the information listed was obtained by means of the inspection.

5.4.4.2 Description

Most women told they cleaned the slab of the latrine regularly, almost every day. Although, at the moment of the inspection, many of them were not considered as clean (see table 5.9). The researchers considered a slab as clean if it was without rests of faeces, urine or other dirt. The easyness of cleaning depends on the slab material. Concrete is easy to clean with water and so is a well-constructed wooden slab. Slabs of earth or earth and wood can hardly not be cleaned with water. In that way, the slab gets muddy and so, only sweeping or throwing new earth from time to time are the common 'cleaning' practices. Sometimes, also ash is used. Because detergent is not used, these slabs of earth or earth and wood are therefore easy contamination places for e.g. Ascaris and the hookworms.

Table 5.9 : Results of functioning and utilization of latrines by means of inspection and questionnaire.

LOCATION	TURVO (+)	TURVO (-)	ANA BENTA	C.ALTA
# LATRINES INSPECTED	8	10	11	22
# PEOPLE/LATRINE	4.9(2-8)	5.8(3-11)	6.1(3-10)	6.7(1-10)
CRITERIA	%	%	%	%
CLEAN SLAB				
YES	62	40	-	14
NO	-	50	82	59
HOLE HAS LID: YES	12	30	9	27
NO	88	70	91	73
ODOURS:				
YES	37	80	82	50
ACCEPTABLE	50	10	18	32
NO	13	10	-	18
CLEANING:				
WATER + DETERGENT	78	50	18	21
WATER	22	40	73	31
SWEEPING	-	-	-	34
ASH	-	-	-	10
NO CLEANING	-	10	9	4
CLEANING MATERIAL AVAILABLE:				
YES	50	30	9	23
NO	50	70	91	77
MATERIAL BEING USED:				
TOILETPAPER	73	40	46	36
COMMON PAPER	27	40	36	58
OTHER	-	20	8	6

Turvo (+) with a percentage of 88% of latrines with concrete slabs shows to have the highest recorded number of clean slabs (62,5%), which is a logical consequence of the easy cleaning with the use of water and detergent. Slabs, constructed out of wood

and earth, are difficult to clean with water. In spite of this fact, the majority of these slabes in A. Benta are cleaned in this way. Sweeping is more common in C. Alta, with the same type of slabs. That the cleaning of these slabs is not easy, becomes clear by the great number of unclean slabs in C. Alta and A. Benta, which were recorded (see table 5.9). This was also recorded in Turvo (-) where the majority of the slabs also consist of wood and earth.

Odours are almost inevitable in a latrine. Although, a clean slab and a lid on the hole can diminish odours efficiently. Table 5.9 shows that a lid mostly is not used. According to the household survey, people mostly mentioned odours as a problem of the functioning of a latrine. Also during the inspection, odours were frequently recorded.

According to table 5.9, cleaning material is mostly not available inside the latrine. If people use the latrine, they take material with them to clean afterwards. The used material is thrown into the pit. Toilet paper is the most expensive cleaning material and therefore little in use by the poorer families. These families use any kind of paper, a piece of cloth or a corn-cob. Only in Turvo (+), the majority of the people use toilet paper (72,7%).

Almost no latrine had washing facilities within a few metres of the latrine. During the household interview, people were questioned about handwashing after defecating. Adults almost always said to wash their hands afterwards with soap. Even part of the children always washed their hands, according to the interview. This percentage was e.g. in Turvo (+) 40% and in C. Alta 71%. Mothers told they teach their children to wash their hands afterwards with soap, but in fact, they really had to pay attention to them if they really did so. The researchers have serious doubts about the correctness of the answers about handwashing practices. Probably, a much greater part of the people who use a latrine, do not wash their hands after defecating because handwashing facilities are often not nearby available. This conclusion was also drawn by Berghuizen et al (1987).

Mothers were asked at what age their children started to use the latrine. This varied between 2-12 years but mostly begins with 3-4 years. Before this age, children defecate in any place around the house. Only few children were noticed, who had fear of the latrine.

The households which use a privada, use the facility during the daytime. At night the majority of the households do not use the privada, but defecate in any place around the house because inside the latrine it is too dark. There are also families which use an urinal during the night, mostly the households with little children. Normally, the contents of the urinal is thrown in the pit, the day after. But there are also households which throw the contents away in any place around the house, where children are playing during the daytime. In this way, contamination of e.g.

Ascaris can occur.

Finally, the 'privada' is a subject about which the people are not used to talk. A latrine smells bad and for this reason you better not pay too much attention to it. So, it was not easy for the researchers to get reliable information about it. If people do not like to answer certain questions, they are likely to give the answer that the interviewer seems to want.

5.4.5 Waste

During the household interview, people were questioned about the practices around waste of the household activities. A short description will be given.

People are used to throw the waste away around the house. From time to time they burn the waste or part of the waste (e.g. toilet paper). Hardly no household has one certain place with a fence to dispose their waste. In this way, it is common that animals scratch close to the waste and children play in the same place.

Most families do not seem to have any problem with their waste. The quantity of waste is considered low, and moreover especially of organic nature. Therefore, the major part of the waste decays rapidly or is partly eaten by chickens and pigs which scratch around the house.

5.4.6 Discussion

Sanitary conditions differ markedly between and within the four population groups. The conditions are highly dependent on the socio-economic and hygienic status, whereas the socio-economic status appears to influence the hygienic status. According to Pacey (1981), socio-economic factors are e.g. type of facility and type of construction and slab material of the latrine.

The sanitary situation shows to be the best in Turvo (+) and Turvo (-), because there the majority of the households appears to have conditions to construct a bath-room, including a w.c.. Within such a bath-room, hygienic conditions are rather easy maintained because the bath-room is easy to clean with water and detergent. Also, these families have conditions to use the hygienic toilet-paper. Besides, within a bath-room with a w.c., a tap is usually present to wash hands afterwards.

If households use a latrine, again in Turvo (+) and in a lesser way in Turvo (-) the families appear to have the best conditions to construct a latrine. Some 80 % of the latrines in Turvo (+) and 40% in Turvo (-) are constructed out of bricks and have concrete slabs. These slabs out of concrete are easily cleaned in a hygienic way with the use of water and detergent. The greater part of the slabs in Turvo (+) and Turvo (-) are cleaned in this

way.

The sanitary situation in C. Alta and A. Benta is worse. If a latrine is constructed, it is constructed in the cheapest way. This means that the superstructures usually are constructed out of wood or pau-a-pique. The slabs are constructed out of wood, wood and earth or only earth. Especially, the slabs out of wood and earth or only earth have hygienic consequenses, because it is difficult to clean them. In this way, contamination of intestinal parasites is more likely to occur with these type of slabs as with concrete slabs. Also in general, handwashing afterwards is not likely to occur in the case of latrine-usage because of the absence of washing facilities, close to the latrine. The sanitary situation in A. Benta and C. Alta suggests a lower socio-economic status than Turvo (+) and Turvo (-).

It can be concluded that the type of sanitary facility has its influence on hygienic conditions, in which the cheapest solutions promote a less hygienic situation in comparison with the more expensive solutions. According to the results, the sanitary conditions in Turvo (+) and Turvo (-) show to be better as in C. Alta and in A. Benta. This suggests a higher prevalence of sanitation-related diseases in the two last-mentioned villages.

In spite of different sanitary solutions within the four population groups, practices around waste are typically the same in Turvo (+), Turvo (-), C. Alta and A. Benta. It gives in all villages the same scene of houses, surrounded with their own waste between which cattle is scratching and children are playing.

5.5 Health

5.5.1 Introduction

In this section, the results of the health investigations will be presented. In terms of this research, special interest existed in health in relation with water and sanitary conditions. Firstly, general health results will be presented, followed by the results of the faeces examination. Then, the results will be given of the investigation of diarrhoeal diseases in under five years old children. This is followed by the results of the measuring of height and weight, again with under five years old children. Finally, the results will be discussed. The data of the statistical analyses can be found in annex W.

5.5.2 General health results

During the household interview, people were questioned about the health of their family in the previous three months (see 3.3.1 and annex G). The results are listed in table 5.10.

Table 5.10 : Percentages of diseases and complaints for a period of three months (feb/march-may/june).

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
INFLUENZA	44	37.9	95	43.8	112	74.2	141	68.4
INTESTINAL PARASITES	15	12.9	45	20.7	64	42.4	47	22.8
DIARRHOEA	11	9.5	22	10.1	33	21.9	23	11.2
BRONQUITE	4	3.4	17	7.8	19	12.6	9	4.4
OTHER COMPLAINTS	12	10.3	29	13.4	33	21.9	61	29.6
OTHER DISEASES	12	10.3	9	4.2	11	7.3	5	2.4

Table 5.10 gives an impression of the health problems in the four population groups. The table shows that influenza, infectious diseases and diarrhoea are the major health problems. This was confirmed by the women of the health post in Turvo. No confirmation was obtained in A. Benta and C. Alta, because of the absence of a health post.

Some remarks must be made about the diseases which are mentioned in table 5.10. Influenza is not really considered as a disease. It is especially common during wintertime, the period in which the research was done. People with influenza have a cold in combination with headache and some rise of body temperature. During wintertime, people easily catch influenza because temperatures can be very low (5-10°C). Every house lacks the presence of a heating, unless they have a wooden fire to prepare food.

With the marking of intestinal parasites, no difference was made between the people who were sure they had parasites because of a faeces examination, and people who thought they had. People of the last group had complaints, concerning lack of appetite, stomach-ache and/or diarrhoea, sometimes with visible worms in the faeces in the case of Ascaris. Diarrhoea was mostly recorded in children. They seem to suffer much more from diarrhoea than grown-ups (see 5.5.3).

People mentioned various complaints. E.g. in C. Alta, where most complaints were recorded (61), some 45 % of the complaints were stomach-ache and some 18 % with head-ache. Both complaints are symptoms of an intestinal infection. Head-ache is also a symptom of influenza.

5.5.3 The faeces examination

Table 5.11 shows the results of the faeces examination for a number of worms and protozoa (see 3.3.3 and annex A and H).

Table 5.11 : Percentages and numbers of infected people for a number of worms and protozoa.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
INFECTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
WORMS:								
ASCARIS	5	4.8	15	10.4	58	25.6	48	25.4
TRICHURIS	3	2.9	1	0.7	19	8.4	12	6.4
ANCYCLOSTOMIDEA	3	2.9	-	-	3	1.3	8	4.2
HYM.NANA	2	1.9	-	-	1	0.4	-	-
STRONGYLOIDES	-	-	1	0.7	1	0.4	4	2.1
PROTOZOA:								
E.COLI	10	9.5	18	12.5	17	7.5	19	10.1
E.HYSTOLYTICA	1	1.0	-	-	1	0.4	-	-
GIARDIA LAMBLIA	17	16.2	12	8.3	14	6.2	20	10.6
E.NANA	1	1.0	2	1.4	-	-	12	6.4
POSITIVE (%)		35.2		32.1		45.9		47.1
NEGATIVE (%)		64.8		67.9		54.1		52.9

TURVO (+):105 PEOPLE
TURVO (-):140 PEOPLE
ANA BENTA:209 PEOPLE
CAP.ALTA :189 PEOPLE

The table shows that the percentages of infected people in A. Benta and C. Alta are significantly higher in comparison with Turvo (+) and Turvo (-) (X^2_{24}= 77,74). This is especially due to the high prevalence of Ascaris in C. Alta and A. Benta, about 25 %. Cairncross et al (1980) refers to Ascariasis and Trichuriasis too as infections which are rarely spread in water supplies. Ascaris and trichuris are soil-transmitted helminths (see annex B). The MEP mentions that their transmission should be reduced by improvements in excreta disposal. Table 5.11 therefore indicates that sanitary conditions are the poorest in C. Alta and A. Benta. This was already concluded in section 5.4. Infections in Turvo (+) and Turvo (-) are, besides Ascariasis, more of a faecal-oral origin: infections with Entamoeba Coli and Giardia Lamblia. Their transmission occurs by person to person contact and domestic contamination (see annex B).

Table 5.12 shows the age-specific prevalence rate. According to the MEP, it is believed that children have the highest prevalence rate. Berghuizen et al (1987) found a higher prevalence rate in the age-groups 0-4 and 5-14. They attributed the higher percentages to the fact that children play on the ground and often do not wash their hands after defecating. Table 5.12 shows that in Turvo (-) and C. Alta also significant more infections are found in children in the age-group 5-14 (X^2_{12}= 46,11). In Turvo (+), the highest percentage is found in children in the age group 0-4. Only in A. Benta, the highest percentage is not found in children. So it is not always true that highest percentages are found in age groups of children. But it is known that children have a lower resistance level than adults and they will therefore suffer more from infectious diseases, because the symptoms appear in an earlier stage.

Table 5.12 : Age-specific prevalence rate of infected and non-infected people.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
AGE CLASS	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE
0-4 YEARS	52.9 (9)	47.1 (8)	92.0 (23)	8.0 (4)	60.0 (18)	40.0 (12)	58.3 (14)	41.7 (10)
5-14 YEARS	64.0 (16)	36.0 (9)	46.2 (18)	53.8 (21)	67.9 (36)	32.1 (17)	41.4 (29)	58.6 (41)
>15 YEARS	68.3 (43)	31.7 (20)	73.0 (54)	27.0 (20)	46.8 (59)	53.2 (67)	60.0 (57)	40.0 (38)
TOTALS	(68)	(37)	(95)	(45)	(113)	(96)	(100)	(89)

Table 5.11 shows that in Turvo (+) with piped water and with a majority of the people who use a w.c., still 35.2 % of the people are infected. This percentage is significantly the same as in Turvo (-) without piped water and rather equal sanitary conditions. Treated water in Turvo (+) does not seem to influence the rate of infection. Water quantities are in both parts

sufficiently available. Table 5.13 indicates whether there is any difference in infection rate between people who use the w.c. and people who use the pit latrine/bush, or not.

Table 5.13 : Rate of infection of people who use the w.c. and people who use the pit latrine or bush.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
SANITARY FACILITY	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE
W.C.	65.2 (43)	34.8 (23)	65.9 (56)	34.1 (29)	63.8 (37)	36.2 (21)	75.0 (18)	25.0 (6)
LATRINE OR BUSH	64.1 (25)	35.9 (14)	69.1 (38)	30.9 (17)	50.3 (76)	49.6 (75)	49.7 (82)	50.3 (83)
TOTALS	(68)	(37)	(94)	(46)	(113)	(96)	(100)	(89)

The table shows no significant difference in infection rate between w.c.- or latrine/bush-use for both parts of Turvo. Section 5.4 showed that both parts have relatively good pit latrines. So sanitary conditions do not seem to influence the rate of infection which was found. This conforms with the origin of the infections in Turvo (+) and (-) which are the most faecal-oral. As pit latrine conditions showed to be poorer in A. Benta and C. Alta, here a significant difference in infection rate is found between w.c.- and latrine/bush- use (X^2_9= 127,37), according to the most prevalent infection: the soil-transmitted Ascariasis.

The faeces examination only recorded the presence or absence of an infection. The intensity of the infection was not recorded. A type of 'intensity' can be expressed by means of the number of single, double or even more infections per person. Plural infections were mostly found in the poorest families with the poorest hygienic conditions. Table 5.14 shows the distribution. In A. Benta and C. Alta with the highest percentages of infections, also the highest percentages of plural infections were found. C. Alta showed to have a significant higher percentage of plural infections than Turvo (+), Turvo (-) and A. Benta (X^2_3= 7,56).

Table 5.14 : Percentages of single and plural intestinal infections.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
SINGLE INFECTION	32	86.5	42	91.3	78	81.3	65	73.0
PLURAL INFECTION ()1)	5	13.5	4	8.7	18	18.7	24	27.0
TOTALS	37	100.0	46	100.0	96	100.0	89	100.0

5.5.4 Diarrhoeal morbidity

In the four villages investigated, the 'diary-assisted recall' method was used for children between the age of two months and five years (see 3.3.5). A list to mark diarrhoea was distributed among the mothers (see annex J). Definition of diarrhoea was left to them.

Table 5.15 shows the number of children who had diarrhoea during the two weeks' investigation. Also, the number and duration of episodes is collocated. Almost all the children of the four population groups within the age group under study were included.

As can be seen in table 5.15 , most episodes last one day, sometimes two days. It also becomes clear that one child can have more than one episode within two weeks. This especially happened in C. Alta where 13 children had 27 episodes. Here, the greatest number of episodes and percentage of children with diarrhoea were found. The difference with the other three children groups is not significant, because of the small numbers of children.

Table 5.15 : Recorded cases of diarrhoea and numbers and duration of episodes.

LOCATION	NUMBER OF CHILDREN	NUMBER OF POSITIVES	NUMBER OF EPISODES	DURATION OF EPISODES (DAYS)							
				1	2	3	4	5	6	7	8
TURVO (+)	17	5	6	4	2						
TURVO (-)	29	9	12	6	3	1	2				
ANA BENTA	30	8	9	3	2	3					1
CAPOEIRA ALTA	24	13	27	13	7	2	2		2		1

Berghuizen et al (1987) mention a study of 24 published studies about diarrhoea to estimate the annual morbidity and mortality rate for acute diarrhoea in the developing world. The median annual diarrhoeal morbidity rate for under five years old children is 2,2 episodes/child. The authors do not give a definition of an episode. Table 5.16 shows the expected morbidity rate for the four population groups which were investigated, according to the 'diary-assisted recall' method.

Table 5.16 shows that the annual rate in the four villages is higher than the median annual rate. Although, a median and an expected rate are two different types of rates, and therefore a statistical analysis was not done. Also, an annual expected rate which is calculated out of a two-weeks' period is far from accurate. But it is the researchers' impression that diarrhoeal prevalence in the investigated villages highly exceeds the given median annual rate. Moreover, this investigation was carried out during wintertime, which was not the time with a high prevalence

Table 5.16 : Expected annual diarrhoeal morbidity rate (median annual rate is 2,2 episodes/child).

LOCATION	ANNUAL RATE (EPISODES/CHILD)
TURVO (+)	9.2
TURVO (-)	10.8
ANA BENTA	7.8
CAPOEIRA ALTA	29.3

of diarrhoea, according to the women of the health post in Turvo. The highest peak occurs during the summer.

It seems strange that there is hardly no difference in diarrhoeal morbidity prevalence between Turvo (+) with piped water and Turvol (-) and A. Benta with wells and springs. Most literature data do find a significant difference. Although, Feachem et al (1978) did not found any difference in diarrhoeal disease prevalence in villages with and without an improved water supply in Lesotho, Africa. They suggest that water quantity is a more important variable than quality as an influence on water-related diseases. Talking about this investigation, water quantities are for hygienic reasons sufficiently available in Turvo (+), Turvo (-) and A. Benta. In C. Alta the situation is worse (see 5.3.4). This conforms to the results of the diarrhoeal morbidity survey. Little water use promotes unhygienic conditions. Moreover, the water used in C. Alta is of a poor quality, especially the river water.

5.5.5 Nutritional status

- The MEP method

Table 5.17 shows the results of measuring 'weight-for-height' and 'height-for-age' in under five years old children within the four population groups. Almost all children were included. For explication of the method, see 3.3.4.

Table 5.17 shows that only in C. Alta one 'wasted' child was recorded. Children who are severely 'wasted' were not recorded within the four population groups. The highest percentage of 'stunted' children was also found in C. Alta (21,7%). Besides, there was one child in Ana Benta where the 'stunting' was severe. The majority of under five years old children are therefore not 'wasted' or 'stunted'. Anyway, the poorest situation is found in C. Alta, where also the greatest number of episodes of diarrhoea

was found with the same' children. 'Weight-for-height' is an indicator of acute malnutrition, related with diarrhoea. Although, the remark must be made that the differences between the four groups of children are not significant because of the small numbers of children.

Table 5.17 : 'Weight-for-height' and 'height-for-age' of under five years old children, according to the MEP.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
WEIGHT FOR HEIGHT:								
<70%	-	-	-	-	-	-	-	-
<80%	-	-	-	-	-	-	1	4.3
<90%	2	12.5	2	7.7	2	7.1	4	17.4
>90%	15	87.5	24	92.3	27	92.9	18	78.3
HEIGHT FOR AGE								
<85%	-	-	-	-	1	3.6	-	-
<90%	1	5.9	2	8.0	2	7.1	5	21.7
>90%	16	94.1	24	92.0	26	89.3	18	78.3

- The 'Brazilian graphs' method

Table 5.18 shows the results, according to the 'Brazilian graphs' method (see 3.3.4 and annex I).

Table 5.18 : Percentages of children with a weight/height, considered too low (negative), according to the Brazilian graphs.

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
WEIGHT: POSITIVE	15	88.2	23	88.5	24	82.8	15	65.2
NEGATIVE	2	11.8	3	11.5	5	17.2	8	34.8
HEIGHT: POSITIVE	12	70.6	16	61.5	14	48.3	9	39.1
NEGATIVE	5	29.4	10	39.5	15	51.7	14	60.9
TOTALS	17	100.0	26	100.0	29	100.0	23	100.0

Table 5.18 gives the same impression as table 5.17. The poorest situation appears to exist in C. Alta. According to 'height', the majority of children in A. Benta (51,7%) and in C. Alta (61%) has a height which is considered too low. But also here, differences which were found are not significant for the same reasons as mentioned with the MEP-method.

Comparing 'negative' in the table above with 'wasted' and 'stunted' in table 5.17, it appears that the norms of the MEP are rather more stringent than the Brazilian norms for a too low weight and/or height. Also, the weight indicator in table 5.18 is different than the MEP-method. The Brazilian method relates weight to age, which does not further comment the reason of a low weight. Although, the MEP relates the weight to height, which does comment the reason of a low weight: acute malnutrition (probably caused by diarrhoea).

5.5.6 Discussion

- General

The general health results show that infectious diseases and diarrhoea are two of the major health problems in the four population groups. This was confirmed by both the faeces examination and the diarrhoeal morbidity survey. Infectious diseases and diarrhoea are both related to the level of water supply, sanitation and hygiene. The socio-economic status seems to be an important interfering variable.

- Faeces examination and diarrhoeal morbidity

The faeces examination showed that there does not exist a significant difference in the rate of infection between Turvo (+) (35,2 %) and Turvo (-) (32,1 %), while Turvo (+) is served by a piped water supply. Water quality does not seem to have its influence, while also the contamination of the water in Turvo (-) appears to be mild (see 5.3.4). Sanitary conditions and used water quantities also do not show great differences. The use of a w.c. instead of a privada did not show a less percentage of infected persons. Besides Ascariasis, infections are of a faecal-oral origin: infections with Entamoeba Coli and Giardia Lambli Therefore, the cultural pattern of hygiene must explain why still one third of the people in these two population groups are infected. Some examples:

- people walk barefoot from time to time, especially children, and poorer families often totally lack the use of shoes;
- young children often defecate around the house, in spite of the presence of a bath-room or pit latrine;
- practices around waste are typically unhygienic;
- when people work in the field, they defecate in any place.

In C. Alta and A. Benta, the rate of infection is significantly higher and can be attributed to the poorer sanitary conditions. Most prevalent intestinal parasite is namely Ascaris, a soil-

transmitted helminth. That water quantities are sufficiently available in A. Benta, does not seem to influence the rate of infection in comparison with C. Alta where water use is low. Sanitation rather than water supply seems to be important in terms of the results. The low water use in C. Alta probably explains the high diarrhoeal morbidity rate in C. Alta. Low water use promotes unhygienic conditions. The water is mostly river water with a poor quality. This happens in a village with the poorest socio-economic level.

- Nutritional status

The nutritional status shows to be rather good in Turvo (+) and Turvo (-) and worse in C. Alta and A. Benta, although differences were not statistically significant. To explain the differences, it appears that socio-economic level has its influence. Under the poorest conditions, nutrition shows to be the worst, including water, sanitary and hygienic conditions.

- General observations

In general, the health status shows to be the best in Turvo (+) and in Turvo (-), becoming poorer in A. Benta and the poorest conditions are to be found in C. Alta. Factors of importance for infectious diseases and diarrhoeal morbidity are: water quality and especially water quantity, sanitation, hygiene and socio-economic conditions, e.g. housing, family income, and household number.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Main objective of the 'Projeto Saneamento Rural' is to improve the health status of the rural population. In terms of this statement, recommendations will be formulated. These recommendations are not only based on the conclusions of the investigation, but also based on the objectives of the investigation (see chapter 2). This final chapter is divided into sections about water, sanitation, extension, health post and a final part.

6.2 Water

It is doubtful that a water supply of SABESP improves the health status of the community. The investigation did not show a significant difference in health status between Turvo (+) (SABESP) and Turvo (-) (springs/wells), concerning nutritional status and diarrhoeal prevalence in under five years old children and rate of infectious diseases. An important reason for this is probably the sufficient availability of water in both parts of Turvo, while the contamination of the well- and springwater in Turvo (-) is mild (hardly no faecal coliforms were detected). In socio-economic terms, both communities appeared to be comparable.

In A. Benta, used water quantities are comparable with those in Turvo, although the quality is worse. The poorest situation exists in C. Alta where used water quantities are much lower than in the other communities. This is fostered by the fact that in C. Alta the majority of the people have to fetch water, often involving a hard water journey. Little water use promotes bad hygiene. Bad hygienic conditions in combination with the poor water quality probably explains the high diarrhoeal prevalence in under five years old children in C. Alta in comparison with Turvo (+) and (-) and A. Benta. But it must also known that socio-economic conditions are the lowest in C. Alta. Hygienic conditions are harder to maintain under these circumstances (e.g. bad housing, big families).

People in C. Alta do not have other options. Digging a well is hardly impossible because of the geographic situation and lack of financial resources. Springs in the neighbourhood are scarce. The priority for implementation of a water supply of SABESP is therefore given to C. Alta. According to the household interviews, the people of C. Alta really want a water supply and they are willing to pay for the water.

It must be noted that it is important to accompany the implementation of a water supply with hygiene extension. One suggestion to achieve this will be described in section 6.4. A co-operation between ERSA and SABESP is necessary to make the implementation successful. As the MEP (1982) mentions, a water supply will only have an impact if it is functioning and utilized in the proper way.

6.3 Sanitation

Sanitary conditions appeared to be better in Turvo (+) and (-) than in A. Benta and C. Alta. In Turvo (+) and (-), the majority of the people uses w.c.'s, and latrines have respectively 75 and 40 % concrete slabs. In A. Benta and C. Alta, the majority of the people uses the pit latrine which almost all have slabs out of wood and/or earth. These types of slabs are hard to clean with water and detergent and therefore easy contamination can take place by soil-transmitted helminths (see annex B).

The prevalence of excreta-related diseases appeared to be significantly higher in A. Benta and C. Alta in comparison with Turvo (+) and (-). Most prevalent infection was with Ascaris, a soil-transmitted helminth. The difference which was found can therefore be related to the poorer sanitary conditions in A. Benta and C. Alta, besides the fact that socio-economic conditions also appeared to be lower than in Turvo (+) and (-).

It is therefore recommended to improve the latrines, especially to promote concrete slabs. This must be accompanied by hygiene education how to impede transmission of infectious agents. It is important to use and clean the latrine in a proper way. E.g. in C. Alta, 38 % of the people do not use the latrine at night but defecate in any place around the house. Installation of a light in the latrine or the use of an urinol can impede transmission. Also a minimal distance between latrine and waterpoint must be maintained to prevent contamination of e.g. well water.

Improval of latrines is prefered to a more sophisticated sanitary facility, which should be implemented by CETESB like a sanitary unit with a w.c., shower and septic tank. Especially the poorer families are more helped with an improval of the existing system by themselves, rather than supplying new systems which involve them less. It is the researchers' belief that the people have to work on their own development. Community participation is extremely important for a successful project-implementation. Impulses can come from the outside by means of extension and financial resources. These impulses can make use of existing organization within the village like the church and if present the 'assosiação' and the health post.

In Turvo (+) and (-) where sanitary conditions appeared to be rather good, still respectively 35,2 and 32,1 % of the people had intestinal parasites after the first examination. Usage of latrine or w.c. does not influence the rate of infection. Besides Ascaris, infections are rather faecal-oral like with Entamoeba Coli and Giardia Lamblia. Transmission occurs by person to person contact and domestic contamination (see annex B). It becomes clear that only the usage of tapwater and a w.c. or an adequate latrine does not guarantee the reduction of infectious diseases. Changes in behavioural patterns by means of extension appears to be necessary to diminish the rate of infection.

6.4 Extension

Extension about hygiene and latrine usage is in the first instance a task of the ERSA and CETESB. This does not mean a single visit to the village to tell the people what they do wrong and how things have to be done in the right way. The ERSA and CETESB should instruct some people of a village, who return then to their village and transmit their acquired knowledge. Their extension is likely to be the most effective because they make part of the community. They can make use of existing organization like a church, an 'assosiação or a health post. Hygiene education is also especially important on schools. Common behavioural patterns are most likely to change when is started with the children. Important habits to change are e.g. the use of shoes, especially for children and people who work out in the field. They are most likely not to use shoes. Further on, a more hygienic handling of waste is preferable, like disposal in one certain place instead of throwing it away in any place around the house.

6.5 Health post

It became evident from the investigation that a health post improves the well-being of the community. The health post in Turvo (+) was well-attended, whereas people in A. Benta and C. Alta had to travel 5-15 km to obtain medical services. This is especially difficult for the poorer families.

A health post has to be obtained by the initiative of the people themselves as happened in Turvo (+). The ERSA can be helpful in this. One impuls can be a regular repetition of the faeces examination which was executed during this investigation. In this way, people can become more conscious of their health and people of the community have to be involved in the organization of such a repetition. These people are maybe the people to run a future health unit. Also, the implementation and maintenance of health posts may have more priority in the health budget of the municipality.

6.6 General

It is long believed that the implementation of water supply and sanitation will increase the health of a community rather automatically. Although, the researchers believe that it is more important for people who work in this area to bear in mind a more general objective of community development, to make the implementation of such facilities successful. Figure 6.1 illustrate that there are a lot of direct and indirect effects of good drinking water and adequate sanitary facilities on the total development of the community. The latter will give rise to increased productivity of the people. So in the end there will be an economical development which enables them to invest again in drinking water and sanitation.

Community development is a long term process and results in an early stage can not be expected. This does not mean that it is not well worth it to invest time and money. It is even more an argument to start initiating community development as soon as possible.

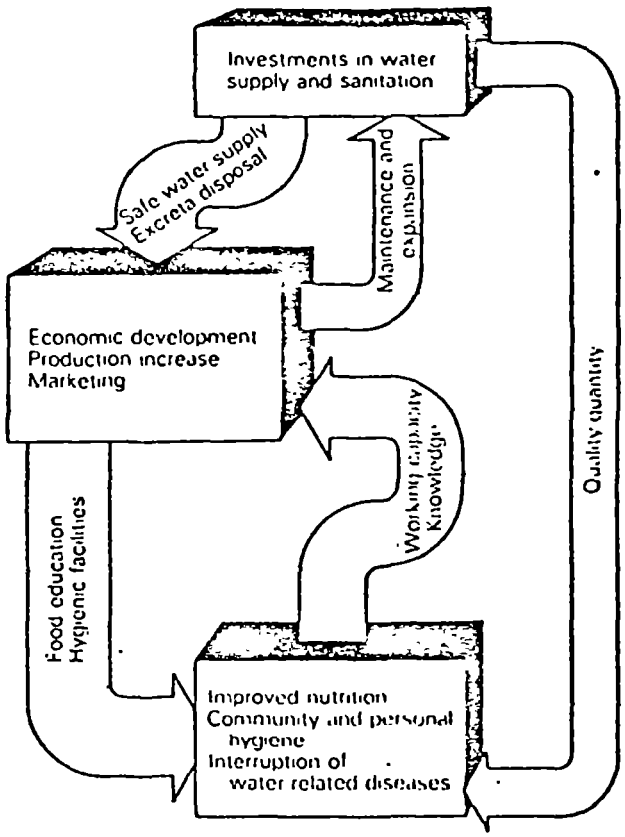


Figure 6.1: Direct and indirect effects of drinking water supply and sanitary facilities.

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ANNEX A: Description of excreta-related diseases

Helminths

- ASCARIASIS

Ascariasis is of particular importance of those engaged in sanitation programs because it is extremely common in most parts of the world and because the eggs are very persistent in the environment and difficult to eliminate by sewage or night soil treatment processes.

Identification

About 85 percent of the infections are symptomless. Heavy burdens of adult worms in the small intestine may cause digestive disorders, nausea, abdominal pain, vomiting, restlessness and disturbed sleep. Death is due to migration of the adult worms to the liver, gall blader or appendix and, rarely, due to perforation of the intestine. Diagnosis is by microscopic identification of the eggs in the feces. The number of eggs counted gives an indication of the number of adult worms which are present.

Transmission

The nematode A. lumbricoides is the roundworm of man. Females are 20-40 cm in length, wheras males are 15-30 cm. The eggs show much identity with that of the pig roundworm, which also can develop maturity in man. This certainly confused some of the environmental studies of ascariasis in communities where domestic pigs are numerous.
The eggs are passed in the feces and become infective after they develop into the second-stage larvae. This occurs after 10-15 days under ideal conditions of moist, shady soil at 22-33oC. The larvae develop after ingestion into adults in about 60-75 days and then live for up to 1,5 years.
The dominant vehicles for Ascaris egg ingestion are contaminated fingers, objects that have been placed on the ground, dirt from the yard and contaminated vegetables, because of the use of night soil. There is a seasonal peak of transmission in the wet season. Domestic animals may also be especially important in distributing human Ascaris eggs.

Control measures

Only environmental and behavioral changes can have a sustained impact on Ascariasis, but mass chemotherapy may be used to reduce infection rates in the short term.

Survival

Ascaris eggs may be the most hardy and resistent of all excreted pathogens. They can survive a variety of environmental conditions for periods of months or even years. They need small quantities of oxygen to develop but can remain viable for long periods in anaerobic conditions. Ascaris eggs in pit latrines can survive for 1-2 years.
Septic tanks and waste stabilization ponds can be efficient removers of Ascaris eggs by means of settling. Chlorination is of no value in Ascaris removal.

- ANCYLOSTOMIASIS

Identification

Ancylostomiasis or hookworm infection is an infection of the small intestine with one of the two species of human hookworms: Necator americanus or Ancylostoma duodenale.
Ancylostomiasis is frequently symptomless. When it does produce illness, the most important features are anemie and its resulting weakness, debility and other consequences. Hookworm is seldom recorded as a direct cause of death. Although, the disease is undoubtedly a common contributory cause of death when other normally nonfatal infections attach a severely anemic and debilitated person.
Definitive diagnosis depends on finding eggs in fecal sample.

Transmission

Man is the reservoir for the human hookworms. The adult males of the sexually dimorphic roundworms are 5-10 mm long and the adult females 10-18 mm. They attach themselves to the mucous membrane of the small intestine. Adult hookworms may live for up to 7 years in the case of A. duodenale and 15 years in the case of N. americanus.
If feces are deposited, eggs can develop into third-stage infective larvae in about 6 days. Optimum conditions are e.g.: shade, a light sandy loam, adequate moisture and temperature between 20-32 oC. Infection occurs when the larvae penetrate the skin, usually between the toes or on the feet and ankles. There exists also oral transmission with A. Duodenale. Possibly, the most percutaneous hookworm infection takes place at habitual defeacation sites and during defeacation.

Control measures

An effective control measure is the wearing of shoes. No special profylactic drugs are available for hookworm infection, but several drugs are effective. Besides, improvements in sanitation and education are necessary.

Survival

For the treatment of feces, infected with hookworms, it must be known that Ascaris eggs provide a better indicator organism for environmental helminthology because they are known to be more hardy than hookworm eggs.

- TRICHURIASIS

Identification.

Trichuriasis is an infection of man by the human whipworm Trichuris trichiura. It is a helminthic infection of the large intestine and cecum. In adults this disease is mostly symptomless, although slight abdominal pain and diarrhoea can occur. In malnourished children however, heavy infections can cause anemia, bloody diarrhoea and sometimes prolapse of the rectum. Trichuris eggs occur in the feces. Treatment is possible by effective drugs (mebendazole).

Transmission.

Trichuris trichiura is a nematode. Adult females are 25-50 mm in length, males measure 30-45 mm. Females can pruduce up to 2.000-10.000 eggs per day. The eggs are discharged in the feces and take 2-5 weeks to develop into the infective stage in a moist warm environment. Development time depends on temperature: 4-6 months at 15 oC, 3-4 weeks at 26 oC, 17 days at 30 oC and 11 days at 35 oC. After ingestion (e.g. by contaminated hands) they hatch in the intestine into small larvae. After a certain period they move to the cecum to become mature adults (maturation takes about 2 months). The adult can live for 5 years in man. Heavy infection up to 30.000 eggs/day.gram feces are known.

Control measures.

No prophylactic drugs or vaccines are available. Until now, mass chemotherapy, using mebendazole and oxantalpyrantel, has become a important control strategy (currative). The same remarks made at the environmental control of ascariasis, can be applied to trichuriasis aswell. Improvement in excreta disposal (especially for children) and changes in behaviour associated with defecation are the goals to be achieved here. Reuse of nightsoil is just allowed when it is treated thoroughly before application to the fields. Effects of the decline of the prevalence rate of Trichuriasis can only be measured many months after environmental measures have been applied, which will interupt transmission.

Survival.

Trichuris eggs can remain alive in the soil for extended periods, especially if conditions are moist, cool and shaded. When fecal material is reused in agriculture, trichuris eggs can be found on crops (transmission). Irrigation workers tend to have a higher

prevalence of trichuriasis. Eggs are concentrated in the sludge of all treatment processes.

-STRONGYLOIDIASIS

Identification

Strongyloidiasis is an infection of the small intestine by the nematode worm Strongyloides stercoralis. Symptoms are often vague or absent, but infection is potentially serious, particularly in malnourished or immunosuppressed individuals. Symptoms are diarrhea with abdominal discomfort, recurrent respiratory symptoms and perhaps a rash.

Transmission

S. stercoralis occurs worldwide and particularly in warm, wet climates. The reservoir of S. stercoralis is man, although dogs and apes have been found naturally infected. The adult female is only 2-2,5 mm long. The larvae are passed in the feces. Transmission occurs when infective filariform larvae penetrate the skin, usually of the foot. Because auto-infection is common, patients may pass larvae for many years.

Control measures

Measures are mass chemotherapy, combined with environmental and educational measures, similar to those with Hookworm. Wearing of shoes is an important measure.

Survival

The optimal conditions for the infective larvae are 20-25 ^{o}C and high moisture, and they live for less than 3 weeks.

-TAENIASIS

Identification

Taeniasis is an infection with the adult stage of the beef tapeworm (T. saginata) or pork tapeworm (T. solium). The adult worm is attached to the wall of the small intestine and typically causes no symptoms. There may be irritation at the site of mucosal attachment and, rarely, abdominal pain, nausea, weakness, loss of weight, increased appetite, headache and intestinal obstruction.
Diagnosis can be made by the examination of eggs and/or recovery of the gravid proglottids in the stools.

Transmission

Man is the reservoir of the adult stage of the worm. Gravid proglottids break of from the chain of segments of an adult worm and usually pass out complete in the feces and release eggs in the soil. The number of eggs per proglottid can be 3.104-9.104 for T. solium and 8.104-1.105 for T. saginata.
The eggs of the tapeworm are immediately infective to the intermediate host, e.g. porks and calves. Then if ingested, they develop into mature bladder worms within 60-75 days: Cellulosae bovis. Human infection of C. bovis is caused by the ingestion of T. solium eggs. This may occur via contaminated food or fingers or via water. Maturity is reached within 6-10 weeks for T. saginata and 5-12 weeks for T. solium. For the epidemiology, two conditions are needed: first, cattle and pigs must eat human feces or fodder, contaminated by human feces; second, beef and pork must be eaten raw or undercooked for the transmission from animal to man.

Control measures

Control rests upon denying cattle and pigs access to inadequately treated human excreta, meat inspection and encouraging thorough cooking of beef and pork. Treatment for taeniasis is by oral drug therapy with niclosamide, praziquantel or other suitable agent.

Survival

Survival in the environment is dependent on temperature and moisture, with greatly reduced survival times in hotter and dryer conditions. Survival times are less than those of Ascaris eggs. Inactivation is totally possible by ways of waste stabilization ponds.

-SCHISTOSOMIASIS

Identification

Schistosomiasis comprises infections of the venous system by several species of the trematode genus Schistosoma. One species, S. haematobium, inhabits the veins around the bladder. The most important species of the intestinal schistosome are S. Mansoni and S. japonicum. Only S. mansoni occurs in Brasil.
The range of disease produced in infected individuals is very great. The intestinal schistosomiasis cause occult bleeding into the bowel, papillomata of the bowel wall and, in heavy infections, bouts of dysentery with passage of blood, which can be life-threatening complications. The brunt of damage falls on the liver.
Diagnosis of S. mansoni is by identification of Schistosoma eggs in the feces.

Transmission

The schistosomes are digenetic trematodes in which the sexes are seperate and differ in size and shape. The broader males are about 10 mm in length.
Man is the effective reservoir of S. mansoni. Each paired female worm lays some 100 of eggs daily from which a part escape in urine or feces. When they pass out of the body they are mature and ready to hatch, as soon as they reach water. The egg shell splits and a larva called miracidium, emerges, encountering a suitable species of aquatic snail to penetrate. In the snail, it develops into a cercaria which emerges from the snail, being able to penetrate the human skin. Then, after about two months, eggs may appear in the human feces. Once mature worm pairs are established, they may live up and continue laying eggs for a long time with half-lives of 3 to 6 years.
The evidence of resistance is doubtful.
In most communities where the disease is endemic, the prevalence is highest in the 5-20 age group because of playing and bathing in infected surface water.

Control measures

During the 1960s the only control method shown to be effective was application of molluscides to host snails. Chemotherapy is now likely to play an increasing role, including water supply, sanitation and health education programs. A mix of the mentioned factors has shown to be the only effective control measure.

Survival

The stages of schistosomes found in the environment are eggs, miracidia and cercariae. Schistosome eggs are considerably less rugged and long lived than those of Ascaris, Trichuris or Taenia worms. None were hatchable after 8 days in urine and feces and in water they rapidly hatch. Schistosome miracidia and cercariae are fragile and must find a snail or vertebrate host within hours or they die.
In sewage treatment, eggs can be removed by sedimentation. Waste stabilization ponds should remove them completely.

Protozoa

-AMEBIASIS

Identification.

Entamoeba hystolica causes amoebic dysentry. It is a parasite of the large intestine. Symptoms are diarrhoea, sometimes bloody and mildpyrexia with or without abdominal pain. Trophozoites of an invasive Ent. hystolica are concentrated in the colon and colonize the submucusal tissues. Ulcers are formed. Amoebe may migrate from the ulcers via the hepatic portal vein to the liver and other organs. Here an amoebic abcess may develop. Diagnosis of the diarrheric stool can identify hematophagous trophozoites

Control measures

A number of drugs are effective in treatment, but there is no vaccine. Individual protection is achieved by cleanliness and care in choice and preparation of drinking water and food. Improved water supply and sanitation facilities may also be important.

Survival

Tests for G. lamblia cysts in water and other samples are currently very inadequate. The cysts are rapidly killed by desiccation and freezing. Their survival can least for months and is primarily temperature dependent.
Waste stabilization ponds are able to remove cysts for 100 percent.

-Entamoeba coli

Entamoeba coli lives in man as a boarder in the large intestine. The cysts are comparable with those of E. histolytica. The cyst is round, usual 0,02 mm in section and has 2 or 8 nuclei. E. coli does not invade tissues and is not considered pathogenic.

-Endolimax nana

Endolimax nana is common in the human intestine and is not considered pathogenic. Only in large amounts this species is harmful. It can cause abdominal pain, diarrhea, flatulence, vomiting and fatigue. The cysts are round or oval and smaller than 0,03 mm. The amoebe has 4 nuclei which are hard to observe.

or the typically 1-4 nucleate cysts in the formed stool. This identifies intestinal amebiasis. When suffering from extra-intestinal amoebiasis (pleural cavity and longs) seriological tests are used.

Transmission.

Amebiasis is an excreta-related disease and occures world-wide. World-prevalence has been estimated at 10 percent. The reservoir of Ent. hystolica is man, although dogs and cats can act as reservoirs aswell. An asymptomatic infected person can produce up to 1.5*10^7 cysts a day in the stool. However the infective dose lies in between 10-100 cysts. Humoral antibodies are produced in response to tissue invasion by amoebae. here is no simple correlation between levels of sanitation or economic development and the prevalence of amebiasis. More than 80 percent of infected persons may stay asymptomatic. Recorded prevalences differ from 3-47 percent in India, 11 percent in Lagos (Nigeria), 7 percent in Bangkok (Thailand) and 50 percent in Medellin (Colombia). Direct fecal-oral transmission of poverty, overcrowding and inadequate water supply and sanitation is the most likely mechanism.

Control measures.

There do exist effective drugs for the treatment of intestinal amebiasis. Mass chemotherapy showed to be successful and resulted in a rapid declination in prevalence.Clorination of water will destroy cysts, but more slowly than fecal bacteria. Iodine is also effective. The die-off curve is temperature-time related. A good operated waste-stabilization pond can reduce the number of cysts of Ent.hystolica up to 100 percent. Aerobic thermophilic composting of sludge or nightsoil will eliminate all cysts.

-GIARDIASIS

Identification

Giardiasis is an infection of man by the flagellate protozoa Giardia lamblia. Symptoms may be absent, but when present may include frequent diarrhea with greasy foul-smelling stools, usually without blood.
The disease is diagnosed by identifying the cysts or trophozoites of G. lamblia in the stools. The disease is about 3 times more common in children than in adults.

Transmission

The reservoir of G. lamblia is man, but there is some evidence that man acquire infections from other animals. Transmission of G. lamblia is by fecal contamination of hands, food and water supplies. Infection in adults have been experimentally observed to last up 41 days.

ANNEX B: environmental classification of excreta-related diseases (Cairncross et al, 1983).

Category	Infection	Pathogenic agent	Dominant transmission mechanisms	Major control measures (engineering measures in italics)
I Faecal-oral (non-bacterial) Non-latent, low infectious dose	Poliomyelitis	V	Person to person contact Domestic contamination	*Domestic water supply* *Improved housing* *Provision of toilets* Health education
	Hepatitis A	V		
	Rotavirus diarrhoea	V		
	Amoebic dysentery	P		
	Giardiasis	P		
	Balantidiasis	P		
	Enterobiasis	H		
	Hymenolepiasis	H		
II Faecal-oral (bacterial) Non-latent, medium or high infectious dose, moderately persistent and able to multiply	Diarrhoeas and dysenteries		Person to person contact Domestic contamination Water contamination Crop contamination	*Domestic water supply* *Improved housing* *Provision of toilets* *Excreta treatment prior to re-use or discha* Health education
	Campylobacter enteritis	B		
	Cholera	B		
	E. coli diarrhoea	B		
	Salmonellosis	B		
	Shigellosis	B		
	Yersiniosis	B		
	Enteric fevers			
	Typhoid	B		
	Paratyphoid	B		
III Soil-transmitted helminths Latent and persistent with no intermediate host	Ascariasis	H	Yard contamination Ground contamination in communal defaecation area Crop contamination	*Provision of toilets with clean floors* *Excreta treatment prior to land application*
	Trichuriasis	H		
	Hookworm	H		
	Strongyloidiasis	H		
IV Beef and pork tapeworms Latent and persistent with cow or pig intermediate host	Taeniasis	H	Yard contamination Field contamination Fodder contamination	*Provision of toilets* *Excreta treatment prior to land application* Cooking and meat inspection
V Water-based helminths Latent and persistent with aquatic intermediate host(s)	Schistosomiasis	H	Water contamination	*Provision of toilets* *Excreta treatment prior to discharge* *Control of animals harbouring infection* Cooking
	Clonorchiasis	H		
	Diphyllobothriasis	H		
	Fasciolopsiasis	H		
	Paragonimiasis	H		
VI Excreta-related insect vectors	Filariasis (transmitted by *Culex pipiens* mosquitoes)	H	Insects breed in various faecally contaminated sites	*Identification and elimination of potential breeding sites* Use of mosquito netting
	Infections in Categories I–V, especially I and II, which may be transmitted by flies and cockroaches	M		

B = Bacterium
H = Helminth
P = Protozoon
V = Virus
M = Miscellaneous

ANNEX C: Water-related infections

- Introduction

Water-related diseases are diseases which in some way are related to water or to impurities in water. Here only infectious water-related diseases will be discussed (not those which are chemical based).
Water-related infections can be distinguished into four distinct water-related mechanisms by which a disease may be transmitted from one person to another. These four mechanisms are considered in this annex.

1. Water-borne mechanism

Water-borne transmission occurs when the pathogen is in water which is drunk by a person or animal which may then become infected. Classical examples are cholera and typhoid, but also infectious hepatitis, diarrhoeas and dysenteries do belong to this categorie.
However, it must be born in mind that all water-borne diseases can also be transmitted by any route which permits faecal material to pass into the mouth. Cholera for instance, can be spread by indirect routes aswell, e.g. contaminated food.

2. Water-washed mechanism

A water-washed disease can be described as one whose transmission will be reduced following an increase in the volume of water used for hygiene purposes, irrespectively of the quality of that water.
Three main types are to be distinguished.

a. Infections of the intestinal tract.

These diseases are all faecal-oral in their transmission route and are therefore potentially water-borne or water-washed. These infections cause diarrhoeal diseases, e.g. cholera and bacillary dysentery.

b. Infections of the skin or eyes.

Bacterial skin sepsis, scabies and fungal infections of the skin are extremely prevalent in many hot climates. Eye infections as trachoma are also common and can lead to blindness. All these diseases will be reduced by increasing the volume of water used for personal hygiene. The diseases are not faecal-oral and not water-borne. They therefore are primarily related to water quantity and not significantly to water quality.

c. Infections by lice and mites.

These infections may be reduced by improving personal hygiene and therefore reducing the probability of infestation of the body and clothes with the anthropods which cause infection. Mites and lices transmit various forms of rickettsial typhus. The regular launder of underclothes will reduce the prevalence.

3. Water-based mechanism

A water-based disease is one in which the pathogen spends a part of its life cycle in a water snail or other aquatic animal. All diseases are due to infection by parasitic worms (helminths) which depend on aquatic intermediate hosts to complete their live cycles. Heavy infections are caused by high numbers of helminths present in the human body. Examples are schistosomiasis and Guinea worm.

4. Insect vector mechanism

This mechanism is based on the spread of diseases by insects which breed in water or bite near water. Examples are malaria, yellow fever, dengue and onchocerciases (river blindness).

Table C.1 lists all four water-related transmission mechanisms and describes the preventive strategies. In table C.2, an environmental classification can be found of all water-related diseases (Cairncross et al, 1983)

Table C.1: the four mechanisms of water-related infection transmission and the preventive strategies appropriate to each mechanism (Cairncross et al, 1983).

Transmission mechanism	Preventive strategy
Water-borne	Improve quality of drinking water Prevent casual use of other unimproved sources
Water-washed	Increase water quantity used Improve accessibility and reliability of domestic water supply Improve hygiene
Water-based	Decrease need for contact with infected water[a] Control snail populations[a] Reduce contamination of surface waters by excreta[b]
Water-related insect vector	Improve surface water management Destroy breeding sites of insects Decrease need to visit breeding sites Use mosquito netting

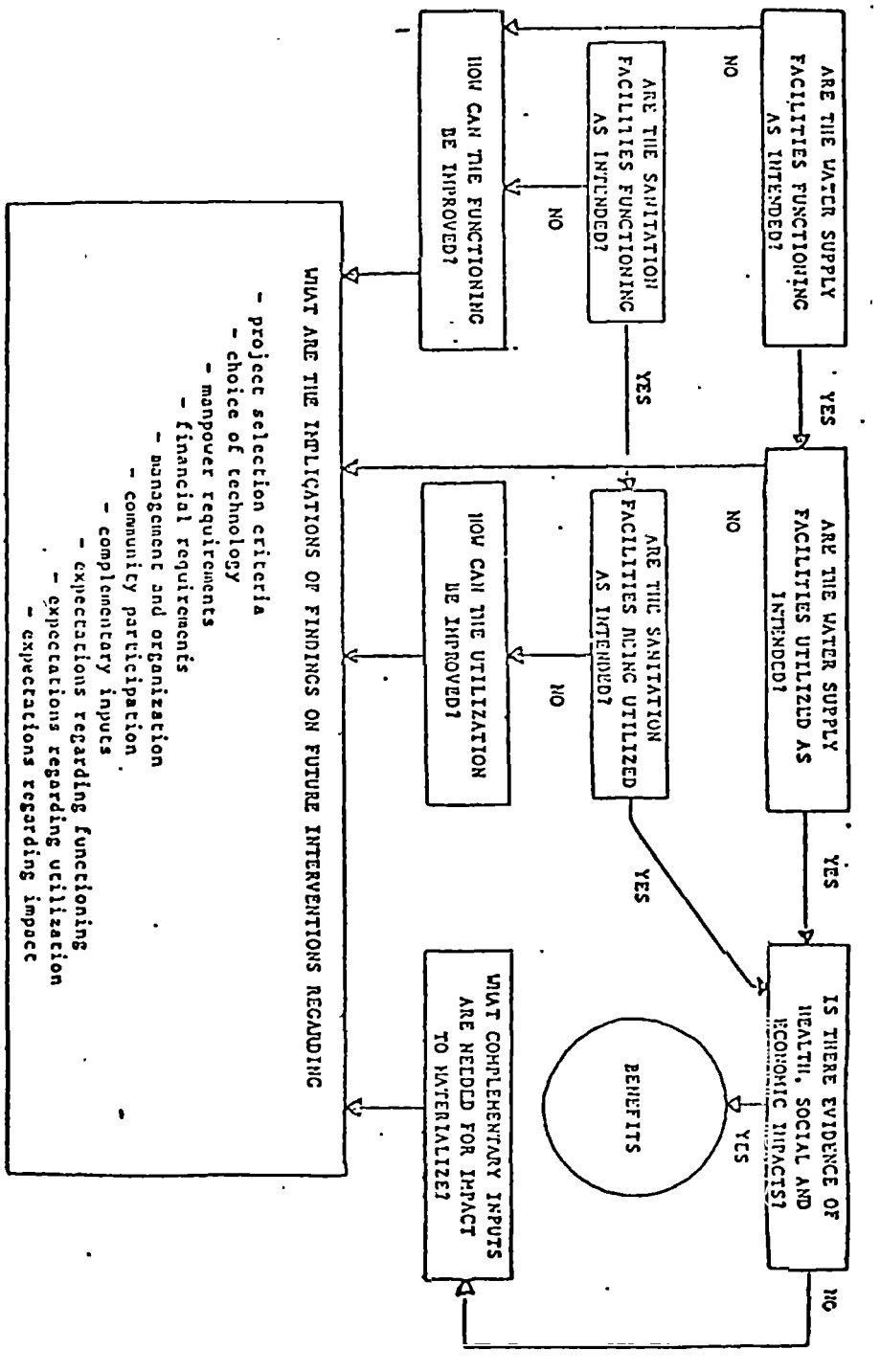
[a] Applies to schistosomiasis only
[b] The preventive strategies appropriate to the water-based worms depend upon the precise life cycle of each (see Appendix C) and this is the only general prescription that can be given.

Table C.2: environmental classification of water-related infections (Cairncross et al, 1983).

Category	Infection	Pathogenic agent
1. Faecal-oral (water-borne or water-washed)	Diarrhoeas and dysenteries	
	Amoebic dysentery	P
	Balantidiasis	P
	Campylobacter enteritis	B
	Cholera	B
	E coli diarrhoea	B
	Giardiasis	P
	Rotavirus diarrhoea	V
	Salmonellosis	B
	Shigellosis (bacillary dysentery)	B
	Yersiniosis	B
	Enteric fevers	
	Typhoid	B
	Paratyphoid	B
	Poliomyelitis	V
	Hepatitis A	V
	Leptospirosis	S
	Ascariasis	H
	Trichuriasis	H
2. Water-washed:		
(a) skin and eye infections	Infectious skin diseases	M
	Infectious eye diseases	M
(b) other	Louse-borne typhus	R
	Louse-borne relapsing fever	S
3. Water-based:		
(a) penetrating skin	Schistosomiasis	H
(b) ingested	Guinea worm	H
	Clonorchiasis	H
	Diphyllobothriasis	H
	Fasciolopsiasis	H
	Paragonimiasis	H
	Others	H
4. Water-related insect vector		
(a) biting near water	Sleeping sickness	P
(b) breeding in water	Filariasis	H
	Malaria	P
	River blindness	H
	Mosquito-borne viruses	
	Yellow fever	V
	Dengue	V
	Others	V

B = Bacterium
H = Helminth
P = Protozoon
M = Miscellaneous
R = Rickettsia
S = Spirochaete
V = Virus

ANNEX D: Questions to be answered in the evaluation of water supply and sanitation programmes.



ANNEX E: Time-schedule of the research

During the first week of the practical term , a project proposal and a time-schedule for the six-month's period was made. The following schedule is the actual schedule which was followed.

11 weeks	4 weeks	1 week	4 weeks	6 weeks
preparation	fieldwork (Turvo dos Almeidas)	data analyses	fieldwork (C. Alta, A. Benta)	report elaboration

During the fieldwork, the following activities were done. The time-schedules differed for practical reasons. This is the time-schedule for Turvo (+).

week 1	week 2	week 3	week 4
-introduction -selecting houses -preliminary questionnaire	- household interview - water sampling - distribution of lists of diarrhoea (including renewed visit for control)	- faeces examination	- collection of lists of diarrhoea - measuring of weight and height

ANNEX F: Preliminary questionnaire

NOME DA FAMILIA:..... DATA:..... RELIGIÃO
[] cath.
LOCALIZAÇÃO:..... [] prot.
[] outra

BAIRRO: [] Turvo das Almeidas [] Ana Benta [] Caipoeira Alta

NOME	M F	IDADE (anos) A. <5 B. 5-14 C. 15-30 D. >30	INSTRUÇÃO até ano ler/esc	EMPREGO (code)	SALARIO (cr$)
marido:					
0.....	[] []	.....	.....	.....	.....
mulher:					
0.....	[] []	.....	.....	.....	.....
crianças:					
1.....	[] []	.....	.....	.....	.....
2.....	[] []	.....	.....	.....	.....
3.....	[] []	.....	.....	.....	.....
4.....	[] []	.....	.....	.....	.....
5.....	[] []	.....	.....	.....	.....
6.....	[] []	.....	.....	.....	.....
7.....	[] []	.....	.....	.....	.....
8.....	[] []	.....	.....	.....	.....
outras:					
1.....	[] []	.....	.....	.....	.....
2.....	[] []	.....	.....	.....	.....
3.....	[] []	.....	.....	.....	.....
4.....	[] []	.....	.....	.....	.....

1 Casa, geral

1.1 Quantas pessoas moram em sua casa?
Nome, idade, mais de uma familia?

1.2 Qual religião da familia?

---

2 Casa e propriedade de terra

2.1 Pode me dizer quantos compartimentos (cômodos) tem a sua casa?

2.1.1 [ ] quarto(s) de dormir
2.1.2 [ ] sala de visita
2.1.3 [ ] cozinha
2.1.4 [ ] privada
2.1.5 [ ] outro (combinação)

2.2 A casa foi construida pelo senhor?

2.2.1 [] sim, só minha família
2.2.2 [] com a ajuda do vizinho
2.2.3 [] não, ...

2.3 Que material?

2.3.1 [] tijolo
2.3.2 [] pau-a-pique
2.3.3 [] madeira
2.3.4 [] outro

2.4 Tem:

2.4.1 [] televisão
2.4.2 [] radio
2.4.3 [] eletrodomésticos
2.4.4 [] automóvel
2.4.5 [] trator
2.4.6 [] nada

2.5 Onde vai buscar água?
Localidade?

2.5.1 [] poço .....
2.5.2 [] fonte,mina .....
2.5.3 [] rio .....
2.5.4 [] torneira .....

2.6.1 Tem animais? Quantos?

2.6.1 [....] vacas
2.6.2 [....] porcos
2.6.3 [....] carneiros
2.6.4 [....] cabras
2.6.5 [....] galinhas
2.6.6 [....] outros
2.6.7 [....] não tem animais

2.6.2 Para consumo ou para venda?

2.6.8 [] consumo
2.6.9 [] venda

2.7.1 A casa e sua propriedade?	2.7.1	[] sim
	2.7.2	[] não,.....
2.7.2 Tem alguma terra?	2.7.3	[] sim
	2.7.4	[] não
2.7.3 Que tamanho?	2.7.5	..... tar/qua/alq
2.7.4 Onde?	2.7.6	.....
2.7.5 O que planta?	2.7.7	[] arroz
	2.7.8	[] feijão
	2.7.9	[] milho
	2.7.10	[] tomates
	2.7.11	[] cebola
	2.7.12	[] outra

3 Salário e emprego

3.1 Quais membros da familia têm emprego ou ganham dinheiro?
Quantos Salários, mais ou menos?
[] salario cs$...../mes

3.2 Qual tipo de emprego?	Camponês :	3.2.1 [] proprietário
		3.2.2 [] camarada
		3.2.3 [] meeiro
	Comércio :	3.2.4 [] padaria
		3.2.5 [] farmácia
		3.2.6 [] pedreiro
		3.2.7 [] mercearia
		3.2.8 [] açougue
		3.2.9 [] ferraria
	Indústria :	3.2.10 [] .....
	Outro :	3.2.11 [] .....

4 Instrução

4.1 Sabe ler e escrever?

4.2 Estudou até que ano?

4.3 Tem pessoas da familia que mudaram para outra cidades para procurar emprego? Quantas?

4.3.2	[] não
4.3.1	[] nome .....
4.3.2	[] cidade .....
4.3.3	[] esta pessoa estudou até ano ..

ANNEX G: HOUSEHOLD INTERVIEW; PERGUNTAS DE AGUA

1. Ir buscar água

1.1 Onde vai buscar água? Qual localidade?	1.1.1 [] poço,.....
	1.1.2 [] fonte,mina,.....
	1.1.3 [] rio,.....
	1.1.4 [] torneira,.....
1.2 Distância até manancial utilizado?	1.2.1 ..... metros
1.3 Por que prefere este manancial de água?	1.3.1 [] proximidade
	1.3.2 [] higiene
	1.3.3 [] água saborosa
	1.3.4 [] água pura
	1.3.5 [] unico
	1.3.6 [] .....
1.4 Sabe de outros mananciais de água? Onde?	1.4.1 [] poço,.....
	1.4.2 [] mina,fonte,.....
	1.4.3 [] rio,.....
	1.4.4 [] torneira,.....
1.5 Quem vai buscar água?	1.5.1 [] pai
	1.5.2 [] mãe
	1.5.3 [] filhos
	1.5.4 [] filhas
	1.5.5 [] outros
1.6 Tempo gasto para buscar água?	1.6.1 ..... minutos
1.7 Quanta água é trazida de cada vez? Posso ver a lata?	1.7.1 ..... litros
1.8 Quando e quantas vezes vão buscar água por dia?	1.8.1 [..] de manhã
	1.8.2 [..] de tarde
	1.8.3 [..] de noite

2. Funcionamento do sistema.

2.1 Quando faltou água pela última vez?	2.1.1 [] ... dias
	2.1.2 [] ... semanas
	2.1.3 [] ... mêses pass.
	2.1.4 [] nunca
2.2 Por que faltou água?	2.2.1 .....
2.3 Esta falta de água acontece muitas vezes?	2.3.1 [] diário
	2.3.2 [] semanal
	2.3.3 [] mensal
	2.3.4 [] estação seca
2.4 Quanto tempo demora para consertar/para usar o manacial de novo?	2.4.1 [..] dias
	2.4.2 [..] semanas
	2.4.3 [..] mêses

3. Manutenção do sistema.

3.1 O manancial tem proprietário?	3.1.1 [] sim,.....
Quem?	3.1.2 [] não
3.2 O sistema tem manutenção?	3.2.1 [] sim
	3.2.2 [] não
3.3 Quem faz a manutenção?	3.3.1 [] usuários
	3.3.2 [] governo
	3.3.3 [] proprietário
3.4 Paga para ter água?	3.4.1 [] sim
	3.4.2 [] não
Quanto?	..... Cz$ / mês

4. Uso de água.

4.1 Quanta água usou durante uma dia todo?	4.1.1 [...] litros
4.2 Usa água de chuva também?	4.2.1 [] sim,....ls/dia
	4.2.2 [] não
Que quantidade?	

4.3 Para que a água é usada, de onde ela vem e qual é a quantidade por dia (ou vezes ou latas)?

	1 ! Quant. !vez./lat!	2 ! poço !	3 ! mina !	4 ! rio !	5 !torn. !	6 ! chuva !
a beber	!	!	!	!	!	!
b cozinhar	!	!	!	!	!	!
c higiene pessoal*	!	!	!	!	!	!
d horta,jardim	!	!	!	!	!	!
e lavar as roupas	!	!	!	!	!	!
f limpar a casa	!	!	!	!	!	!
i outras	!	!	!	!	!	!

* banho, lavagem de rosto e mãos

4.4. Usa a mesma quantidade durante o ano?	4.4.1 [] sim
	4.4.2 [] não
Por que não?	.....
4.5 Joga fora a água limpa que sobra?	4.6.1 [] sim,....ls/dia
Quanta?	4.6.2 [] não

4.6 Onde joga fora a água usada?	4.6.1 [] na latrina
	4.6.2 [] perto da casa
	4.6.3 [] no quintal
	4.6.4 [] outra
4.7 Onde guarda a água?	4.7.1 [] pote,talha
Posso ver ?	4.7.2 [] filtro
	4.7.3 [] bilha,moringa
Usa tampa?	4.7.4 [] sim
	4.7.5 [] não
Limpa?	4.7.6 [] sim
	4.7.7 [] não
Quantas vezes limpa o pote?	4.7.8 [..] vezes semana
4.8 O que faz com a água antes de beber?	4.8.1 [] coa
	4.8.2 [] ferve
	4.8.3 [] clora
	4.8.4 [] filtra
	4.8.5 [] nada
Quando?	4.8.6 [] todo dia
	4.8.7 [] às vezes
	4.8.8 [] quando alguém está doente

4.9 Como acha que o sistema de abastecimento de água de vocês pode ser melhorado? Pagaria por isso?

4.9.1 .....

.....

Dejetos e lixo

1.1 Onde as crianças fazem cocô? 1.1 1 [] rio
1.1.2 [] privada
1.1.3 [] mato
1.1.4 [] quintal
1.1.5 [] outro

1.2 E os outros membros da família ? (Os mais velhos) 1.2.1 [] rio
1.2.2 [] privada
1.2.3 [] mato
1.2.4 [] quintal
1.2.5 [] outro

1.3 Qual o tipo da privada e onde fica? Distancia? 1.3.1 [] fossa negra....
1.3.2 [] fossa seca.....
1.3.3 [] outra.....
distancia:.....m

1.4 A privada é somente da sua família? 1.4.1 [] sim
1.4.2 [] não, vizinho
1.4.3 [] outra

1.5 Quando foi construida a latrina?
1.5.1 [] anos passados .....

1.6 Quem construiu? 1.6.1 [] família
1.6.2 [] família + governo
1.6.3 [] só governo

1.7 Teve de pagar para construir a privada?
1.7.1 [] sim, cz$....
1.7.2 [] sim, mas recebi ajuda do governo
1.7.3 [] não, só ajuda do governo

Funcionamento

1.8 Há problemas com a funcionamento da privada?
1.8.1 [] insectos
1.8.2 [] ratos
1.8.3 [] mau-cheiro
1.8.4 [] entupimento
1.8.5 [] perigo para as crianças ou idosos
1.8.6 [] distância muito grande
1.8.7 [] falta de isolamento

1.9 Limpa a privada? 1.9.1 [] sim, limpo com detergente
1.9.2 [] sim, com água
1.9.3 [] sim, limpo e esfrego
1.9.4 [] não tenho tempo
1.9.5 [] não há água disponível
1.9.6 [] não há utensílios para limpar
1.9.7 [] não há razão

1.10 Que material usam as crianças depois para limpar-se? 1.10.1 [] papel comum
1.10.2 [] papel higiênico
1.10.3 [] folhas
1.10.4 [] sabugo
1.10.5 [] trapo
1.10.6 [] outra

1.11 E os adultos? 1.11.1 [] papel comum
1.11.2 [] papel higiênico
1.11.3 [] folhas
1.11.4 [] sabugo
1.11.5 [] trapo
1.11.6 [] outra

1.12 As crianças lavam as mãos depois de fazer as necessidades? 1.12.1 [] sempre
1.12.2 [] às vezes
1.12.3 [] nunca

Por qué não? 1.12.4 [] não água disponível
1.12.5 [] preguiça
1.12.6 [] não sabe

1.13 Depois fazer as necessidades as crianças usam sabonete/sabão para lavar as mãos? 1.13.1 [] sempre
1.13.2 [] ás vezes
1.13.3 [] nunca, muito caro
1.13.4 [] nunca, não disponível
1.13.5 [] nunca, não sabe a porquê

1.14 E os outros membros da família, eles lavam os mãos depois fazer as necissidades? 1.14.1 [] sempre
1.14.2 [] às vezes
1.14.3 [] nunca

Por qué não? 1.14.4 [] não água disponível
1.14.5 [] preguiça
1.14.6 [] não sabe

1.15 Os mais velhos usam sabonete/sabão para lavar os mãos?
1.15.1 [] sempre
1.15.2 [] ás vezes
1.15.3 [] nunca, muito caro
1.15.4 [] nunca, não disponível
1.15.5 [] nunca, não sabe a porquê

1.16.1 Usa um pinico/urinol durante a noite?
1.16.1 [] sim
1.16.2 [] não

1.16.2 Que a senhora faz com o conteudo? 1.16.3 [] jogo na latrina
1.16.4 [] jogo na rio
1.16.5 [] jogo na quintal
1.16.6 [] outra

---

2 Melhoramento da privada

2.1 Quer melhorar a privada?
- 2.1.1 [] outro tipo de privada
- 2.1.2 [] outro privada perto da casa
- 2.1.3 [] outro local
- 2.1.4 [] não há razão
- 2.1.5 [] não tenho dinheiro
- 2.1.6 [] não sei como?

2.2 Pagaria por este melhoramento?
Quanto?
- 2.2.1 [] sim, cz$ .....
- 2.2.2 [] não tenho dinheiro
- 2.2.3 [] problema do governo
- 2.2.4 [] outro.....

---

3 Lixo

3.1 Que a senhora faz com o lixo?
- 3.1.1 [] jogo no rio
- 3.1.2 [] jogo no quintal
- 3.1.3 [] jogo .....
- 3.1.4 [] enterro
- 3.1.5 [] queimo

3.2 As crianças brincam perto do lixo?
- 3.2.1 [] sim
- 3.2.2 [] nunca
- 3.2.3 [] ás vezes

3.3 E os animais ficam perto do lixo?
- 3.3.1 [] sim
- 3.3.2 [] não

3.4 Há cerca?
- 3.4.1 [] sim
- 3.4.2 [] não

3.5 O lixo é sempre fica lá ou é tirado de vez em quando?
Para onde?
- 3.5.1 [] sempre,.....
- 3.5.2 [] ás vezes,.....
- 3.5.3 [] nunca

3.6 Pagaria pelo servico de colleta do lixo?
- 3.6.1 [] sim, cz$.....
- 3.6.2 [] não tenho dinheiro
- 3.6.3 [] problema do governo
- 3.6.4 [] outro

3.7 Tem animais em/perto da casa?
- 3.7.1 [] ratos
- 3.7.2 [] barbeiro
- 3.7.3 [] mosquitos
- 3.7.4 [] baratas
- 3.7.5 [] outra

NOME DA FAMILIA:..... DATA:.....

LOCALIZAÇAO:.....

NOME	M	F	IDADE	DOENÇAS Di.	Ve.	Lo.	Gr.	Br.	x	y	z
marido:											
o.....	[]	[]	.....								
mulher:											
o.....	[]	[]	.....								
crianças:											
1.....	[]	[]	.....								
2.....	[]	[]	.....								
3.....	[]	[]	.....								
4.....	[]	[]	.....								
5.....	[]	[]	.....								
6.....	[]	[]	.....								
7.....	[]	[]	.....								
8.....	[]	[]	.....								
outras:				Di.	Ve.	Lo.	Gr.	Br.	x	y	z
1.....	[]	[]	.....								
2.....	[]	[]	.....								
3.....	[]	[]	.....								
4.....	[]	[]	.....								

A. <5
B. 5-14
C. 15-30
D. >30

Di. = Diarréia
Ve. = Verminose
Lo. = Lombriga
Gr. = Gripe
Br. = Bronquite

x = ...
y = ...
z = ...

ANNEX H: Form of investigated helminths and protozoa in stool examinations.

SECRETARIA DE ESTADO DA SAUDE
C.R.S. - 5 - ERSA 39 -

Data de entrega
__/__/__
N° geral

LABORATÓRIO_____

UNIDADE REQUISITANTE

NOME: IDADE.

N° MATRÍCULA SEXO EST DE ORIGEM

Médico Responsável

SUSPEITA CLÍNICA:

ESQUISTOSSOMOSE. ☐ DIAGNÓSTICO ☐ CONTROLE

OUTRAS PARASITOSES ☐ _____

Entrada de Material
__/__/__
N° geral

RESULTADO – PARASITOLÓGICO DE FEZES

PROTOZOARIOS	TROF	CISTOS
Entamoeba coli	☐	☐
E histolytica	☐	☐
Giardia lamblia	☐	☐
Chilomastix mesnili	☐	☐
Iodamoeba butschlii	☐	☐
Endolimax nana	☐	☐
Trichomonas hominis	☐	
Embadomonas intest	☐	
Balantidium coli	☐	☐
Isospora hominis		
Isospora belli		

HELMINTOS	
Ascaris lumbricóides	☐
Trichocephalus trichiurus	☐
Ancylostomidae	☐
Schistosoma mansoni	☐
Hymenolepis nana	☐
Enterobius vermicularis	☐
Taenia sp	☐
Strongyloides stercoralis	☐
Trichostrongylidae	☐
Hymenolepis diminuta	☐

Local, data

_____ __/__/ 19__ _____ _____

Técnico Responsavel

ANNEX I: 'Brazilian graphs' for height and weight'.

Secretaria de Estado da Saúde

Nº _____

Gráfico para acompanhamento de crescimento e desenvolvimento

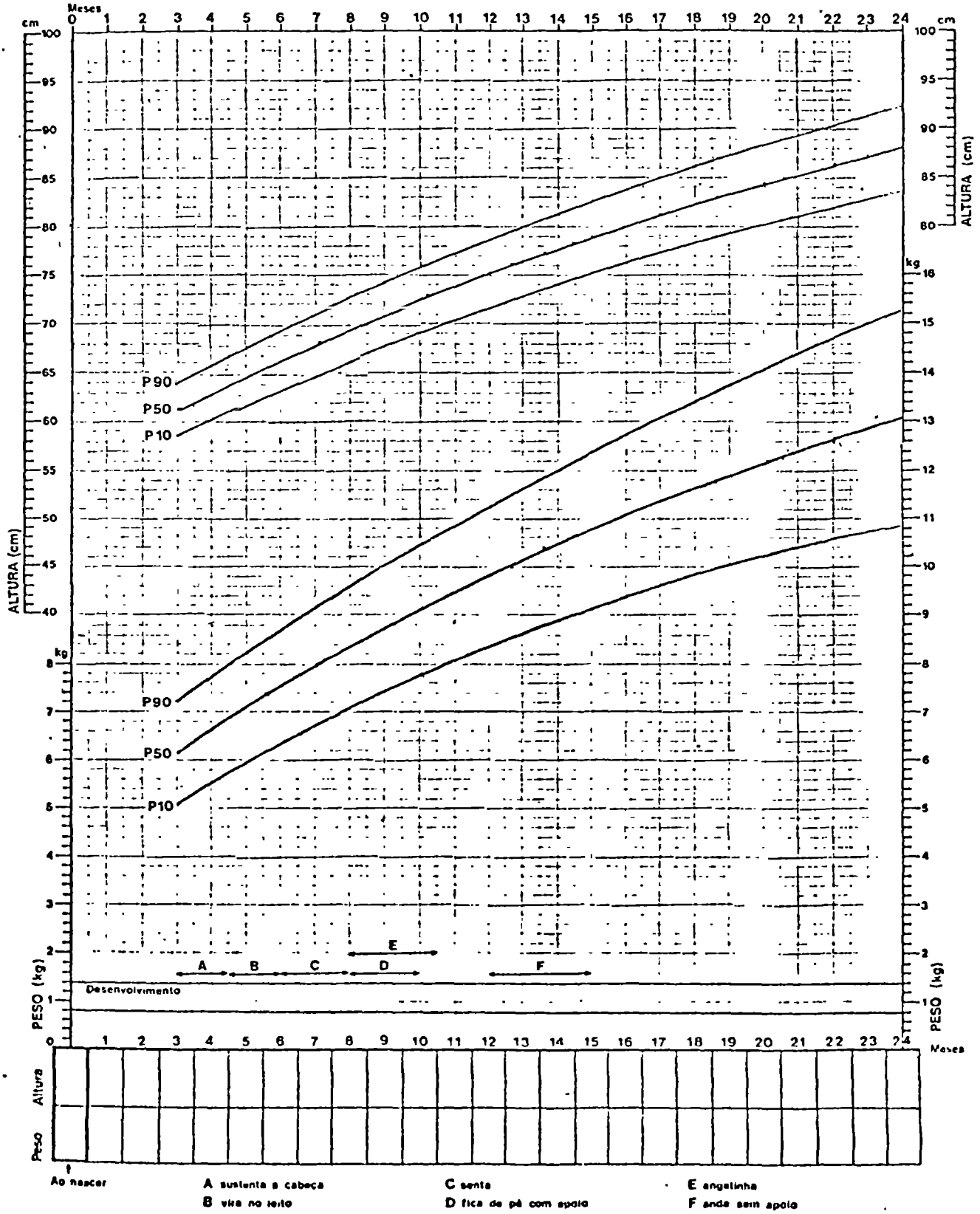
Nome _____

Data do Nascimento ___/___/___ Dados ao nascer: PESO (g) _____ ALTURA (cm) _____

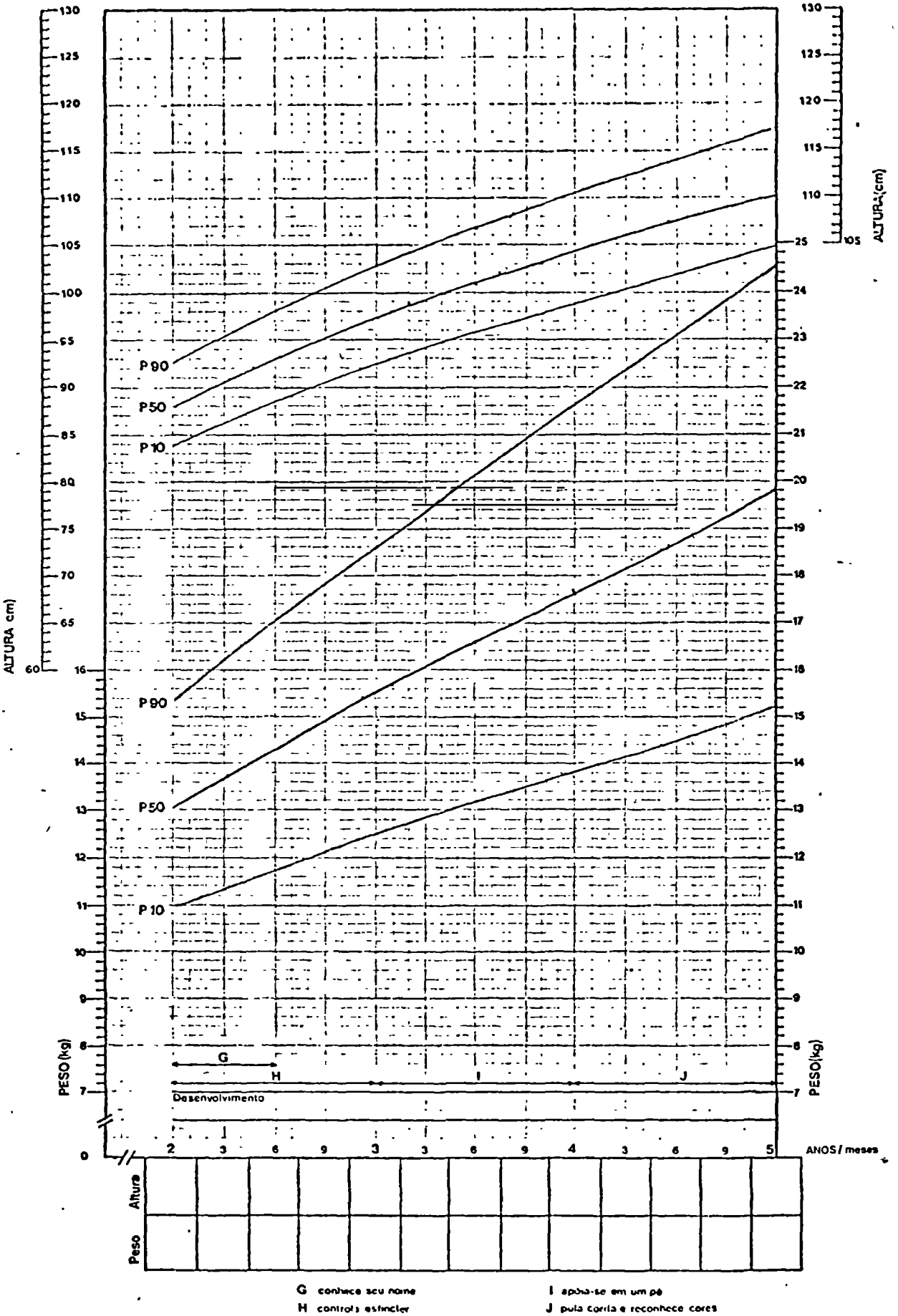
A TERMO ( ) _____ semanas (37 a 42 semanas)

PRÉ-TERMO ( ) _____ semanas (<37 semanas)

PÓS-TERMO ( ) _____ semanas (>42 semanas)



A sustenta a cabeça
B vira no leito
C senta
D fica de pé com apoio
E engatinha
F anda sem apoio



Fonte — MARQUES, Rubens Murillo; MARCONDES, Eduardo; BERQUÓ, Elza; PRANDI, Reginaldo & YUNES, João. Crescimento e Desenvolvimento Pubertário em Crianças e Adolescentes Brasileiros. II. Altura e Peso. São Paulo, Editora Brasileira de Ciências, 1982.

Diagramação, Composição, Fotolito e Impressão
Fundação Sistema Estadual de Análise de Dados — SEADE

ANNEX J: Diarrhoeal form

REGISTRO DE DIARREIA INFANTIL

LOCALIDADE _____ FAMÍLIA _____ PERÍODO __/__/__ A __/__/__

ENDEREÇO _____ NOME _____ IDADE _____

DIA		
1º		
2º		
3º		
4º		
5º		
6º		
7º		
8º		
9º		
10º		
11º		
12º		
13º		
14º		
TOTAL		

ANNEX K: LIST OF CRITERIA FOR INSPECTION OF WATER POINTS

BAIRRO: [] TURVO DOS ALMEIDAS [] CAPOEIRA ALTA [] ANA BENTA

LOCATION:..... DATE:.....

HEALTH- AND SOCIO-ECONOMIC CRITERIA:

1.1 Type of facility:
- [] poço(well)
- [] fonte,mina(spring)
- [] other.....

1.2 Construction, material?.....
.....

2. Number of users? .....

3. Distance to nearest latrine ? ..... m
Topographia?
- [] downhill
- [] uphill
- [] plain

	YES	ACCEPTABLE	NO
4.1 Animals close to the water point? Which?	[]	[]	[]
4.2 Drinking-trough for animals?	[]	[]	[]
5.1 Water point has a lid?	[]	[]	[]
5.2 Special construction for taking water up?	[]	[]	[]
6.1 Bucket specially for taking water up?	[]	[]	[]
6.2 Bucket for transportation is being rinsed before usage?	[]	[]	[]
7. Protection around the water point? Material? ..... Height? ..... m	[]	[]	[]
8. Pools around the water point?	[]	[]	[]
9. Hygiene in general good?	[]	[]	[]
10. Water during the whole year?	[]	[]	[]

11. Remarks.....
.....
.....

ANNEX L: LIST OF CRITERIA,FOR INSPECTION OF LATRINES (PRIVADAS)

BAIRRO: [] TURVO DOS ALMEIDAS [] CAPOEIRA ALTA [] ANA BENTA

LOCATION: ..... DATE:.....

HEALTH- AND SOCIO-ECONOMIC CRITERIA:

1.1 Type of facility: [] pit latrine,.....
[] pour-flush,.....
[] outro,.....

1.2 Material: [] brick(tijolo) [] bamboo
[] wood(madeira) [] other.....

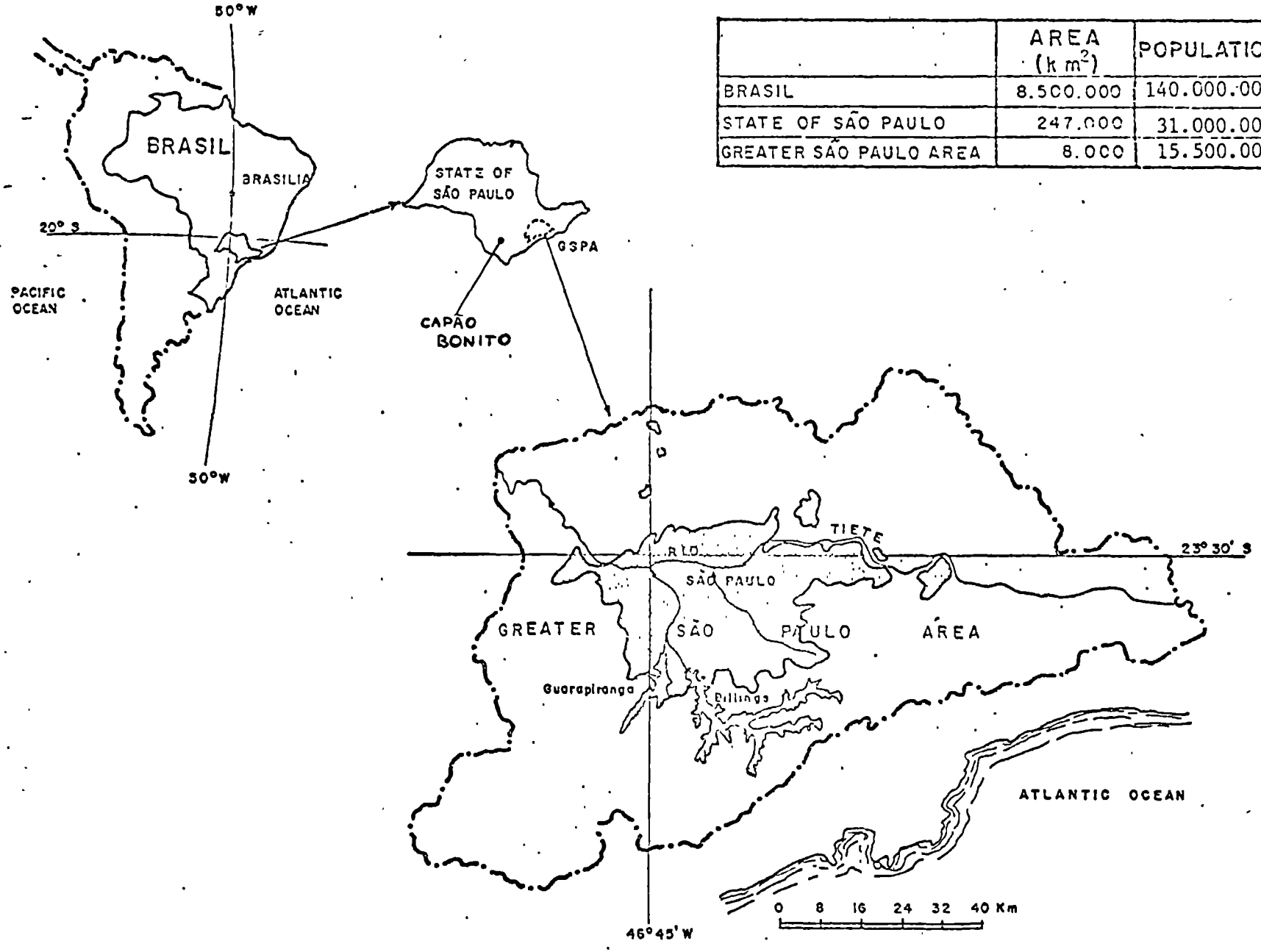
1.3 Numbers of users: .....

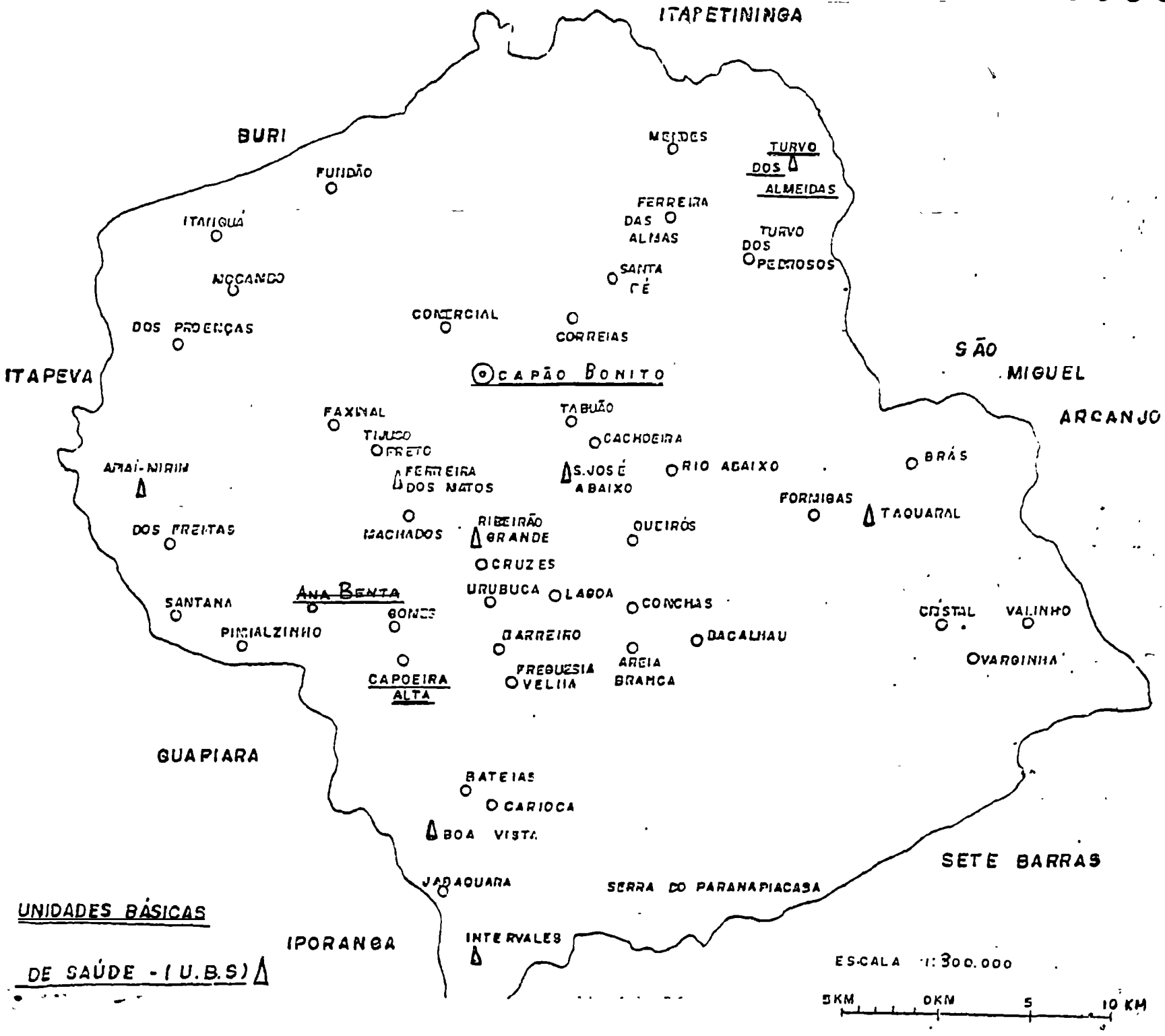
	YES	ACCEPTABLE	NO
2. Pollution of soil?	[]	[]	[]
3. Groundwaterpollution? (distance to source)	[]	[]	[]
Distance to nearest water source:.....			
Topografia? [] downhill [] uphill [] plane			
4. Surface water pollution?	[]	[]	[]
Distance to nearest surface water:.....			
5. Access by insects?	[]	[]	[]
6. Handling of fresh excreta?	[]	[]	[]
7.1 Odours?	[]	[]	[]
7.2 Clean slab?	[]	[]	[]
8. Facilities for handwashing?	[]	[]	[]
9. Cleaning material available? (toilet paper, etc.)	[]	[]	[]
10. Easy cleaning?	[]	[]	[]
11. Simple daily operation?	[]	[]	[]
12. Local material and technology?	[]	[]	[]
13. Minimal use of water?	[]	[]	[]
How many liters/ flush/day:.....			
14. Comfortable use?	[]	[]	[]
15. Support of superstructure?	[]	[]	[]
Material:.....			

17. Remarks.....
.....

ANNEX M: Brazil, State of São Paulo and the Greater São Paulo Area.

	AREA (km^2)	POPULATION
BRASIL	8.500.000	140.000.000
STATE OF SÃO PAULO	247.000	31.000.000
GREATER SÃO PAULO AREA	8.000	15.500.000





ANNEX N: Map of Capão Bonito (M) and location of health units (UBS).

ANNEX O: RESULTS OF INSPECTION OF WATERPOINTS

LOCATION	TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	Z	NUMBER	Z	NUMBER	Z
INSPECT.WATERPOINTS	18		4		3	
MATERIAL:						
CONCRETE	10	55.6			1	33.3
BRICKS	6	33.3	1	25	2	66.7
CONCRETE AND BRICKS	2	11.1	3	75		
FOUNDATION	2		1			
DISTANCE TO LATRINE	2-50M		10-50M		15-30M	
ANIMALS CLOSE	12Y/6N		3Y		3Y	
LID: WOOD	13		1		2	
CONCRETE	5		1			
OTHER			1			
NONE			1		1	
PROTECTION OF WATERP	2		3		NONE	
WATER WHOLE YEAR	18		4		3	
TOPOGRAHIA	FLAT		HILLY		HILLY	
DEPTH	3-10M		4-12M		3-10M	
HYGIENE	3Y/11A/4N		0Y/3A/1N		0Y/2A/1N	
PUMP	24 OF 31		16 OF 31		4 OF 10	
ROPE AND PULLEY	7 OF 31		9 OF 31		6 OF 10	
CAIXA	24 OF 31		17 OF 31		3 OF 10	

Y=YES A=ACCEPTABLE N=NO

ANNEX P: WATERUSAGE IN THE FOUR COMMUNITIES, EXCLUDED QUANTITIES FOR WASHING CLOTHES

LOCATION	TURVO (-)			TURVO (+)			ANA BENTA			CAPOEIRA ALTA		
DESCRIPTION	I	II	III	I	II	III	I	II	III	I	II	III
WELL + PUMP + RESERVOIR	n=2 78 (56-100)	n=2 94 (62-125)	n=16 111 (62-167)				n=7 59 (44-83)	n=4 69 (50-100)	n=5 93 (70-125)	n=1 25 (25)		n=2 73 (71-25)
WELL WITHOUT PUMP OR FETCHING WATER OUT OF WELL WITH PUMP	n=4 24 (22-30)	n=2 65 (47-83)					n=8 19.8 (3-21)			n=6 17 (10-24)		
SPRING WITH RESERVOIR			n=1 125 (125)					n=1 60 (60)	n=2 159 (100-218)	n=1 60 (60)		n=1 50 (50)
WELL WITHOUT RESERVOIR			n=2 98 (71-125)							n=4 11 (8-16)		
RIVER WITH PUMP (RESERVOIR)										n=1 25 (25)	n=5 48 (21-75)	n=1 50 (50)
RIVER WITHOUT PUMP										n=12 11 (5-25)		
SABESP				n=4 37 (20-70)	n=5 66 (30-87.5)	n=10 66 (35-125)						

I= USE BUSH OR LATRINE FOR DEFECATION AND HAVE WASHING-BOWL
II= USE BUSH OR LATRINE FOR DEFECATION AND HAVE SIMPLE SHOWER
III= HAVE PROPER W.C. AND SHOWER

ANNEX 8: BACTERIOLOGAL WATERQUALITY IN THE FOUR COMMUNITIES

LOCATION	TURVO (+)				TURVO (-)				ANA BENTA				CAPOEIRA ALTA			
DESCRIPTION	# SAM	TOTAL COL	FECAL COL	TPC	# SAM	TOTAL COL	FECAL COL	TPC	# SAM	TOTAL COL	FECAL COL	TPC	# SAM	TOTAL COL	FECAL COL	TPC
1.WELLS WITHOUT PUMP																
1.1 DIRECTLY	1	14	ABSENT	)6500	2	)1600	ABSENT	)6500	2	)1600	4-140	500-)6500	1	1600	17	280
1.2 WELL + RESERVOIR																
1.3 WELL+RES.+TAP									2	)1600	4-110	)6500				
1.4 WELL + BUCKET	1	ABSENT	ABSENT	ABSENT					1	)1600	ABSENT	)6500				
2. WELL WITH PUMP																
2.1 DIRECTLY	2	220-280	ABSENT	510-)6500	1	1600	6	)6500	2	)1600	8-ABSENT	1700)6500	2	1600	280-ABSEN	1300-2000
2.2 WELL + RESERVOIR					4	2-)1600	34-ABSENT	170-)6500	1	)1600	900	)6500				
2.3 WELL+RES.+TAP	1	220	ABSENT	)6500					2	)1600	ABS.-220	)6500	2	300-)1600	2-4	970-1900
2.4 WELL + BUCKET																
3. SPRING																
3.1 DIRECTLY +/-PUMP					4	9-350	ABSENT(4)	800-)6500	2	-	ABSENT(2)	23-460	1	1600	ABSENT	)6500
3.2 SPRING + TAP					2	ABSENT-34	ABSENT	78-)6500								
4. RIVER																
4.1 DIRECLTY									1	1.7E4	500	1.7E4	4	5-8E3	130-1.3E3	22E2-69E2
4.2 RIVER+PUMP+RES. TAP													2	800-2300	70	25E2-18E3
4.3 RIVER + BUCKET													2	2.3-3E3	11-34	26-45E2
5. SABESP																
5.1 DIRECTLY	2	ABSENT	-	20-ABSENT												
5.2 VIA RESERVOIR	1	ABSENT	-	ABSENT												
TOTALS	8				13				13				14			

TPC = TOTAL PLATE COUNT/ML
FECAL AND TOTAL COLIFORMS / 100ML

ANNEX R:AGE DISTRIBUTION IN THE FOUR VILLAGES

LOCATION	TURVO (+)						TURVO (-)						ANA BENTA						CAPOEIRA ALTA					
AGE	MALE		FEMALE		TOTAL		MALE		FEMALE		TOTAL		MALE		FEMALE		TOTAL		MALE		FEMALE		TOTAL	
	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)	NO.	(Z)		
0-1 YEAR	2	1.7	1	0.8	3	2.6	1	0.4	0	0	1	0.4	2	0.9	5	2.2	7	3.1	0	0	5	2.4	5	2.4
1 UP TO 4 YEARS	10	8.6	5	4.3	15	12.9	15	6.0	16	6.3	31	12.3	15	6.7	11	4.9	26	11.6	11	5.2	9	4.3	20	9.5
5 UP TO 14 YEARS	14	12.1	12	10.3	26	22.4	27	10.7	28	11.1	55	21.8	27	12.0	25	11.1	52	23.1	31	14.7	42	19.9	73	34.6
15 UP TO 30	22	19.0	16	13.8	38	32.8	56	22.1	40	15.8	96	37.9	36	16.0	32	14.2	68	30.2	25	11.8	27	12.8	52	24.6
)30 YEARS	17	14.7	17	14.7	34	29.3	34	13.4	36	14.2	70	27.6	40	17.8	32	14.2	72	32.0	29	13.7	32	15.2	61	28.9
TOTALS	65	56.1	51	43.9	116	100.0	133	52.6	120	47.4	253	100.0	120	53.4	105	46.6	225	100.0	96	45.4	115	54.6	211	100.0

ANNEX S: EDUCATION OF THE POPULATION IN THE FOUR COMMUNITIES

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
INSTRUCTION	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	Z
NONE	4	4.1	18	8.2	18	9.7	25	13.5
1 UP TO 4 YEARS	68	69.3	156	70.6	133	71.5	93	50.0
MORE THAN 4 YEARS	4	4.1	8	3.6	1	0.5	14	7.5
STILL STUDYING	22	22.5	39	17.6	34	18.3	54	29.0

ANNEX T: DISTRIBUTION OF TYPES OF HOUSES IN THE FOUR COMMUNITIES

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
MATERIAL	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	Z
BRICKS	24	96.0	40	72.7	35	76.1	16	44.5
WOOD	-	-	5	9.1	4	8.7	4	11.1
PAU-A-PIQUE	1	4.0	10	18.2	7	15.2	16	44.4
TOTALS	25	100.0	55	100.0	46	100.0	36	100.0

ANNEX X: REASONS FOR WATERSOURCE PREFERENCE

LOCATION	TURVO (+)		TURVO (-)		ANA BENTA		CAPOEIRA ALTA	
DESCRIPTION	NUMBER	Z	NUMBER	Z	NUMBER	Z	NUMBER	Z
NO.HOUSEHOLDS	22		20		29		29	
NEAREST FACILITY		0	3	15.0	2	6.9		
HYGIENIC REASONS	10	45.5	2	10.0	10	34.5	12	41.4
TASTE	1	4.5	1	5.0				
ONLY SOURCE	5	22.7	12	60.0	15	51.7	17	58.6
PRACTICAL	6	27.3	2	10.0	2	6.9		

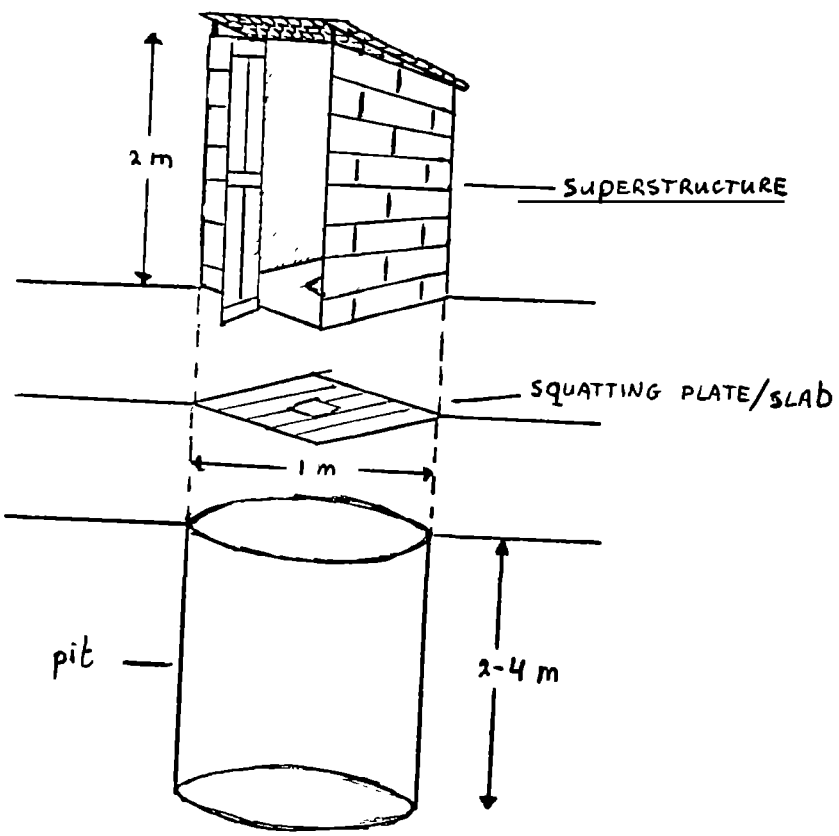
ANNEX U: Causes of hospital internation in Capão Bonito (1986) and activitiés of UBS in Turvo.

19 principal causes of internation	nr. of cases
- Normal childbirths	1519
- Diseases of the respiratory system	1081
- Diseases of the digestive system	603
- Signals and symptoms	544
- Intestinal infectious diseases	381
- Caesarian sections	370
- Hart diseases	302
- Diseases of the genital feminal organs	240
- Diseases of over-sensitiveness	208
- Diseases of the urinal system	185
- Brain diseases	124
- Traumatism	119
- Nervous system disease	99
- Muscle diseases	88
- Prenatal infections	74
- Fractures	68
- Blood disease	67
- Mental disturbances	62
- Intercranial lesions	61
- Other	633
Total	6828

Activities of the UBS in Turvo during the period 2-27 may 1988.

Type of assistance	nr. of cases
- Blood pressure measuring	43
- Injections	31
- Simple curative treatments	30
- Treatment of complaints (e.g. diarrhoea)	26
- Sensibility tests	10
- Inhalation of medicine	8
- Immobilization/ to place bandages	2
- Home visits	2
- Providence of medicine on the spot	1
- Reference to a doctor	1
Total	154

ANNEX V: Pit latrine



ANNEX W: Statistical analyses

W.1 : Figure 5.1; age distribution (male).
W.2 : Figure 5.1: age distribution (female).
W.3 : Figure 5.2; education.
W.4 : Table 5.3 ; illiteracy.
W.5 : Table 5.11; prevalence of worms and protozoa.
W.6 : Table 5.12; age-specific prevalence rate.
W.7 : Table 5.13; rate of infection per w.c./privada(bush).
W.8 : Table 5.14; percentages of single and plural infections.
W.9 : Table 5.15; cases of diarrhoea.
W.10: Table 5.15; duration of episodes.
W.11: Table 5.17; 'weight-for-height'.
W.12: Table 5.17; 'height-for-age'.
W.13: Table 5.18; low weight.
W.14: Table 5.18; low height.

W.1

```
Chi-square = 14.4616 with 12 D.F.   Sig. Level = 0.272205
WARNING: Expected values in 4 cells < 5 and 4 cells < 2
Contingency Coefficient = 0.183718
Lambda (Asymmetric) = 0.0363636 with Rows Dep.
                      0.0391459 with Columns Dep.
Lambda (Symmetric) = 0.0377698
Cramer's V = 0.107907
Uncertainty Coeff. (Asym.) = 0.0128999 with Rows Dep.
                             0.0131428 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0130202
Kendall's Tau B = 0.0113096 with Sig. Level =  .7847
Kendall's Tau C = 0.0110465
Conditional Gamma = 0.0153613
Somer's D (Asymmetric) = 0.0112818 with Rows Dep.
                         0.0113375 with Columns Dep.
Somer's D (Symmetric) = 0.0113096
Press ENTER to continue.
```

W.2

```
Chi-square = 15.0986 with 12 D.F.   Sig. Level = 0.236089
WARNING: Expected values in 4 cells < 5 and 1 cells < 2
Contingency Coefficient = 0.19282
Lambda (Asymmetric) = 0.0510949 with Rows Dep.
                      0.0701107 with Columns Dep.
Lambda (Symmetric) = 0.0605505
Cramer's V = 0.113454
Uncertainty Coeff. (Asym.) = 0.0162188 with Rows Dep.
                             0.0170813 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0166389
Kendall's Tau B = -0.0587492 with Sig. Level =  .1675
Kendall's Tau C = -0.0574739
Conditional Gamma = -0.0798227
Somer's D (Asymmetric) = -0.0590343 with Rows Dep.
                         -0.0584655 with Columns Dep.
Somer's D (Symmetric) = -0.0587485
Press ENTER to continue.
```

```
Chi-square = 34.5893 with 9 D.F.   Sig. Level = 7.03844E-5
Contingency Coefficient = 0.218336
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0595745 with Columns Dep.
Lambda (Symmetric) = 0.0393812
W.3  Cramer's V = 0.129173
Uncertainty Coeff. (Asym.) = 0.0279388 with Rows Dep.
                             0.0198779 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0232289
Kendall's Tau B = 0.0236849 with Sig. Level =  .4786
Kendall's Tau C = 0.0194744
Conditional Gamma = 0.0380822
Somer's D (Asymmetric) = 0.0199346 with Rows Dep.
                         0.0281407 with Columns Dep.
Somer's D (Symmetric) = 0.0233373
Press ENTER to continue.
```

```
Chi-square = 7.24204 with 3 D.F.   Sig. Level = 0.0645706
Contingency Coefficient = 0.101842
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0148936 with Columns Dep.
Lambda (Symmetric) = 0.0130841
Cramer's V = 0.102374
W.4  Uncertainty Coeff. (Asym.) = 0.017823 with Rows Dep.
                                  4.12279E-3 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 6.69655E-3
Kendall's Tau B = 0.0914471 with Sig. Level =  .0089
Kendall's Tau C = 0.0646308
Conditional Gamma = 0.260545
Somer's D (Asymmetric) = 0.0441054 with Rows Dep.
                         0.189604 with Columns Dep.
Somer's D (Symmetric) = 0.0715637
Press ENTER to continue.
```

```
Chi-square = 77.4474 with 24 D.F.   Sig. Level = 1.54376E-7
WARNING: Expected values in 18 cells < 5 and 12 cells < 2
Contingency Coefficient = 0.437055
Lambda (Asymmetric) = 0.0742574 with Rows Dep.
                      0.097561 with Columns Dep.
W.5  Lambda (Symmetric) = 0.0859951
Cramer's V = 0.280547
Uncertainty Coeff. (Asym.) = 0.0751264 with Rows Dep.
                             0.0975449 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0848803
Kendall's Tau B = -0.110629 with Sig. Level =  .0165
Kendall's Tau C = -0.107699
Conditional Gamma = -0.148674
Somer's D (Asymmetric) = -0.115414 with Rows Dep.
                         -0.106043 with Columns Dep.
Somer's D (Symmetric) = -0.11053
Press ENTER to continue.
```

TUE AUG 2 1988 09:53:35 AM Page 1

Data Editor Maximum Rows: 9

Date Updated: 08/02/88 Number of Cols: 5

W.5

Row	VERMINOSE	LOCAL	LOCAL	LOCAL	LOCAL
1	ASCARIS	5	15	58	48
2	TRICHIURIS	3	1	19	12
3	ANCYLOSTOM	3	0	3	8
4	HIM.NANA	2	0	1	0
5	TRONYGYLOI	0	1	1	4
6	E.COLI	10	18	17	19
7	E.HISTOLYS	1	0	1	0
8	G.LAMBLIA	17	12	14	20
9	E.NANA	1	2	0	12
Length		9	9	9	9	9	0
Type		C	N	N	N	N	N

W.6

Chi-square = 46.1185 with 15 D.F. Sig. Level = 5.09107E-5
Contingency Coefficient = 0.258697
Lambda (Asymmetric) = 0.0186047 with Rows Dep.
0.0668203 with Columns Dep.
Lambda (Symmetric) = 0.0428241
Cramer's V = 0.154622
Uncertainty Coeff. (Asym.) = 0.0211804 with Rows Dep.
0.0257857 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0232572
Kendall's Tau B = 0.0847969 with Sig. Level = .0089
Kendall's Tau C = 0.085776
Conditional Gamma = 0.111232
Somer's D (Asymmetric) = 0.0876601 with Rows Dep.
0.0820273 with Columns Dep.
Somer's D (Symmetric) = 0.0847502
Press ENTER to continue.

TUE AUG 2 1988 03:07:26 PM Page 1

Data Editor Maximum Rows: 9

Date Updated: 08/02/88 Number of Cols: 15

W.6

Row	IDADE	L	L	L	L
1	+0 A 4	23	9	18	14
2	5 A14	18	16	36	29
3	15 E MAIS	54	43	59	57
4	- 0 A 4	4	8	12	10
5	5 A 14	21	9	17	41
6	15 E MAIS	20	20	67	38
7					
8					
9					
Length		6	6	6	6	6	0
Type		C	N	N	N	N	N

```
Chi-square = 127.375 with 9 D.F.   Sig. Level = 0
Contingency Coefficient = 0.406622
Lambda (Asymmetric) = 0.0876777 with Rows Dep.
                      0.09447 with Columns Dep.
Lambda (Symmetric) = 0.0911215
Cramer's V = 0.256966
Uncertainty Coeff. (Asym.) = 0.0791696 with Rows Dep.
                             0.0776383 with Columns Dep.
W.7  Uncertainty Coeff. (Symmetric) = 0.0783965
Kendall's Tau B = 0.233305 with Sig. Level =  .0000
Kendall's Tau C = 0.226595
Conditional Gamma = 0.31229
Somer's D (Asymmetric) = 0.231572 with Rows Dep.
                         0.235052 with Columns Dep.
Somer's D (Symmetric) = 0.233299
Press ENTER to continue.
```

```
Chi-square = 7.58198 with 3 D.F.   Sig. Level = 0.0559871
Contingency Coefficient = 0.165656
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0348837 with Columns Dep.
Lambda (Symmetric) = 0.0269058
Cramer's V = 0.167977
Uncertainty Coeff. (Asym.) = 0.0304594 with Rows Dep.
                             0.0113181 with Columns Dep.
W.8  Uncertainty Coeff. (Symmetric) = 0.0165038
Kendall's Tau B = 0.145019 with Sig. Level =  .0102
Kendall's Tau C = 0.135943
Conditional Gamma = 0.313955
Somer's D (Asymmetric) = 0.0953478 with Rows Dep.
                         0.220566 with Columns Dep.
Somer's D (Symmetric) = 0.133141
Press ENTER to continue.
```

```
     TUE AUG 2  1988   10:10:19 AM                          Page 1
                                Data Editor      Maximum Rows:     9
     Date Updated: 08/02/88                      Number of Cols:  10

 Row  NUMERO          LOC       LOC       LOC       LOC
   1  1                32        42        78        65
   2  2 OU MAIS         5         4        18        24
   3
W.8  4
   5
   6
   7
   8
   9

Length   2         2         2         2         2         0
Type     C         N         N         N         N         N
```

```
Chi-square = 6.87674 with 3 D.F.   Sig. Level = 0.075932
Contingency Coefficient = 0.256066
Lambda (Asymmetric) = 0.114286 with Rows Dep.
                      0.0735294 with Columns Dep.
Lambda (Symmetric) = 0.0873786
Cramer's V = 0.264898
Uncertainty Coeff. (Asym.) = 0.0521455 with Rows Dep.
                             0.0249539 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0337547
W.9   Kendall's Tau B = 0.16453 with Sig. Level =  .0768
Kendall's Tau C = 0.191587
Conditional Gamma = 0.27512
Somer's D (Asymmetric) = 0.12976 with Rows Dep.
                         0.208617 with Columns Dep.
Somer's D (Symmetric) = 0.16
Press ENTER to continue.
```

```
Chi-square = 3.77473 with 6 D.F.   Sig. Level = 0.707131
WARNING: Expected values in 8 cells < 5 and 2 cells < 2
Contingency Coefficient = 0.255608
Lambda (Asymmetric) = 0.0357143 with Rows Dep.
                      0 with Columns Dep.
Lambda (Symmetric) = 0.0181818
Cramer's V = 0.186952
Uncertainty Coeff. (Asym.) = 0.0450179 with Rows Dep.
                             0.0387006 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0416209
W.10  Kendall's Tau B = 0.0720875 with Sig. Level =  .5519
Kendall's Tau C = 0.0699588
Conditional Gamma = 0.110749
Somer's D (Asymmetric) = 0.0706127 with Rows Dep.
                         0.0735931 with Columns Dep.
Somer's D (Symmetric) = 0.0720721
Press ENTER to continue.
```

```
Chi-square = 3.32424 with 3 D.F.   Sig. Level = 0.344283
WARNING: Expected values in 4 cells < 5 and 1 cells < 2
Contingency Coefficient = 0.183872
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0454545 with Columns Dep.
Lambda (Symmetric) = 0.038961
Cramer's V = 0.187062
Uncertainty Coeff. (Asym.) = 0.0447589 with Rows Dep.
                             0.0117266 with Columns Dep.
W.11  Uncertainty Coeff. (Symmetric) = 0.0185842
Kendall's Tau B = -0.0989727 with Sig. Level =  .2944
Kendall's Tau C = -0.0771191
Conditional Gamma = -0.247863
Somer's D (Asymmetric) = -0.0520179 with Rows Dep.
                         -0.188312 with Columns Dep.
Somer's D (Symmetric) = -0.0815179
Press ENTER to continue.
```

```
Chi-square = 3.10463 with 3 D.F.   Sig. Level = 0.375773
WARNING: Expected values in 4 cells < 5 and 0 cells < 2
Contingency Coefficient = 0.187718
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0508475 with Columns Dep.
Lambda (Symmetric) = 0.0428571
Cramer's V = 0.191115
Uncertainty Coeff. (Asym.) = 0.0477588 with Rows Dep.
                             0.013403 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0209317
W.12
Kendall's Tau B = -0.170458 with Sig. Level =  .0876
Kendall's Tau C = -0.139516
Conditional Gamma = -0.411765
Somer's D (Asymmetric) = -0.0938547 with Rows Dep.
                         -0.309582 with Columns Dep.
Somer's D (Symmetric) = -0.144041
Press ENTER to continue.
```

```
Chi-square = 5.31081 with 3 D.F.   Sig. Level = 0.150402
WARNING: Expected values in 3 cells < 5 and 0 cells < 2
Contingency Coefficient = 0.230095
Lambda (Asymmetric) = 0 with Rows Dep.
                      0.0454545 with Columns Dep.
Lambda (Symmetric) = 0.0357143
Cramer's V = 0.236439
Uncertainty Coeff. (Asym.) = 0.0535908 with Rows Dep.
                             0.0190154 with Columns Dep.
W.13
Uncertainty Coeff. (Symmetric) = 0.0280706
Kendall's Tau B = 0.192738 with Sig. Level =  .0411
Kendall's Tau C = 0.183934
Conditional Gamma = 0.396371
Somer's D (Asymmetric) = 0.124066 with Rows Dep.
                         0.299423 with Columns Dep.
Somer's D (Symmetric) = 0.175439
Press ENTER to continue.
```

```
Chi-square = 4.89922 with 3 D.F.   Sig. Level = 0.179327
Contingency Coefficient = 0.221453
Lambda (Asymmetric) = 0.136364 with Rows Dep.
                      0.030303 with Columns Dep.
Lambda (Symmetric) = 0.0727273
Cramer's V = 0.227092
Uncertainty Coeff. (Asym.) = 0.0379701 with Rows Dep.
W.14                         0.0191613 with Columns Dep.
Uncertainty Coeff. (Symmetric) = 0.0254695
Kendall's Tau B = 0.207319 with Sig. Level =  .0281
Kendall's Tau C = 0.251745
Conditional Gamma = 0.336493
Somer's D (Asymmetric) = 0.169806 with Rows Dep.
                         0.253119 with Columns Dep.
Somer's D (Symmetric) = 0.203256
Press ENTER to continue.
```

CETESB

BOLETIM DE EXAMES DE ÁGUAS
MODELO -I-

O.S. 090000
Amostra nº 18898

ANNEX Y: Example of form of the Waterlaboratory of CETESB.

DADOS SOBRE A AMOSTRA

Local da coleta: Poço nº 36 - Capoeira alta - direto do poço com balde estéril
Município: Capão Bonito Estado SP Manancial -
☒ bruta ☐ fonte Temperaturas: Amostra 18,0 °C Ar 20,0°C Chuvas. ☐ sim ☒ não
☐ somente clorada ☐ poço Cloro residual - mg/l Cl_2
☐ tratada ☐ abast. público Data da coleta 05/07/88 Hora: 09:40 Data entrada laboratório 05/07/88
Responsável pela coleta: Anal.Lab.Sr. Carlos J.Brandão

EXAMES FISICO-QUÍMICOS

1) Características Físicas e Organolépticas

Parâmetro	Expresso como	V.M.P.	Resultado	Parâmetro	Expresso como	V.M.P.	Resultado
Aspecto	–	Límpido	-	pH (campo)	–	4 – 10	5,3
Cor	mgPt/l	5 – 30	-	Sabor	–	não objetável	-
Odor	–	não objetável	-	Turbidez	U.N.T.	5 – 10	-

2) Características Químicas

Parâmetro	Expresso como	V.M.P mg/l	Resultado mg/l	Parâmetro	Expresso como	V.M.P. mg/l	Resultado mg/l
Alcal. Bicarbonatos	$CaCO_3$	250	14	Fluoreto	F	0,6 – 1,7	-
Alcal. Carbonatos	$CaCO_3$	120	0	Manganês	Mn	0,05	-
Alcal. Hidróxidos	$CaCO_3$	0	0	Mercúrio	Hg	0,002	-
Alumínio	Al	0,1	-	Nitrog.Albuminóide	N	0,08 – 0,15	-
Arsênio	As	0,05	-	Nitrog. Amoniacal	N	0,05 – 0,08	0,03
Bário	Ba	1,0	-	Nitrog. Nitrato	N	2 – 10	7,90
Cádmio	Cd	0,01	-	Nitrog. Nitrito	N	ausente	nd
Chumbo	Pb	0,05	-	Oxigênio Consumido	O_2	2,0 – 3,5	1
Cianeto	CN	0,2	-	Prata	Ag	0,05	-
Cloretos	Cl	100 – 250	13,0	Selênio	Se	0,01	-
Cobre	Cu	1,0	-	Sólidos Dissolvidos	–	500	-
Cromo Hexavalente	Cr	0,05	-	Sólidos Totais	–	500	-
Cromo Total	Cr	0,05	-	Sulfato	SO_4	250	-
Dureza	$CaCO_3$	100 – 300	-	Surfactantes	LAS	0,2	-
Fenóis	C_6H_5OH	0,001	-	Zinco	Zn	5,0	-
Ferro	Fe	0,3	0,01	pH	-		6,69

3) Biocidas Orgânicos Sintéticos

Nome do Biocida	V.M.P. (µg/l)	Resultado (µg/l)	Nome do Biocida	V.M.P. (µg/l)	Resultado (µg/l)
Aldrin	1,0		Metoxicloro	100	
Clordano	3,0		Toxafeno	5,0	
DDT	50,0		2,4 – D	20,0	
Dieldrin	1,0		2,4,5 T	2,0	
Endrin	0,2		2,4,5 TP	30,0	
Heptacloro	0,1		Pest. fosforados e carbamatos	100	
Lindano	4,0				

EXAMES BACTERIOLÓGICOS

1) Contagem padrão de bactérias: 280 Colônias/ml a 35 °C 48 h
2) Coliformes totais 1600 ☒ N M P /100 ml ☐ NC.MF/100 ml
3) Coliformes fecais: 17 ☐ N M.P./100 ml ☐ NC.MF/100 ml
4)
5)
6)
7)

CONCLUSÕES

Vide verso nota(s) número(s) 27 e 33

Chefe Div. Controle Ingestão

04 / 08 / 88

Nota nº	Conclusão
1	Análise para controle de água.
2	Atende aos Padrões Físico-Químicos de Potabilidade, quanto aos parâmetros analisados.
3	Não atende aos Padrões Físico-Químicos de Potabilidade.
4	Parâmetros da NTA-60 do Decreto nº 12 486 de 20.10.78 do Estado de São Paulo.
5	Parâmetros da portaria 56 Bsb de 14.03.79 do Decreto 79 367 de 09 03 77 do Ministério da Saúde.
6	V M P. para a Cor. Fonte 5 mgPt/l; Abastecimento Publico, 20 mgPt/l; Poços: 30 mgPt/l.
7	V M P para pH Fontes. 4 a 10, Abastecimento Público 5 a 9, Poços 5 a 10.
8	V M P. para Turbidez Fontes e Abastecimento Público: 5 UNT, Poços: 10 UNT.
9	V M P para Cloretos Fontes 100 mg/l Cl, Abastecimento Público e Poços 250 mg/l Cl.
10	V.M P. para Dureza. Fontes 300 mg/l $CaCO_3$; Poços: 200 mg/l $CaCO_3$. Não há referência para Abastecimento Público.
11	V M.P. para Fluoreto é função da temperatura do ar; vide tabela abaixo.
12	V.M P para Nitrogênio Albuminóide Fontes 0,08 mg/l N, Poços: 0,15 mg/l N. Não há referência para Abastecimento Público.
13	V M P. para Nitrogênio Amoniacal: Fontes 0,05 mg/l N; Poços 0,08 mg/l N. Não há referência para Abastecimento Público.
14	V M.P. para Nitrogênio Nitrato Fontes. 5 mg/l N, Poços. 6 mg/l N face a exames bacteriológicos satisfatórios; Abastecimento Público 10 mg/l N.
15	V.M.P para Nitrogênio Nitrito Fontes e Poços. ausente; 0,02 mg/l N face a exames bacteriológicos satisfatórios.
16	V M P. para Oxigênio Consumido. Fontes 2,0 mg/l O_2; Poços 3,5 mg/l O_2 e Abastecimento Público 2,5 mg/l O_2.
17	Ferro elevado, refletindo na cor e turbidez.
18	Nitrato elevado, não se recomenda para ingestão de crianças recém nascidas, devido ao risco de metemoglobinemia infantil.
19	Cloreto elevado; água salobra.
20	Alcalinidade elevada; água salobra.
21	Sulfato elevado, pode provocar perturbações gastro-intestinais.
22	Dureza elevada, pode provocar incrustações em canalizações e dificuldades na dissolução de sabões.
23	Fenóis elevados; aceitabilidade organoléptica prejudicada.
24	Manganês elevado, pode provocar alterações nas características estéticas, escurecendo caixas d'água e peças de cerâmica.
25	Matéria orgânica elevada
26	Atende aos padrões bacteriológicos de potabilidade.
27	Acusa poluição; recomenda-se inspeção, proteção e desinfecção da unidade ou sistema. Após tais medidas novos exames deverão ser realizados.
28	Acusa poluição; recomenda-se inspeção, proteção e aumento do nível de cloro no sistema. Após tais medidas novos exames deverão ser realizados.
29	Água poluída, imprópria para o consumo humano.
30	Atende aos padrões bacteriológicos de potabilidade; devido à elevada contagem-padrão de bactérias recomenda-se a inspeção, proteção e/ou desinfecção do sistema.
31	Atende aos critérios de balneabilidade.
32	Não atende aos critérios de balneabilidade Recomenda-se adequação do tratamento de água e obediência às normas de freqüência às piscinas. Após tais medidas, novos exames deverão ser realizados.
33	Não atende aos padrões bacteriológicos de potabilidade.

Média temperatura máxima diária do ar (°C)	Limites recomendados para Fluoreto, mg/l F
10,0 – 12,1	0,9 – 1,7
12,2 – 14,6	0,8 – 1,5
14,7 – 17,7	0,8 – 1,3
17,7 – 21,4	0,7 – 1,2
21,5 – 26,3	0,7 – 1,0
26,4 – 32,5	0,6 – 0,8

Observação: Métodos de análise baseados na 16.ª edição do "Standard Methods for the Examination of Water and Wastewater" – publicação APHA, AWWA, WPCF.

Abreviaturas: V.M.P.: valor máximo permitido pela legislação.
nd: não detectado, mas sempre inferior ao V.M.P.
N.M P.: número mais provável.
NC.MF: número de colônias, membrana filtrante.

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GLOSSARY

Arrendatário - see 4.4.1.

Associação - cooperation of farmers (see 4.4.1).

Bairro - district of a municipality, mostly including one or more villages.

Bomba - pump to take up water.

Camarada - see 4.4.1.

Capão - name of the town Capão Bonito.

C.B. - municipality of Capão Bonito.

CETESB - Companhia de Technologia de Saneamento Ambiental; a São Paulo State control agency for environmental pollution.

Cruzado - monetary unit of Brazil.

DAEE - Departamento de Agua e Energia Eléctrica; water resources and electric energy agency.

ERSA - Escritório Regional de Saúde; regional secretary of health.

Meeiro - see 4.4.1.

Mensalista - see 4.4.1.

Mina - spring.

Pau-a-pique - type of house with a frame out of bamboo, filled up with mud or a mixture out of mud with cement.

Poço - well.

Privada - latrine.

Projeto Saneamento Rural - project to supply the Brazilian population with adequate water and sanitation facilities.

Proprietário - see 4.4.1.

SABESP - Companhia de Saneamento Básico do Estado de São Paulo; the São Paulo State water and sewage systems agency.

Turvo (+) - part of Turvo dos Almeidas with SABESP-water.

Turvo (-) - part of Turvo dos Almeidas with well- and spring water.

UBS - Unidade Básica de Saúde; basic health unit or health post.