TUBERCULOSIS INFECTION IN SCHOOL CHILDREN:

PREVALENCE, ANNUAL RISK AND DETERMINANTS

IN
YIFATNA TIMUGA AWRAJA.

ETHIOPIA

by

DR. YITADES GEBRE

Thesis submitted as partial fulfillment of the requirements for the degree of Master of Science

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DEDICATION

I WISH TO DEDICATE THIS THESIS TO
MY YOUNGEST BROTHER GIRUMNEH GEBRE(1965 - 1987) .

ACKNOWLEDGEMENTS

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SUMMARY

In a tuberculin survey in Yifatna Timuga Awraja, Northern Shoa , Ethiopia 1997 elementary school children; 1046 (52.4%) males & 951 (47.6%) females were in the age group 7 to 14 participated in the study . The survey consisted of a set of questionnaire, assessement of nutritional status , examination of the presence of BCG scar and tuberculin skin testing with PPD - RT 23 .

The prevalence of tuberculosis infection was 12.6% (11.17% to 14.0%; confidence limits 95%) . The mean age was 10.3 years . The avarage annual risk of tuberculosis infection was 1.35% (1.18% to 1.5 %, confidence limits 95%) . Boys &girls have equal risk of infection , unlike children coming from bigger family sized have greater ($P < 0.05$) . It was also found that children who drink cows' milk have equal risk of infection compared with those do not ($P > 0.05$) , relative risk is 1 . The data also provided that the BCG coverage in this age group was 8.41% . The proportion of positives for BCG scar increased as the distance of their homes from health institution decreased ($P < 0.001$ for the trend) .

The nutritional status of the surveyed children was assessed for mantoux positives and mantoux negatives . 13.7 % of children in this study were severeley undernourished .

Another significant observation was that there was no difference in the risk of tuberculosis infection malnourished compared with well nourished children ($P > 0.05$ for the trend) . Data on history of cough experienced by any one of family members for morethan a month showed that 10.3% of the children had someone in the household who coughed .

This study had also estimated the incidence of smear positive tuberculosis which is 81 cases per 100,000 population per year that is 334 cases in Yifatna Timuga . The incidence of tuberculosis meningitis in age group 0 - 4 in this study is 7/ 100,000 total population , that is 28 cases per year in Yifatna Timuga awraja .

CHAPTER I

INTRODUCTION

The tuberculosis problem in the world has become almost static . Although in many developed countries a steady decline is still being observed, the actual problem in these area is low already and the impact on the worldwide incidence is therefore minimal (1) . However in most developing countries the control of tuberculosis has been much slower and more difficult . In Ethiopia tuberculosis is one of the major health problems . By modest estimate the prevalence of pulmonary tuberculosis is considered to be 1 - 2% among the general population (2). Analysis of reports on some leading causes of hospitalization in the 14 regions (Addis Ababa and Asseb not included) during the period 1982/83 showed tuberculosis to be a major cause of morbidity and mortality, 13.6% and 11.4% respectively (2). Respiratory tract infections were the most frequently reported in the ten top deseases , accounting for 20% of all clinic visits in Yifatna Timuga Awraja in 1986 . Probably many of these cases were various stages of tuberculosis . Respiratory deaths accounted for 8.7 % of the deaths in children 1 - 4 in the Awraja in the same year .

However little attention has been given to etiologies of respiratory infections . Notification of the number of new cases as currently reported is not a very helpful index (3) . To determine the magnitude of the tuberculosis problem in the Awraja; it was necessary to carry out studies on the epidemiology of disease .

The number of notified cases of tuberculosis only gives a general impression of the incidence of tuberculosis in district or country . This is usually not a very reliable picture . The number of notified cases depends primarily on case finding (4) . A more reliable index of the tuberculosis situation is the "annual risk of infection " and, more importantly, the trend of the annual risk of infections (5) . The annual risk of infection is derived from a tuberculin survey and is independent of control measures , accessibility , and efficiency of the health services . Tuberculin skin test survey of unvaccinated specific age children who are randomly selected will enable investigators to compute tuberculosis infection rate(3) . The annual risk of infection with tubercle bacilli is defined as the probability that an individual who has not previously been infected with tubercle bacilli will become infected during the ensuing period of one year (6) .

This will depend on the extent of exposure to human and /or bovine bacilli and the intensity, frequency and duration of the exposure . Many other characterstics of the individual are important : nutritional immunological , physical condition , intercurrent illness and other factors . However even if it is found that the risk of infection varies according to different circumustances it is unlikely that it will be possible to attribute the variation to any single factor (6) . The annual risk of tuberculous infection is thus a single composite measure which expresses the total of all the factors influencing the transmission of tubercle bacilli from a diseased person or animal to uninfected person .

The determination of the average annual risk of infection to tuberculosis was major objective of this study .

The specific objective are as follows :

- To measure the mantoux positivity rates in rural school children .
- To determine environmental & nutritional circumstances which place children at increased risk for tuberculosis .
- To determine the BCG scar rate in school children and to assess the relationship between BCG coverage and distance from a health institution .

The investigation was conducted in five woredas of Yifatna Timuga awraja which is located in the northern part of Shoa region in central Ethiopia . The awraja has population of approximately 412,000 in 1987 . It is a relatively underdeveloped district, which covers 6,763 sq.km. There are 186 localities of which 7 are towns and 179 are farmers (peasants) association villages .

CHAPTER II

LITERATURE REVIEW

It is more than 100 years since Koch discovered that subjects who had been infected with tubercle bacilli showed a localised reponse to tuberculin when this was injected through the skin (6) . It is evident that it is difficult to collect information on the interaction between the tubercle bacillus and human in a community under natural condition without any interference in the from of direct or indirect control measures (7) . Tuberculin testing is one of the reliable sources of information in studing the tuberculosis problem . The results of tuberculosis prevalence surveys carried out by WHO teams in various developing countries in the 1950's and 1960's are the main sources of information for studing the natural history of tuberculosis .

One study was conducted in 11 regions of Ethiopia from 1953 - 1955 (2), it revealed a prevalence rate of 30% in children 7 - 14 years . Similarly a prevalence survey in 1963/64 in AddisAbaba , and rural community resulted 32.0% and 22% respectively.(2)In southewestern Ethiopia Fuller G.K., 1978 found a prevalence of 28% .(23)

Information on the level of the annual risk of tuberculosis infection is insufficient for a full evaluation of the epidemiological situation of tuberculosis in a country . It is also essential to know the trend in the risk of infection in that country; that is to say whether the annual rate has been decreasing or not and if so, what is the risk of infection (8) . To obtain reliable estimates of the annual tuberculosis infection rates and their changes in a particular period several tuberculin surveys , each in representative sample of non-BCG vaccinated subjects of the same age and tested by the same technique are required at intervals . For a continous evaluation of the tuberculin testing , a representative sample of children must be repeated, say, every 5 years . This is actually very rare in developing countries .

In Lesotho (Basutoland), the first tuberculin survey was carried out in 1957 and the second one in 1965 . It was concluded in the WHO report that children living in the rural lowlands were exposed to the same risk of infection in 1965 as in 1957 namely about 3% . (8)

In studing the prevalence of source of infection it is important to follow persons who have been in intimate contact with tuberculosis patients(9) . These studies demonstrate that smear positives patients play the greatest role in spreading infection to child contacts (0 - 14 years), smear positive index cases transmitted tuberculosis to about 50% of child contacts as compared with about 6% in child contacts of smear negative index cases and 1 % in the same age group among the general population (10) .

In developing countries, where the risk of infection is still high , a relatively small sample of 3-4000 children aged about 10 years would suffice for the estimation of tuberculosis infection . Care should be taken to exclude from the sample children who have already had BCG vaccination (11) . However, in countries where the prevalence of tuberculosis infection is low and has been decreasing rapidly . It will be necessary to test many more unvaccinated children . A simple method of survey would be to pick a sufficient number of schools at random and test all children in these schools in the chosen age group every five years . The most convenient approach would be to test about one - fifth of the selected schools each year, so that about 800 children would be tested each year in a developing country and about 3,000 to 4,000 each year in a developed country (11) .

The advantage of summarising the tuberculosis position in a country in terms of tuberculosis infection rates in particular years is that these rates provide a readily intelligible measure of the impact of tuberculosis on the community at different times . This approach also facilitates comparisons of the tuberculosis infection in different countries . Moreover, knowledge of the trend of annual tuberculosis infection rates enables comprehensive prediction to be made, both of the prevalence of tuberculosis infection and the expected incidence of tuberculosis in the population at different ages . This provides guidance on the likely magnitude of the tuberculosis problem in a country during the following ten to fifteen years (11,12).

The prevalence of the disease , measured in occassional surveys, provides an estimates of the potential case load and therefore is obviously highly relevant to programme planning . It is not a suitable indicator for determining the trend in epidemiological terms (11) .

The relation between the annual risk of infection and other epidemiological indices was analyzed (13) . Which is a correlation with other epidemiological indices . The incidence of tuberculosis meningitis among children of 0 to 4 years age per 100,000 population

is obtained by multiplying the annual risk of infection expressed in percentage by 5 . The incidence of smear positives cases among the whole population per 100,000 is obtained by multiplying the annual risk of infection expressed in percentage by 60 . This makes it possible to estimate roughly the number of new smear positive cases in a community within one year based on the annual risk of infection .

The reliability of the annual risk of infection is reduced in countries where the coverage by previous BCG vaccination programme among children is high or where the prevalence of atypical mycobacterial infection is so high that the discrimination between natural infection and atypical mycobacterial infection by tuberculin test is difficult .

Styblo and Meijer (14) confirmed the substantial direct effect of BCG vaccination especially, at school leaving age will influence the chain of transmission and to prevent the development of tuberculosis in unvaccinated subjects . This is what one may call the "indirect " effect of BCG vaccination . Studies showed that (14) BCG vaccination , even if used in a mass campaign throughout the age range 15 to 30 years, will not substantially influence the chain of transmission especially if the risk of tuberculosis infection is high and has not been decreasing .

METHODOLOGY

STUDY POPULATION

The Awraja Education Office was requested to provide a complete list of all elementary schools in the Awraja (district). With the number of children enrolled . Out of 64 elementary schools, 11 schools were selected by simple random process . At the selected schools in five woredas (sub-districts) all children from grades one, two and three were included in the survey with probability proportional to size . A total of 2000 school children in the age group 7 to 14 will be selected . A letter was sent to all the selected schools to inform them of the intended survey, the purpose of the survey and to explain the procedure .

Survey of children attending primary schools have the major advantage that school children are readily accessible and that such surveys are comparatively quick and cheap . The main disadvantage is that they may be less reliable as children attending schools may not be representative for all children . The International Tuberculosis Surveillance Center (ITSC) recommends school surveys under the restriction that at least 60% of all children in the eligible age group are attending school (7) .

CONDUCT OF SURVEY

The survey was conducted from October 1987 till December 1987 . a few days before the survey was scheduled to take place in September the selected schools were visited by the principal investigator to explain the procedure orally .

At the second visit, the children were placed in line and a pretested set of questionnaries was used to obtain all required information and entered on a separate paper for each individual. (see appendix C)

The survey team consisted of two tuberculin tester and readers (nurses) trained for this survey by the National Tuberculosis Control Programme at the Addis Ababa Tuberculosis Treatement & Training Center . There were also two nutritional status assessors and one clerk .

The survey consisted of a questionnairs (see appendix C), examination for the presence of BCG scar, assessment of nutritional status, tuberculin skin testing and reading of the reaction at 72 hourse .

NUTRITIONAL STATUS ASSESSMENT

This was done by measurement of the weight and height of the subjects under study .

WEIGHT

A bathroom scale was used on which the child was made stand . The scale read to maximum of 100kg with increaments of 100gm . The readings were taken to the nearest 100gm . The accuracy was checked before each survey session by comparing the scale reading with a 5 litre plastic container filled with water (which weighed 5kg) .

HEIGHT

A vertical measuring tape was used . The measuring scale was up to 175cm. and measured to an accuracy of 0.1cm. The method of taking measurements was strictly followed according to the guide lines of WHO .

In the analysis individuals with weight for height Z-scores values of less than -2.00 standard deviation (about 80% of median) were considered nutritionally wasted .

TUBERCULIN TESTING

All children were carefully examined for a BCG scar on the right shoulder and upper arm and the result ("yes" or "no ") was noted on the individual study paper . Then all children with no BCG scar were injected with 0.1ml of TU PPD RT 23 with Tween 80 added as a stablilizing diluent (appendix) .

Special 1ml syringes graduate in hundreths of milimetre were used with 25 or 26 gauge 10 mm long dispossible needles .

The test inflitration was given on the dorsal aspect of the left arm . Reading of the test was done at 72 hrs .

The induration at the test site was carefully palpated and its limits were determined at the transverse diameter , . (see appendix) . Induration size of10mm and above was considered to be positive for the test (WHO), (22) following national practice(2) .

Tuberculin testing was done one monday, Tuesdays, and Wedensdays . Reading were carried out on Thursdays, Fridays and Saturdays . Absentees were marked on the list and excluded from analysis .

If a child was positive for BCG scar, automatically he or she was elimenated from the Tuberculin Testing . All other data were analysed for all this children .

Teachers at the selected schools assisted in the estimation of residence distance of the students from health institutions . This is considered to make the estimation more reliable and accurate .

Twohundred students participate in the pretesting phase of the questionnaire . This has helped in the arrangement of procedures, addressing students , using school teachers for the process in lining students, to keep them desciplined . One of the important points brought after the pretest was that school teachers were as direct respondants to question regarding geographical distances between residence of students and Health Institutions .

CALCULATION OF THE AVERAGE ANNUAL RISK OF TB INFECTION

Positive tuberculin subjects with diameter of 10mm more will be considered and the risk of infection is calculated as follows .

1. The age range 7 - 14 years
2. Mean age 10 years
3. Let P= proportion of tuberculosis positive due to TB infection .
4. If i = The annual risk of infection

   Then : Probability (not infected in 1 year) 1 - i

   Probability (not infected in 10 years)$=(1-i)^{10}$

   Probability (infected in 10 years)$1-(1-i)^{10}$

From 3; P = proportion of Tuberculosis Positive

$1 - (1 - i)^{10}$

Therefore :

$$1 - P = (1 - i)^{10}$$

$$10 \log (1 - i) = \log (1 - P) /10$$

$$1 - i = e^{\log (1 - P) /10}$$

$$i = 1 - e^{\log (1 - p) /10}$$

Cortsey - Dr John Smith, London school of Hygiene and Tropical Medicine..

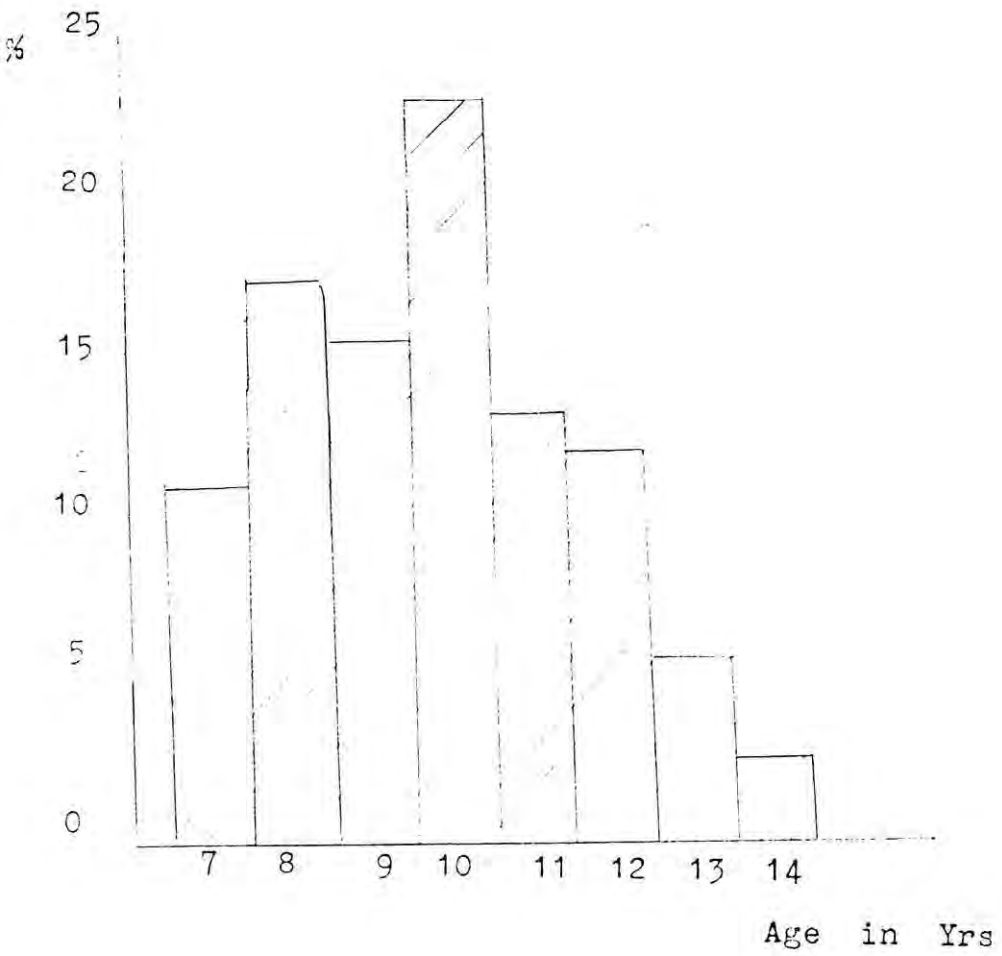
"NB. This formula gives an average of the annual risk of infection in the first 10 years of life . It is based on the assumption that the risk of infection has remained constant throughout each calendar year and each year of age."

RESULTS

The total number of children enrolled at the 11 schools was 6166 . The study included 1997 school children in the age group 7 to 14 from grades one to three . There were 1046 (52.4 %) males and 951(47.6%) females . Fig. I shows the percentage distribution of surveyed children by age .

FIG . I

Percentage distribution of surveyed children by age .



Out of the total 1997 (22.9%) 458 were at age 10,310 (15.5%) at age 9 and 346 (17.3 %) at age 8. In general 66.59% (1330) were under the age of 10.

Among the 1997 school children surveyed 92.08 % were Amhara, 4.30 % Oromo and 3.02 % were of mixed ethnic groups .

BCG SCAR

Out of the total 1997 surveyed school children 168 (8.65%) were positive for BCG scar . There were 86 males (51.2%) and 82 females (48.8) .

TABLE I

DISTRIBUTION OF CHILDREN WITH BCG SCAR BY AGE

	CHILDREN WITH BCG SCAR			
Age Yrs	Male	Female	total	%
7	22	25	47	27.97 %
8	18	8	26	15.47
9	14	17	31	18.5
10	14	16	30	17.85
11	9	7	16	9.52
12	5	4	9	5.35
13	2	4	6	3.57
14	2	1	3	1.78
Total	86	82	168	99.91 %

TUBERCULIN TESTING

Out of the total 1997 surveyed children 1,892 were tested with tuberculin . These were 960 males (52.5%) and 869 (47.5 %) females unvaccinated children . Of these 231 were positives . This shows a prevalence rate of 12 . 63 % of tuberculousis infection . (11.17 % to 14.0 %; confidence limits 95 %) . The mean positive size (induration) was 14.2mm with a standard deviation of ± 3.6mm . The mantoux results of unvaccinated children is given in figure 3 . The prevalence of infection in boys and girls is given below in table II. There is no significant difference between males and females . The average annual risk of infection is calculated to be 1.35 % (1.18 % to 1.5% confidence limits 95 %) .

TABLE II

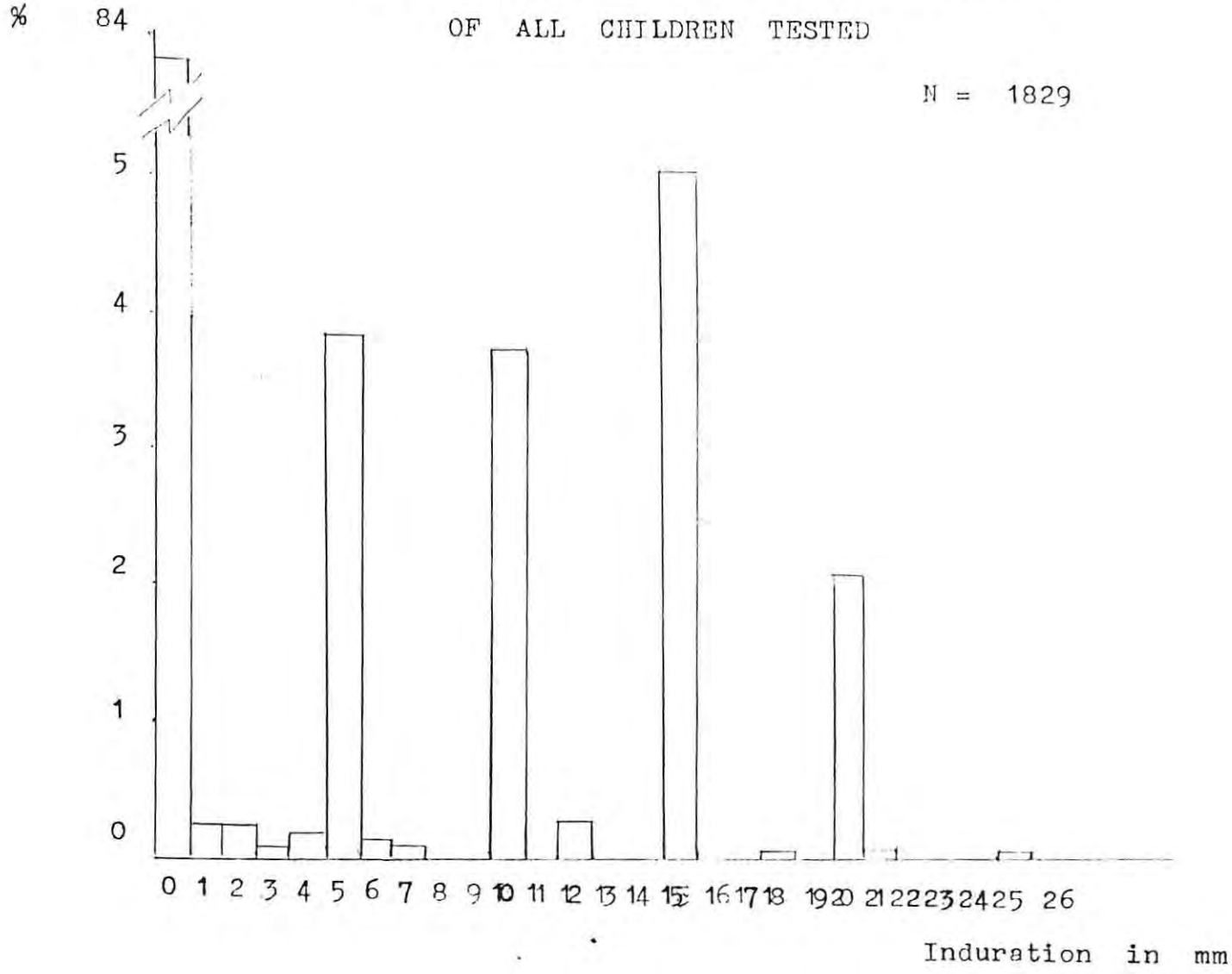
PREVALENCE OF TUBERCULOSIS INFECTION IN BOYS & GIRLS

Number	Number infected	Percentage infected
Boys 960	120	12.5 %
Girls 869	111	12.7 %
TOTAL 1829	231	12.63%

DISTRIBUTION OF DIAMETERS OF INDURATION

OF ALL CHILDREN TESTED

N = 1829



As indicated in table III below the age distribution of mantoux positives , the mean age was 10 years with a standard devation ± 1.8 Yrs .

TABLE III

PREVALENCE OF TUBERCULOSIS INFECTION

IN

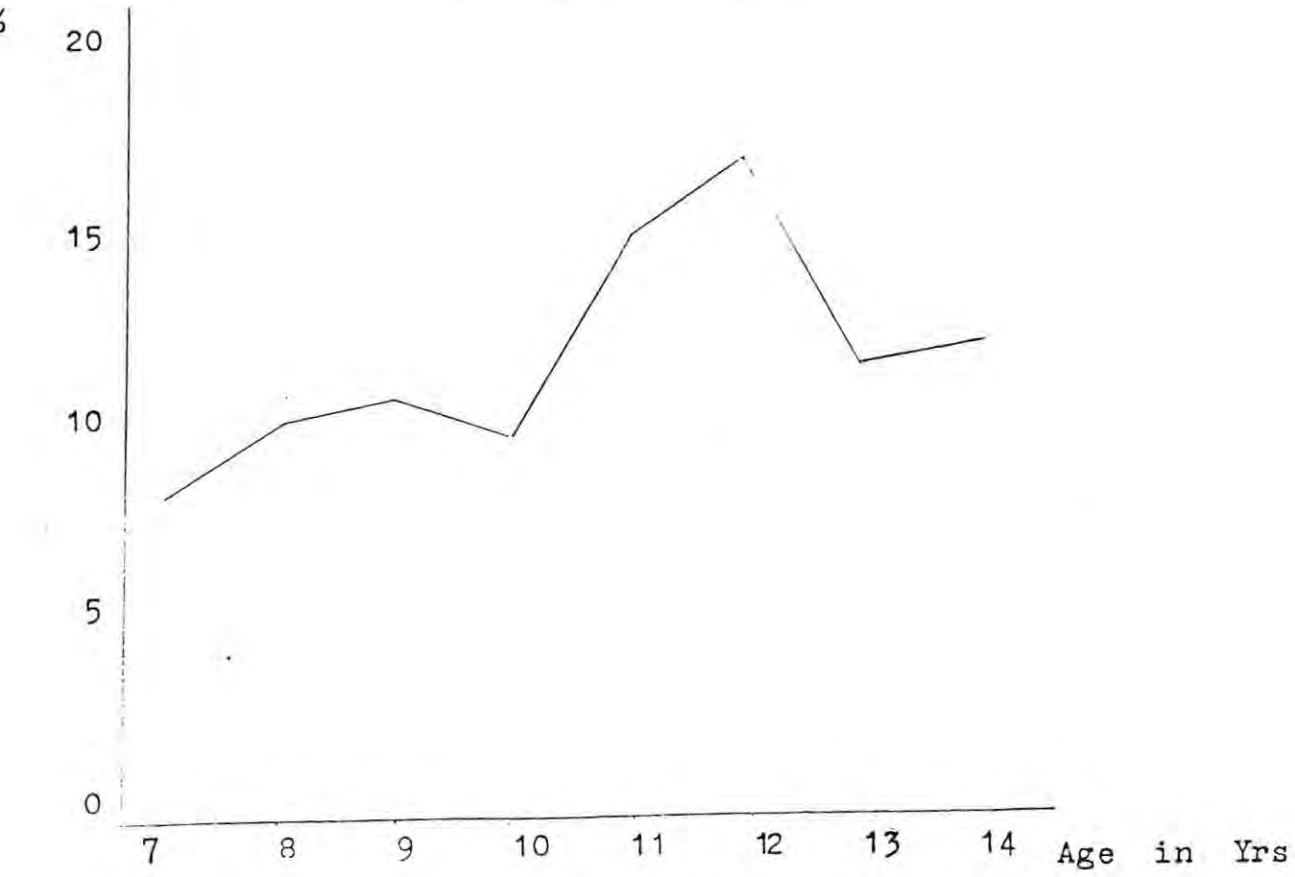
SCHCOL CHILDREN BY AGE , 1987

Age in Yrs	Total Mantoux Positives	%	Cumulative Frequency	% CF
7	18	7.8	18	7.8
8	35	15.2	53	22.9
9	34	14.7	87	37.66
10	45	19.9	132	57.1
11	39	16.9	171	74.0
12	41	17.7	212	91.77
13	13	5.6	225	97.4
14	6	2.6	231	100.00

The prevalence of tuberculosis infection by age and for both sexes in given in figure 4 on the next page .

Fig. 4

Prevalence of tuberculosis infection in school children



NUTRITIONAL STATUS

The nutritional status results for all surveyed children are given in table IV . 274 children 13.7 % were nutritionally wasted .

TABEL IV

CLASSIFICATION OF NUTRITIONAL STATUS

OF ALL SURVEYED CHILDREN

	NUTRITIONAL LEVEL	TOTAL
No	Above Median-2 SD	1723 (86.3 %)
No	Below Median -2 SD	274 (13.7 %)
	Total	1997

The result on nutritional status of 231 mantoux positives showed that 11.6% were below median -2 SD . There was no significand difference between nutritional status of mantoux positive and negatives .
($P > 0.05$, $X^2 = 0.041$)

DISTANCE OF RESIDENCE FROM HEALTH INSTITUTION

Out of 1997 school children surveyed 85.8% were lived less than four kilometers distance from health units .

Among the BCG scar positive children 98.2% (165 children) were living less than four km. distance from health units . The proportion of students with BCG scar decreased with distance away from health institution ($P < 0.001$ for the trend) .

TABLE VI

DISTRIBUTION OF ALL CHILDREN BY FAMILY SIZE

Family Size (Person)	No of Children	%
2 - 4	386	19.5
5 - 7	1,031	52.1
8 - 10	481	24.3
11^{+}	81	4.1

COWS MILK CONSUMITON

1951 (97.6%) of the 1997 children surveyed gave answers about cows milk consumption . Out of these, 1196 (61.3%) children, drink raw cows milk, while 755 (38.7%) denied drinking cows milk at all . Out of 231 mantoux positives , 142 (62.3%) were drinking cows milk . The association between cows milk consumption and mantoux positivity of children was not statistically significant . ($P > 0.05$ $X_1^2 = .21$) .

TABLE V

DISTRIBTION OF STUDENTS BY DISTANCE OF RESIDENCE FROM HEALTH INSTITUTION

N = 1997

Residence Distance in Km.	No of Children	%	CF	%
Less than 1 km	570	28.5	570	28.5
1 - 4	1145	57.3	1715	85.8
5 - 9	149	7.4	1864	93.3
10^{+}	133	6.6	1997	99.9

FAMILY SIZE

1979 of the 1997 school children gave responses to the question on family size . The average family size for all children interviewed was 6.3 persons . Of the total 231 mantoux positives 44.6% were coming from families of 7 and above, the average family size for mantoux positives was 6.7 persons .

Mantoux positives have significantly higher family size compared with mantoux negatives ($P < 0.05$, $X^2 = 3.92$)

HISTORY OF COUGH

History of cough experienced by any one of the family member for more than one month's duration was elicted . Of the 231 mantoux positive children (families) 26 (11.2%) replied positively for such experience, while 205 (88.8%) did not . Among the mantoux negative children 180 (9.8%) had someone in the household with a chronic cough of more than one month's duration . This difference is not statistically significant . ($P > 0.05$ X_1^2 0.81) .

DISCUSSION

Estimation of the annual risk of infection by means of tuberculin survey of unvaccinated school children provides a general impression of tuberculosis incidence in an area . The principal aim of this survey was to get baseline data on the epidemiological trend and magnitude of tuberculosis problem in the awraja .

Evidence from this study indicated that tuberulosis remains as major puplic health problem in Yifatna - Timuga awraja . A prevalence of 12.6% (11.17% to 14.0% confidence limits 95%), and 1.35% of annual risk of infection was estimated in this study . It indicates that 1350 persons of each 100,000 inhabitants will be infected , during twelve months, with virulent tubercle bacilli from source of infection . A certain proportion of the 1350 persons infected annually will acquire primary infection (mostly children and young adults), the reminder (middle-aged, elderly and old people), will be re-infected .

It is important to note, however, that the estimate of averarage annual risk of infection is based on the assumption that is no significant changes in the risk of infection either with calendar years or with age . This underscores the necessity for periodic tuberculin surveys in order to assess secular or age related changes in tuberculosis transmission .

In the view of estimating smear positive pulmonary tuberculosis cases from experience (2) it is estimated to have 590 cases per year/per health institution according to National TBC Control Programme ie. in Hospital & Health Centers . In Yifatna Timuga there are two health centers the estimated smear positive will be 1180 . However this is over estimated (tripled) in comparison to the present study which is 334 per year .

K.Styblo (8) relating tuberculin surveys from different countries to parameters of the incidence of smear positives tuberculosis in these countries , indicates that there seems to be a relatively constant ratio between the incidence of smear positive tuberculosis and the risk of tuberculosis infection . (lower for developed and higher for developing countries) He concluded that in developing countries each 1% of the annual risk of infection corresponds to 50 - 60 smear positive pulmonary tuberculosis per 100,000 population . For Yifatna Timuga awraja, which has annual risk of infection of 1.35 % this would mean an incidence of smear positive TB of 68-81 cases per 100,000 population . In a population of 412,000 the number of new cases of smear positive tuberculosis would be 278 - 334 per year .

Incidence of tuberculos. meningitis (TBM) in age group 0 - 4 in our present study was estimated to be 7/100,000 per year, as obtained by multiplying the average annual risk of infection expressed in percentage by 5 (13) . This is similar to the average annual incidence of TBM for Cape Western region, South Africa, for the period 1979 - 81 (15), as estimated from hospital records and local authority notifications, which was 7.5/100,000 per year in the age group 0 to 14 .

The estimation of tuberculous meningits is based on annual risk of infection . Limitation of its use depend on high coverage of BCG vaccination in children and high prevalence of low grade sensitivity to tuberculin . The prevalence of BCG vaccination in this study is 8% which make the obtained estimates acceptable . Unlike pulmonary tuberculosis , TBM always causes an illness grave enough to require hospital admission . It is virtually impossible for a patient either to get facilities for impatient care and or for the establishement of diagnosis of TBM in Yifatna Timuga awraja .

The (8.6%) of BCG positives for all children in this study shows the recent trend of expended programme on immunization activitiy in the area . The low coverage of BCG in all this age group indicates that mass vaccination was not practies in the past even as much in most developing countries (3) .

Vaccination at entry school age usually at 7 should be carried out irrespective of vaccination at birth as stated in the ninth report (5) .

The reaction of unvaccinated children for the tuberculin as shown if fig. 3 . Seem to fall in to two groups . The group on the left comparises the small induration, the group on the left consists of large reaction . The group on the right presumably represents the group of children infected with tubercule bacilli . The group of children on the left would represent the unifected (16) . The small reaction could be due to infection with non-tuberculosis mycobacteria (17) . Non-specific tuberculin sensitivity manifest itself as a relatively weak allergy giving cross reactions to a low dose of tuberculin , usually induration less than 10mm (3) . In this study however, distribution of tuberculin reaction size in tested group show clear separation .

The prevalence of tuberculosis as shown in this study indicates that there was no difference in the exposure for the bacilli between males and females similarly to the study in Zimbabwe (17) . Based on the Yifatna Timuga sample results , it may be seen that females compared with males have equal risk of tuberculosis infection .

Although some degree of chronic malnutrition was very common, 13.7% of children in this study were very severely undernourished . Among the mantoux positives it was 11.7% of the total 231 . A recent study (18) reported that the prevalence of severe malnutrition in Ethiopia ranges from 17% in AddisAbaba and Hararge to 40% in Kefa; many factors may account for malnutrition in children (19) . For instance, the daily per capital calorie intake in Ethiopia has declined from an average of 2500 in 1959 to just over 1700 in 1978 . Famine recurrently has attacked Yifatna Timuga area which probably had adverse effects on the nutritonal status os children . However was no statistically significant difference between the nutritional status of mantoux positives and negatives .

In the results of residence distance from health units 85.8% of all students were living less than four kilometers radius away . For the BCG scar positives the proportion increased as the distance from the health units decreased . ($P < 0.001$) . This suggests that the health activities of particular health unit service area hardly go beyond 5 kilometers radius . A health station is expected to serve in 10 kilometers radius (20) .

The average family size for all surveyed children was 6.3 person . It was also found for the mantoux positives have significantly higher family size compared with mantoux positives ($P<0.05$) . Overcrowding favours the transmission of tubercle bacilli through inhalation of droplets nuclei . Tuberculosis has notoriously been associated with poverty, wich means malnutrition , overcrowding etc . Malnutriton is one of the factors which result in acquiered immune deficiencies and which influence susceptibility to particular infections, diseases like tuberculosis . The result on nutritional status of mantoux positive and mantoux negative has showed no statistical difference in this study . Eventhough the above statement holds true in a state of chronic malnutrition the reaction to the immune system progresses to impaierment . Similarly in this study some children may be negative for the tuberculin hypersensitivity and result in no difference .

Drinking unpasteurized milk from tuberculous cows may intiate infection of alimentary tract (21) . Tuberculin skin tests does not pick specifying infections to that occured due to M . tuberculosis or bovine type . Hence this study has tried to

show the relationship of infection acquiered from bovine tubercle bacilli after eliciting questions about cows milk consumption . It was found that there was no statistical significance between mantoux positivity and cows milk consumption . This could be due to the fact that most infection source are human origin in the area .

History of cough experienced by any one of the family members of the surveyed children as shown in the results; there was no statistical differences between mantoux positives and mantoux negatives.

It's a well known fact that tubercle bacilli are excreted in aerosolized droplets during coughing, sneezing and spealting and in susceptible host infection may result . The lack of association between cough history in the household and mantoux reaction status in this study could be the possiblity of misclassification of individuals with history of cough and without . Since the respondants for this questions were the students in the age group 7 - 14 .

A strong association is not also expected since not all " cough " symptoms which persist morethan four weeks, attributed to tuberculosis other chronic obstructive lung diseases also result similar complaints .

CHAPTER VI

CONCLUSION

This study has demonstrated the importance of tuberculin survey in determining the average annual risk of infection . Furthermore, it was also possible to estimate the incidence of smear positive cases and tuberculous meningitis cases annually . If one gets these incidence figures percisely, it helps in the planning of control measures of TBC . Since only as little as one-third of smear positives cases , the transmitter of the disease , are diagnosed . This study could show tuberculosis situation in the awraja as a sample survey .

It is evident that this study gives also the prevalence of tuberculosis and its determinants in the surveyed school children . Eventhough socio-economic status is improving from ancient times at present the study confirmed that overcrowding plays a significant role in the transmission of tuberculosis in the area .

This study has also pointed out the coverage of BCG vaccination in the area was very low . Therefore there is a good reason for introducing re-vaccination at school entry age and

irrespective of vaccination at birth . Vaccination at school is feasible and due to growing school attendance, it will cover the majority of children . It is also important to know that most infections occure at school age and puperty .

RECOMMENDATIONS

1. Tuberculosis being one of the common leading cause of morbidity in the country; attention has not been given to study the trend in epidemiological terms . This study has showed still its burden on the publics health . Therefore it will be essential to conduct nation wide survey inorder to determine the magnitude .

2. Tuberculin survey at a paricular age and year is not enough to study the trend of risk of infection . It's highly recommended to study the pattern with similar methods and representative sample periodically ; five years .

3. Appropriate , effective and with high technical & low cost control programme as part of PHC activities will be mandatory inorder to decrease and minimize the case load . Since casefinding and treatement is the basis in tuberculosis control programme .

4. It was found that there was no association between mantoux positivity and raw cows milk consumption . It will be appreciable and of highly relevant to conduct study on the prevalence of bovine tuberculosis since their is large livestock population .

APPENDIX - A

APPENDICES

SAMPLING OF SCHOOL.

After a list has been prepared for the district with accumulated totals, a fixed number of schools will then be selected with probability proportional to size . If there are a few extremely large schools in the selected areas these schools will be subdivided into two or more"blocks" .

DIFFERENT OUT OFF POINTS

Usually induration of 10mm and over are considered to be specific for past infection with M. tuberculosis . The prevalence of infection is then calculated by taking all subjects with induration of 10mm and over as numberator and the total of all subjects tested as denominator .

TECHNIQUE OF TESTING AND READING

The tuberculin test is carried out with 2 TU Ppd Rt 23 with Tween 80 added as ostablizing diluet . The tuberculin used was from the stock solution prepared by the Statens Seruminstitute , Copenhagen . The dilution prepared by National Health Research Institute, in Addis Ababa .

PPD TEST PROCEDURE

Special syringe 1ml, graduated in hundreths of a mililiter and used with 25 or 26 gauage 10mm long, disposable needles .

The needle point is inserted in the superficial layer of the skin of the forearm while the skin is lightly stretched in the direction of the needle and length wise of the arm . The syringe is held by the barrel only and the plunger is not touched until the needle has been satisfactorily inserted . The volume of 0.1ml is slowly injected, and the finger removed from the end of the pulnger before the needle is withdrawn (22) . This will result in a 3 - 5ml diameter a that anaemic weal .

MEASUREMENT OF REACTION AND RECORDING

The test is read (examined) 72 hours after it has been given . The reading is limited to single aspect of the reaction , viz. the induration . The test is carfully palpated and if an induration is present its limits are determined and its transvers diameter (transverse relative to the arm) is measured in milimeters . Transparent firm rulers with milimeter graduation used for measurement .

The widest transverse diameter of the induration is recorded in milimeters . If there is no palpable induration , "0" is recorded . The results were recorded on the individual study paper .

MEASUREMENT OF NUTRITIONAL STATUS

The relationship between weight and hight which can only determine the present nutritional status without any reference to possible past episodes of malnutriton (WHO) .

To facilitate the calculation for the overall prevalence (all ages and both sexes combined) , of malnutrition was defined as : the number of children in the population falling below the median -2Sd ., by comparison with the reference population . The chosen cut-off point in our case is 2 standard deviation or more below the median weight for height of the reference population .

PERCENTAGE WEIGHT FOR HEIGHT DISTRIBUTION

Between -1 SD and median	Between -2 SD and -1 SD	Below -2 SD
30.4	34.3	13.7%

APPENDIX - B

CALCULATION OF AVERAGE ANNUAL RISK OF INFECTION

Positive tuberculin subjects with diameter 10mm or more will be be considered and the risk of infection is calculated as follows .

1. The age range 7 - 14 years
2. Mean age 10 years
3. Let P = Proportion of tuberculosis positive due to TB infection
4. If i = The average annual risk of infection

Then : Probability (not infected in 1 year) $= 1 - i$

Probability (infected in 10 years) $= 1 - (1 - i)^{10}$

From 3; Proportion of tuberculosis positives $= 1 - (1 - i)^{10}$

Therefore

$$1 - P = (1 - i)^{10}$$

$$P = .1263$$

$$1 - .1263 = (1 - i)^{10}$$

$$.8737 = (1 - i)^{10}$$

$$(1 - i) = \sqrt[10]{.8737}$$

$$(1 - i) = (.8737)^{1/10}$$

$$i = 1-.9865$$

$$i = .0135$$

$$i = 1.35\ \%$$

APPENDIX

Estimating the Risk of Infection from Prevalence Data (6)

Methods of estimation

The relationship between the prevalence of infection, that is , the proprtion of a cohort which has been infected by a particular age , and the annual risk of infection to which that cohort has been subject, is basically a simple one . It is most easily expressed in terms of the qualities which are complementary to the prevalence of infection and the risk of infection, namely the proportion of the cohort which has remained uninfected and the annual risks of escaping infection . The relationship is that the proportion of the cohort which is still uninfected by a particular age is equal to the product of the annual risks of escaping infection experienced by the cohort up to that age .

This relationship may readily be used to determine the average annual risk of infection in a cohort, from a prevalence figure at a particular age . However, it is considerably more complicated to discover more about the variations in the annual risk (in particular from year to year and from one age to another), and thus to reconstruct the series of estimates of the annual risks of infection actually

experienced by the cohort. This is possible only if other prevalence figures are available for the same representative section of the population, at different times and at differeng ages . Moreover, the extent to which variations in the risk of infection can be quantified depends closely on the nature, as well as the extent , of the additional information .

APPENDIX - C

STUDY No

YIFATNA TIMUGA AWRAJA

TUBERCULOSIS INFECTION RATE STUDY

INVESTIGATION FORM

1 - WOREDA _____ KEBELE _____

2 - NAME OF SCHOOL _____

3 - NAME OF STUDENT _____

4 - AGE _____ Yrs SEX _____ M / F

5 - ETHINCITY _____

6 - WEIGHT _____ Kg wt/ht _____ SD

7 - HEIGHT _____ Cms

8 - BCG SCAR _____ Y/N

9 - MANTOUX REACTION SIZE _____ mm

10- ADDITIONAL CHARACTER OF INDURATION _____

11- DATE OF TESTING _____

12- DATE OF READING _____

13- DISTANCE OF HEALTH INSTITUTION FROM YOUR RESIDENCE _____ Km

14- DO YOU DRINK COWS MILK ? _____ Y/N

BOILED _____ RAW _____

15- HOW MANY PERSONS ARE LIVING IN YOUR HOUSE _____ (FAMILY SIZE)

16- IS THERE ANY ONE WHO HAS COUGH FOR A LONGER PERIOD (1 MONTH) IN YOUR HOUSE _____ Y/N

APPENDIX - D

LIST OF ELEMENTARY SCHOOLS
IN THE DISTRICT WITH
ACCUMULATED TOTALS

No	NAME OF SCHOOL	ENTRANTS	ACCUMULATED TOTAL
1	Effesson No 1	935	935
2	Effesson No 2	618	1553
3	Senbete Sch.	494	2047
4	Karamara Sch.	679	2726
5	Jewha Sch.	398	3124
6	Bergibe Sch.	772	3896
7	AlalaAman Gebeya	385	4281
8	Abalo Feres	418	4699
9	Meskelber	540	5239
10	Magna	215	5454
11	Zenbo	141	5495
12	Negesso	349	5944
13	Dullet	159	6103
14	Sellelo	192	6295
15	Bette	171	6466
16	Wutage	186	6652
17	Yemelo	230	6882
18	Lulgeseret	147	7029
19	Falma	117	7146
20	Lugo	134	7280

No	Name of school	Entrant	Accumulated Total
21	Abeye	1564	8844
22	Armanya	798	9642
23	SholaMeda	361	10003
24	RasaGoba	191	10194
25	Sengota	268	10462
26	Shotel Amba	284	10746
27	MamiAmaba	229	10975
28	Kedebura	123	11098
29	Waylo	129	11270
30	Medina	147	11347
31	Kureberet	88	11462
32	Giltebert	198	11660
33	Guenet	300	11960
34	Robi	1408	13368
35	Zutti	478	13816
36	Kobbo	324	14170
37	Terre	353	14523
38	Kewot	350	14873
39	Yellen	283	15156
40	NefesonaGossa	353	15509
41	Arada	211	15720
42	Wokifle	195	15915
43	Wonberya	59	15915
44	Dorasemet	223	16169

No	Name of School	Entrants	Accumulated Totals
45	Wosen Kerker	136	16333
46	Balche	202	16535
47	Ayaber	183	16718
48	Majete	822	17540
49	Ankar	172	17712
50	Daniso	175	17887
51	Addis Alem	267	18154
52	ZoneAmba	141	18295
53	Chere	151	18446
54	EdoMedine	246	18692
55	Safra	140	18832
56	Muachera	175	19007
57	Degoche	78	19085
58	Kabina Saramba	193	19278
59	Dingay Mezge	284	19502
60	Shasho Addis Amba	74	19636
61	Jarra	63	19699
62	Odabella	120	19819
63	Bekeja	102	19921
64	Gefram	330	20251

VIII

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DECLARATION

I, the undersigned, declare that this thesis is my work and that all cources of material used for this thesis have been duly acknowledged .

Name Dr. Yitades Gebre

Signature

Place Addis Ababa

Date of Submission