AN INVESTIGATION OF HYPERTENSION IN A SLUM OF NAKHON RATCHASIMA

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Abstract. There is evidence that Thai people living in slums may be at high risk of developing hypertension. The present study was undertaken on a random sample of 1,000 subjects aged 20 and over living in a slum in Muang district of Nakhon Ratchasima during 1 February to 31 may 1988. This study consisted of measurements of blood pressure and body build, with administration of an interview on demographic characteristics, sociocultural factors and food frequency patterns. The results were based on 804 respondents. It was found that the prevalence of hypertension was 16.9%, nearly half of the hypertensives being mild cases. Only a low proportion of the proven cases was both aware of their condition and receiving treatment. About one fifth of the treated cases had blood pressure under 160 mm Hg systolic and 95 mm Hg diastolic.

Based on these findings, it is concluded that these slum inhabitants are at high risk of developing hypertension. Community interventions are needed in order to prevent complications related to hypertension. Health education aimed at increasing community awareness of hypertension should be a major component of the community intervention.

INTRODUCTION

Hypertension is a major risk factor for cardiovascular diseases such as myocardial infraction and congestive heart failure. It is also a major risk factor for cerebrovascular disease, such as stroke. Globally, hypertension is a frequent and almost ubiquitous health disorder, prevalent in both developed and developing countries (WHO, 1983; Hatano, 1980).

Control of high blood pressure at the community level through pharmacologic and non-pharmacologic approaches has also been under investigation. The North Kaleria Project (Puska *et al,* 1981) in Finland and the Minnesota Heart Health Program (Blackburn *et al,* 1985) in the United States are examples of studies in this area.

However, very few studies on prevalence, risk factors and community intervention trials have been carried out in developing countries. In Thailand there have been a number of studies investigating the prevalence of hypertension (Achananuparp *et al,* 1989; Sitthi-Amorn *et al,* 1989; Jaroonvesama *et al,* 1980; Leelarassamee *et al,* 1978; Viseshakul *et al,* 1979). There are fewer studies examining risk factors (Sitthi-Amorn *et al,* 1989; Hathirat *et al,* 1980; Suvachittanont *et al,* 1983; Hathirat *et al,* 1983). As yet, there has been only one study on the prevalence of hypertension among slum residents, a group considered to be expectedly at high risk (Sitthi-Amorn *et al,* 1989). This particular study showed an unusually high prevalence (17%) compared to other studies (less than 12%) (Achananuparp *et al,* 1989; Jaroonvesama *et al,* 1980; Leelarassamee *et al,* 1978; Viseshakul *et al,* 1979) in different settings in Thai communities.

The objectives of this study were to investigate adults aged 20 and over living in slums of the Muang district of Nakhon Ratchasima Province in order to (1) estimate the prevalence of hypertension, (2) describe disease awareness, treatment

and the control of hypertension and (3) investigate potential risk factors for hypertension. This report will address the results related to the first and the second objectives.

Nakhon Ratchasima, where the present study was carried out, is the largest province of the northeastern region of Thailand in terms of area (12,800,000 rai or 82,193 km^2) (National Statistical Office, 1987). The population of 2.3 million is second only to Bangkok, the capital city. Administratively, the province is divided into 23 districts; the center of the province is Muang district which is subdivided into an urban area and a suburban area. Even though the total population of both areas is similar, the population density of the urban area (5161 per km^2) is nearly 20 times that of the suburban area (Nakhon Ratchasima Provincial Health Office, 1988).

Taking socioeconomic characteristics into account, 1.6 million people of this province were of working age and only a small fraction of them (1.4%) was unemployed. Most of the population (85%) worked in the agricultural sector and the remainder worked in the commercial and industrial sectors.

Regarding health statistics, cardiovascular mortality ranked highest among the top seven leading causes of death of Nakhon Ratchasima during 1985-1987 classified by the ICD-9 (Nakhon Ratchasima Provincial Health Office, 1988).

Table 1

Health service facilities of Nakhon Ratchasima.

Type	No. of beds	number
Hospital		
Regional	1000	1
Psychiatric	150	1
Military	400	1
	40	1
District	60	4
	30	6
	10	9
Private	150	1
	100	1
	≤ 50	5
Private clinics		171
Pharmacies		474
Health centers		264

To understand how health problems are handled, information about the health care facilities of Nakhon Ratchasima is presented in Table 1 showing the distribution of hospitals, clinics, pharmacies and health centers across the province (Nakhon Ratchasima Provincial Health Office, 1988). All private hospitals except one was in the urban area of Muang district. This was also the case for most private clinics, most pharmacies and nearly all other hospitals, except the district hospitals.

The study area comprised 8 slums scattered around the commercial zone in the urban area of Muang district. Based on a 1986 household survey (Nakhon Ratchasima Municipality Office, 1988), there were 16,368 residents, 7,683 of them aged 20 years and over, living in 2,287 households throughout the 8 slums. The biggest slum comprised more than 2,000 people, the medium slums about 1,000 and the smallest slums less than 500.

Most of the slums were crowded in blocks along a road. Two of them formed clusters beside the Lam Takhong River which passes through the northern part of Muang district. Half of these slum clusters are more than 30 years old and the other half are between 15 to 20 years. There are usually only 1 or 2 entrances to each slum. Within each slum, there are usually houses on both sides of a main path which is connected to the main road.

Each house was built of wood with a single floor raised about 1-2 meters above the ground and had a corrugated zinc roof. There was usually one or two rooms in each house. Underneath each house, it was dark and filled with sewage and swamp water, with many mosquitos. Mostly, slum residents rent the houses and land and some built their own houses on rented land. Except for those living in the biggest slum, most owned their own land. Piped water was available to every household. The slum residents were mostly poor, living on wages and salaries. Most of them were laborers and a number of them sold food or other goods in stalls at markets. Their working hours usually started at 7 am and lasted until late in the evening, 6-7 days a week. Gambling and consumption of

alcohol were common practices even though nearly all the people were Buddhists. Formally, there was one community committee appointed by popular vote, and a number of health volunteers for each slum. Transportation between the slums and the outside was made by bus, tricycle or motored tricycle. The bus fare was 2 baht per trip within Muang district; by tricycle or motor tricycle to the regional hospital, the fare varied from 15 to 50 baht per trip (daily income was less than 80 baht).

MATERIALS AND METHODS

The present study is a cross-sectional community survey undertaken from 1 February to 31 May 1988. At the beginning, the director of the Department of Social Medicine of the regional hospital to whose jurisdiction the study area belonged was contacted and requested to provide the relevant information and necessary contact with the community. Then the community leaders and health volunteers were informed about the study and were asked to support it.

Before the actual data collection commenced, community members were informed about the study and asked to participate. Two qualified nurses, who had been working in the study area for at least 2 years, were selected from the Department and trained to collect the data.

A pilot study was undertaken to test the feasibility and validity of the data collection procedures. This involved a convenient sample selected from a number of arbitrarily chosen households in the suburb of Muang district. Special emphasis was put on the clarity and specificity of the interview schedule.

Based on the findings of the pilot study, it was decided that the appropriate time to conduct the survey was around 5-7 pm on weekdays and 7-10 am on weekends in order to maximize the chance of seeing the people at home.

All adults of aged 20 and over living in a house were eligible subjects for the study. The sampling units were individual houses in the slums. The total number of households in each slum formed the sampling frame. Systematic random sampling was undertaken to draw household samples from each slum in proportion to the total number of households. This resulted in 298 household samples with 1,000 eligible subjects. Eight hundred and four of them participated in the study, a responding rate of 80.4%.

The actual data collection comprised appointment visits, data collection visits and referral of detected cases. One week before the data collection, the sampled households in the slum were visited by the nurses. They asked all adults of the specified age range in each household to participate in the study; pregnant women past the first trimester were not included. On the following week, the nurses visited selected households in the evening between 4.30 pm and 7.00 pm (after working hours) and also on Sunday morning between 10.00 am and 12.00 noon. Each of them collected the data on each subject in the following way : (1) identified and introduced herself to the subject, (2) created a friendly atmosphere and explained the data collection steps to the subject, (3) measured blood pressure of the subject, (4) made anthropometric measurements, (5) interviewed the subject. Every detected hypertension case in this study was advised to see his/her doctor as soon as possible.

An autoinflating digital blood pressure monitor (Healthcheck) was used to measure blood pressure in order to minimize inter-and intra-observer variations. The blood pressure measurement was undertaken according to the protocol shown in Appendix II. The autoinflating blood pressure monitor was calibrated against a standard sphygmomanometer at weekly intervals and its power supply was replaced twice weekly to ensure accurate reading throughout the period of the survey. A digital balance was used for measuring body weight. An interview schedule was used to collect data about demographic, socioeconomic and food frequency patterns.

The average systolic and diastolic blood pressure for each individual subject was determined by averaging all three readings.

Definitions of hypertension

Three groups of individuals were considered as hypertensive for the purpose of the study. First, those with an average diastolic blood pressure (DBP) of 95 mmHg or greater regardless of the magnitude of systolic blood pressure (SBP); second, those with an exclusive average SBP of 160

mmHg or greater; third, those with DBP of less than 95 mmHg or SBP of less than 160 mmHg but reporting that they had been informed by a doctor that they were hypertensives or were taking antihypertensive medication at the time of survey.

Prevalence of hypertension

On estimating the prevalence of hypertension, the first and second criteria mentioned above were applied to the subjects. This resulted in two groups of cases which were combined to form a total number of cases. Then the number of cases was divided by the number of respondents to yield the prevalence of hypertension for this community.

Severity of hypertension

To estimate the proportion of the different degrees of severity of hypertension, only the first criterion was used to define cases. Those whose average DBP ranged from 95 to 104 mmHg, 105 to 114 mmHG, and 115 mmHg or above were subclassified into mild, moderate, and severe hypertensives, respectively. The proportion of each subcategory was then calculated as a percentage.

Disease awareness, treatment and control status

To estimate the proportion of disease awareness, the denominator was defined by all the criteria mentioned in the definitions of hypertension. The numerator was the number of those cases reporting that they had been informed by a doctor that they were hypertensives.

To estimate the proportion of treated cases, the denominator was the numerator for estimating the proportion of disease awareness. Those reporting current use of antihypertensive medication were difined as treated cases (the numerator).

Similarly, the numerator for estimating the proportion of treated cases was the denominator for estimating the proportion of treated cases whose blood pressures were under sufficient control. Those whose SBP or DBP below 160 mmHg or 95 mmHg respectively were defined as under sufficient control (numerator). The proportion of each group was then calculated.

A 95% confidence interval was calculated using the method described by Gardner and Altman (1990) where appropriate. Chi-square test (Dunn, 1977) was carried out to determine the significance of prevalence difference among various age-groups.

RESULTS

The target population of this study was slum inhabitants aged 20 and over, estimated to be 7,683 in number who were living in approximately 2,287 households (Nakhon Ratchasima Municipality Office, 1988) within 8 slums in the urban area of the Muang district of Nakhon Ratchasima Province.

From the 2,287 households, 298 households were drawn by systematic random sampling. There were 1,000 persons aged 20 and over living in the selected households. Eight hundred and four of them participated in the study. As a result, the responding rate was 80.4%.

Fig 1 depicts the age distribution of the respondents which is skewed to the left. Body mass index distribution is shown in Fig 2; this also is skewed to the left. The distributions of income and education (Fig 3 and Fig 4, respectively) suggest that the respondents came from low socioeconomic groups. The sex ratio of males to females was 1 : 1.5 among the respondents.

Prevalence of hypertension

Regarding prevalence of hypertension, definition 1 and 2 were employed to define subjects. By these criteria, 136 respondents were classified as hypertensives. Consequently, the prevalence of hypertension was estimated to be 16.9% with a 95% confidence interval between 14.3% and 19.5%.

Further analysis of the prevalence of hypertension in relation to age-groups revealed a steadily increasing trend of hypertension towards older age-groups in a statistically significant fashion ($p < 0.0001$, Chi-square = 104.7, df = 6; see Fig 5).

Since a single arm cuff size was used throughout the study, over estimation of blood pressure was expected to occur among overweight and obese subjects. In order to appreciate the extent of biases resulting from this limitation, prevalence estimation upon subjects (624) with body mass

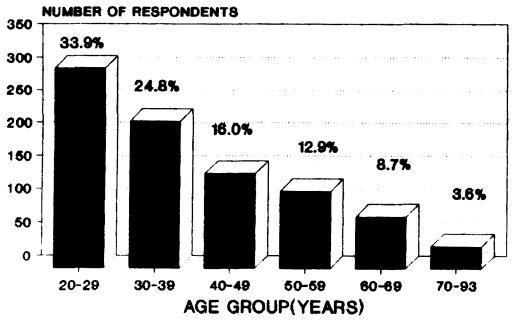

Fig 1—Age group distribution of the respondents.

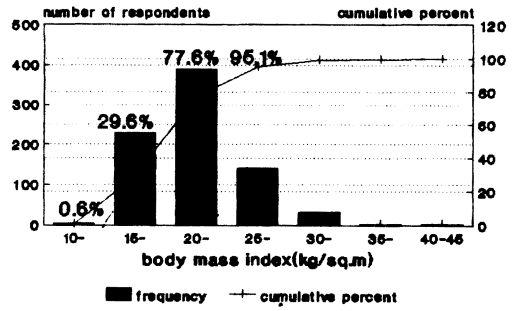

Fig 2—Body mass index distribution of the respondents.

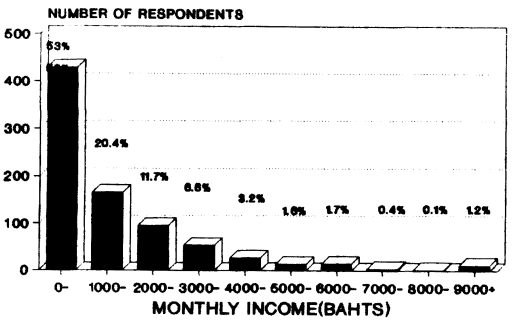

Fig 3—Income distribution of respondents.

index lower than 25 kg/m^2 was carried out. It was found that the prevalence in these subjects was 14.1% with a 95% confidence interval between 11.2% and 16.8%.

Severity of hypertension (diastolic)

With regard to severity of hypertension, definition 1 was employed to define the subjects. As a result 134 respondents with an average DBP of 95 mmHg or over were classified as hypertensive.

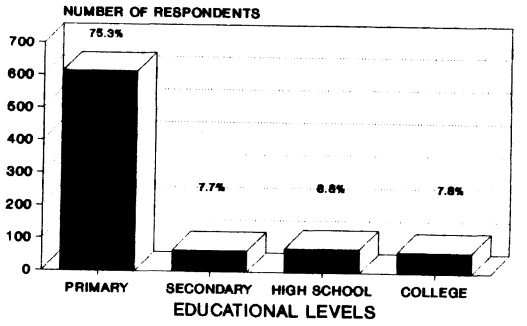

Fig 4—Educational levels of respondents.

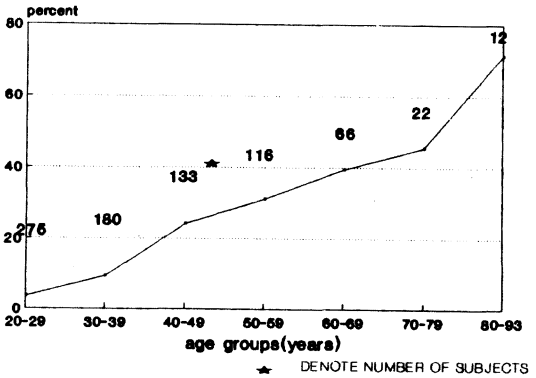

Fig 5—Prevalence of hypertension by age group.

The proportions of mild (DBP = 95-104 mmHg), moderate (DBP = 105-114 mmHg), and severe (DBP > 114 mmHg) diastolic hypertension were calculated and these are summarized in Table 2.

Among the 134 cases, mild hypertensives were the most common (45), though 36% had moderate hypertension, and there were substantial numbers (19%) of severe hypertensives.

Awareness of hypertension

For the examination of awareness of hypertension, hypertensives included (a) the 136 cases classified in (1); (b) those with DBP of less than 95 mmHg or SBP of less than 160 mmHg but reported to be informed by a doctor that they had high blood pressure, and (c) those who were taking antihypertensive medication at the time of survey with a lower blood pressure. In particular, those subjects in categories (b) and (c) were considered to be aware of hypertension.

Table 2

Proportions of diastolic hypertension classified by severity.

Severity of hypertension	No. of subjects	%
Mild (DBP = 95-104 mmHg)	60	45
Moderate (DBP = 105-114 mmHg)	45	36
Severe (DBP > 114 mmHg)	26	19

Fig 6 depicts the proportion of hypertensives (a) who were aware of their illness, (b) who were not only aware of their illness but also taking antihypertensive medication at the time of the survey and (c) who were aware and were taking the medication and whose SBP was below 160 mmHg or DBP below 95 mmHg.

From the data in Fig 6, less than one third of all the hypertensives were aware of their illness and among those who were aware, only one fifth were under treatment at the time of the survey. Additionally, only one fifth of the currently treated cases had SBP less than 160 mmHg or DBP below 95 mmHg.

To shed more light on the nature of the awareness of hypertension, chi-square test was performed to test the relationship of sex and the awareness (Table 3). It was found that women tended to be more aware of hypertension than men although there was no statistically significant difference between sexes (Chi-square = 0.5, p = 0.48).

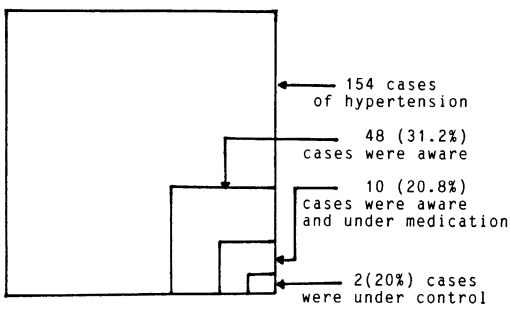

Fig 6—Disease awareness, treatment and control status among hypertensives.

Table 3

Disease awareness among hypertensives by sex.

	men		women	
	No.	%	No.	%
Aware	15	26.5	33	33.7
Unaware	41	73.2	65	66.3
Total	56	100	98	100

DISCUSSION

The present study was undertaken on a random sample of 1,000 subjects aged 20 and over living in a slum in Muang district of Nakorn Ratchasima between February 1 and May 31, 1988. The results were based on 804 respondents. It was found that the prevalence of hypertension of the study population was 16.9%. Nearly half of the hypertensives were mild cases. A very low proportion of the detected hypertensives was both aware of their condition and receiving treatment. A detailed discussion of these findings follows.

In the present study, the prevalence of hypertension was estimated to be 16.9%. This was similar to the finding (17%) of the Chitr *et al* (1989) study but higher than those (6-11%) of other reports in Thailand (Achananuparp *et al,* 1989; Jaroonvesama *et al,* 1980; Leelarassamee *et al,* 1978; Viseshakul *et al,* 1979). However, a direct comparison with earlier studies is difficult because most of them used non-random samples and populations with different age structures and different criteria of hypertension compared to the present study.

What major biases may have influenced the present estimate of prevalence? Based on 95% confidence limits of 14.3 and 19.5%, the problem of reliability of the result can be regarded as minimal. However, since the prevalence was based on a single casual blood pressure measurement, the problem of regression to the mean is likely. In addition, using an automated blood pressure monitor with a fixed arm-cuff size can give an over estimation of blood pressure in overweight

(BWI = 25-30 kg/m^2) and obese subjects (BMI > 30 kg/m^2) who comprised 22.4% of the respondents. Therefore, the prevalence of hypertension found by the present study appears to be somewhat higher than the true prevalence. The prevalence estimation in the non-obese subjects shows a figure of 14.1% (95% CL : 11.2%-16.8%) which is slightly lower than the overall prevalence (16.9%). The finding of this study is thus in agreement with the comparable study of Chitr *et al* (1989) suggesting that the urban poor or slum residents in Thailand are likely to be at high risk of developing hypertension. This clearly has important implications for health planners since the urban slum populations of Thailand are increasing. Several specific recommendations will be made as a consequence of this finding.

An important point of the present study was to investigate the awareness and treatment practices of the population. The data show that there was a very low proportion of the hypertensive subjects (154 cases) who were aware of their condition (31.2%) or whose condition was under treatment (20.8%) or well controlled (20%). These proportions were well below the rule of halves shown by many studies in western society (Wilhelmsen, 1973; Wilber, 1972). However, these results were very similar to that found by Chitr *et al* (1989), the only broadly comparable study to the present one.

Since the availability of health services in the present study area is higher than those in rural areas, it is surprising to find that the proportion of awareness of the hypertensives in the present study was nearly half of that reported by Achananuparp *et al* (1989) in a rural community.

This difference in awareness can hardly be explained by differences in case definition between these studies since the same definition was used in both studies. However, it may be explained by different techniques of data collection.

The present study employed two nurses to interview the respondents. These nurses had worked in the study area for at least two years. As a consequence, they were more familiar with the local people. Those interviewers used by the Achananuparp study had not previously worked in the study area. Courtesy bias may thus be more likely to occur in the latter than in the present study. The result of this bias could be an over reporting of awareness and treatment by respondents.

Despite these differences, there was an agreement between the present study and the Achananuparp *et al* (1989) study on the proportions of awareness between sexes, that is the male proportion was half of the female. This finding of the difference in awareness between males and females also confirmed the evidence of other studies in other countries (Schoenberger *et al*, 1972; National Center for Health Statistics, 1977). One possible explanation for the lower awareness of hypertension in men is that their work precludes their accessibility to health services. It is in the light of this knowledge and rationale that several worksite programs for hypertension control have been developed (Alderman and Davis, 1976; Alderman and Melcher, 1983). In fact, this strategy has been shown to be effective for controlling hypertension among middle-aged men who belong to a high-risk, difficult-to-reach group (Alderman and Davis, 1976; Alderman and Melcher, 1983). The sex difference in awareness found by the present study supports the rationale to investigate the feasibility and effectiveness of a hypertension control program developed for worksites in Thai settings.

The proportion of the hypertensives found to be under antihypertensive medication in the present study (20%) was somewhat lower than the proportion of 30% found by the Achananuparp *et al* (1989) study, but a little higher than that (13%) of the Chitr *et al* (1989) study. However, this strict comparison may not be valid since the estimates of awareness and treatment status of all three studies were based on small samples. In summary, the findings confirm the very low level of disease awareness and treatment status of the hypertensives in this community. The implications of this for public health programs are important and suggest the need to develop systematic and efficient programmes for screening and educating people in high risk communities.

Nearly half the hypertensives detected in this study were mild hypertensives : this was somewhat lower than the proportion reported by the Chitr *et al* study (1989). This finding has a significant implication for public health. Based on the findings of the British Whitehall study (Rose, 1981), most cases, and many excess cases of coronary heart disease and cardiovascular disease attributable to hypertension occur in mild hyper-

tensives. Rose (1981) estimates that the effect of a reduction in the blood pressure mean and distribution of only 2-3 mmHg would be equivalent to the effect of all current medical antihypertensive management.

With respect to the control of mild hypertensives, non-pharmacological treatment has been shown to be beneficial to the control of their blood pressure (Patel, 1975a; Patel, 1975b; Patel and North, 1975). Moreover, pharmacological treatments have been implicated in compromising the quality of life via side effects (Veteran Administration Cooperative Study Group on Antihypertensive Agents, 1967; Veteran Administration Cooperative Study Group on Antihypertensive Agents, 1970; Hypertension Detection and Follow-up Program Cooperative Group, 1979a,b). There is, thus, a need to study the possibility of employing non-pharmacological treatment alone or in combination with an effective drug in controlling mild hypertension.

As expected from the lower proportion of mild hypertensives in the present study, the proportion of severe hypertension in the present study (19%) was higher than that (11%) of the Chitr *et al* (1989) study. The most likely explanation is that the present study employed a single casual measurement of blood pressure with a single-size arm cuff as discussed above.

Another explanation is the effect of selection bias by which persons with high blood pressure were more likely to be included in the present study. However, the possibility of this selection bias in the present study is unlikely since it was shown that very few hypertensive subjects were aware of their hypertension.

Nevertheless, the study indicates that there is a very large group of people with serious levels of blood pressure, and so at considerable risk of serious cardiac and cerebrovascular complications, as well as a large group with mildly raised blood pressure and with the potential for serious problems in the future.

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