CHAPTER IV

RESULTS

1. Background

A cross sectional study was conducted to investigate whether the use of biomass fuel (wood) for household cooking or heating is associated with increased risk of acute respiratory infection (ARI) and respiratory symptoms among children under 5 years of age. In this study, 180 mothers from four health centers at Thimphu were interviewed. Data were collected by standardized questionnaire interview from 5th February to 3rd March 2005. The interviewees were all mothers attending mother and child clinics at four health centers. Both urban as well as rural area have three health centers each. Two health centers were selected from urban (mostly unexposed) by simple random sampling and two health centers were selected purposively from rural (mostly exposed) (the third rural center is very inaccessible). All two hundred and eleven children (211) children aged 0-5 years were included in this analysis, even though only 180 mothers were interviewed. Information on specific mothers was not recorded in the analytical dataset, so it was not possible to conduct analysis for 180 children of 180 mothers (only one child per mother). In this analysis, the main cooking or heating fuel was grouped into two groups-biomass fuel (wood) and cleaner fuels (gas, electricity and liquid petroleum gas). Descriptive statistics (such as frequencies, percentage, means and standard deviation) were used to describe general characteristics of children and their mothers. Chi-square test was used to test associations between independent and

dependent variables. In this study (p-value less than 0.05) was considered as statistically significant (alpha =0.05). Results are presented in the order indicated immediately below.

1. Characteristics of children
2. Socio-demographic variables of their mother
3. Associations between the independent and dependent variables

2. Characteristics of Children Under Five

2.1 Age and Sex

As shown in Table 1, age ranged from 1 minimum to 59 maximum months. The mean age is 25.32 months. The standard deviation of age is 16.60 months. When the age is categorized into groups, 29.4 % of children were <11 months old, 20.4 % in range of 12 –23 months old and 50.2% were in age category of 24-59 months old. There were somewhat more males than females (55 %and 45 % respectively).

Table 1: Frequency and percentage of children under five by age and gender*

Age Group	Frequency	Percentage	Gender	Frequency	Percentage
0-11 mo.	62	29.4	Male	116	55.0
12-23	43	20.4	Female	95	45.0
24-59	106	50.2			
Total	211	100.0	Total	211	100.0

* Mean age = 25.32 months, standard deviation = 16.60 months

As shown in Table 2,the distribution of number of children ranged from 1 to 3 children. Majority of respondents had 1 child (71.6 %), 25.6%, two children and 2.8% 3 children

Table 2: Frequency and percentage of number of children <5 years in the family

Number of children	Frequency		% of children
	Children	Mothers	
1	151	151	71.6
2	54	27	25.6
3	6	2	2.8
Total	**211**	**180**	**100**

2.2 Other Child Factors

Table 3 shows that 95.3 % of the children were breast-fed. 17.1 % of the children had physician–diagnosed pneumonia and 1.4 % children under age five had physician-diagnosed illness such as asthma, bronchitis, and tuberculosis.

Table 3: Frequency and percentage of child factors with previous history of illnesses

Child's factors	Status	Frequency	Percentage
Breast feeding	No	10	4.7
	Yes	201	95.3
Physician diagnosed illness			
Asthma	No	208	98.6
	Yes	3	1.4
Bronchitis	No	207	98.1
	Yes	4	1.9
Pneumonia	No	207	82.9
	Yes	36	17.1
Tuberculosis	No	208	98.6
	Yes	3	1.4

3. Characteristics of Mother

Mother were described by age, number of children, education and occupation. Table 4 shows that age of mothers ranged from 14 to 49 years. It also showed that 55.0% of children were born to mother age between 24-33 years, 34.1 % to 14-23 years and rest 10.9% to 34-49 age groups.

3.1 Age of mother

Table 4: Frequency and Percentages of mother age

Mother's age	Frequency	Percentage
14-23	72	34.1
24-33	116	55.0
34-49	23	10.9
Total	**211**	**100**

3.2 Education

Table 5 shows that 51.1% were uneducated 17.8% and 12.2% had education up to primary and lower secondary levels and 18.9% had above higher secondary levels.

Table 5: Frequency and Percentage of Education level of mothers

Education Level	Frequency	Percentage
None	106	51.1
Primary level	36	17.8
Lower secondary level	25	12.2
> Higher secondary level	44	18.9
Total	**211**	**100**

3.3 Occupation

Table 6 shows that 59.7 % of mothers were housewife, which represent highest in the study sample and 17.5 % of mothers were farmers. Government services and business formed 18.0% and 4.7 % respectively.

Table 6: Frequency and Percentage of Occupation of mothers

Occupation Level	Frequency	Percentage
Housewife	126	59.7
Government services	38	18.0
Business	10	4.7
Farmers	37	17.5
Total	211	**100**

4. Prevalence of ARI and other Respiratory Conditions

Table 7 gives the prevalence of ARI in last two weeks and other respiratory conditions. ARI was reported in 19.0 % of children under age 5. Illness with cough in last six weeks was accounted for 66.4 % of children. Prevalence of ARI in the last 6 weeks could not be ascertained, due to a logical inconsistency in the questionnaire. Cough and sputum of any duration was reported in 21.8% of children. Wheezing was reported in 28.4% of children.

Table 7: Frequency and percentage of ARI and Respiratory conditions

Conditions	Status	Frequency	Percentage
ARI in last 2 weeks	No	171	81.0
	Yes	40	19.0
Illness with cough in last 6 weeks	No	71	33.6
	Yes	140	66.4
Cough &Sputum (any duration)	No	165	78.2
	Yes	46	21.8
Wheeze	No	151	71.6
	Yes	60	28.4

5. Environmental Features

Table 8 shows that 28.0 % used wood for cooking and 46.9% used wood for heating and 49.8% used wood for cooking or heating and 52.6% had separate kitchen. About 11.4 % of mothers had smoked in the past and 2.8 % mother smoked during pregnancy. And 3.8% mother smoked during first year of child's life, 28.9 % of other family members smoked in first year of child's life and 31.3 % smoked in last five

years.35.5 % of family members ever smoked. In all, 35.5 % of family members including mother of child ever smoked.

Table 8: Frequency and Percentage of Environmental factors

Environmental factors	Status	Frequency	Percentage
Wood for cooking	No	152	72.0
	Yes	59	28.0
Wood for heating	No	112	53.1
	Yes	99	46.9
Wood for cooking or heating	No	106	50.2
	Yes	105	49.8
Separate kitchen	No	100	47.4
	Yes	111	52.6
Chimney	No	151	71.6
	Yes	60	28.4
Ever smoked by mothers	No	187	88.6
	Yes	24	11.4
Maternal smoking (during pregnancy)	No	205	97.2
	Yes	6	2.8
Maternal smoking (in 1st year of child's life)	No	203	96.5
	Yes	8	3.8
Other family members smoke in 1st t year of	No	150	71.1
child's life	Yes	61	28.9
Other family members (smoked last 5 years)	No	145	68.7
	Yes	66	31.3
Smoking by anyone ever	No	136	64.5
	Yes	75	35.5

6. Tests of Associations Between Independent Variables and Dependent Variables

In this study the only biomass fuel used was wood. Wood was used in some homes for cooking and in some homes for heating. The independent variables of main interest were therefore"wood for cooking, "wood for heating," and " wood for heating or cooking." The four dependent variables were ARI in the last 2 weeks, illness with cough in the last 6 weeks, presence of cough and sputum of any duration, and wheeze.

6.1 Association between Independent variables and ARI in last 2 weeks

Table 9 summarizes chi-square tests of association of ARI in last 2 weeks with the 3 main independent variables mentioned above and with other independent variables (potentially confounding factors). Wood used for cooking, wood heating and wood used for cooking or heating was not found associated with ARI and this was not statistically significant for any of the three main independent variables (p-value at least 0.213). Presence of chimney was associated with statistically significantly increased ARI frequency (p=0.029). Age of child was not statistically significant (p-value 0.428). The number of children under five was negatively associated, and marginally statistically significant (p-value 0.089). Gender was not statistically significant with ARI (p-value 0.157). Education was not found associated and was not statistically significant (p-value 0.307). Mother's occupation was marginally associated and statistically significant (p-value 0.086). Higher education and occupation was associated with lower illness frequency. Smoking was not found to be statistically significant (p-value-0.774). Location was not found statistically significant (p-value-0.321)

Table 9: Chi-square test of association of independent variables and ARI in last 2 weeks

Variables	Status	ARI		Total	$\chi 2$	P-value
		Yes (%)	No (%)			
Wood for cooking	No	32(21.1)	120(78.9)	152(100)		
	Yes	8(13.6)	51(86.4)	59(100)	1.553	.213
Wood for heating	No	23(20.5)	89(79.5)	112(100)		
	Yes	17(17.2)	82(82.8)	99(100)	.387	.534
Wood (cooking or	No	23(21.7)	83(78.3)	106(100)		
heating)	Yes	17(16.2)	88(83.8)	105(100)	1.041	.307
Chimney	No	23(15.2)	128(84.8)	151(100)		
	Yes	17(28.3)	43(71.7)	60(100)	4.797	.029
Age of child	0-11	15(24.2)	47(75.8)	62(100)		
(months)	12-23	8(18.6)	35(81.4)	43(100)		
	24-59	17(16.0)	89(84.0)	106(100)	1.698	.428
Number of children<	1	33(21.9)	118(78.1)	151(100)		
5 years old	>1	7(11.7)	53(88.3)	60(100)	2.901	.089
Gender	Female	14(14.7)	81(85.3)	95(100)		
	Male	26(22.4)	90(77.6)	116(100)	2.003	.157
Mother's education	No	23(21.7)	83(78.3)	106(100)		
	Yes	17(16.2)	88(83.8)	105(100)	1.041	.307
Mother's occupation	Lower	35(21.5)	128(78.5)	163(100)		
	Higher	5(10.4)	43(89.6)	48(100)	2.950	.086
Smoking by anyone	No	25(18.4)	111(81.6)	136(100)		
ever	Yes	15(20.0)	60(80.0)	75(100)	.082	.774
Location	Urban	31(20.7)	119(79.3)	150(100)		
	Rural	9(14.8)	52(85.2)	61(100)	.987	.321

6.2 Association between Independent variables and illness with Cough in last 6 weeks

Table 10 summarizes chi-square tests of association of illness with cough in last 2 weeks with the 3 main independent variables mentioned above and with other independent variables (potentially confounding factors). Wood used for cooking, for heating and wood used for cooking or heating was found positively associated with illness with cough in last 6 weeks this was statistically significant with the 3 main independent variables (p value at least=0.011). Chimney was not associated (p-value 0.701). Age of the child was not associated and not statistically significant (p-value 0.432). The number of children under five was negatively associated and statistically significant (p= 0.012). Gender was associated and found marginally statistically significant with cough frequency (p-value 0.07), with higher frequency in males than females. Mother's education was marginally significantly associated (p-value 0.099). Mother's occupation was found to be statistically significant (p-value 0.042). Higher education and occupation were associated with lower illness frequency. Smoking was positively associated and statistically significant (p=0.012). Location was found to be statistically significant (p-value.006), with higher frequency in the rural area.

Table 10: Chi-square test of association of independent variables and illness with cough in last six weeks

Variables	Status	Cough in last 6 weeks		Total	$\chi 2$	P-value
		Yes (%)	No (%)			
Wood for cooking	No	93(61.2)	59(38.9)	152(100)		
	Yes	47(79.1)	12(20.3)	59(100)	6.499	.011
Wood for heating	No	65(58.0)	47(42.0)	112(100)		
	Yes	75(75.8)	24(24.5)	99(100)	7.392	.007
Wood (cooking or	No	60(56.6)	46(43.4)	106(100)		
heating)	Yes	80(76.6)	25(23.8)	105(100)	9.064	.003
Chimney	No	99(65.5)	52(34.4)	151(100)		
	Yes	41(68.3)	19(31.7)	60(100)	.148	.701
Age of child	0-11	43(69.4)	19(30.6)	62(100)		
(months)	12-23	31(72.1)	12(27.9)	43(100)		
	24-59	66(62.3)	40(37.7)	106(100)	1.679	.432
Number of children< 5	1	108(71.5)	43(28.5)	151(100)		
years old	>1	32(53.3)	28(46.7)	60(100)	6.363	.012
Gender	Female	57(60.0)	38(40.0)	95(100)		
	Male	83(71.6)	33(28.4)	116(100)	3.122	.077
Mother's education	No	76(71.7)	30(28.3)	106(100)		
	Yes	64(61.0)	41(39.0)	105(100)	2.728	.099
Mother's occupation	Lower	114(69.9)	49(30.1)	163(100)		
	Higher	26(54.2)	22(30.1)	48(100)	4.131	.042
Smoking by anyone	No	82(60.3)	54(39.7)	136(100)		
ever	Yes	58(77.3)	17(22.7)	75(100)	6.286	.012
Location	Urban	91(60.7)	59(39.3)	150(100)		
	Rural	49(80.3)	12(19.7)	61(100)	7.508	.006

6.3 Association between Independent variables and Cough and Sputum of any duration

Table 11 summarizes chi-square tests of association of cough and sputum any duration with 3 main variables mentioned above, and other independent variables (potentially confounding factors). Wood used for heating and wood used for cooking or heating was positively associated with illness with cough and sputum and marginally statistically significant (p-value at least 0.07). Presence of chimney was not statistically found significant (p-value 0.132). Age of the child was associated and found statistically significant (p-value 0.001), with higher frequency of illness with cough and sputum in age group of 12 –23 months. The number of children was not associated and was not statistically significant (p-value 0.442). Gender was also not found to be statistically significant (p-value 0.364) Mother's education was not found statistically significant (p-value 0.103). Occupation was not found associated and not statistically significant (p-value0.327). Smoking was not associated and was not found statistically significant (p-value 0.903). Location was not associated and statistically not significant (p-value 0.173)

Table 11: Chi-square test of association of independent variables and Cough and sputum (any duration)

Variables	Status	Cough and Sputum		Total	$\chi 2$	P-value
		Yes (%)	No (%)			
Wood for cooking	No	31(20.4)	121(79.6)	152(100)		
	Yes	15(25.4)	44(74.6)	59(100)	.631	.427
Wood for heating	No	19(17.0)	93(83.0)	112(100)		
	Yes	27(27.3)	72(72.7)	99(100)	3.276	.070
Wood(cooking or	No	18(17.0)	88(83.0)	106(100)		
heating)	Yes	28(26.7)	77(73.7)	105(100)	2.903	.088
Chimney	No	37(24.5)	114(75.5)	151(100)		
	Yes	9(15.0)	51(85.0)	60(100)	2.275	.132
Age of child	0-11	4(6.5)	58(93.5)	62(100)		
(months)	12-23	16(37.2)	27(62.8)	43(100)		
	24-59	26(24.6)	80(75.5)	106(100)	15.019	.001
Number of children	1	35(23.2)	116(76.8)	151(100)		
< 5 years old	>1	11(18.9)	48(81.1)	60(100)	.591	.442
Gender	Female	18(18.9)	77(81.1)	95(100)		
	Male	28(24.1)	88(75.9)	116(100)	.825	.364
Mother's education	No	28(26.4)	78(73.6)	106(100)		
	Yes	18(17.1)	87(82.9)	105(100)	2.660	.103
Mother's occupation	Lower	38(23.3)	125(76.7)	163(100)		
	Higher	8(16.7)	40(83.3)	48(100)	.961	.327
Smoking by anyone	No	30(22.1)	106(79.9)	136(100)		
ever	Yes	16(21.3)	59(78.7)	75(100)	.015	.903
Location	Urban	29(19.3)	121(80.7)	150(100)		
	Rural	17(27.9)	44(72.1)	61(100)	1.853	.173

6.4 Association between Independent variables and Wheeze

Table 12 summarizes chi-square tests of association of wheeze with 3 main variables mentioned above, and other independent variables (potentially confounding factors). Out of three main independent variables as mentioned above, only wood used for cooking was associated with wheeze and found to be statistically significant (p-value 0.014). However, these three main independent variables was positively associated with wheeze frequency. Presence of chimney was statistically not significant (p-value 0.183). Age of child was not statistically significant (p-value 0.376). The number of children under five was not statistically significant (p-value 0.169). Mother's education was found to be associated and was statistically significant (p-value 0.007). Occupation was statistically significant (p-value 0.005). Higher education and occupation were associated with lower illness frequency. Smoking by any one ever was found associated and was statistically significant (p-value 0.014,with higher frequency of illness to those children exposed to smoking. Location was significantly associated with wheeze (p-value 0.025), with higher frequency in the rural area.

Table 12: Chi-square test of association of independent variables and Wheeze

Variables	Status	Wheeze		Total	$\chi 2$	P-value
		Yes (%)	No (%)			
Wood for cooking	No	36(23.7)	11(76.3)	152(100)		
	Yes	24(40.7)	35(59.3)	59(100)	6.032	.014
Wood for heating	No	28(25.0)	84(75.0)	112(100)		
	Yes	32(32.3)	67(67.7)	99(100)	1.385	.239
Wood (cooking or	No	27(25.5)	79(74.5)	106(100)		
heating)	Yes	33(31.4)	72(68.6)	105(100)	.920	.338
Chimney	No	39(25.8)	112(74.5)	151(100)		
	Yes	21(35.0)	39(65.0)	60(100)	1.957	.183
Age of child	0-11	14(22.6)	48(77.4)	62(100)		
(months)	12-23	15(34.9)	28(65.1)	43(100)		
	24-59	31(29.2)	75(70.8)	106(100)	1.957	.376
Number of children	1	47(31.1)	104(68.9)	151(100)		
< 5years old	>1	13(21.7)	47(78.3)	60(100)	1.889	.169
Gender	Female	28(29.5)	67(70.5)	95(100)		
	Male	32(27.6)	84(72.4)	116(100)	.091	.762
Mother's education	No	39(36.8)	67(63.2)	106(100)		
	Yes	21(20.0)	84(80.0)	105(100)	7.309	.007
Mother's occupation	Lower	54(33.1)	109(66.9)	163(100)		
	Higher	6(12.5)	42(87.5)	48(100)	7.754	.005
Smoking by anyone	No	31(22.8)	105(77.2)	136(100)		
ever	Yes	29(38.7)	46(61.3)	75(100)	5.985	.014
Location	Urban	36(24.0)	114(76.0)	150(100)		
	Rural	24(39.3)	37(60.7)	61(100)	5.017	.025