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Original Article

Prevalence of Congenital Anomalies and Non-Communicable Diseases in Women of Age 12-75 Years in District Bhimber, Azad Jammu and Kashmir, Pakistan

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Abstract

Background: The advancement in the healthcare systems, stringent interventions for infectious diseases and improved diet has significantly shifted the patterns of morbidities, and consequently hereditary and congenital anomalies (CA) and non-communicable diseases (NCDs) have emerged as the most common causes of morbidity and mortality. In Pakistan, there is no systematic health surveillance system to assess the impact of such diseases particularly on the young and adult populations.

Methods: In order to glean into the health and morbidity profile of Azad Jammu and Kashmir we have carried out an epidemiological study in Bhimber District in the north-east of Pakistan. A total of 1,731 female subjects of age 12-75 yr originating from Bhimber were recruited through a cross-sectional study.

Results: There were 74 cases (and 15 types) of CA with a prevalence estimate of 42.75/1,000. CA was significantly higher in subjects who were illiterate and married, speaking Pahari language and belonged to rural areas and nuclear families. Additionally, there were 104 cases (and 21 types) of NCDs (prevalence 60.08/1,000). NCDs were observed to have higher prevalence in subjects who were illiterate and married, speaking Punjabi language, and belonged to higher age groups and nuclear families.

Conclusion: This study explores the types and dynamics of morbidity across the major socio-demographic parameters of adult females of Bhimber and would be helpful in estimating the impact of morbidity in this population. A comprehensive country-wide study is the need of the time to identify specific risk factors associated with certain morbidity types and help prioritize areas for interventions.

Keywords: Congenital anomalies, Non-communicable disorders, Epidemiology, Azad Kashmir, Pakistan

Introduction

The advancement in the healthcare systems, stringent interventions for infectious diseases and improved diet have significantly shifted the pattern of morbidities in many parts of the world. Consequently, hereditary and congenital anomalies (CA) and non-communicable diseases (NCDs) which previously contributed only a minor fraction have emerged as the most common causes of morbidity and mortality (1). Health surveillance systems implemented in various countries monitor the impact of such morbidities in the society (2). CA are important to monitor in order to access the genetic load in the populations (3).

Of the estimated 57 million global deaths in 2008, 36 million (63%) were due to NCDs (2,4). Population growth and increased longevity are leading to

a rapid increase in the total number of middle-aged and older adults with a corresponding increase in the number of deaths caused by NCDs. Epidemiological studies have identified a number of risk factors associated with certain NCDs. For instance, behavioral risk factors including tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol, are estimated to be responsible for about 80% of coronary heart disease and cerebrovascular disease (4).

In Pakistan, there is no systematic health surveillance registry for CA and NCDs, particularly among the young and adult population strata (5-6). Better understanding of the epidemiological correlates of morbidities is essential for the intervention programs, planning rational health care strategies, and for estimating any possible future increase due to any associated risk factor (3).

Azad Jammu and Kashmir (AJK) in the north-east of Pakistan is a relatively less developed territory. There is no study available which could show a comprehensive picture of CA and NCDs prevalent in AJK. We have therefore, conducted a study in order to generate base-line information on the morbidity profile of the adult women in Bhimber District of AJK.

Materials and Methods

District Bhimber

Bhimber District of Mirpur Division is the southernmost of the ten districts of AJK (Fig. 1). *Tehsil* Bhimber is the chief town of District Bhimber besides two other tehsils, Barnala and Samahni. More than 85% of its population lives in rural areas. District's population comprises 401 thousand individuals (2009 projections), with an annual growth rate of 2.6% (7). Bhimber has an agriculture/livestock based economy and majority of the rural population is connected with it. Bhimber District is a heterogeneous assemblage of various sub-populations. There are a number of ethnic/caste groups most prominent of which are Jatt, Rajput, Gujjar and Mirza. The primary languages are Punjabi and Pahari, and the literacy rate is 60% which is higher than the adjoining districts (8).

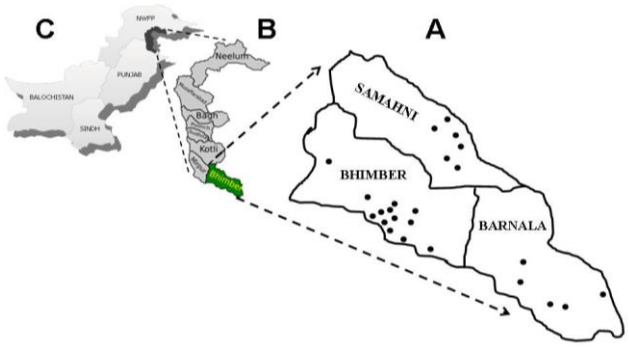

Fig. 1: Map of District Bhimber (A) superimposed on map of Azad Jammu and Kashmir (B) and Pakistan (C). Sampling sites in three Tehsils namely Bhimber, Samahni and Barnala are depicted as dots

Methodology and sample ascertainment

Women comprise approximately 50% of Bhimber's population and play an active role in the agro-based economy of the District. To get an insight into the morbidity profile of young and adult women of Bhimber District a cross-sectional epidemiological study was conducted from February to October 2010. Only the female subjects belonging to Bhimber District and consenting to provide complete information were recruited in the study.

There were a total of 24 different sampling sites encompassing essentially the main towns/villages in the three tehsils of Bhimber District (Fig. 1A). There were 13, 5 and 6 sites from tehsils Bhimber, Barnala and Samahni, respectively.

Each recruited subject was interviewed and physically examined to access the morbidity status. Photographs depicting the phenotypic detail and relevant medical record were obtained from the subjects with any kind of morbidity. Multiple anomalies presented in a subject were accounted for separately. The anomalies were categorized in two broad groups: congenital/ hereditary anomalies (CA) and non-communicable diseases (NCDs). CA were mainly the developmental disorders present since birth while the NCDs had mostly late onset and non-genetic etiologies with no evidence of familial history. CA and NCDs was classified according to the standard medical databases (9-10). Prevalence in married females was estimated in the total sample and was represented as per 1,000

subjects. Confidence intervals (CI) were calculated from the proportion of anomalies in the respective socio-demographic category. Descriptive summaries were generated and the departure from random distributions was evaluated with χ^2 test and Fisher's exact test statistics with 0.05 significance level. Spearman's linear correlation was calculated to assess the relationships between some variables (11).

Results

Data were obtained from 1,731 female respondents belonging to District Bhimber and with an age range of 12-75 years (33.22±11.58 years). There were 764 (44.14%) subjects originating from tehsil Bhimber, 454 (26.23%) from Barnala, and 513 (29.63%) from Samahni (range of sample: 20-214; mean 72.13±51.95). The key findings for CA and NCDs have been separately described.

Congenital anomalies (CA)

A total of 74 CA were observed in the sample (Table 1). Hence, the prevalence of congenital anomalies in the female participants was 42.75/1,000 (CI of prevalence: 0.0332-0.0523). Limb anomalies had the highest proportion among the CA (n=51; prev.: 29.44/1,000; CI: 0.0215-0.0374), followed by the deaf-mute cases (n=7; prev.: 4.04/1,000; CI: 0.0011-0.0070) (Table 1). It is worthwhile to mention that 74 CA were witnessed in 67 subjects, hence, the prevalence of affected subjects was 38.64/1,000 (CI: 0.0296-0.0477).

Cases of CA were categorized into 15 distinct types. Among the total hereditary anomalies and within the limb defects category, club-thumb had the highest representation (n=18), followed by brachydactyly (n=12), camptodactyly (n=8; 10.81%), and clinodactyly (n=7) (Table 1).

Majority of the CA had sporadic occurrences (n=63; 85.14%), while there were 11 cases with familial evidence of segregation (Table 2). Inheritance pattern in most of the familial cases was autosomal dominant (n=4). The detailed distributions of CA across different variables are provided in Table 2.

Table 1: Prevalence of congenital anomalies in recruited females of Bhimber, AJK

Anomaly	No.	Percentile	Prevalence/ 1,000	95% CI	OMIM	ICD-10
Limb defects (n=51)	***51***	***0.6892***	***29.46***	***0.6674-0.7110***		
Club-thumb	18	0.2432	10.40	0.2230-0.2634	113200	Q68.1
Brachydactyly	12	0.1622	6.93	0.1448-0.1796	112500	
Camptodactyly	8	0.1081	4.62	0.0935-0.1227	114200	
Clinodactyly	7	0.0946	4.04	0.0808-0.1084	112700	
Polydactyly	4	0.0541	2.31	0.0434-0.0648	603596	Q69.1
Synpolydactyly	1	0.0135	0.58	0.0081-0.0189	186000	Q70.4
Brachy-syndactyly	1	0.0135	0.58	0.0081-0.0189		
Other anomalies (n=23)	***23***	***0.3108***	***13.29***	***0.2890-0.3326***		
Deaf-mute	7	0.0946	4.04	0.0808-0.1084	304400	Q16
Stuttering/mute	3	0.0405	1.73	0.0312-0.0498	607485	Q18
Microtia	3	0.0405	1.73	0.0312-0.0498	600674	Q17.2
Mental retardation	3	0.0405	1.73	0.0312-0.0498	300243	F03
Squint eyes	2	0.0270	1.16	0.0194-0.0346	231000	Q10
Orofacial defects	2	0.0270	1.16	0.0194-0.0346		
Hand-feet allergy	2	0.0270	1.16	0.0194-0.0346		T78.4
Trembling body	1	0.0135	0.58	0.0081-0.0189	245180	
Total	**74**	**1.0000**	**42.75**	**1**		

OMIM= Online Mendelian Inheritance in Man; ICD-10= International Classification of Disease criteria

Table 2: Hereditary nature and total affected family members in cases with congenital anomalies (n=74)

Anomaly type	Cases	Hereditary nature		Familial cases	
		Sporadic	Familial	Total no. of affected in all families	Affected male/female ratio
Limb defects	***51***	***42***	***9***	***27***	***7:20***
Club-thumb	18	16	2	5	1:4
Brachydactyly	12	7	5	14	3:11
Camptodactyly	8	7	1	6	2:4
Clinodactyly	7	6	1	2	1:1
Polydactyly	4	4			
Synpolydactyly	1	1			
Brachy-syndactyly	1	1			
Other anomalies	***23***	***21***	***2***	***9***	***5:4***
Deaf-mute	7	6	1	3	1:2
Stuttering/mute	3	3			
Microtia	3	3			
Mental retardation	3	3			
Squint eyes	2	2			
Orofacial defects	2	2			
Hand-feet allergy	2	1	1	6	4:2
Trembling body	1	1			
Total	**74**	**63**	**11**	**36**	**12/24**

Congenital limb anomalies

The limb defects appeared as the largest representatives among the CA. There were seven distinct types of limb anomalies which were primarily affecting the autopod/digits. Majority of the limb defects were sporadic (n=42; 82.35%), while there were only nine malformations with an evidence of familial segregation. The involvement of upper limbs was more common compared to the lower limbs (36 vs. 15) (Table 3). Among the cases with affected upper limbs, majority had the involvement of both limbs (n=25; 69.44%). Among the unilateral cases of upper limbs, there was a preferential involvement of left hand (n=9; 81.81%). In the subjects with lower limbs involvement, the left foot was more frequently affected (n=7; 46.67%). Preaxial and postaxial defects were almost in equal proportions. Collectively, there were 31 cases with bilateral presentations and 20 had unilateral involvement. Of the 31 bilateral cases, 15 (48.39%) had symmetrical phenotypes in both limbs (Table 3).

Table 3: Phenotypic variability in limb anomalies (n=51)

Anomaly	No.	Laterality		Symmetry*		Upper limb			Lower limb			Axis involved		
		Unilateral	Bilateral	Sym.	Asym.	R	L	B	R	L	B	Pre-axial	Meso-axial	Post-axial
Club-thumb	18	4	14	7	7	1	3	14				18		
Brachydactyly	12	6	6	1	5			1	2	4	5			12
Camptodactyly	8	3	5	2	3	1	2	4			1			8
Clinodactyly	7	1	6	5	1		1	6						7
Polydactyly	4	4					3			1		1	1	2
Synpolydactyly	1	1								1			1	
Brachy-syndactyly	1	1								1				1
Total	**51**	**20**	**31**	**15**	**16**	**2**	**9**	**25**	**2**	**7**	**6**	**19**	**2**	**30**

*Symmetrical presentations among the bilateral cases. /Sym.=symmetrical; Asym.= asymmetrical; R=right, L=left, B=both.

Eleven limb anomalies demonstrated co-occurrence with certain other anomaly types. For instance, there were 12 individuals with brachydactyly, and five (41.67%) of them also exhibited certain other malformation (Table 4).

The prevalence of CA was quite variable across various socio-demographic attributes of Bhimber population. Among the three tehsils, Bhimber was observed to have the highest prevalence of CA as compared to Barnala and Samahni. The prevalence of CA was significantly higher among the subjects speaking Pahari language, belonging to rural areas and having no education (P<0.0001) (Table 6). The prevalence of CA was not associated with variables like parental consanguinity, linguistic groups, and family/house-hold type. With respect to ethnicity, the highest prevalence was observed in caste systems of Malik and Mirza (75.47/1,000 and 71.06/1,000, respectively) (data not shown).

Non-communicable diseases (NCDs)

There were a total of 104 NCDs observed in the sample (prevalence 60.08/1,000). Majority of the NCDs were involving the skeleton (Table 5). There was highest representation of subjects with certain type of limb amputations (n=19; prev.: 10.98/1,000; CI: 0.0061-0.0159), followed by subjects with arthritis (n=15; prev.: 8.66/1,000; CI: 0.0043-0.0130), and acro-osteolysis (n=12; prev.: 6.92/1,000; CI: 0.0030-0.0108) (Table 5). Subjects with limb amputations included the cases with accidental loss of either upper or lower limb due to the encounter with crossfire, agriculture tools or domestic violence. The 104 anomalies were observed in 82 subjects, hence, the prevalence of affected subjects was 47.29/1,000 (CI: 0.0373-0.0573).

Among the three tehsils, NCDs were witnessed to be highest in Bhimber as compared to Barnala and Samahni. With respect to ethnicity morbidity was quite variable and ranged from 34/1,000 to 193/1,000. The prevalence of NCDs was significantly higher among the subjects belonging to rural areas, speaking Punjabi language, and having no education (P<0.0001) (Table 6). An increasing trend in the prevalence of NCDs was witnessed with the increasing age of subject (Spearman correlation, r=0.9643; P=0.0028) (Fig. 2). The prevalence of NCDs was not associated with variables like linguistic groups, ethnicity, family/house-hold type, and parental consanguinity (data not shown).

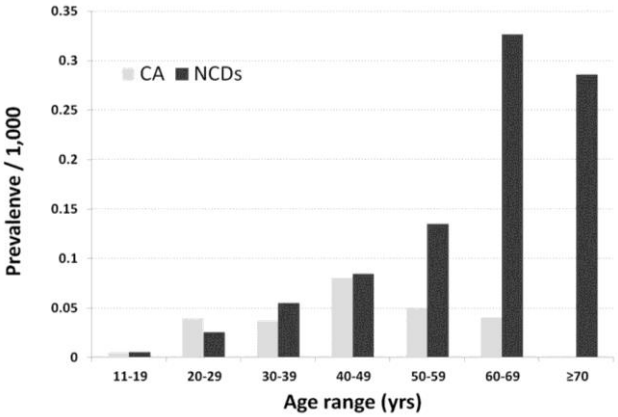

Fig. 2: Prevalence of CA and NCDs plotted against the age range of subjects

Table 4: Co-occurrence of limb anomalies with other CA and/or NCDs in the same subject

Limb anomaly	Total cases	Associated anomalies							
		Club-thumb	Deaf	Limb amputation	Arthritis	Acrooste-olysis	Stomach problem	Nail problem	Total associations
Club-thumb	18			1			1		2
Brachydactyly	12	2			1		1	1	5
Camptodactyly	8	1	1			1			3
Polydactyly	4			1					1
Total	**42**	**3**	**1**	**2**	**1**	**1**	**2**	**1**	**11**

Table 5: Prevalence of non-communicable disorders (n=104) in the female participants of Bhimber

Non-communicable disorder	No.	Percentile	Prevalence/ 1,000	95% CI *	ICD-10
Limb amputations (accidental)	19	0.1827	10.98	0.1645-0.2009	Y83.5
Arthritis (generalized)	15	0.1442	8.67	0.1277-0.1607	M00
Acro-osteolysis	12	0.1154	6.93	0.1003-0.1305	
Stomach problem	6	0.0577	3.47	0.0467-0.0687	K31.9
Vitiligo	6	0.0577	3.47	0.0467-0.0687	L80
Diabetes #	6	0.0577	3.47	0.0467-0.0687	E10
High blood pressure #	5	0.0481	2.89	0.0380-0.0582	I11
Tumors #	5	0.0481	2.89	0.0380-0.0582	D28
Goiter #	4	0.0385	2.31	0.0294-0.0476	E04
Asthma #	4	0.0385	2.31	0.0294-0.0476	J45
Hepatitis	4	0.0385	2.31	0.0294-0.0476	B16
Nail problems	4	0.0385	2.31	0.0294-0.0476	L60
Skin allergy	4	0.0385	2.31	0.0294-0.0476	L23.6
Eye loss (traumatic)	2	0.0192	1.16	0.0127-0.0257	S05
Insane/mental ailment	2	0.0192	1.16	0.0127-0.0257	F99
Hernia	1	0.0096	0.58	0.0050-0.0142	K40
Stiff jaw	1	0.0096	0.58	0.0050-0.0142	K07.5
Paralysis	1	0.0096	0.58	0.0050-0.0142	G83.9
TB of spinal cord	1	0.0096	0.58	0.0050-0.0142	M49.0
Body swelling/allergy	1	0.0096	0.58	0.0050-0.0142	T78.4
Anemia	1	0.0096	0.58	0.0050-0.0142	D50
Total	**104**	1.0000	60.08		

late onset/ * calculated from percentile

Table 6: Distribution of CA and NCDs across socio-demographic attributes of Bhimber population

Demographic variable	Congenital anomalies				Non-communicable diseases			
	Affected	Unaffected	Proportion of anomaly	Prevalence/ 1,000	Affected	Unaffected	Proportion of anomaly	Prevalence/ 1,000
Tehsil								
Bhimber	42	722	0.57	54.97	53	711	0.51	69.37
Barnala	9	445	0.12	19.82	25	429	0.24	55.07
Samahni	23	490	0.31	44.83	26	487	0.25	50.68
Total	74	1657	1.00	42.75	104	1627	1.00	60.08
	χ^2=8.675, df. 2, *P*=0.0131, Sig.				χ^2=2.172, df. 2, *P*=0.3375, NS			
Linguistic groups								
Punjabi	50	1166	0.68	41.12	78	1138	0.75	64.14
Pahari	24	491	0.32	46.60	26	489	0.25	50.49
	Fisher's *P*=0.6047, NS				Fisher's *P*=0.3195; NS			
Origin/locality								
Rural	64	180	0.86	262.30	93	151	0.89	381.15
Peri-Urban	10	142	0.14	65.79	8	144	0.08	52.63
Urban	0	1335	0.00	0.00	3	1332	0.03	2.25
	χ^2=349.0, df. 2, *P*<0.0001, Sig.				χ^2=524.6, df. 2, *P*<0.0001, Sig.			
Education								
Illiterate	40	488	0.54	75.76	65	463	0.63	123.11
Literate (all)	34	1169	0.46	28.26	39	1164	0.38	32.42
	Fisher's *P*<0.0001, Sig.				Fisher's *P*<0.0001, Sig.			

Sig. =significant; NS=not significant

Discussion

The prevalence of CA was estimated to be 42.75/1,000 in the female participants in the present study. Previously, an urban community based study in Pakistan showed that CA account for 40/1,000 live births (12). However, hospital based studies conducted by Yaqoob et al. (13), and Khaskheli et al. (14) established higher estimates (128/1,000, and 161/1,000, respectively). This variation in the prevalence rate could be due to the variability in the ascertainment methods, sampling and study design, and the underlying heterogeneity among the populations.

Limb defects appeared as the largest category among the CA (n=51). Interestingly, all of these limb defects were pertaining to the autopod/digits. Due to their non-lethal characteristics the limb defects are usually ignored in the surveillance and epidemiological studies. Particularly, partial cutaneous syndactyly, minor polydactyly, camptodactyly and clinodactyly do not get attention of the medical practitioner (15-16). The pattern of limb defects observed in the present study was quite distinct, and club thumb and brachydactyly were the most common anomalies. Other studies have shown that polydactyly was the most frequent type of CA in various Pakistani populations, which was only represented by four cases in the present sample (17). Furthermore, there is a published report on Kashmiri individual with thumb deficiency and toe webbing (18). No such phenotype was witnessed in this study.

There were a total of 104 NCDs observed in the recruited subjects. Curiously, accidental limb amputations appeared as the largest group. These included the subjects with loss of limb due to encounter with crossfire which is common due to the volatile political situation at the line-of-control between AJK and the Indian held Jammu and Kashmir (19). The second important cause witnessed was the accident with agriculture tools, used for mowing grass and cutting fodder for cattle. Thirdly, a rare reason for the loss of limb was observed to be the domestic violence. Acro-osteolysis, a rare limb anomaly with progressive loss of terminal digits, was witnessed to be the third most common NCDs in the recruited individuals. All of these cases were sporadic and hence, may have a common non-genic etiology.

All of the NCDs encountered in the present study had late-onset and no evidence of familial aggregation. However, we could not exclude the possibility for few of the cases of being hereditary in nature. It is of note that the NCDs of complex nature like cardio-vascular defects; diabetes, hypertension, etc. were not observed in significant proportions. It is quite likely that these disorders are more prevalent in urban areas which are not well-represented in the current study. Our data suggests a highly significant increase in the prevalence of NCDs with age. This situation is quite alarming due to the fact that several of the NCDs could be easily prevented by simple safety measures.

The present study has several limitations. For instance, it only focuses married females and does not present the spectrum of morbidities in the male population. Male subjects not only have a different pattern of malformations but also have higher estimates of morbidities. Hence, the true prevalence estimates of several diseases may be compromised while reporting only the female sample. Additionally, there are a number of early onset and lethal CA which may not appear in the adult population. Furthermore, the present study does not focus on the etiology of malformations. It would also be worthwhile to explore the causative factors of anomalies which are more prominent in Bhimber population. This however, would require an independent molecular genetics study to identify both genetic and non-genetic factors underlying CA and NCDs, respectively.

Conclusion

This study presents a preliminary overview of morbidity in the young and adult female population of Bhimber which is a representative Kashmiri population. A comprehensive country-wide epidemiological study is vital to quantify a national impact of morbidity in the adult population of

Pakistan, and that data would promise better intervention and prudent management plans to combat diseases.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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