



## **Determinants of Consanguinity and Inbreeding Coefficient $F$ in Dir Lower District, North-West Pakistan: A Multivariate Approach**

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### **Dear Editor-in-Chief**

Consanguinity is common in many countries and the rates of Consanguineous Unions (CU) and Inbreeding Coefficient  $F$  (ICF) have been observed in various isolated as well as metropolitan populations across the globe (1). Studies on the dynamics of consanguinity in transitory and fragmented populations are however, scarce (2). The Pashtun tribal belt living on both sides of the Durand Line at Pakistan-Afghanistan border, are the victim of 'war-on-terror' due to the international counter terrorism strategy. The combat, Talibanization and military operations rendered 1.9 million individuals as Internally Displaced Persons (IDPs), and had a devastating effect on the well-being, and socio-economic and demographic foundations of Pashtuns populations dwelling across the North-Western territories of Pakistan (3). The nature of this demographic transition remains unexplored. To this end, as an indicator of the socio-biological composition of the Pashtun tribes we have studied consanguinity and ICF in the population of Dir Lower district, which borders the turbulent territory at the North-West of Pakistan and is a victim of post-war consequences and natural disasters like recurrent floods.

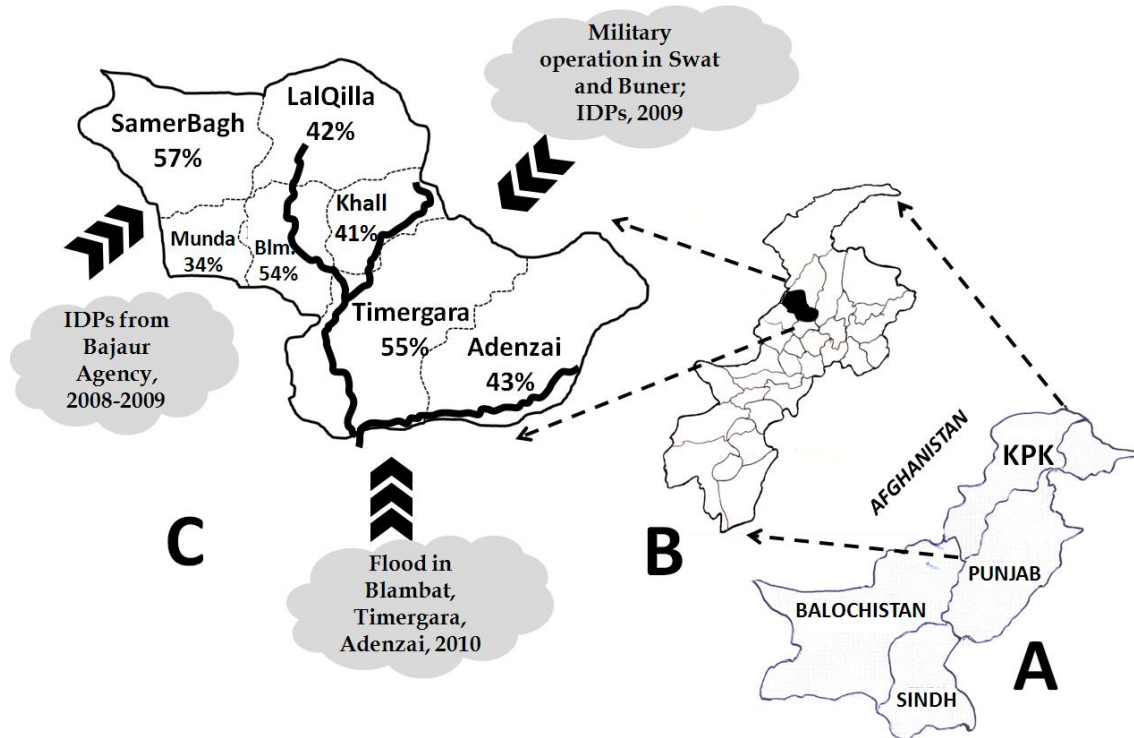
Through a cross-sectional study, 1250 random individuals were enrolled and data were obtained on marital union types and socio-demographic variables. Collectively, CU and non-consanguineous

unions were observed to be 46.2% and 53.8%, respectively, and ICF was calculated to be 0.0249. Across the seven tehsils of Dir Lower, highest rate of consanguinity was witnessed in Samar Bagh (57%), followed by Timergara (55%), and Balambat (54%) (Fig. 1).

The rate of consanguinity was higher in subjects originating from rural areas compared to their urban counterparts (46% vs. 39%). Among various Pashtun tribes, consanguinity was observed to be highest in Mashwani (57%) and Uthman Khels (51%). Further, the rate of CU was witnessed to be significantly higher in the literate individuals compared to the illiterate group (49% vs. 28%;  $P < 0.0001$ ). Within the literate sample, CU and ICF were generally rising with increasing literacy level. Among the occupational groups, CU were highest in subjects engaged in sales/business (50%;  $ICF = 0.0273$ ), and skilled manual jobs (48%;  $ICF = 0.0267$ ). In the average monthly income categories the prevalence of consanguinity was rising with increasing income ( $P = 0.0029$ ). According to their family types, the highest rate of CU was observed in individuals having 'extended family' (50%;  $ICF = 0.0267$ ) ( $P < 0.0001$ ). For the multivariate logistic regression analyses, a stepwise likelihood ratio was estimated and the independent parameters were considered one-by-one and only the significant variables were retained. In the final

model, tehsil-wise origin, literacy, monthly income, ethnicity and family type were the significant predictors of consanguinity (Table 1). Further,

literacy, monthly income and family type remained significant even after removing variables like tehsil, rural/urban status and ethnicity.



**Fig. 1:** Map of Pakistan (A) with zoom-in map of KPK province (B) depicting Dir Lower district as filled area. Map of Dir Lower (C) with seven tehsils and their respective consanguinity rates (in %). The population displacement factors and influx of IDPs into Dir Lower are demonstrated with filled arrow-heads. The thick lines through the district landmark the Panjkora river/glacier streams heavily flooded in 2010. (Blm.=Blambat tehsil)

**Table 1:** Significant predictors of consanguinity as revealed by multivariate logistic regression

Variable	OR*	Std. Err	P	95% CI
<b>Tehsils</b>				
Balambat	2.45	0.69	0.0010	1.414-4.242
Timergara	3.25	0.88	<0.0001	1.912-5.514
Samar Bagh	3.00	0.93	<0.0001	1.636-5.510
<b>Literate</b>				
	1.98	0.41	0.0010	1.315-2.978
<b>Income (Rs.) &gt;40,000</b>				
	1.59	0.31	0.0190	1.080-2.340
<b>Ethnicity</b>				
Uthman Khel	2.82	1.43	0.0400	1.048-7.615
Mashwani	1.85	1.05	0.2830	0.602-5.655
Others	2.73	1.44	0.0570	0.971-7.687
<b>Family type</b>				
More-than-one-couple	1.65	0.44	0.0610	0.976-2.773
Extended	1.81	0.30	<0.0001	1.318-2.496
_cons	0.06	0.03	<0.0001	0.020-0.184

\*OR= Odd Ratios

Remarkably, consanguinity was observed to be highest in tehsils profoundly affected by the war/post-war events. For instance, Samar Bagh tehsil adjoins Bajaur Agency where military operation was launched (Fig. 1). Samar Bagh and Timergara tehsils received a large influx of IDPs after the military operation in 2009 (4-5). Further, Adenzai, Balambat and Timergara tehsils were severely affected by the flood in 2010. Thus, it appears that consanguinity is on the rise in areas exposed to adverse security conditions, population displacements and natural calamities (2, 5). Curiously, the present data demonstrated that consanguinity was significantly higher in the literate sample compared to the illiterate. It has been argued that in societies where significant change in the social system has not occurred, literacy may have a positive impact in contracting cousin marriages because of social pressure and political and economic imperatives (6). In this sample, the positive relationship between consanguinity and literacy may be indirectly associated with the economic status as literacy was higher in economically better-off families who prefer arranging marriages among close relatives.

In conclusion, this study showed that tehsil-wise origin, literacy, high monthly income, ethnicity and extended family type were significant determinants of consanguinity in Dir Lower which is a geo-politically disturbed population in the North-West of Pakistan. The increase in the rate of CU in this population is expected to impact the health variables like fertility, child morbidity/mortality, and the incidence of congenital and hereditary anomalies.

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