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Differential Mortality Risk among the Government Employees during Service Period in Nagaland

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ABSTRACT

The ill-health and mortality of the government employees while in service can cause great loss and irreparable financial hardship to the concerned family in particular and to the society as a whole. The mortality risk of an employee may differ due to the differences in the nature of service. Objectives are to study the differential risks of mortality due to the difference in the service period sub-interval, occupation, and age at entry into service. Data were collected from Pension Payment Orders (PPOs) from three treasury offices – Kohima North, Kohima South and Dimapur for those employees who were appointed into the Nagaland government service during 1964-2011. PPOs revealed that 1257 deaths occurred to those employees who entered into service in the age interval 18-26 years. The entire service period of 35 years is divided into seven sub-intervals, [0-5), [5-10), [10-15), [15-20), [20-25), [25-30), [30-35). The occupations were classified into two categories- Police Service (PS) and Other Than Police Service (OTPS). Death ratios, death rates and relative risks of deaths by service period sub-intervals and occupations were obtained. In PS, the highest death ratio (0.1806) occurred in 16-20 years of service period. But, in OTPS, the highest death ratio (0.1940) occurred in 26-30 years of service period. The relative risk of death for the employees who joined service in 18-26 years of age in PS (1.253) was higher than that of the employees in OTPS (0.925). The employees in PS face higher risks of deaths compared to employees in OTPS.

KEYWORDS: Government Employees, Differential Mortality Risk, Occupation, In Service.

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INTRODUCTION

The entry into the world of work may be defined as a socioeconomic event called employment. The paid employment in a government organisation having the character of an occupation may be termed here as 'work'^{1,2}. The occupation or work is considered as the main source of income in our society. The working people have a fixed age of retirement called the superannuation age³ and normally every employees, once enter into service, can continue to remain in service till his/her superannuation age of retirement in an organised sector, particularly in the government organisation in India and in most developing countries.

The very vital and crucial force for the development of any country or the society is the working force constituted by the adults of age 18 to 60 years as they are economically productive, biologically reproductive and responsible for the support of the children and elderly population. The age of the government employees also usually ranges from 18 to 60 years of age. Thus, a major subgroup of the adult population in the country is the government employees. Moreover, it is considered as one of the most important subgroups of the adult population as far as their education, income and regenerative abilities are concerned. The ill health and mortality may cause impairment to the government employees which in turn can cause great loss and irreparable financial hardship to the concerned family in particular and to the society as a whole as adults' ill health and mortality can directly affect the production, earnings, investment and consumption and health of the other members of the household. The premature death of an adult member in a family, especially when he/she is the principal income earner creates many problems for the surviving members including serious financial hardship to the family. The excess risk of premature deaths of adult middle aged male employees due to variations in occupations was observed in a comparative study in Western Europe in the 1980s⁴.

The study of occupational differential mortality risk has been among the major topics of interests as the occupation of a person determines the socioeconomic status of that person in the society. In India, few studies were carried on occupational differential mortality risks of the old aged retired government employees^{1,2,3}. Few studies were also carried out on adult mortality in India^{5,6,7}. But, most of the studies emphasised on the level, trend and gender differentials only. Hardly any study has focused on the occupational differential mortality risks of adult population.

The mortality risk of an employee while in service begins with his/her entry into service and continues till the exit either by the death during the service period or by the retirement from service on reaching superannuation age. Of course, in some cases, he/she may escape the risk of death during the service period by taking voluntary retirement.

The variations in the mortality risks of an employee may be different due to the variation either in the length of service or in the nature of jobs attached to different occupations. For example, the death risks of an in-service employee while in police service may be much higher than those of any other service. Police have a high-risk job compared to many others. The unique job hazards are associated with the jobs of police and fire fighters. The workers in police and fire fighters are more likely than other workers to die violently—from gunshots, vehicle accidents, and fire related incidents. The mortality risk either in the initial stage or in the later stage of the service period to the employees in police service compared to any other service like teaching service, medical service, etc., may not exhibit a similar picture. This may happen by virtue of the nature of their jobs. A set of death ratios readily permits the comparison of the relative severity or importance of mortality risk of a particular sub-interval or group of sub-intervals of service period of an occupation.

OBJECTIVES:

1. To study whether mortality risks varies due to variation in length of service in a particular occupation. That is, to see the relative severity or importance of risks of deaths of a particular service period sub-interval within a particular occupation.
2. To study whether the mortality pattern varies due to the difference in occupation. That is, to see the occupational differential mortality risk among the employees while in service prior to reach superannuation retirement age in Kohima and Dimapur districts.
3. To study whether the mortality pattern varies due to the variation in age at entry into service.

MATERIALS AND METHODS:

(a) Data:

The state Nagaland was established in 1st Dec, 1963. We considered the employees who were appointed into the Nagaland government service since 1st January 1964 and are in service till 31st December 2011.

Pension Payment Orders (PPOs) of the Family Pension and also of the living pensioners issued by Accountant General (AG), Nagaland is the non-conventional data source. Data were collected and compiled from the three treasury offices – Kohima North, Kohima South and Dimapur Treasury Offices.

PPOs provide information on – name, address, sex, date of birth, date appointment, date of death of the employees who died during their service period before reaching the superannuation age.

Observed data from PPOs revealed that 77.21% of the total employees joined the service in the age interval 18-26 years and only 22.79% joined the service beyond 18-26 years of age under Nagaland government during 1964-2011 (Table-1).

Table-1: Distribution of Employees who joined service during 1964-2011:

Age at Entry (in years)	Police Service (PS)	Other Than Police Service (OTPS)	All Services together
15-17	75	219	294
18-20	552	1101	1653
21-23	193	1006	1199
24-26	113	627	740
27-29	63	350	413
30-32	32	134	166
33-35	14	106	120
35-37	7	60	67
Total	1049	3603	4652

(Source: PPOs issued by Accountant General (A.G.) Office, Nagaland.)

This indicates that most of the employees (more than three-fourth) entered into government service under Nagaland government in the age group 18-26 years and therefore the employees who joined their services in age interval 18-26 years were considered for the purpose of analysis with an assumption that the removal of the rest of the employees will not affect our analysis.

Table-2: Distribution of observed No. of deaths who joined in 18-26 years of age during 1964-2011:

Length of Service(in years)	PS		OTPS		All	
	Number	Percent of total	Number	Percent of total	Number	Percent of total
0-5	45	10.56	76	6.43	121	7.53
5-10	64	15.02	145	12.28	209	13.01
10-15	71	16.67	182	15.41	253	15.74
15-20	77	18.08	222	18.80	299	18.61
20-25	69	16.20	218	18.46	287	17.86
25-30	55	12.91	206	17.44	261	16.24
30-35	45	10.56	132	11.18	177	11.01
35-40	10	36	46	2.78
Total	436	100.00	1217	100.00	1653	100.00

(Source: PPOs issued by Accountant General (A.G.) Office, Nagaland.)

From Table-2, it is observed that a very small percentage (2.78%) of employees died after serving 35 years. We assume that if this percentage of employees is neglected, it will not affect our

analysis. Therefore, only 35 years of service period is considered as the total length of service period to study the in-service occupational differential mortality risks. The entire service period of 35 years is divided into seven sub-intervals [0-5), [5-10), [10-15), [15-20), [20-25), [25-30), [30-35), each of five years length.

From the PPO's of the Family Pensioners, it is found that out of the total of 1653 observed deaths, 1257 deaths occurred to those employees (3592 in number) who joined service in the age interval 18-26 years and the rest of the deaths occurred to those employees who joined the service beyond the age interval 18-26 years (Table-1). Therefore, we censored the deaths that occurred to the employees who joined government service beyond 18-26 years of age. This censoring was necessary as the mortality risk increases with age^{8,9} and so the employees who joined government services on or after 27 years of age may have higher mortality risks within service period due to higher age compared to those who joined in 18-26 years of age. Moreover, smaller age interval 18-26 years is more or less uniform in age with respect to the occurrence of death.

Table-3: Distribution of No. of Employees and Deaths who joined service during 1964-2011:

Occupation	No. of employees (% of Total) joined			No. of Deaths (% of Total) occurred to those who joined service		
	at any age	in 18-26 years of age (i.e., on Censoring)	Absolute percent deviation on censoring	at any age	in 18-26 years of age (i.e., on censoring)	Absolute percent deviation on censoring
PS	1049 (22.55)	858 (23.88)	1.33	436 (26.38)	360 (28.64)	2.26
OTPS	3603 (77.45)	2734 (76.22)	1.23	1217 (73.62)	897 (71.36)	2.26
All	4652 (100.00)	3592 (100.00)		1653 (100.00)	1257 (100.00)	

From Table-3, we also see that there exists a very small amount of absolute deviation of the percent of total number of the employees who joined government service on censoring the age at entry into service (1.33% for the employees in PS and 1.23% for OTPS). The corresponding amount of absolute deviation of the percent of total deaths of the employees who joined government service on censoring the age at entry into service was also very small (only 2.26% in PS as well in OTPS). This may also claim that censoring the age at entry into service had negligible effect for the purpose of analysis. Thus, 1257 deaths were considered for the purpose of final analysis.

People have a common perception that the mortality risk of the employees is higher in police service compared to any other services. The police personnel face high risks of deaths and

homicides^{10,11}. Moreover, the proportion of deaths that occur in the early stage of the service in police service may be higher compared to any other services such as teaching service, engineering service, medical service, etc. Therefore, occupations are classified into two groups- Police Service (PS) and Other Than Police Service (OTPS). Here, the group OTPS includes all the rest of the services except police service such as teaching service, engineering service, medical and family health welfare services, services in agriculture department, etc.

We assumed that the in-service number of employees diminishes through deaths only. The cases of superannuation retirement are not considered here. The factors such as transfer in-and-out, if any, may be very small in proportion and hence neglected.

(b) Methods:

To analyse the data, we shall use proportion of deaths or death ratios and the death rates. Death ratios will provide us a process of comparing the severity of risk of death for a particular service period sub-interval in a particular occupation. On the other hand, death rates will provide us a comparison of deaths per thousand in a given time for one population with another population. The methods are given below:

(i) The proportion of deaths or, death ratio is obtained by the following formula:

$${}_n P_x = \frac{{}_n D_x}{D} \dots\dots\dots (1)$$

Where, ${}_n D_x$ represents the number of observed deaths that occurred to those employees who died during the service period sub-interval $[x, x+n)$ years, where, $x = 0,1,2,\dots,35$ and $n = 5$ years and D represents the total number of observed deaths that occurred at any time in service.

(ii) Death rates are obtained by the following formula:

$${}_n M_x = \frac{{}_n D_x}{{}_n P_x} \times 1000 \dots\dots\dots (2)$$

Where, ${}_n D_x$ represents the number of observed deaths that occurred to those employees who died during the service period sub-interval $[x, x+n)$ years and ${}_n P_x$ represents the person-years lived by those employees who were at risk of death at the beginning of the service period sub-interval $[x, x+n)$ years. The person-years lived is calculated by the following formula:

$${}_n P_x = (N_x - {}_n D_x) \times n + ({}_n D_x / 2) \times n$$

$$\text{Or, } {}_n P_x = \left(N_x - \frac{{}_n D_x}{2} \right) \times n$$

Where, N_x represents the number of employees who are at risk of death at the beginning of the service period sub-interval $[x, x+n)$ years and n is the number of years in the service period sub-interval (or, the length of the service period sub-interval) $[x, x+n)$ years. Also, since the population under study are the adults of ages ranging from 18 to 60 years, the deaths may be assumed to be uniformly distributed over the small sub-intervals of time i.e., the death rates are considered to be linear in small age intervals.

The conventional denominator for a death rate consists of an estimate of person-years lived during the period in which deaths are recorded. Here, to estimate the person-years lived, we have considered all those employees who joined the service to be at risk of death from the moment of joining their service.

(iii) Finally, the Relative Risk (RR) of death is obtained by the formula¹⁷:

$$RR \text{ of } i^{\text{th}} \text{ Occupation} = \frac{{}_nM_x \text{ of } i^{\text{th}} \text{ Occupation}}{{}_nM_x \text{ of All}}; (i = 1 = PS \ \& \ i = 2 = OTPS).....(3)$$

Where, PS stands for Police Service and OTPS for Other Than Police Service. If the relative risk for a particular occupation is more than one then that occupation bears more risks of death and vice-versa.

RESULTS

It is clear from Table-4 and Figure-1 that within PS, the highest death ratio (0.1806) occurred in 16-20 years of service period. On the other hand, the highest death ratio (0.1940) for OTPS occurred in 26-30 years of service period. Considering few sub-intervals together, it is seen that the death ratios for employees in PS are higher in the middle parts (i.e., 10-15, 15-20 and 20-25 years) than in the early (i.e., 0-5 and 5-10 years) and later parts (i.e., 25-30 and 30-35 years) of their services. On the other hand, the death ratios for the employees in OTPS are higher in the later part (i.e., 15 -20, 20-25 and 25-30 years) of their service. Moreover, the death ratios increases till the middle stage of the service period but diminishes thereafter as the length of service increases for the employees in PS. On the other hand, the death ratio increases almost uniformly over the service period except in the last few years of service for the employees in OTPS (Figure-1).

Table-4: Death Distribution and Death Ratios of Employees who joined service in 18-26 years of age:

Length of Service (in years)	PS		OTPS		All	
	Number	Death Ratio	Number	Death Ratio	Number	Death Ratio
0-5	40	0.1111	49	0.0546	89	0.0708
5-10	50	0.1389	102	0.1137	152	0.1209
10-15	59	0.1639	126	0.1405	185	0.1472
15-20	65	0.1806	158	0.1761	223	0.1774
20-25	58	0.1611	162	0.1806	220	0.1750
25-30	46	0.1278	174	0.1940	220	0.1750
30-35	42	0.1167	126	0.1405	168	0.1337
Total	360	1.0000	897	1.0000	1257	1.0000

(Source: PPOs issued by Accountant General (A.G.) Office, Nagaland.)

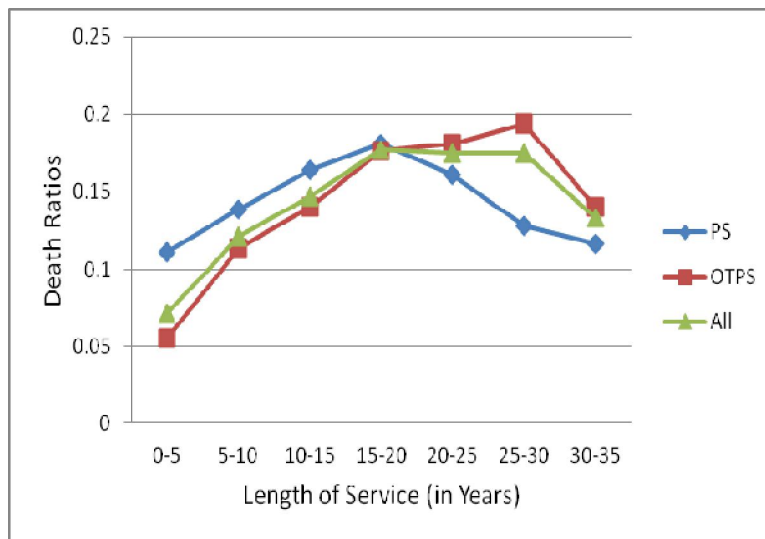


Figure-1: Death Ratios of Employees who joined service in 18-26 years of age during 1964-2011:

From Table-4(a) and Figure-2, it is seen that the death rates of the employees in PS increases continuously up to 20 years of service and decreases thereafter. On the other hand the death rates increase continuously up to 30 years of service for those employees who were in OTPS. But, when all the employees are considered together, it is found that the death rates increases continuously up to 30 years of service and decreases thereafter.

Table-4(a): Death Rates of Employees who joined service in 18-26 years of age during 1964-2011:

Length of service (in years)	PS			OTPS			All		
	No. of employees	No. of deaths	Death Rate	No. of employees	No. of deaths	Death Rate	No. of employees	No. of deaths	Death Rate
0-5	858	40	9.55	2734	49	3.62	3592	89	5.02
5-10	818	50	12.61	2685	102	7.75	3503	152	8.87
10-15	768	59	15.98	2583	126	10.00	3351	185	11.36
15-20	709	65	19.21	2457	158	13.29	3166	223	14.60
20-25	644	58	18.86	2299	162	14.61	2943	220	15.53
25-30	586	46	16.34	2137	174	16.98	2723	220	16.84
30-35	540	42	16.18	1963	126	13.26	2503	168	13.89

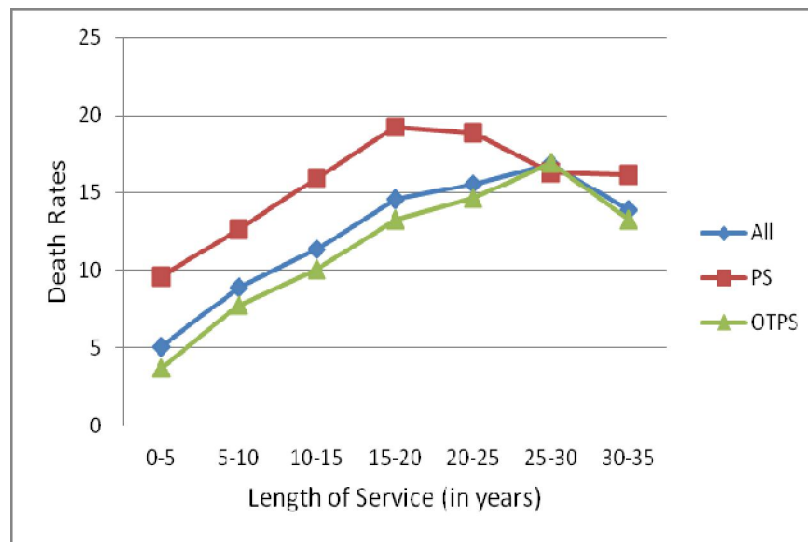


Figure-2: Death Rates of Employees who joined service in 18-26 years of age during 1964-2011:

The overall death rate of the employees who joined service in 18-26 years of age in PS (15.17 per 1000) was found to be higher than that of the employees in OTPS (11.21 per 1000). Accordingly, the RR of death for the employees in PS (1.253) was higher than that of the employees in OTPS (0.925) [Table-4(b)].

Table-4(b): Relative Risk of Death of Employees who joined service in 18-26 years of age:

Occupation	No. of Employees	No. of Deaths	Death Rates	Relative Risk of death
Police Service (PS)	858	360	15.17	1.253
Other than Police Service (OTPS)	2734	897	11.21	0.925
All	3592	1257	12.12	1.000

From Table-4(c), we see that, for the employees who joined service in the age group 18-20 years of age, the death rates are higher in the first five service period sub intervals, each of five years length, for PS compared to OTPS and the death rates are higher in OTPS than in PS in the 6th and 7th service period sub intervals i.e., 26-30 years and 31-35 years of service for the same group of employees. But for the employees who joined service in the age groups 21-23 and 24-26 years of age, the death rates are higher in all the service period sub intervals for the employees in PS than in OTPS [Table-4(c)].

Table-4(c): Death Rates per 1000 Employees of Nagaland during 1964-2011:

		Police Service (PS)				Other Than Police Service (OTPS)			
(1)	(2)	(3)	(4)	(5)	(6)	(3)	(4)	(5)	(6)
18-20	0-5	552	17	2718	6.25	1101	14	5470	2.56
	5-10	535	28	2605	10.75	1087	30	5360	5.6
	10-15	507	36	2445	14.72	1057	38	5190	7.32
	15-20	471	45	2243	20.06	1019	53	4963	10.68
	20-25	426	37	2038	18.16	966	67	4663	14.37
	25-30	389	28	1875	14.93	899	73	4313	16.93
	30-35	361	24	1745	13.75	826	66	3965	16.65
21-23	0-5	193	15	928	16.16	1006	15	4993	3
	5-10	178	14	855	16.37	991	39	4858	8.03
	10-15	164	16	780	20.51	952	57	4618	12.34
	15-20	148	12	710	16.9	895	60	4325	13.87
	20-25	136	12	650	18.45	835	57	4033	14.13
	25-30	124	10	595	16.81	778	58	3745	15.49
	30-35	114	12	540	22.22	720	48	3480	13.79
24-26	0-5	113	8	545	14.68	627	20	3085	6.48
	5-10	105	8	505	15.49	607	33	2953	11.18
	10-15	97	7	468	14.96	574	31	2793	11.1
	15-20	90	8	430	18.6	543	45	2603	17.29
	20-25	82	9	388	23.2	498	38	2395	15.87
	25-30	73	8	345	23.19	460	43	2193	19.61
	30-35	65	6	310	19.35	417	12	2055	5.84

(1) Age at Entry (in years); (2): Length of service (in years); (3): No. of employees in the beginning of the interval; (4): No. of deaths; (5): Person-years lived; (6): Death Rate.

The RR of deaths are higher in PS compared to OTPS in all the first five service period sub intervals, each of 5 years service period for those employees who joined service in age group 18-20 years of age (Table-5). That is, RR of death for this group of employees is higher in PS compared to OTPS up to 25 years of service. On the other hand, the RR of death is higher in OTPS than PS in the

6th and 7th service period sub intervals i.e., 26-30 years and 31-35 years of service (Table-5). But, the RR of death are higher in all the service period sub intervals for the employees in PS than in OTPS for those employees who joined service in 21-23 years and 24-26 years of age (Table-5). Thus, we see that the RR of deaths in almost all the service period sub-intervals who joined government service in 18-26 years old during 1964-2011 are higher for the employees in PS compared to OTPS.

Table-5: Relative Risks of Deaths of Employees in Nagaland during 1964-2011:

Length of Service (in years)	Age (in years) at entry into service and Occupation								
	18-20			21-23			24-26		
	PS	OTPS	All	PS	OTPS	All	PS	OTPS	All
0-5	1.65	0.68	1.00	3.18	0.59	1.00	1.90	0.84	1.00
5-10	1.46	0.77	1.00	1.76	0.87	1.00	1.31	0.94	1.00
10-15	1.52	0.76	1.00	1.52	0.91	1.00	1.28	0.95	1.00
15-20	1.48	0.79	1.00	1.18	0.97	1.00	1.07	0.99	1.00
20-25	1.17	0.93	1.00	1.25	0.96	1.00	1.37	0.94	1.00
25-30	0.92	1.04	1.00	1.07	0.98	1.00	1.15	0.98	1.00
30-35	0.87	1.06	1.00	1.49	0.92	1.00	2.54	0.77	1.00

From Table-6, it is clear that the relative mortality levels are more among the employees in PS than OTPS for all the employees joining service in 18-20, 21-23 and 24-26 years of age. That is, the mortality risk is higher in PS compared to OTPS irrespective of age at entry into the government service.

Table-6: Death Rates (DR) and Relative Risks (RR) of Deaths of Employees during 1964-2011:

Occupation	Age at Entry (in years)							
	18-20		21-23		24-26		18-26	
	DR	RR	DR	RR	DR	RR	DR	RR
PS	13.82	1.20	17.63	1.43	17.94	1.37	15.17	1.25
OTPS	10.47	0.91	11.37	0.92	12.29	0.94	11.21	0.93
Total	11.55	1.00	12.31	1.00	13.10	1.00	12.12	1.00

DISCUSSION

It is observed that the death ratio and the death rates of the employees in PS is higher in the middle part of their service than in the early and later parts [Table-4 and Table-4(a)]. This happens possibly because in most of the field duties such as operations against armed gang of robbers, kidnappers, drug peddlers, nabbing members of banned armed organisation, etc., the middle aged police personnel who are experienced but young and energetic might be deployed to lead. Deaths

among police personnel at the service year 15-20 may be more due to the fact that by that time they become expert in profession and physically also they used to have the physical energy level high (at this point they may be at the last part of 25-35 age group or first part of 30-40 age group taking recruitment at 18-22 years age group is more in police jobs), and hence they may be put in operational works than that of normal duties like- security guard, traffic maintenance, desk work, etc. Moreover, the newly recruited police personnel need some years in the beginning of their career to be experienced to lead field duties as mentioned. On the other hand, the police personnel with the help of promotions try to get more of the office duties than the field duties in the later part of their services. Police personnel in senior levels are mostly busy in administrative nature works. This fact may be seen in postings of SP/ DSPs in districts. Therefore, the work related death risks for very young police personnel in the beginning of the career and the old police personnel in the later part of the career is lesser than the young but energetic as well as experienced police personnel in the middle part of their career. But, the death ratios and death rates for the employees in OTPS increases more or less uniformly throughout the service period as the service period increases [Table-4 and Table-4(a)]. Obviously, age may be the prime cause for it as risk of death increases with every increase in age of the adult people. The risks of having affected by NCDs such as cardiovascular diseases, cancer, diabetes, etc. increases for adult population with increase in age^{6,12,13,14}.

The employees in PS face higher risks of deaths compared to employees in non police service. The higher risks of deaths and injuries in police service may be due to many operations such as fighting insurgency, unlawful elements, bombing, etc. which are absent in case of non police service. The police personnel face high risks of deaths and homicides. Homicide is more common for United States personnel doing undercover work, making arrests, conducting drug raids, attending domestic disputes or pursuing speeding motorists^{10,11}. A few personnel in the United States have been killed off-duty, most commonly after intervening in robberies, or when on-duty police mistook them for gang members¹⁵. Some died through unintentional firearm discharges, typically when personnel ignored firearms safety rules while unloading and disassembling weapons¹⁶. Police personnel are likely to get injected by communicable diseases while investigating crimes, conducting searches, taking samples, or arresting suspects. During the body search of a suspected drug user or his/her premises, there is always the risk of a puncture wound from secreted needles which may be contaminated with HIV, hepatitis B or another debilitating virus or bacteria¹⁷.

Police suffer a range of other work-related injuries like from jumping over fences during chases and illnesses such as hypertension¹⁸. Personnel involved in arson, bomb and fraud investigations may be exposed to poisonous chemicals and vapours (with acute and long-term health

effects), insecure buildings, explosions (for example, from letter bombs) as well as unbalanced or coldly calculating offenders¹⁹.

The employees in police services experience higher levels of stress than other occupational groups. This was supported in an earlier study where a strong relationship was discovered between on-the job stress and type of stressors, with police stress found to be more closely related to job stressors than was teacher stress²⁰. Stress for police officer is related to their work experiences and that different levels of stress exist in different management environments²¹. The police personnel suffer stress through constant exposure to danger, traumatic events, prisoner threats, conflicting task demands, short staffed stations, court appearances (often requiring detailed recollection of events from years earlier), departmental inquiries and work in isolated rural areas^{22,23,24}.

The employees in other services also bear stress. For example, teachers experience stress due to so many factors such as relationships with colleagues, administrative staff, clerical staff and students; complex communication needs related to the wide range of skills of students, and the task of dealing with inattentive students, discussing discipline procedures with students, and listening to students' personal and academic problems²⁵. Teachers experience conflicting expectations for job performance²⁶. They are expected to accomplish their tasks with limited resources²⁵. But, the gravity of stress in teaching job compared to police service is lesser²¹ and possibly because of that the effect on mortality is lesser in teaching services, one of the components of OTPS than police services.

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