Analysis of Variance (ANOVA) for Medically Certified Causes of Deaths/ICD-10 in Delhi during the year 2005-2014

Hemant kumar*,Sanjay Gupta#, Sarvesh Kumar@and HimanshuMoudgil

*Statistician, Dte of Family Welfare, GNCT of Delhi-7th floor,VikasBhawan-II,Civil Line,110054,E-mail-iitd.hemant@gmail.com

#Lecturer, Govt. Polytechnic Manesar,Gurugram, Haryana 122051,E-mail- space1_gupta@yahoo.co.in

@Sr. Software Developer, Carlton leisure travels private limited, [April 17, 2017 at 4:22:24 PM UTC+5:30] Sarvesh Kumar Singh (sarveshmcasoft@gmail.com): Paschimvihar[April 17, 2017 at 4:22:35 PM UTC+5:30] Sarvesh Kumar Singh (sarveshmcasoft@gmail.com): , Delhi[April 17, 2017 at 4:22:40 PM UTC+5:30] Sarvesh Kumar Singh (sarveshmcasoft@gmail.com): 110063E-mail- sarveshmcasoft@gmail.com

**Auditor, PCDA, Ministry of Defence, GOI,Delhi-110011, E-mail- himanshumoudgil@yahoo.com

First & Correspondence Author:-Hemant Kumar

Abstract- This paper is based on final CRS data for the year 2005-2014 on the 10 leading Medically Certified Causes of Death (MCCD)/International Causes of Death-10 in the Delhi (India) by age, sex, race. The Leading causes of infant, neonatal, and post-neonatal death are not analyzed in this paper. The major objective of paper is "To check the variability of causes of death by ten major diseases over the time period of ten years among the age group of specified causes of death. The overall research work of this paper is fully based on most powerful statistical concept i.e. Analysis of Variance (ANOVA) for better output of CRS data of Certified Leading causes of death.

Methods—Data in this paper are based on information of death eventsrecorded in concerned Hospitals/Registration Centers of five local bodies of NCT of Delhi by Civil Registration System, (SRS) in last ten years i.e. 2005-2014 . **ICD-10** is the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (**ICD**), a medical classification list by the World Health Organization (WHO).The 10 leading Medically Certified Causes of Death diseases has been considered on the basis of Causes of death classified as ICD–10 according to the number of deaths occurred due to concerned diseases. Cause-of-death statistics are based on the underlying cause of deathwith exploring the relationship among variation of occurrence on particular diseases over a time period and classified age group for the year 2005-2014 is the one of the approaches of this paper. We have performed analysis of variance (ANOVA) to establish the relationship between years and diseases for checking the exact variation of occurrences of diseases over the years. Also, we have done that for Disease wise analysis with respect of Age Group over the Years. We have also used the independent t-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014 with the help of SPSS-22.0.

Results—In the year 2005-2014, the 10 leading Medically Certified Causes of Death were considered as: 1-Tuberculosis (A15-A19);2-Endocrine, nutritional & metabolic diseases(E00-E89); 3-Bacterial diseases(A20-A49);4-Infectious & Parasitic diseases(A00-B99); 5-Neoplasms(C00-D48);6- Nervous system disorders(G00-G98); 7-Circulatory system diseases(I00-I99);8-Respiratory system diseases(J00-J98);9-Digestive system diseases(K00-K92); 10-Accidents & consequences of external causes(V01-Y89) which is assigned as numeric digit with corresponding MCCD as per ICD-10. These 10 causes accounted at around 65% of all deathsoccurred in the NCT of Delhi during2005-2014. The conclusion drawn from investigating the major death causing diseases in Delhi Region from reveals that:-Infectious & Parasitic diseases, Circulatory system diseases, neoplasms, Respiratory system diseases, bacterial diseases and accidental death cases claimed more lives. It can be concluded that the cause-specific death ratios based on the objective of study indicated that among the leading causes of death Infectious & Parasitic diseases, Circulatory system diseases, and Bacterial diseases and accidents were the most common. It is necessary to point out that Infectious & Parasitic diseases, bacterial diseases and accidental deaths demonstrated an upward trend while that of circulatory system diseases exhibited a pattern of downward trend.

Keywords: Medically Certified Causes of Death (MCCD) / ICD–10;leading causes of death ; vital statistics ;CRS; **Hypothesis ;**ANOVA; independent t-test and SPSS.

INTRODUCTION

As we are aware that the coding of the Medically Certified Cause of Death(MCCD) is fully based on **ICD-10** with the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), a medical classification list by the World Health Organization (WHO). It contains codes for diseases, signs and symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or diseases.The code set allows more than 14,400 different codes and permits the tracking of many new diagnoses. The codes can be expanded to over 16,000 codes by using optional sub-classifications**.** Themajor work of this paper is the statistical analysis of occurrences of medically certified death events received from all the local bodies of Delhi under the scheme CRS (Civil Registration System) in Delhi during last ten years i.e. 2005-2014. As we aware that , in Delhi, the Chief Registrar (Birth & Death) is responsible for monitoring the registration of Birth & Death with the help of five local bodies/Delhi Municipal Corporation(DMC) i.e. North DMC, South DMC, East DMC, New Delhi Municipal Council & DCB in Delhi. The office of Registrar General of India (ORGI) , Ministry of Home Affairs ,Govt of India is the Nodal Agency to monitor all type of functioning of registration of Birth & Death all over the India and provide the time to time guidelines to Chief Registrars (Birth & Death) of State Government and UT's.There are total twenty major classification of MCCD/ICD-10 coding available in Annual Report/MCCD Report (Birth & Death) of Delhi in each year. But have only taken under consideration of major ten diseases among these twenty who having maximum contribution of causes of death during the entire years. We want to establish theexact relationship among the variation of occurrence of particular diseases over a certain time period and classified age group for the year 2005-2014.

Source of data: The complete CRS data of MCCD with entire description of age groups for all major diseases for the ten years (2005-2014) has been collected from website of Directorate of Economics &Statistics, GNCT of Delhi which is also working as Office of Chief Registrar (Birth& Death) of Delhi. This data was collected from the all the local bodies of Delhi (i.e. North DMC, South DMC, East DMC,NDMC &DCB) over that particular year. The entire zonal offices of local bodies are directly engaged with public for collecting the data of birth/death event occurred either in institution or in domicile on the basis of information provided by the informant /uses/public.We have filtered out the major 10 diseases causing the highest no. of deaths during the time period 2005-2014. These major 10 diseases and their corresponding death over the ten years are given below in T1.

YEARS	**MAJOR 10 DISEASES FOR THE TIME PERIOD 2005-2014(**T1)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2005	3279	1156	7067	11302	1565	1726	6448	2769	1598	1339
2006	3064	5166	4235	8365	1471	1656	6848	2316	1471	2025
2007	2018	3874	5923	9099	1911	1642	13476	2465	1604	941
2008	2139	4001	5297	8513	2204	1426	12949	2696	1750	1030
2009	2251	4598	5590	9171	3227	1676	13904	3115	1902	1002
2010	3065	1401	5002	15879	5436	961	8215	3746	2116	2456
2011	3603	1707	5699	10652	9266	905	8435	3942	2686	4715
2012	3118	1784	5348	9984	5772	1202	9420	4215	3197	4724
2013	3239	2171	5940	10929	4109	1360	9617	4655	2814	5098
2014	4350	2002	6970	12529	5479	1208	9455	5282	3542	7119

For analysing these 10 major diseases (total deaths caused by them) with respect to the given time period of ten years 2005-2014, we have conducted an ANOVA test with the above data (Table no. 1). Where numerical number assigned as corresponding diseases as mentioned in introduction part. For analysing these 10 major diseases (total deaths caused by them) with respect to the given time period of ten years 2005-2014, we have conducted an ANOVA test with the above data (Table no. 1).Their results & interpretation have been also discussed in this paper for better understanding. For analysing these 10 major diseases (individually) with respect to the total deaths caused by them in specified age groups in 10 years, we have again conducted ANOVA tests with the following data in T2-T11.

Total deaths in given age groups due to Tuberculosis from 2005-2014

T2	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	33	204	223	466	572	568	515	355	111	193

2006	141	69	129	388	510	568	472	423	137	223
2007	54	39	87	295	337	342	360	266	88	150
2008	83	20	63	329	343	370	369	331	97	134
2009	24	11	54	276	364	407	465	409	107	134
2010	37	29	100	481	531	558	530	442	138	219
1011	26	33	126	565	578	630	620	554	177	294
2012	28	34	127	424	499	572	523	488	150	273
2013	39	31	101	451	505	532	539	481	481	217
2014	60	28	134	632	637	719	692	788	249	406

TABLE NO. 2

Total deaths in given age groups due to Endocrine diseases from 2005-2014

T3	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	8	7	14	13	27	72	204	288	134	308
2006	7	903	617	417	325	367	610	695	328	891
2007	350	173	133	269	261	320	559	668	328	813
2008	564	173	141	273	276	339	518	608	303	803
2009	646	141	140	269	271	363	580	775	393	1019
2010	12	12	14	26	32	79	257	342	163	464
2011	8	40	35	32	38	2701	273	452	219	509
2012	62	28	32	59	52	105	320	469	211	446
2013	60	20	20	38	57	186	355	514	263	558
2014	60	29	11	28	40	134	389	528	272	510

TABLE NO. 3

Total deaths in given age groups due to Bacterial diseases from 2005-2014

T4	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	80	1261	1014	778	648	646	665	699	38	851
2006	328	359	291	489	515	495	509	537	226	484
2007	188	422	411	753	770	767	832	753	311	716
2008	217	182	166	450	635	884	779	993	307	680
2009	645	195	177	314	507	942	796	944	383	684
2010	741	226	266	314	353	429	717	680	312	964
2011	784	217	227	304	361	462	685	900	403	1356
2012	745	192	231	257	343	459	634	877	413	1197
2013	762	195	241	310	427	527	737	1005	443	1293
2014	934	241	292	369	499	612	861	1076	477	1438

TABLE NO. 4

Total deaths in given age groups due to Infectious diseases from 2005-14

T5	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	131	1676	1505	1493	1470	1422	1353	407	507	1167

2006	518	554	559	1026	1189	1194	1123	1051	398	747
2007	335	575	631	1182	1247	1249	1348	1139	441	952
2008	318	257	296	860	1138	1402	1304	1521	459	952
2009	708	295	335	719	1072	1553	1458	1524	536	968
2010	1448	524	736	1527	1736	1925	2272	2275	968	2468
2011	915	352	495	1064	1124	1283	1455	1580	635	1749
2012	1025	326	523	845	1038	1227	1328	1504	604	1564
2013	938	310	493	1006	1185	1311	1489	1679	735	1783
2014	1124	331	524	1147	1289	1495	1711	2098	772	1948

TABLE NO. 5

Total deaths in given age groups due to Neoplasms from 2005-2014

T6	**<1**	**1-4**	**5 14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	4	37	70	91	129	160	231	272	130	224
2006	22	28	59	99	90	156	279	339	144	240
2007	20	37	61	87	111	231	414	401	205	344
2008	27	56	66	122	186	241	510	544	190	258
2009	50	104	138	289	394	434	591	588	256	381
2010	293	112	212	386	558	681	922	1028	437	807
2011	745	242	297	825	902	1173	1581	1739	695	1067
2012	431	131	241	389	431	679	1093	1131	462	784
2013	128	83	184	278	305	544	807	917	331	532
2014	86	86	232	383	438	738	1104	1234	483	684

TABLE NO. 6

Total deaths in given age groups due to Nervous system disorders from 2005-14

T7	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	2	24	42	31	22	36	45	32	19	38
2006	257	212	257	228	188	142	130	101	51	87
2007	227	229	227	146	155	176	174	142	57	109
2008	104	236	186	138	82	211	187	190	22	70
2009	111	263	205	134	174	279	207	193	39	71
2010	43	102	94	95	85	83	277	81	30	71
2011	44	139	181	77	87	82	85	104	34	72
2012	188	94	118	121	129	115	141	125	49	122
2013	185	106	154	137	115	139	164	153	72	135
2014	188	83	126	104	134	126	120	151	53	118

TABLE NO. 7

Total deaths in given age groups due to Circulatory system diseases from 2005-14

T8	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	26	291	287	358	529	685	1063	1170	353	1272

2006	96	209	219	497	538	765	1105	1346	608	1451
2007	493	286	409	908	1159	1431	2028	2415	1231	3116
2008	363	272	330	916	1279	1489	2020	2432	1097	2734
2009	569	364	390	939	1280	1563	2099	2544	1176	2958
2010	198	120	200	476	697	944	1536	1600	708	1736
2011	173	122	154	426	578	873	1387	1801	772	2149
2012	263	98	205	510	716	1016	1585	1968	961	2098
2013	318	81	159	505	653	1003	1621	2008	916	2144
2014	271	84	163	408	592	908	1559	2184	892	2373

TABLE NO. 8

Total deaths in given age groups due to Respiratory system diseases from 2005-14

T9	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	13	436	294	179	164	201	324	428	198	428
2006	223	164	120	98	117	152	307	424	208	494
2007	187	179	141	138	150	180	317	434	241	497
2008	170	176	134	128	178	346	205	507	292	558
2009	201	368	232	201	293	308	325	385	272	528
2010	476	182	154	231	285	336	536	556	264	726
2011	289	134	239	193	222	339	517	685	325	999
2012	491	144	130	209	240	348	570	770	369	944
2013	478	133	152	241	307	390	610	888	393	1063
2014	531	131	139	287	348	514	700	1110	456	1115

TABLE NO. 9

Total deaths in given age groups due to Digestive system diseases from 2005-14

T10	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	12	89	78	144	189	284	291	209	74	137
2006	74	62	103	123	190	229	275	205	69	138
2007	59	48	66	108	186	273	331	273	83	177
2008	47	22	73	115	186	246	322	294	166	277
2009	49	23	38	205	286	324	385	248	171	173
2010	82	38	86	162	259	364	461	316	127	221
2011	117	67	93	243	334	484	514	449	143	242
2012	230	44	79	222	359	639	655	502	165	302
2013	127	31	73	195	366	565	566	473	159	259
2014	119	61	105	234	440	676	736	606	192	355

TABLE NO. 10

Total deaths in given age groups due to accidents & consequences of external causes from 2005-14

T11	**<1**	**1-4**	**5-14**	**15-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-69**	**>=70**
2005	0	86	87	250	263	258	176	107	34	61
2006	24	88	119	395	404	347	258	182	65	141
2007	16	31	51	186	187	166	109	97	27	71
2008	30	30	34	104	132	156	171	201	49	123
2009	31	28	23	134	152	185	168	150	45	85
2010	219	47	85	197	249	257	344	403	170	485
2011	276	99	130	349	350	352	653	885	414	1107
2012	254	74	112	292	372	457	680	853	425	1205
2013	275	83	100	368	458	513	677	935	464	1225
2014	248	103	151	443	602	716	1041	1363	632	1776

TABLE NO. 11

We have tabulated the total number of deaths in the time period 2005-2014 (irrespective of these 10 mentioned diseases) for better analysis and understanding. In this part we also present the brief discussion about the proportion of MCCD considered as compared to total death along with % effect of major cause of death during the particular years. The data of total death and medically certified cause of death observed in CR office during the year are presented below. The proportionality of medically certified cause of death over total deaths is also presented for observation of coverage of deaths in T12:-

Year (T12)	**Total Certified Causes of deaths**	**Total Death**	**Percentage of Certified Cause of Death over Total Death**
2005	56390	94187	59.87
2006	60254	98908	60.92
2007	59256	100974	58.68
2008	57122	107600	53.09
2009	68373	112013	61.04
2010	76373	124353	61.42
2011	68326	112142	60.93
2012	67856	104616	64.86
2013	68135	97185	70.11
2014	74591	121286	61.5

TABLE 12.

Also, we are presenting the data of total cause of death considered of major ten diseases in this paper over the total cause of death observed by CRS data of Delhi CR office as per Annual Report in last ten years. The proportionality of coverage of certified cause of death i.e. considered 10 major diseases over the overall certified cause of death presented in Annual reports of Delhi for the time period 2005-2014 is also seen with its mean values.

Year (T13)	**Coverage of total cause of deaths of 10 major diseases**	**Total Certified Cause of death**	**Percentage of coverage/considered deaths**
2005	40003	56390	70.93%
2006	38668	60254	64.17%
2007	44999	59256	75.93%
2008	44010	57122	77.04%
2009	48285	68373	70.61%
2010	52757	76373	69.07%

2011	54413	68326	79.63%
2012	52027	67856	76.67%
2013	52922	68135	77.67%
2014	61222	74591	82.07%

Analysis of variance (**ANOVA**) is a collection of statistical methods used to analyze the differences among group means and their associated procedures such as "variation" among and between groups, developed by statistician and evolutionary biologist Ronald Fisher. In the ANOVA setting, the observed variance in a particular variable is partitioned into components attributable to different sources of variation. In its simplest form, ANOVA provides a statistical test of whether or not the means of several groups are equal, and therefore generalizes the *t*-test to more than two groups. ANOVAs are useful for comparing/testing three or more means (groups or variables) for statistical significance. It is conceptually similar to multiple two-sample t-tests, but is less conservative (results in less type I error) and is therefore suited to a wide range of practical problems.

STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES: SPSS is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis. In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary was stored in the datafile) are features of the base software.Statistics included in the base software:**Descriptive statistics:** Cross tabulation, Frequencies, Descriptives, Explore, Descriptive Ratio Statistics.**Bivariate statistics**: Means, t-test, ANOVA, Correlation (bivariate, partial, distances), Nonparametric tests**. Prediction for numerical outcomes**: Linear regression.**Prediction for identifying groups**: Factor analysis, cluster analysis (two-step, K-means, hierarchical), Discriminate**.** The many features of SPSS Statistics are accessible via pull-down menus or can be programmed with a proprietary 4GL *command syntax language*. Command syntax programming has the benefits of reproducibility, simplifying repetitive tasks, and handling complex data manipulations and analyses. Additionally a "macro" language can be used to write command language subroutines. A Python programmability extension can access the information in the data dictionary and data and dynamically build command syntax programs.SPSS Statistics places constraints on internal file structure, data types, data processing, and matching files, which together considerably simplify programming. SPSS datasets have a two-dimensional table structure, where the rows typically represent cases (such as individuals or households) and the columns represent measurements (such as age, sex, or household income). Only two data types are defined: numeric and text (or "string"). All data processing occurs sequentially case-by-case through the file. Files can be matched one-to-one and one-to-many, but not many-to-many. In this entire work, we have used the **Independent sample t test**.

ANALYSIS & INTERPRETATIONS we have performed analysis of variance (ANOVA) to establish the relationship between years and diseases for checking the exact variation of occurrences of diseases over the years. Also, we have done that for Disease wise analysis with respect of Age Group over the Years .

Lastly, we have used the independent t-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014.we have to establish the relationship b/w two factors i.e. Years and Diseases for checking the exact variation of occurrences of diseases over the years: Let us define the Hypothesis for Total deaths from jth disease in ith year, (i=2005, 2006,.....2014 , j=1,2,....10) = y_{ij}.

Null Hypothesis:

H_{OY} : $\mu_{2005}=\mu_{2006} = \ldots . = \mu_{2014}$,i.e .there is no significant difference among the years.

H_{OD} : $\mu_{.1} = \mu_{.2}= \ldots . . .= \mu_{.10}$, i.e there is no significant difference among the diseases.

Alternative Hypothesis:

H_{1Y}: At least two of μ_{2005} , μ_{2006}, ..., μ_{2014} are different, i.e at least two of the years differ significantly.

H_{1D}: At least two of the $\mu_{.1}$, $\mu_{.2}$, ... $\mu_{.10}$are different, i.e at least two of diseases significantly different.

In usual notations, we have: k=10, h=10, and N=h*k=10*10=100

Assumptions :

ANOVA test is based on the test statistics F (i.e. variance ratio)

For the validity of the F-test in ANOVA, the following assumptions are made:

1. The observations are independent.

2. Parent population from which the observations are taken is normal
3. Various treatment & environmental effects are additive in nature.

Calculations: (with respect to data in Table no. 1)

R.S.S = $\sum\sum y_{ij}^{\ 2}$ 3566467568

Correction Factor = $(G^2)/N$ = 2394203616

Total S.S = R.S.S – C.F =3566467568 – 2394203616 = 1172263952

Row Sum of squares = $\frac{\sum_i T_{i.}^{\ 2}}{10} - C.F$ 511.04

Column Sum of squares = $\frac{\sum_j T_{.j}^{\ 2}}{10} - C.F$ 719.2

Error Sum of squares= T.S.S –Row S.S- Col S.S = 237209721.4

ANOVA TABLE(T14)				
Sources of Variation	**Sum of squares**	**Degrees of freedom**	**Mean sum of squares**	**F statistic**
Between columns(diseases)	890413719.2	10-1=9	98934857.69	33.78
Between Rows (years)	44640511.04	10-1=9	4960056.782	1.69
Error	237209721.4	9*9=81	2928515.079	
Total	1172263952	10*10-1=99		

Conclusion

(Based on T14): Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 33.783 is greater than the tabulated value, it is significant and H_{OD} is rejected at 5% level of significance and we conclude that there is significant difference among the diseases.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 1.693 is less than the tabulated value, it is not significant and H_{OY} is accepted at 5% level of significance and we conclude that there is no significant difference among the diseases.

Disease wise analysis with respect of Age Group over the Years using ANOVA

To set the Hypothesis over the age groups and yearsas :-

For Age Groups (taken in columns)

Null Hypothesis (H_{OA}) : There is no significant difference in the death toll for different age groups for that particular disease.

Alternative Hypothesis (H_{1A}): There is a significant difference in the death toll for different age groups for that particular disease.

For Years (taken in rows)

Null Hypothesis (H_{OY}): There is no significant difference in the death toll for different years for that particular disease.

Alternative Hypothesis (H_{1Y}): There is a significant difference in the death toll for different years for that particular disease.

Analysis & Interpretations based on ANOVA

TUBERCULOSIS"*Calculations done with reference to table no. 2*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.347 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.

Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.086 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Tuberculosis.

ENDOCRINE, NUTRITIONAL & METABOLIC DISEASES

Calculations done with reference to table no. 3

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.345 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.

Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.89 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Endocrine diseases.

BACTERIAL DISEASES:*Calculations done with reference to table no. 4*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.127 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.13 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Bacterial diseases.

INFECTIOUS &PARASITIC DISEASES:*Calculations done with reference to table no. 5*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.116 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.09 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Infectious & Parasitic diseases.

NEOPLASMS:*Calculations done with reference to table no. 6*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.309 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.41 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Neoplasms.

NERVOUS SYSTEM DISORDERS:*Calculations done with reference to table no. 7*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.065 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.19 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Nervous system disorders.

CIRCULATORY SYSTEM DISEASES:*Calculations done with reference to table no. 8*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.437 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.

Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.09 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Circulatory system diseases.

RESPIRATORY SYSTEM DISEASES:*Calculations done with reference to table no. 9*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.240 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.152 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Respiratory System diseases.

DIGESTIVE SYSTEM DISEASES:*Calculations done with reference to table no. 10*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.333 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.154 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Digestive system diseases.

ACCIDENTS & CONSEQUENCES OF EXTERNAL CAUSES:-*Calculations done with reference to table no. 11*

Tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.49 is less than the tabulated value, it is not significant and (H_{OA}) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.Again, tabulated $F_{0.05}$ for (9,81) d.f is 1.997 and since the calculated value of F, i.e 7.869 is more than the tabulated value, it is significant and (H_{OY})is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for

the above mentioned cause -Accidents & Consequences of external causes.Thus, making a general conclusion of these individual ANOVA tests (taking age groups & years) we can say that the death toll due to all these causes has taken a significant leap from 2005 to 2014.This may be due to so many varied reasons , say, bad sanitation facilities, growing population & poverty, improper and inadequate medical facilities, lack of education, etc.

Now days, it is seem that data analysis work is mostly performed on either by SPSS and SAS for getting maximum accuracy and better conclusion of results. In this report we are using SPSS version 22.0 for analysis of various result in the direction of achieving the desired object of the research. We have already worked out above result with the help of available statistical software in DES, Delhi. Now we are presenting the analysis of independent sample t-test for these ten diseases as compared to gender which are seen in next part.Herewe have used the independent t-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014(i.e., your dependent variable would be "Male & Female deaths due to respective diseases" and your independent variable would be "gender", which has two groups: "male" and "female").

The null hypothesis for the independent t-test is that the population means from the two unrelated groups (Male & Female) are equal:

$H_0: u_1 = u_2$

In most cases, we are looking to see if we can show that we can reject the null hypothesis and accept the alternative hypothesis, which is that the population means are not equal:

$H_A: u_1 \neq u_2$

To do this, we need to set a significance level (alpha) that allows us to either reject or accept the alternative hypothesis. Most commonly, this value is set at 0.05.

The SPSS Output Result of t-test for ten considered diseases are seen as in Table 15 to 24-:-

- **Accidents & consequences of external causes**

Group Statistics

T15(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	3646.40	1765.339	558.249
	Female	10	2051.20	1040.488	329.031

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
T15(b)		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Deaths	Equal variances assumed	5.659	.029	2.46	18	.024	1595.2	648.00	233.80	2956.59
	Equal variances not assumed			2.46	14.58	.027	1595.2	648.00	210.54	2979.85

- **Bacterial diseases**

Group Statistics

T16(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	3440.00	456.171	144.254
	Female	10	2267.10	416.717	131.777

Independent Samples Test

T16(b)		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Deaths	Equal variances assumed	.064	.803	6.00	18	.000	1172.90	195.38	762.41	1583.38
	Equal variances not assumed			6.00	17.85	.000	1172.90	195.38	762.17	1583.62

- **Circulatory system diseases**

Group Statistics

T17(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	6261.20	1696.507	536.483
	Female	10	3615.50	1012.927	320.316

Independent Samples Test

T17(b)		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Deaths	Equal variances assumed	3.253	.088	4.23	18	.000	2645.70	624.83	1332.97	3958.42
	Equal variances not assumed			4.23	14.69	.001	2645.70	624.83	1311.47	3979.92

- **Digestive system diseases**

Group Statistics

T18(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	1603.40	547.396	173.102
	Female	10	664.60	197.237	62.372

Independent Samples Test

T18(b)	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Differen	95% Confidence Interval of the Difference

								ce	Lower	Upper
Deaths	Equal variances assumed	12.655	.002	5.10	18	.000	938.800	183.996	552.239	1325.36
	Equal variances not assumed			5.10	11.29	.000	938.80	183.99	535.12	1342.47

- **Endocrine, nutritional & metabolic diseases**

Group Statistics

T19(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	1590.00	876.719	277.243
	Female	10	1196.00	593.365	187.639

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
T19(b)		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Deaths	Equal variances assumed	4.666	.044	1.177	18	.255	394.00	334.77	-309.32	1097.32
	Equal variances not assumed			1.177	15.81	.257	394.00	334.77	-316.35	1104.35

- **Infectious & Parasitic diseases**

Group Statistics

T20(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	6607.20	1354.191	428.233
	Female	10	4035.10	953.981	301.675

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
T20(b)		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Deaths	Equal variances assumed	.278	.604	4.910	18	.000	2572.10	523.82	1471.58	3672.61
	Equal variances not assumed			4.910	16.168	.000	2572.10	523.82	1462.57	3681.62

- **Neoplasms**

Group Statistics

T21(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	2475.10	1513.081	478.478
	Female	10	1568.90	980.575	310.085

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
T21(b)		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Deaths	Equal variances assumed	1.441	.245	1.589	18	.129	906.20	570.17	-291.68	2104.08
	Equal variances not assumed			1.589	15.426	.132	906.200	570.17	-306.17	2118.57

- **Nervous system disorders**

Group Statistics

T22(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	830.80	229.298	72.510
	Female	10	522.10	121.066	38.284

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
T22(b)		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Deaths	Equal variances assumed	3.823	.066	3.765	18	.001	308.70	81.99	136.43	480.96
	Equal variances not assumed			3.765	13.656	.002	308.70	81.99	132.41	484.98

- **Respiratory system diseases**

Group Statistics

T23(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean

Deaths	Male	10	2221.30	588.675	186.155
	Female	10	1298.80	419.407	132.628

Independent Samples Test

T23(b)		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Deaths	Equal variances assumed	1.767	.200	4.03	18	.001	922.50	228.57	442.29	1402.70
	Equal variances not assumed			4.03	16.265	.001	922.50	228.57	438.59	1406.40

- **Tuberculosis**

Group Statistics

T24(a)	Male_female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	2008.80	479.362	151.587
	Female	10	1003.80	245.748	77.712

Independent Samples Test

T24(b)		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Deaths	Equal variances assumed	1.825	.193	5.90	18	.000	1005.00	170.34	647.115	1362.88
	Equal variances not assumed			5.90	13.42	.000	1005.00	170.34	638.170	1371.83

Interpretation of Independent t test for the disease- TUBERCULOSIS(T15): Looking at the group statistics table, we may conclude that male deaths due to tuberculosis are nearly double to that of female deaths due to the same disease for the whole tenure of 2005-2014.

Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to tuberculosis differ significantly.

The F value = 1.825.From the 95% confidence interval, we conclude that the difference of male & female deaths due to tuberculosis ranges on an average from 640-1365.

Interpretation of Independent t test for the disease- Endocrine diseases (T16) : Looking at the group statistics table, we may conclude that male deaths due to endocrine problems are greater than female deaths due to the same disease for the whole tenure of 2005-2014.

The group means (male & female) are not significantly different as the sig(2-tailed value) is more than 0.05. Thus, male and female deaths due to endocrine problems do not differ significantly.

The F value = 4.666.From the 95% confidence interval, we conclude that the difference of male & female deaths due to Endocrine and Metabolic diseases ranges on an average from 0-1100.Negative value shows there is non-linearity between the smallest observed value and a value of 0, and the inference on the intercept should therefore be ignored.

Interpretation of Independent t test for the disease- Infectious diseases(T17): Looking at the group statistics table, we may conclude that male deaths due to infectious diseases are greater than female deaths due to the same disease for the whole tenure of 2005-2014.Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to infectious diseases differ significantly.The F value = 0.278.From the 95% confidence interval, we conclude that the difference of male & female deaths due to Infectious diseases ranges on an average from 1471-3672.

Interpretation of Independent t test for the disease- Bacterial diseases(T18):Looking at the group statistics table, we may conclude that male deaths due to bacterial diseases are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to bacterial diseases differ significantly.

The F value = 0.064.From the 95% confidence interval, we conclude that that the difference of male & female deaths due to Bacterial diseases ranges on an average from 762-1583.

Interpretation of Independent t test for the disease- Neoplasms(T19):Looking at the group statistics table, we may conclude that male deaths due to neoplasms is greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are not significantly different as the sig(2-tailed value) is more than 0.05. Thus, male and female deaths due to neoplasms do not differ significantly.The F value = 1.441.From the 95% confidence interval, we conclude that the difference of male & female deaths due to Neoplasms ranges on an average from 0-2104. Negative value shows there is non-linearity between the smallest observed value and a value of 0, and the inference on the intercept should therefore be ignored.

Interpretation of Independent t test for the disease- Nervous system disorders(T20): Looking at the group statistics table, we may conclude that male deaths due to nervous system disorders are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to nervous system problems differ significantly.The F value = 3.823.From the 95% confidence interval, we conclude that that the difference of male & female deaths due to Nervous system disorders ranges on an average from 136-481.

Interpretation of Independent t test for the disease- Circulatory problems(T21): Looking at the group statistics table, we may conclude that male deaths due to circulatory system diseases is nearly double to that of female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to circulatory problems differ significantly. The F value = 3.253

From the 95% confidence interval, we conclude that that the difference of male & female deaths due to Circulatory system diseases ranges on an average from 1333-3958.

Interpretation of Independent t test for the disease- Respiratory problems(T22): Looking at the group statistics table, we may conclude that male deaths due to respiratory problems are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to respiratory problems differ significantly.The F value = 1.767.From the 95% confidence interval, we conclude that the difference of male & female deaths due to Respiratory system diseases ranges on an average from 442-1403.

Interpretation of Independent t test for the disease- Digestive problems(T23): Looking at the group statistics table, we may conclude that male deaths due to digestive system problems is even greater than double to that of female deaths due to the same disease for the whole tenure of 2005-2014.Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to digestive problems differ significantly. The F value = 12.655.From the 95% confidence interval, we conclude that the difference of male & female deaths due to Digestive system diseases ranges on an average from 552-1325.

Interpretation of Independent t test for the disease- Accidents(T24): Looking at the group statistics table, we may conclude that a male death due to accidents & consequences of external causes is greater than female deaths due to the same disease for the whole tenure of 2005-2014.Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to accidents & consequences of external causes differ significantly.The F value = 5.659.From the 95% confidence interval, we conclude that the difference of male & female deaths due to accidents & consequences of external causes ranges on an average from 234-2957.

LIMITATIONS : Since, only major 10 medically certified causes of death are taken into consideration; it doesn't serve the purpose of studying all the causes (the population). When information about each unit/cause of population is required, complete enumeration of causes is required. Moreover, as discussed, the ANOVA is valid only under certain assumptions, denying to which it will lead to illogical results and interpretations. Thus, the assumptions are to be stringently kept into mind before reading ANOVA. Same is the case with independent sample t test.We are unable to give the optimum suggestion to government due to unavailability of data on socio-economic condition of disease affected person. Health facilities provided by government are not known or not taken in this research work.

CONCLUSION: The analysis of causes of death is an optimum way to know the relative impact of the particular diseases on the life. This way, it may also help to improve the health facilities for preventing from these diseases after formulating the better plan and introducing the various schemes. Government may also improve the health facilities for prevention of most fatal diseases among the various age groups of persons who are mostly affected. The conclusion drawn from investigating the major death causing diseases in Delhi Region from reveals that:▪Infectious & Parasitic diseases, Circulatory system diseases, neoplasms, Respiratory system diseases, bacterial diseases and accidental death cases claimed more lives.▪It can be concluded that the cause-specific death ratios based on the objective of study indicated that among the leading causes of death Infectious & Parasitic diseases, Circulatory system diseases, and Bacterial diseases and accidents were the most common.▪It is necessary to point out that Infectious & Parasitic diseases, bacterial diseases and accidental deaths demonstrated an upward trend while that of circulatory system diseases exhibited a pattern of downward trend. Future expected death cases from Infectious & Parasitic diseases, bacterial diseases and accidents may increase while that of Circulatory system may decrease throughout the forecasted period of study. For a better conclusion to be realized, future studies may involve other institutions to come forward with the current situation. It is also necessary for the government to channel resources in this area to alleviate the trend of the diseases.

SUGGESTIONS & FUTURE PROSPECTS: There should be a campaign, in support by youth on major diseases as control programs. Major issues include lack of qualified and well equipped trained staff, limited availability of medications and insufficient financial resources. The Government and civil society must take a series of actions to review and develop health legislation and a comprehensive strategy and policy to promote the health care delivery service in the Delhi. There must be an improvement in the data capture on morbidity and mortality .Departments can organize routine data management training for the staffs who are responsible for all records relating to the health service. The ministry of health should collaborate with the food and drugs Board to monitor the quality of food and drugs imported at road check points. Scientists revealed that, the body loses and replaces approximately 1.5 million skin cells every hour. It is very essential to bath frequently, at least twice daily. This helps to prevent skin infections. Sweats and oil secretions on the skin enable bacteria and fungi to breed easily.

Finger nails should always be kept short and clean so that they do not provide breeding grounds for germs. The spaces between teeth where food particles are trapped provide convenient breeding grounds for bacteria. Hence teeth should therefore be cleaned at least twice every day, in the morning and preferably in the evening after meal. In addition to cleanliness, other factors which are important in promoting health include exercises, recreation and rest. Exercises make the muscles strong and help to get rid of metabolism as well as improving the action of glands and the nervous system. Recreation such as gardening, reading and playing games can remove any dullness, stress and mental tiredness resulting from every day's work. The best form of rest is sleep. Adults need eight hours sleep daily. A great deal of repair of worn-out tissues in the body and the building up of new ones takes place when the body rests. Other good personal habits include avoiding smoking and alcoholic drinks. Moreover, there should be yearly promotional campaigns on vaccination and immunization program against communicable diseases by the government and the Ministry of Health (M H O).The Ministry of Health in collaboration with the World Health Organization (WHO), if possible, should establish law enforcement against cigarette smoking in public.

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research analysis. Fourth author always engaged in cheeking the statistical table and its accuracy presented in various tables especially in research analysis part of paper.

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