

The source of the data is kaggle on: Worldwide deaths by country/risk factors WHO data - deaths by country and risk factors url link<https://www.kaggle.com/vanpi94/worldwide-deaths-by-risk-factors> The data was previously downloaded from WHO Website.

```
In [2]: #import the necessary libraries
import pandas as pd
import numpy as np
from sklearn.decomposition import FactorAnalysis
from factor_analyzer import FactorAnalyzer
import matplotlib.pyplot as plt
```

```
In [3]: #path to the data
path='D:/coding/deaths2.csv'
Data=pd.read_csv(path)
Data.head()
```

Out[3]:

	Unsafe water source	Unsafe sanitation	No access to handwashing facility	Household air pollution from solid fuels	Non-exclusive breastfeeding	Discontinued breastfeeding	Child wasting	Child stunting	Low birth weight for gestation	Secondhand smoke	...	High systolic blood pressure
0	7554.049543	5887.747628	5412.314513	22388.49723	3221.138842	156.097553	22778.84925	10408.43885	12168.56463	4234.808095	...	28183.98335
1	7359.676749	5732.770160	5287.891103	22128.75821	3150.559597	151.539851	22292.69111	10271.97643	12360.63537	4219.597324	...	28435.39751
2	7650.437822	5954.804987	5506.657363	22873.76879	3331.349048	156.609194	23102.19794	10618.87978	13459.59372	4371.907968	...	29173.61120
3	10270.731380	7986.736613	7104.620351	25599.75628	4477.006100	206.834451	27902.66996	12260.09384	18458.42913	4863.558517	...	30074.76091
4	11409.177110	8863.010065	8051.515953	28013.16720	5102.622054	233.930571	32929.00593	14197.94796	19958.38854	5292.379854	...	30809.49117

5 rows × 29 columns

I then filled any missing values in the data with a zero

```
In [4]: Data1= Data.fillna(0)
```

Adequacy Test Before I performed factor analysis, I evaluated the “factorability” of the dataset which means can we found the factors in the dataset?”. The two main methods to check the factorability adequacy are:

Bartlett’s Test Kaiser-Meyer-Olkin Test

```
In [5]: #step 2 determining factorability using bartlett-sphericity method
from factor_analyzer.factor_analyzer import calculate_bartlett_sphericity
chi_square_value,p_value=calculate_bartlett_sphericity(Data1)
chi_square_value,p_value
```

Out[5]: (920298.3045915877, 0.0)

since we found the data to be statistically significant I went ahead with the analysis

```
In [6]: #KMO test
from factor_analyzer.factor_analyzer import calculate_kmo
kmo_all,kmo_model=calculate_kmo(Data1)
print("\n\nKMO Model\n",kmo_model)

n
KMO Model
0.9310832018826186
```

The KMO Value is more than 0.5 so we proceed with the analysis.

```
In [7]: #extract the factors
factor=FactorAnalysis().fit(Data1)
Factors=pd.DataFrame(factor.components_)
print(Factors)
```

	0	1	2	3	4	\
0	113856.951345	83590.009787	66248.451654	166055.838007	21343.658553	
1	98457.102489	76062.757171	59021.213812	79985.233377	18271.207564	
2	16751.273885	11283.947595	10955.094073	-36508.766773	664.988040	
3	-5139.182210	-3557.161669	-3583.771424	5331.532247	-526.404285	
4	7951.885701	8082.366441	1015.469668	-1056.232175	1897.482590	
5	11227.261200	4782.709906	485.141911	7369.339862	-2873.380861	
6	-2499.291876	-701.369504	368.822831	-5056.557237	1708.329892	
7	-2858.831494	-2944.892112	-195.087848	784.382639	1544.538887	
8	-10803.605805	-7830.717611	-6687.826303	14163.593559	1041.370810	
9	5764.256602	3854.772361	1241.710425	-868.542086	-613.350963	
10	-805.478074	-91.435740	111.423630	1651.070635	-320.375709	
11	3574.918396	3418.384360	1171.837517	1343.521841	-42.079005	
12	978.626842	1790.722780	-114.065300	-1658.980840	-289.349981	
13	1090.863140	-44.478747	1257.242433	1593.562018	-828.616490	
14	-569.306180	-311.283698	-711.668401	-3127.269613	-198.679971	
15	514.573806	750.630523	-1886.156713	-350.556888	104.498218	
16	4.079557	-1412.143839	1518.075619	-1755.278971	-51.133674	
17	847.961090	-540.773861	-557.468145	-1050.505290	820.144475	
18	408.289426	-53.024600	58.019442	-346.187205	140.761414	
19	459.794766	-146.168339	-150.651770	220.542969	636.815889	
20	663.784725	-1274.408594	648.714061	511.032994	423.093359	
21	-33.474348	38.769459	518.451283	2.708432	766.223194	
22	106.549336	-481.870724	67.676407	125.443508	575.001117	
23	171.979218	-361.662496	474.442476	-118.899623	629.555508	
24	563.480132	-230.891043	-1028.291017	60.819496	252.539386	
25	473.684948	-589.294272	47.242213	39.735443	-895.103820	
26	216.967610	-98.963007	-253.399593	-21.649609	102.762036	
27	-1.754601	-37.077841	10.462208	-0.011809	133.160088	
28	2.538540	-1.606661	-1.421763	-0.833070	15.479783	

	5	6	7	8	9	\
0	1350.224661	147038.176381	39639.495793	111578.198182	97730.465970	
1	1181.920844	134491.980126	40730.522205	73344.934442	6414.047433	
2	119.116204	8805.531425	2725.243015	5633.898015	-19701.332966	
3	-58.440316	-5208.948074	-1562.467565	-2388.701719	4023.217158	
4	77.321992	11125.831854	6194.221332	2716.845275	-211.953699	
5	-286.319969	-25980.496653	-8414.539445	2006.901049	1418.610043	
6	171.745875	11903.841565	4616.170639	-501.380626	1867.188587	
7	154.933033	10356.915987	2832.030616	339.818638	1114.487887	
8	65.646276	354.914633	-1569.158749	6599.888218	5617.691641	
9	-57.847243	-3260.259373	-120.263672	-2028.306161	-1701.434453	
10	-35.935248	2936.790397	792.728049	-6570.320799	192.368739	
11	5.277151	-4120.380802	-1262.363317	2355.832724	161.975389	
12	-17.946554	-306.114956	611.070894	604.066106	736.856972	
13	-130.336009	117.265693	180.425603	-7462.621466	-849.232296	
14	-13.792483	-210.644435	953.534003	524.578420	619.144400	
15	15.498516	-565.997341	1079.948926	-519.281625	1655.754288	
16	37.069018	840.317949	-1604.659155	532.016230	-1499.903659	
17	147.801406	543.782510	263.859025	-296.916187	1472.161339	
18	51.299606	-278.877666	325.602409	-22.412718	1180.340284	
19	107.911414	837.471120	-995.668550	-641.501929	466.738011	
20	118.927247	-529.181658	-76.191499	206.793638	-188.965909	
21	90.183073	-303.522176	91.376041	-163.172454	496.594719	
22	85.949365	-203.891361	1472.768669	-19.858609	-649.144509	
23	78.656017	-234.027399	-274.692267	99.551381	572.919528	
24	44.442110	98.569796	-320.353664	71.709194	-448.346894	
25	-122.534416	76.436323	182.149576	55.392407	299.518766	
26	42.268452	-11.439528	-64.274626	-3.716497	-194.479017	
27	-26.491093	-4.439927	-16.831692	-24.880062	-9.557362	
28	-128.042411	-0.522492	-0.291560	0.643629	-0.812950	

	19	20	21	22	\
0	677645.532404	524665.599921	6697.833727	39422.496656	
1	-56885.781914	-47102.206423	5844.941056	41140.909294	
2	23301.681900	-29599.930263	733.061392	3466.651838	
3	-7809.033386	4078.345425	-226.169825	-1945.890177	
4	2128.860091	24055.551142	660.071718	5458.278538	
5	4398.231666	-34925.682638	119.654261	-9820.762264	
6	23159.917239	-21644.341988	-69.930532	5206.113729	
7	-2307.463473	-11224.260913	-201.902682	3741.505825	
8	1088.395415	-1795.044163	-266.474607	-2145.731683	
9	6074.266865	99.883432	243.529552	-187.576631	
10	-356.967168	844.812186	-182.953418	1420.453994	
11	-906.639603	1167.113084	337.448844	2902.597435	
12	-3908.370731	366.660449	286.886655	538.242017	
13	464.134926	-311.412571	-211.473093	1413.449864	
14	-836.475329	174.976089	9.897170	1269.309191	
15	-668.773848	-138.880974	43.379106	1440.390771	
16	-39.030795	21.318819	-183.344804	-626.176796	
17	380.776391	-82.159692	-308.754863	-1190.720363	
18	425.631589	11.827261	97.463418	38.893815	
19	-541.741804	125.618695	-266.587500	-1360.315012	
20	-72.720250	136.691681	-318.217277	1074.171252	
21	-216.165233	-107.407032	-215.437256	104.370872	
22	-46.229374	16.876436	-163.274775	-751.190293	
23	-109.950527	43.820998	-169.058132	452.674548	
24	58.144528	-4.985825	-115.135639	264.900241	
25	-106.283242	9.946485	234.124926	-153.598823	
26	-0.189508	5.786960	27.857827	77.317048	
27	-2.049032	-0.416953	452.834007	-0.352824	
28	0.068073	0.234007	-11.841479	0.232593	

	23	24	25	26	27	\
0	18262.986644	380288.804489	227079.562069	227165.220702	208711.838337	
1	-2.951322	72481.629868	-4096.008532	-4099.208654	-11470.326530	
2	1479.816232	-46331.068649	-21561.232610	-67950.616385	3788.167926	
3	-386.146071	8262.772177	4522.684634	13801.845035	-985.924304	
4	-395.150265	-8255.471163	-6996.033991	-23712.729288	2051.010611	
5	2215.825525	22560.034422	16942.261823	-10718.141383	6295.337661	
6	-3111.746980	-9725.239831	-6324.978838	9021.404716	12439.471117	
7	566.891004	-518.439729	-3565.280780	17948.543532	-5468.450791	
8	-1758.877268	1638.225424	-14654.654560	-6896.323833	1825.832220	
9	798.174059	-4436.994082	-7874.569474	4281.663987	-2302.605957	
10	294.253017	-72.404369	-2650.844948	-773.048575	-2842.519956	
11	215.052728	548.530217	-6099.097164	3036.128018	-544.881237	
12	-136.634879	-2196.290202	223.473337	1228.835542	3397.038277	
13	92.367991	2508.927715	-1996.058319	-1054.940363	246.880097	
14	233.070405	3086.793521	-2282.016106	-283.112772	2132.264503	
15	255.000900	7.255058	358.545114	650.189721	-593.959432	
16	281.497785	1322.938314	-572.685900	173.080816	-904.618417	
17	368.929348	181.599533	-61.448657	-395.103546	-232.691541	
18	-312.230935	-38.233250	20.049287	-402.922606	-232.790502	
19	-92.524658	-335.203845	47.916600	211.810587	1041.959468	
20	373.948840	-424.971993	40.475510	67.375358	1014.979191	
21	137.282391	-35.467360	-24.124348	199.874559	523.349522	
22	38.184428	111.596094	-0.093197	39.130252	-176.288993	
23	-265.891376	-74.931697	-11.482193	-34.024246	-892.958804	
24	722.568344	54.723555	-20.844243	-10.575932	-220.597424	
25	-25.265653	-113.246637	3.101590	65.363993	-21.072042	
26	-762.752826	66.172717	-2.887726	27.557939	35.451192	
27	38.548140	3.296447	0.852598	-1.078402	12.175791	
28	-3.631259	-0.031548	-0.014132	0.153140	0.942300	

	28
0	134