Identifying Latent Factors of Cardiovascular Disease Risk

A MULTIVARIATE ANALYSIS

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Introduction

Heart disease is the leading cause of death among Americans; stroke is the fourth most-common cause (CDC/NCHS, 2025). "Cardiovascular disease" (CVD) is an umbrella term encompassing several conditions, including arteriosclerosis, peripheral artery disease, deep vein thrombosis, pulmonary embolism, myocardial infarction (heart attack), congestive heart failure, and cerebrovascular accidents (strokes).

Early stages of cardiovascular disease often begin with arteriosclerosis, which is the hardening and narrowing of large arteries due to the buildup of fat and plaque. These plaques are called *thrombi* (plural of *thrombus*) and are commonly composed of platelets (sticky blood cells) and proteins. For example, deep vein thrombosis is a condition where thrombi build up in the veins of the lower extremities, causing severe pain and swelling of the lower limbs. When a thrombus detaches from the blood vessel wall, it becomes an *embolus*, capable of travelling through the circulatory system and lodging in distant blood vessels. An embolus that travels to the lungs is called a pulmonary embolism, which is a life-threatening emergency. A thrombus or embolus inside the heart or in blood vessels that supply the heart can cause a myocardial infarction (heart attack), while a thrombus or embolus in an artery in the brain can cause an ischemic stroke.

Strokes come in two types: ischemic, caused by blockage of a blood vessel resulting in oxygen deprivation of the tissue, and hemorrhagic strokes, caused by internal bleeding. Pulmonary embolism, heart attack, and stroke are all considered "cardiovascular events" that carry a significant risk of death. If survived, long-term effects include fatigue, pain, weakness, paralysis, cognitive deficit, and psychiatric disorders such as depression, anxiety, and post-traumatic stress disorder.

Therefore, understanding risk factors that negatively impact cardiovascular health is critical for improving not only life expectancy, but also quality of life.

Objective

The purpose of this analysis is to identify latent factors behind CVD risk. Such factors are composed of variables that "move together", i.e. variables that tend to change as the others change.

We seek to discover the latent factors so that we can describe associations between variables which are known, in isolation, to contribute to CVD risk. Factors composed of multiple related variables can be used to generalize broader categories of risk factors for CVD, potentially simplifying patient education about CVD and how to mitigate risk factors with lifestyle choices.

Data

The “Elderly CV/MRI and Biomarkers” dataset used in this factor analysis is sourced from RCTdesign.org, an R package sustained by five biostatisticians and medical professionals.

Eighteen out of thirty features included in the data set were retained. These are all numeric variables that are either continuous or count (integer) data. These variables include:

- Age (yrs)
- Weight (lb)
- Height (cm)
- Smoking Pack-Years (the number of packs the patient smokes per day, multiplied by the number of years they have been a smoker)
- Years since Quitting Smoking (integer count in years)
- Alcohol Consumption (drinks/week)
- Physical Activity Level (kcal burned/week)
- Low-Density Lipoprotein (mg/dL)
- Albumin Level (g/dL)
- Creatinine Level (mg/dL)
- Platelet Count (1000 platelets/µL)
- Systolic Blood Pressure (mm Hg)
- Ankle-Arm Index (systolic pressure ratio)
- Forced Expiratory Volume (L/sec)
- Digit Symbol Substitution Test Score (number correct)
- Brain Atrophy Measure (representation of neuronal loss on a scale of 0-100)
- Number of Brain Infarcts (integer count)
- Volume of Brain Infarcts (mL).

Twelve features were disqualified from use in factor analysis:

- Patient ID is unique to each patient and thus irrelevant for factor analysis.
- MRI Date and Observation Time are both time variables recorded for data completeness, but also irrelevant for factor analysis.
- The remaining nine variables are of type “factor,” meaning they are either character or integer data representing levels of a variable and not continuous numeric variables. Variables in this category include Sex, Race, Congestive Heart Failure Status, Chronic Heart Disease status, Stroke History, Diabetes Status, General Health Status, White Matter Hyperintensity Grade, and Mortality Status.

The data originally had 735 observations. 47 were omitted by SAS due to missing values.

Methods

Factor analysis is a statistical method used to discover hidden, latent processes (or "factors") that cause variables to move "together". Some variables don't vary independently – for instance, those who tend to be older also tend to have lower muscle mass. Factor analysis seeks to discover underlying variables that can't be measured directly, using variables we do have.

There are several ways to identify how many factors one should consider. The first is the eigenvalues table – factors with eigenvalues greater than or equal to 1 should be considered, whereas those with eigenvalues less than 1 may be negligible.

Looking at the eigenvalues table, we see 7 factors with eigenvalues greater than or equal to 1, indicating that 7 factors would be the optimal number to consider.

Eigenvalues of the Correlation Matrix: Total = 18 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	2.60434384	0.62629531	0.1447	0.1447
2	1.97804853	0.58677582	0.1099	0.2546
3	1.39127272	0.14687449	0.0773	0.3319
4	1.24439823	0.08388094	0.0691	0.4010
5	1.16051728	0.09580852	0.0645	0.4655
6	1.06470877	0.03811470	0.0592	0.5246
7	1.02659407	0.06273012	0.0570	0.5817
8	0.96386396	0.03825019	0.0535	0.6352
9	0.92561377	0.03028136	0.0514	0.6866
10	0.89533241	0.05824924	0.0497	0.7364
11	0.83708317	0.08215085	0.0465	0.7829
12	0.75493232	0.02219705	0.0419	0.8248
13	0.73273527	0.08592315	0.0407	0.8655
14	0.64681212	0.06907236	0.0359	0.9015
15	0.57773976	0.08492567	0.0321	0.9336
16	0.49281409	0.06072108	0.0274	0.9609
17	0.43209301	0.16099633	0.0240	0.9849
18	0.27109668		0.0151	1.0000

Table 1. Table of Eigenvalues of the Correlation Matrix of variables of the Cardio data set.

A second way, the Scree plot, can be used to visually analyze the results of the eigenvalues for determining the number of factors we should consider for optimal information. A Scree plot is a linear graph displaying eigenvalues for each factor sequentially. To analyze the results of a Scree plot, we look for an "elbow" (a sharp corner along the curve) and consider the value on the x-axis immediately preceding the elbow.

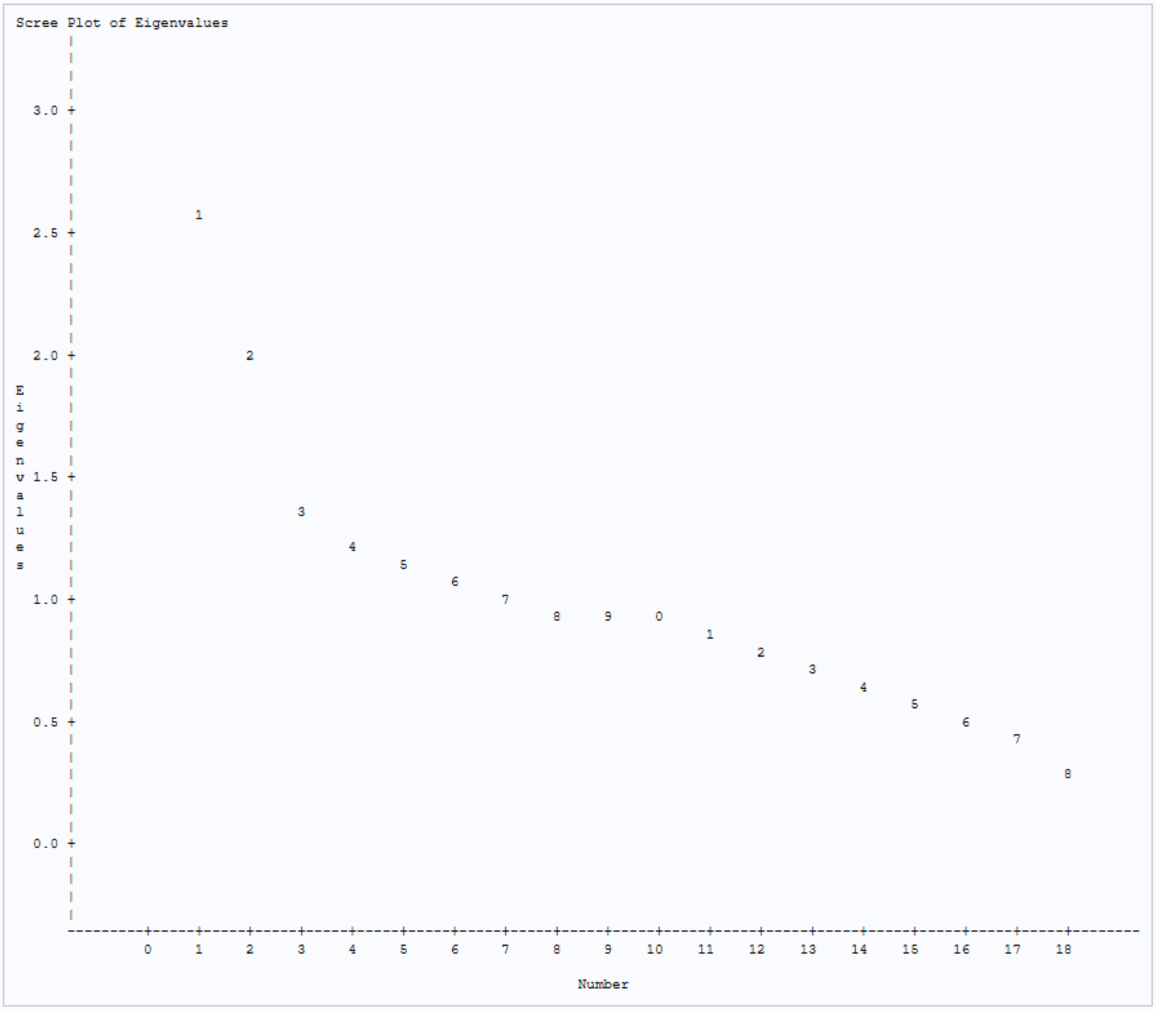

Figure 1. Scree plot of Eigenvalues of the Correlation Matrix of the Cardio data set.

From the scree plot, we see two major "elbows" that signal cutoff points for optimal factor counts; one at eigenvalue 4, and one at eigenvalue 8. Respectively, these should indicate keeping either 3 or 7 factors.

The third way is to examine the root-mean squared residuals (RMSR), which is the square root of the average of the squared differences between the residuals observed and the reproduced residuals. The smaller the RSMR, the better the factor solution is at explaining the observed correlations.

When considering the residuals with 7 factors, the overall RMSR is not optimal in either of these cases, producing values greater than 8%. We want the overall RMSR to be less than 5% ideally, or between 5% and 7.5% acceptably.

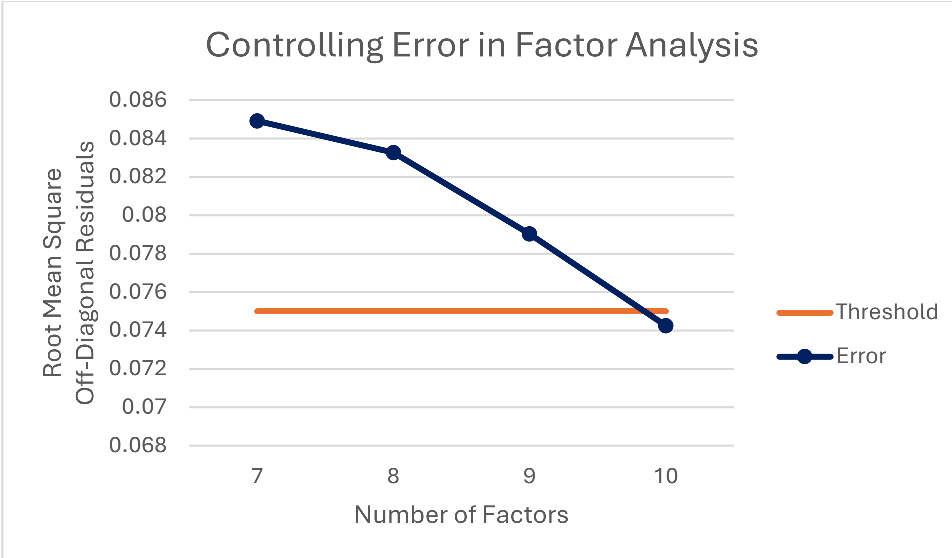

Figure 2. Root Mean Square Off-Diagonal Residuals vs Number of Factors. Controlling error to under 7.5% necessarily increased the number of latent factors from 7 to 10.

Starting with 7 factors, we iteratively increased the number of factors by one until the RMSR fell under 7.5%. Control of error was achieved at 10 factors, with an error of 7.4251%. Reexamining our previous methods for selecting number of factors, we see that eigenvalues 8, 9, and 10 have values close to 1. Additionally, 10 factors explain 73.64% of the variation present in the data, compared to only 58.17% explained by 7 factors.

Another method commonly used in determining the number of factors present is hypothesis testing. In SAS, the `METHOD=ML` option in `PROC FACTOR` automatically tests whether the number of factors specified is sufficient to explain the data. However, this method relies on the assumption of multivariate normal data. Our data includes several zero-inflated columns which would violate this assumption, so we instead used the `METHOD=PRIN` option, which uses principal components and thus does not make any assumptions about the distribution of the data.

Factors

Observing the rotated factor pattern of our 10 factors, we look at each variable and determine which factor it has the highest standardized correlation (loading) with. For example, the variable “Age” has the highest correlation with factor 2, whereas “PhysAct” (physical activity level) has the highest correlation with factor 7. The complex nature of biological data means that some of our variables have only moderate correlation with their latent factors.

Rotated Factor Pattern										
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10
Age	-0.27302	**-0.56876**	0.07667	-0.12652	0.55707	-0.08024	-0.09190	0.07178	-0.10948	0.00785
Weight	**0.78195**	0.06913	0.05306	0.09388	-0.10497	0.07280	-0.17761	-0.05286	0.03707	-0.00192
Height	**0.82352**	-0.01321	-0.03357	0.15071	0.09383	-0.20655	0.07478	-0.01693	0.02170	0.04907
PackYrs	0.09179	-0.04459	-0.02603	**0.87348**	-0.10701	-0.01596	-0.07691	0.04885	0.07295	0.06977
YrsQuit	0.24516	-0.22657	-0.14465	0.20172	0.39548	0.14084	0.25395	**-0.44032**	0.09975	-0.05333
Alcohol	0.02911	0.24902	0.21032	**0.55556**	0.35453	0.03129	0.25174	-0.08419	-0.22279	-0.05531
PhysAct	0.01315	-0.03746	-0.01551	-0.00936	-0.15473	-0.04680	**0.87255**	0.03438	0.00067	0.06847
LDL	0.00941	-0.08869	0.00404	-0.04082	-0.06405	**0.78796**	-0.12672	-0.00102	-0.06472	0.32290
Albumin	0.03635	0.07086	-0.01631	0.05287	0.06841	0.04231	0.07563	-0.04758	0.02792	**0.90955**
Creatinine	**0.48389**	-0.34805	-0.06204	0.22004	0.12411	-0.17550	-0.09594	0.30908	-0.06432	0.04972
Platelets	-0.25004	0.13584	0.03107	0.04530	0.02151	**0.69324**	0.07950	0.05045	0.05850	-0.30102
SystolicBP	0.01003	-0.04163	**0.88320**	-0.10334	0.05304	-0.01925	0.06768	0.06411	-0.08358	-0.03031
AnkleArmIndex	0.13648	0.20119	**-0.67224**	-0.23303	0.00010	-0.06699	0.13573	-0.01306	-0.24416	-0.01647
ForcedExpiratoryVolume	**0.74384**	0.16156	-0.13947	-0.22135	0.03531	-0.05098	0.22445	-0.01500	-0.07922	0.01364
DigitSymbSubTest	0.04265	**0.84279**	-0.16879	0.00803	0.05522	-0.01388	-0.07850	-0.03561	-0.09440	0.07065
Atrophy	0.07106	0.04552	0.03767	-0.01148	**0.79334**	-0.03934	-0.16816	0.08320	0.10859	0.07680
NumInfarct	0.01804	-0.10162	0.04756	0.04440	0.10742	0.07785	0.07900	**0.86141**	0.11925	-0.06957
VolumeInfarct	-0.01071	-0.04650	0.06065	0.00096	0.07764	-0.01301	0.00416	0.08497	**0.93473**	0.01972

Table 2. Rotated Factor Pattern, with highest-magnitude loadings highlighted. For a larger-print version, please see Appendix.

Below is the full factorization we derived from the rotated factor patterns (loadings) table, with factors numbered 1-10 and titles in blue:

1. Physiology: Weight, Height, Creatinine, Forced Expiratory Volume

The variables "Weight," "Height," "Creatinine," and "Forced Expiratory Volume" have to do with an individual's Physiology. Increased weight is well-known to be a risk factor for cardiovascular disease. Height is also a risk factor, because veins (comparatively weaker than arteries) must work to return blood from the lower extremities back to the heart, against gravity. Slower blood has an increased chance of pooling and forming a clot. Creatinine is a normal waste product of muscle breakdown, which kidneys remove from the blood. High creatinine values could indicate that the kidneys have reduced ability to clear creatinine from the blood. Kidney disease is most often due to chronic conditions such as diabetes or hypertension, but these organs are also susceptible to damage from blood clots. Finally, forced expiratory volume is a measure of the amount of air a person can forcefully exhale. The higher the score, the healthier the lung function; however, this variable may be somewhat confounded with Height, since taller people have larger lungs and can expel more air.

2. Senescence: Age, Digit Symbol Substitution Test Score

The variables "Age" and "Digit Symbol Substitution Test Score" both have to do with Senescence, which is defined as the process of deterioration with age. Age in years is self-explanatory and a general indicator of the stage of natural cell death. The Digit Symbol Substitution Test (DSST) is an indicator of general cognitive function, as impaired processing speed, working memory, and attention all contribute to lower scores. Notice that in this factor, Age has a negative loading while DSST has a positive one. The opposite signs show the contrast between these two variables, capturing the inverse relationship between age and cognitive test performance.

3. Blood Pressure: Systolic Blood Pressure, Ankle-Arm Index

"Systolic Blood Pressure" and the "Ankle-Arm Index" are both variables having to do with Blood Pressure. Systolic blood pressure is the first or "top" number in a blood pressure (BP) reading (the second or "bottom" number is known as "diastolic blood pressure"). Systolic blood pressure measures the pressure the blood exerts against arterial walls while the heart muscles are contracting. Higher systolic BP can indicate narrower arteries due to plaque buildup, which increases the risk of cardiovascular events. The Ankle-Arm Index measures the systolic pressure at two locations: the ankle and the upper arm. The pressure measured at the ankle is divided by the pressure measured at the arm, giving a ratio. A ratio of 1 or above is considered healthy; lower ratios indicate peripheral artery disease (narrowing of lower limb arteries), which is associated with a greater risk of cardiovascular events. Therefore, it makes sense that in this factor, Systolic BP is positive, and Ankle-Arm Index is negative, since higher Systolic BP and lower Ankle-Arm Index are associated with greater risk of cardiovascular events. This is another example of an inverse relationship reflected in the contrast of a factor.

4. Substance Use: Smoking Pack-Years, Alcohol Consumption

"Smoking Pack-Years" and "Alcohol Consumption" are two examples of Substance Use. Tobacco and alcohol are both considered recreational drugs with risk of dependence (also known as addiction, or substance use disorder). Reducing or abstaining from substance use can have a huge positive impact on an individual's cardiovascular health.

5. Atrophy: Brain Atrophy Measure

The human brain is not only surrounded by cerebrospinal fluid but also contains reservoirs which are filled with cerebrospinal fluid, called ventricles. The ventricles appear on brain scans as blank areas within the neuronal tissue. The Brain Atrophy Measure is a score of how enlarged the ventricles are (and consequently, how much the neuronal tissue has shrunk) relative to a normal brain with no atrophy. A score of 0 indicates no atrophy while a score of 100 indicates maximal atrophy. To some degree, brain atrophy is normal as individuals age, but severe atrophy is associated with cognitive deficit and degenerative processes. It's also worth noting that "Age" has a large positive loading in this factor, nearly equal in magnitude to its loading in the Senescence factor. Aging could also be described as a process of atrophying: muscle mass, bone density, connective tissue elasticity, and cognitive function all decline as people age. Thus, this factor, composed of "Age" and "Brain Atrophy Measure," can be called Atrophy.

6. Lab Values: Low-Density Lipoproteins, Platelet Count

“Low-Density Lipoproteins” and “Platelet Count” are both Lab Values from common blood tests. Low-density lipoproteins (LDL), commonly known as “bad cholesterol,” contribute to the clogging of arteries with plaque buildup. A person’s LDL levels are checked on a blood test called a lipid panel. Platelets are sticky blood cells that are essential to clotting and scab formation in response to lacerations. However, excessive amounts of platelets increase the risk of forming a thrombus or embolus. A thrombus is a buildup of material on the wall of a blood vessel, narrowing the vessel and increasing blood pressure. If the thrombus breaks off from the vessel's wall, it becomes an embolus, capable of travelling through the circulatory system and causing a heart attack or stroke. On the other hand, an abnormally low platelet count increases the risk of a hemorrhagic stroke, in which a torn blood vessel cannot appropriately clot, resulting in internal bleeding. A platelet count, measured in thousands of platelets per microliter (or cubic millimeter), is a standard measurement on a blood test called a complete blood count.

7. Physical Activity

Physical Activity, measured in kilocalories burned in the week prior to the patient’s MRI, gives an idea of how physically active the individual is. “Physical Activity” is the only variable with a substantial loading on this factor, indicating it cannot be consolidated with other variables under a latent factor. However, this stresses the importance of physical activity to mitigating cardiovascular disease risk.

8. Atherosclerosis Burden: Years Since Quitting Smoking, Number of Brain Infarcts

“Years Since Quitting Smoking” is somewhat of a paradoxical variable; a value of 0 could indicate either a current smoker or a never-smoker. Exclusive of 0, larger values indicate more time since quitting smoking, which is a net positive for an individual’s health. However, 0 can either reflect a protective effect against cardiovascular incidents as in the case of never-smokers, or increased risk of cardiovascular incidents as in the case of current smokers.

Brain infarcts, more commonly known as ischemic strokes, are serious risks of poor cardiovascular health. In general, the more strokes an individual has had, the poorer their health. There is also an increased conditional probability of having a stroke if one has had a stroke before.

“Years Since Quitting Smoking” and “Number of Brain Infarcts” are both components of an individual’s medical history giving clues to their atherosclerosis burden. In this factor, the loading associated with “Years Since Quitting Smoking” is negative. Values of 0 in the case of never-smokers contrast with the number of strokes a person has had in determining a person’s atherosclerosis burden.

9. Volume of Brain Infarctions

The Volume of Brain Infarctions, as measured by brain scans, shows how serious past brain infarctions were. Small strokes may even slip by unnoticed, while large strokes are more likely to have life-altering consequences, such as paralysis, speech dysfunction, or cognitive deficits. The location of the stroke also determines the severity of its impact on quality-of-life, but that data is not captured here. This is another single-variable factor.

10. Albumin

Albumin is a protein found in blood. It is produced by the liver and has many essential functions. Notably for our purposes, albumin helps maintain blood pressure and volume. Serum albumin levels have been reported to have an inverse correlation with coronary artery disease (atherosclerosis of the blood vessels supplying oxygen to the heart).

Conclusion

We conclude that the following latent factors (not all directly measurable) contributing to cardiovascular disease risk include the following:

1. Physiology
2. Senescence
3. Blood Pressure
4. Substance Use
5. Brain Atrophy Measure
6. Lab Values
7. Physical Activity
8. Atherosclerosis Burden
9. Volume of Brain Infarctions
10. Albumin

Brain Atrophy Measure, Physical Activity, Volume of Brain Infarctions, and Albumin are single-factor variables. Their dimension could not be reduced while controlling error, so these factors are not latent.

Biological systems are incredibly complicated. While medical research constantly expands the scientific body of knowledge regarding human health, it falls to medical providers to simplify this information in a way that patients can understand and feel agency over. While some of the latent factors contributing to risk of cardiovascular disease are difficult or impossible to change, factors like Blood Pressure, Substance Use, and Physical Activity are within the patient's ability to control to improve their cardiovascular health and hence risk of cardiovascular accidents.

References

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Appendix

SAS Code:

```
data cardio;
    infile "/home/u63861860/STA 3013/Project/mriCardioVars.csv"
          dsd dlm=',' firstobs=2 missover;
    input Age Weight Height PackYrs YrsQuit Alcohol
          PhysAct LDL Albumin Creatinine Platelets
          SystolicBP AnkleArmIndex ForcedExpiratoryVolume
          DigitSymbSubTest Atrophy
          whgrd NumInfarct VolumeInfarct;
run;

proc factor data=cardio method=prin nfact=10 scree res
     rotate=varimax;
     var Age Weight Height PackYrs YrsQuit Alcohol
          PhysAct LDL Albumin Creatinine Platelets
          SystolicBP AnkleArmIndex ForcedExpiratoryVolume
          DigitSymbSubTest Atrophy
          NumInfarct VolumeInfarct;
run;
```

Rotated Factor Pattern										
	Factor1	**Factor2**	**Factor3**	**Factor4**	**Factor5**	**Factor6**	**Factor7**	**Factor8**	**Factor9**	**Factor10**
Age	-0.27302	**-0.56876**	0.07667	-0.12652	**0.55707**	-0.08024	-0.09190	0.07178	-0.10948	0.00785
Weight	**0.78195**	0.06913	0.05306	0.09388	-0.10497	0.07280	-0.17761	-0.05286	0.03707	-0.00192
Height	**0.82352**	-0.01321	-0.03357	0.15071	0.09383	-0.20655	0.07478	-0.01693	0.02170	0.04907
PackYrs	0.09179	-0.04459	-0.02603	**0.87348**	-0.10701	-0.01596	-0.07691	0.04885	0.07295	0.06977
YrsQuit	0.24516	-0.22657	-0.14465	0.20172	0.39548	0.14084	0.25395	**-0.44032**	0.09975	-0.05333
Alcohol	0.02911	0.24902	0.21032	**0.55556**	0.35453	0.03129	0.25174	-0.08419	-0.22279	-0.05531
PhysAct	0.01315	-0.03746	-0.01551	-0.00936	-0.15473	-0.04680	**0.87255**	0.03438	0.00067	0.06847
LDL	0.00941	-0.08869	0.00404	-0.04082	-0.06405	**0.78796**	-0.12672	-0.00102	-0.06472	0.32290
Albumin	0.03635	0.07086	-0.01631	0.05287	0.06841	0.04231	0.07563	-0.04758	0.02792	**0.90955**
Creatinine	**0.48389**	-0.34805	-0.06204	0.22004	0.12411	-0.17550	-0.09594	0.30908	-0.06432	0.04972
Platelets	-0.25004	0.13584	0.03107	0.04530	0.02151	**0.69324**	0.07950	0.05045	0.05850	-0.30102
SystolicBP	0.01003	-0.04163	**0.88320**	-0.10334	0.05304	-0.01925	0.06768	0.06411	-0.08358	-0.03031
AnkleArmIndex	0.13648	0.20119	**-0.67224**	-0.23303	0.00010	-0.06699	0.13573	-0.01306	-0.24416	-0.01647
ForcedExpiratoryVolume	**0.74384**	0.16156	-0.13947	-0.22135	0.03531	-0.05098	0.22445	-0.01500	-0.07922	0.01364
DigitSymbSubTest	0.04265	**0.84279**	-0.16879	0.00803	0.05522	-0.01388	-0.07850	-0.03561	-0.09440	0.07065
Atrophy	0.07106	0.04552	0.03767	-0.01148	**0.79334**	-0.03934	-0.16816	0.08320	0.10859	0.07680
NumInfarct	0.01804	-0.10162	0.04756	0.04440	0.10742	0.07785	0.07900	**0.86141**	0.11925	-0.06957
VolumeInfarct	-0.01071	-0.04650	0.06065	0.00096	0.07764	-0.01301	0.00416	0.08497	**0.93473**	0.01972

The FACTOR Procedure

Input Data Type	Raw Data
Number of Records Read	735
Number of Records Used	688
N for Significance Tests	688

The FACTOR Procedure
Initial Factor Method: Principal Components

Prior Communality Estimates: ONE

Eigenvalues of the Correlation Matrix: Total = 18 Average = 1				
	Eigenvalue	**Difference**	**Proportion**	**Cumulative**
1	2.60434384	0.62629531	0.1447	0.1447
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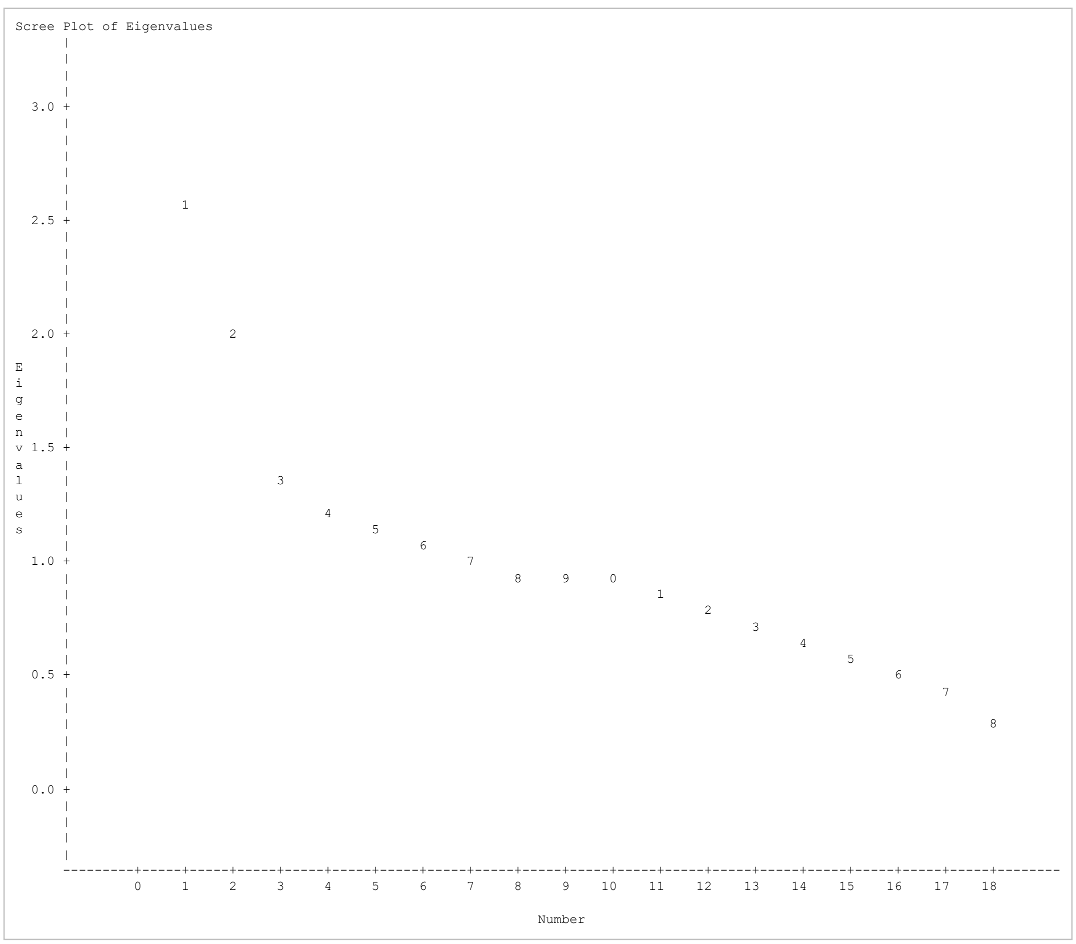
17	0.43209301	0.16099633	0.0240	0.9849
18	0.27109668		0.0151	1.0000

10 factors will be retained by the NFACTOR criterion.



Factor Pattern										
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Age	-0.34856	0.54430	-0.32879	0.44884	-0.07142	0.05952	0.04113	0.09064	-0.10067	0.07957
Weight	0.67250	0.10099	0.12329	-0.20310	0.22371	-0.09819	0.21773	0.13363	-0.08753	-0.16840
Height	0.82931	0.24414	-0.02384	-0.07214	-0.00342	0.01231	0.06319	0.03875	0.02029	-0.05688

Factor Pattern										
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10
PackYrs	0.22266	0.27161	0.59111	-0.10558	-0.05840	-0.12394	-0.43333	-0.12653	-0.30327	0.07628
YrsQuit	0.27924	0.21274	0.15036	0.42161	-0.14029	0.28339	-0.14182	0.22919	0.04165	-0.34999
Alcohol	0.15318	0.17291	0.54260	0.21071	-0.45169	-0.11450	-0.03454	0.08984	0.15221	0.15435
PhysAct	0.11519	-0.13056	-0.00665	-0.19241	-0.42145	0.65638	-0.15952	0.02860	0.25257	0.17132
LDL	-0.16887	-0.09936	0.38611	0.12267	0.51884	0.31376	0.27151	0.27355	-0.18127	0.08695
Albumin	0.16872	-0.01063	0.25156	0.30408	0.29327	0.40369	0.17290	-0.55389	0.01626	0.28577
Creatinine	0.44743	0.47417	-0.13533	-0.05970	0.08889	-0.03321	-0.08427	0.08097	-0.22592	0.21094
Platelets	-0.39739	-0.16274	0.37650	-0.03549	0.13973	0.04653	-0.03519	0.53980	0.15710	-0.03908
SystolicBP	-0.22317	0.40123	0.12870	-0.30392	-0.28756	-0.00124	0.61492	-0.05975	0.16776	-0.00990
AnkleArmIndex	0.32560	-0.52090	-0.32302	0.25952	0.03110	0.02179	-0.20176	0.15895	0.00181	0.17838
ForcedExpiratoryVolume	0.72972	-0.11070	-0.17996	-0.05347	0.02806	0.12627	0.20537	0.18821	0.18551	0.00334
DigitSymbSubTest	0.22914	-0.54119	0.24825	0.13143	0.03785	-0.40005	0.05760	-0.12407	0.37038	0.15357
Atrophy	0.06548	0.43700	-0.03478	0.52620	0.12439	-0.23555	0.06297	0.04093	0.37095	0.07033
NumInfarct	-0.09671	0.37729	-0.11081	-0.33146	0.22265	-0.03942	-0.18636	0.22962	0.22261	0.58123
VolumeInfarct	-0.09481	0.33753	0.00925	-0.21733	0.40874	0.11646	-0.35215	-0.21269	0.48062	-0.37734

Variance Explained by Each Factor									
Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10
2.6043438	1.9780485	1.3912727	1.2443982	1.1605173	1.0647088	1.0265941	0.9638640	0.9256138	0.8953324

Root Mean Square Off-Diagonal Residuals: Overall = 0.07425074														
Age	Weight	Height	PackYrs	YrsQuit	Alcohol	PhysAct	LDL	Albumin	Creatinine	Platelets	SystolicBP	AnkleArmIndex	ForcedExpiratoryVolume	DigitSymbSubTest
0.05700647	0.06741794	0.04783414	0.06578609	0.09639887	0.08646142	0.08311324	0.08202843	0.07181375	0.07619188	0.08652130	0.06503030	0.07306513	0.06227388	0.06916472

The FACTOR Procedure
Rotation Method: Varimax

Orthogonal Transformation Matrix										
	1	2	3	4	5	6	7	8	9	10
1	0.89004	0.15922	-0.24671	0.17114	0.02545	-0.23265	0.10865	-0.08018	-0.06857	0.12094
2	0.17310	-0.56971	0.44030	0.28687	0.46204	-0.13967	-0.10201	0.25915	0.24238	0.00334
3	-0.03171	0.33902	0.27655	0.70572	-0.03564	0.49341	0.03248	-0.17206	0.02920	0.18250
4	-0.17627	-0.03066	-0.36441	-0.01274	0.72816	0.06577	-0.09893	-0.39599	-0.24133	0.27505
5	0.16294	-0.02126	-0.26636	-0.21642	-0.05576	0.44860	-0.51747	0.26012	0.43771	0.35191
6	0.02963	-0.43052	-0.04171	-0.15728	-0.15738	0.27978	0.69085	-0.13947	0.12420	0.41485
7	0.24255	0.10333	0.63756	-0.48022	0.03659	0.17775	-0.17076	-0.15151	-0.40036	0.21924
8	0.21891	-0.14260	-0.14748	-0.07253	0.18179	0.60590	0.12950	0.14759	-0.22958	-0.64290
9	-0.00313	0.54892	0.15891	-0.27097	0.43031	-0.01500	0.38747	0.16800	0.48007	-0.07599
10	-0.10773	0.12680	-0.09910	0.09664	0.08338	-0.01203	0.16077	0.76153	-0.47642	0.33661

Rotated Factor Pattern										
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10
Age	-0.27302	-0.56876	0.07667	-0.12652	0.55707	-0.08024	-0.09190	0.07178	-0.10948	0.00785
Weight	0.78195	0.06913	0.05306	0.09388	-0.10497	0.07280	-0.17761	-0.05286	0.03707	-0.00192
Height	0.82352	-0.01321	-0.03357	0.15071	0.09383	-0.20655	0.07478	-0.01693	0.02170	0.04907
PackYrs	0.09179	-0.04459	-0.02603	0.87348	-0.10701	-0.01596	-0.07691	0.04885	0.07295	0.06977
YrsQuit	0.24516	-0.22657	-0.14465	0.20172	0.39548	0.14084	0.25395	-0.44032	0.09975	-0.05333
Alcohol	0.02911	0.24902	0.21032	0.55556	0.35453	0.03129	0.25174	-0.08419	-0.22279	-0.05531
PhysAct	0.01315	-0.03746	-0.01551	-0.00936	-0.15473	-0.04680	0.87255	0.03438	0.00067	0.06847
LDL	0.00941	-0.08869	0.00404	-0.04082	-0.06405	0.78796	-0.12672	-0.00102	-0.06472	0.32290
Albumin	0.03635	0.07086	-0.01631	0.05287	0.06841	0.04231	0.07563	-0.04758	0.02792	0.90955
Creatinine	0.48389	-0.34805	-0.06204	0.22004	0.12411	-0.17550	-0.09594	0.30908	-0.06432	0.04972
Platelets	-0.25004	0.13584	0.03107	0.04530	0.02151	0.69324	0.07950	0.05045	0.05850	-0.30102
SystolicBP	0.01003	-0.04163	0.88320	-0.10334	0.05304	-0.01925	0.06768	0.06411	-0.08358	-0.03031
AnkleArmIndex	0.13648	0.20119	-0.67224	-0.23303	0.00010	-0.06699	0.13573	-0.01306	-0.24416	-0.01647
ForcedExpiratoryVolume	0.74384	0.16156	-0.13947	-0.22135	0.03531	-0.05098	0.22445	-0.01500	-0.07922	0.01364
DigitSymbSubTest	0.04265	0.84279	-0.16879	0.00803	0.05522	-0.01388	-0.07850	-0.03561	-0.09440	0.07065
Atrophy	0.07106	0.04552	0.03767	-0.01148	0.79334	-0.03934	-0.16816	0.08320	0.10859	0.07680
NumInfarct	0.01804	-0.10162	0.04756	0.04440	0.10742	0.07785	0.07900	0.86141	0.11925	-0.06957
VolumeInfarct	-0.01071	-0.04650	0.06065	0.00096	0.07764	-0.01301	0.00416	0.08497	0.93473	0.01972

Variance Explained by Each Factor									
Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10
2.3111324	1.3908317	1.3682550	1.3310088	1.3263559	1.2271364	1.0920821	1.0750478	1.0727788	1.0600647