

Assessment of the Prevalence of Kidney Stone Disease: A Structural Equation Model

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Abstract

Background : This study entitled “Assessment of the Prevalence of Kidney Stone Disease: A Structural Equation Model” deals with the Kidney stones are of many types and have many causes, treatment depends on the size, nature and cause of the stone. Calcium and Oxalate stones are the most common varieties. Changes in the daily intake of Sodium, Protein, Calcium, Oxalate and fluid will slow stone formation. Dietary restrictions slow but do not cure kidney stones.

Materials and Method : A retrospective cross-sectional study design was conducted. In this study, we have discussed the detection of kidney stones using structural equation modeling (SEM).

Results : In general, structural equation models with scores for these measures of 0.9 or above are considered to have acceptable model fit and RMSEA is also a very popular measures this value is 0.19. This value indicates a not good model fit.

Conclusion : There is strong evidence that there is no association between stone size, age, sex, height, BMI, and hydronephrosis.

Keywords : *Structural equation modeling (SEM), Confirmatory factor analysis (CFA), Patients with Kidney stone disease, Stone size and Demographic variables.*

Introduction

Kidney stones are one of the everyday problems people face. Increasing the prevalence of Chronic Kidney Disease (CKD) is an important public health problem, especially for the elderly. The burden of CKD is severe in terms of medical costs and shortened health care, and people with CKD are at increased risk of end-stage kidney disease, cardiovascular disease, and premature death^{1,2}. Kidney stone disease is a devastating disease, with recurring pain episodes, surgical intervention, drug use and risk of side effects, all of which affect the quality of life of patients³. Early detection of decreased renal function can help prevent kidney disease from progressing to kidney failure, cardiovascular events, and early death^{4,5}. Although CKD risk factors such as poorly controlled diabetes mellitus and hypertension are well established, efforts to reduce these risk factors alone have not yet led to a reduction in the prevalence of CKD⁶.

Nearly 12 percent of our country suffers from kidney stone damage. There are two reasons why stones come in the kidneys. One comes from outside. This includes factors such as food, drinking water, and lifestyle. Another is the damage to the body. Children are often affected in this manner. That is, the heredity of the genus is kidney stones. The lack of adequate water is the main reason for the formation of kidney stones. Excess calcium, uric acid, oxalate, phosphate nutrients excretion in urine. It is necessary to dissolve them in liquid form and drink enough water to get rid of the urine. Otherwise, excreting calcium, uric acid, oxalate salts in the urine will be completely dissolved in liquid water and stay on the urine track. Then it will grow into a kidney stone.

A kidney can also be affected either at the same time or at both kidneys. These can come in many different sizes and different forms. There are 5 types of kidney stones. First type of calcium phosphate Oxalate type

stones. This type of stones is mostly formed by people over the age of 30. More than 60 percent of kidney stones are affected by this type of stone. The main reason is the excess of calcium nutrients in the urine. This means that more calcium supplements, high Vitamin D pills, stoic drugs, more nutritious food consumers, lactic drinkers and calcium-rich water are not affected by this type of stones. Once these stones come once again in 2 or 3 years, there is a chance to be back again. About 60 per cent of these people have a problem. By the end of the year they are also broken by the stones on the kidney path, and there is a risk of permanent kidney failure due to infection. Citric acid has the power to prevent such stones. Lemon and orange juice help prevent kidney stones. The following can be said of uric acid stones in the order of impact. This impact cannot be detected by an image. Ultra-scan or CT scan can only be found. This impact will be easier for mobile lovers. Uric acid stones are at risk for damaging the urine, especially the liver and the brain. Some medications, pillars and uric acid gems come. Even some people have inherited this disease. 3rd Type Oxalate Stones. Adding some of the ingredients like tomatoes, spinach leaves, chocolate, drinking tea, cashews, almonds, and pistachios can also cause this effect. 4th type Sistine stones. This is often the impact of children. Or maybe descending. Adults rarely occur. 5th Stones Invention Stone, which comes from urinary tract infection. This is a very hazardous. Because of this damage there is a risk of permanent kidney failure. These stones can also come back to the urinary tract infected. Therefore, urine should not be ignored.

It is important to investigate the long-term follow-up of disease rather than kidney disease and cross-sectional studies as a potential risk factor for kidney disease. Such insights will lead to new strategies to prevent the development of kidney disease. Therefore, the purpose of this longitudinal study was to investigate whether stone size, age, sex, height, BMI and hydronephrosis are a risk factor for decreased renal function ⁴.

Materials and Method

Subject and methods

A retrospective cross-sectional study design was conducted. This study population includes all patients who have been diagnosed with kidney stones in the medical

records of the tertiary care center of Vedanayagam Hospital, RS Puram, Coimbatore. In order to quantify the prevalence of kidney stones among patients admitted to Vedanayagam Hospital, steps were taken to collect a random sample from them and to differentiate between patients with kidney stones and those without kidney stones. The present study uses a 95% confidence level with an acceptable error of 1% ³.

Study population

A hospital-based observational study was conducted during August 2017–August 2018 in Coimbatore district of Tamil Nadu state, India. Coimbatore is the largest district of Tamil Nadu with an approximate population of 15.1 lakhs. The city is famous for medical tourism because of its wide network of cost-effective tertiary-care hospitals catering to the need of population of not only from Tamil Nadu but also from neighboring states and even from abroad.

Sample size

A sample-size of 150 was decided on the basis of review of data of the Department of Urologist which revealed that at least 23 subjects (newly diagnosed) were presented every month.

Study limitation

The limitation of the study was due to relatively small sample size. Although the minimum sample size of the proposed model is satisfied, the structural equation requires at least 150 samples to make the sample size reliable in the model. With a sufficient sample size, the mediation effect may be apparent by the structural equation model of relationships between the variables ⁷.

Data Analysis

The quantitative data analysis process includes an analysis of the descriptive statistics using the SPSS AMOS statistical program (Statistical Package for the social Sciences for Windows (student version)) to describe the general information. Furthermore, the SEM models of general public services in Coimbatore district were assessed using a continuity measurement index and empirical data. Therefore, we used structural equation modeling to test our

hypothesis model, using data from patients with kidney stone disease Vedanayagam Hospital in Coimbatore district ⁸.

Statistical Analysis

Frequency analysis

A frequency is used for looking at detailed information on nominal (category) data and describing the results. Frequencies options include a table 1 showing counts and percentages.

Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a multivariate analysis technique. It is used to estimate

simultaneous multiple hypothesis relationships between latent variables (or underlying constructs) and observable variables ⁹. This study used a cross-sectional design and structural equation modeling (SEM) to analyze the relationships between the variables ¹⁰ related to the patients with kidney stone disease. The model was evaluated using several criteria: χ^2/χ^2 value indicating the probability was <0.05 significance, Goodness-of-Fit Index (GFI) greater than 0.90, Comparative-Fit Index (CFI) greater than 0.90, Normed-Fit Index (NFI) greater than 0.90, and Root Mean Square Error of Approximation (RMSEA) less than 0.08 ¹¹⁻²⁵. The conceptual model specifying the relationships between the concepts that are employed in this study (numbered) can be seen in Fig.1. As a precursor, we predicted 4 pathways that directly and / or indirectly affect the kidney, emerging from stone size variable ⁸.

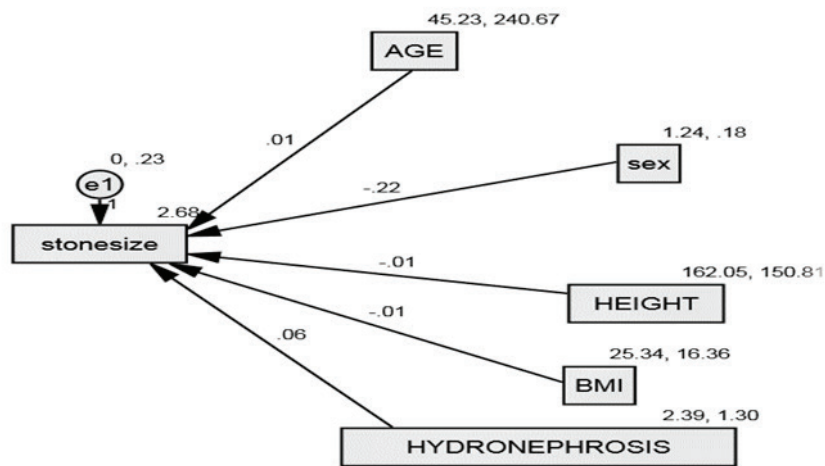


Fig. 1 Association between Stone size and demographic variables: Best-fitting model with pathways and standardized estimates

Results and Discussion

Table 1 Frequency analysis for Demographic variables

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Male | 114 | 76.0 |
| Female | 36 | 24.0 |
| Total | 150 | 100.0 |
| Weight | Frequency | Percent |

Cont... Table 1 Frequency analysis for Demographic variables

| | | |
|-----------|-----------|---------|
| 10-20 | 2 | 1.3 |
| 21-40 | 2 | 1.3 |
| 41-60 | 33 | 22.0 |
| above 60 | 113 | 75.3 |
| Total | 150 | 100.0 |
| Height | Frequency | Percent |
| 80-100 | 2 | 1.3 |
| 121-140 | 1 | .7 |
| 141-160 | 48 | 32.0 |
| 161-180 | 98 | 65.3 |
| above 180 | 1 | .7 |
| Total | 150 | 100.0 |

Information on socio-demographics including gender, weight, and height should be concise³. Table 1, shows that it can be seen that 76% of the respondents are male and 24% of the respondents are female, it can be seen that 1.3% of the respondents are 10-20, 1.3% of the respondents are 21-40, 22% of the respondents are 41-60 and 75.3% of the respondents are above 60, and 1.3% of the respondents are 80-100, 0.7% of the respondents are 121-140, 32% of the respondents are 141-160, 65.3% of the respondents are 161-180 and 0.7% of the respondents are above 180.

Table 2 H₀: There is no association between stone size and demographic variables

| | | | | | |
|----------------------|---------------|-------------|---------------|-------------|---------|
| CMIN | | | | | |
| Model | NPAR | CMIN | DF | P | CMIN/DF |
| Default model | 17 | 67.063 | 10 | .000 | 6.706 |
| Saturated model | 27 | .000 | 0 | | |
| Independence model | 12 | 85.519 | 15 | .000 | 5.701 |
| Baseline Comparisons | | | | | |
| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
| Default model | .216 | -.176 | .244 | -.214 | .191 |
| Saturated model | 1.000 | | 1.000 | | 1.000 |
| Independence model | .000 | .000 | .000 | .000 | .000 |

Cont... Table 2 H₀: There is no association between stone size and demographic variables

| FMIN | | | | |
|--------------------|---------|-------|---------|--------|
| Model | FMIN | F0 | LO 90 | HI 90 |
| Default model | .450 | .383 | .234 | .583 |
| Saturated model | .000 | .000 | .000 | .000 |
| Independence model | .574 | .473 | .303 | .694 |
| RMSEA | | | | |
| Model | RMSEA | LO 90 | HI 90 | PCLOSE |
| Default model | .196 | .153 | .241 | .000 |
| Independence model | .178 | .142 | .215 | .000 |
| HOELTER | | | | |
| Model | HOELTER | | HOELTER | |
| | .05 | | .01 | |
| Default model | 41 | | 52 | |
| Independence model | 44 | | 54 | |

Table 2, shows that more popular measures of model fit include the not significance level of our chi-square value, the ratio of chi-square divided by its degrees of freedom (CMIN/DF), NFI (Normed Fit Index) and CFI (comparative fit index), RMSEA (Root Mean Square Error of Approximation) and Hoelter's critical N. So, it would not be considered to have good model fit using this measure. Next, NFI and CFI are popular measures of model fit. Both of these measures range on scale from 0 to 1. Both NFI and CFI were 0.21 and 0.19 respectively. In general models with scores for these measures of 0.9 or above are considered to have acceptable model fit and RMSEA is also a very popular measures this value is 0.19. This value indicates a not good model fit.

Conclusion

Fig.1 shows that, it infers that there is strong evidence that there is no association between stone size, demographic variables.

Kidney stones can be formed by precipitation or crystallization of minerals and urine components. This is a common problem worldwide, manifested by a series of intermittent pain episodes, surgical interventions, and medication

consumption affecting patients' quality of life³. The present evidence strongly concludes that the variables taken in this study had no association between age, sex, height, BMI, hydronephrosis and the size of the stones. The study also considers that kidney stones may come in some other way.

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Contributorship statement K. Lokesh designed the study, carried out the study, analyzed the results, and contributed to the discussion of results and drafting of the manuscript. Dr. K. Alagirisamy contributed to designing the study and discussion of results, and the final manuscript. All authors have read and approved the final manuscript.

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Compliance with ethical standards

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Before any study-related activity, eligible patients were provided with oral and written study information, and their informed consent was obtained.

Competing interests The authors declare that they have no competing interests.

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