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# *A Long- Term Retrospective Study on the Incidence of Urinary Stones in Wuwei City, Gansu Province, China from 1995 to 2016*

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***Abstract:*** This retrospective longitudinal study investigated the reasons for the increased morbidity of urinary stones in Wuwei City, China, between 1995 and 2016. To extract the case history of patients with urinary stones from 12 hospitals in Wuwei City, and analyze them with Excel 2019, Joinpoint v10.2 and SPSS v22.0. ArcGIS v10.2 was used to map the geographical distriburinary stoneson and SaTScan v9.6 was used for spatial-temporal analysis to identify clusters of occurrence. Clusters of outbreaks were identified using SaTScan v9.6. Of the 5497 urinary stones patients (43.07 ± 15.95 years), male (3843, 69.9%) with a Gender ratio of 2.32:1. The morbidity of urinary stones in men and women shows total growth trend. From 1995 to 2016, the annual percentage change (APC) is 15.1% (95% confidence interval (CI): 12.3–18.1%) and 19.4% (19.4% (95% CI: 16.4-22.5%), respectively. Identifying four clusters that dynamically develop and monitor urinary stones in Uwajima. To discover and prevent the occurrence of acute and severe diseases in time, and to prevent and manage urinary stones. The study could be guide local authorities in initiating urinary stones prevention and management activities.

## 1. Introduction

Urinary stones is a common urological disorder that seriously affects the quality of life of patients [1],[2],[3]. All kinds of factors, including Climate change, dietary structure change and BMI increase, so much so that in countries where the frequency of urinary stones was inferior, the incidence and prevalence of urinary stones augment [4]. Epidemiological study of urinary stones in China has added dramatically from 5.95% in 1991 to 10.63% in 2011[5]. With the rapid development of western China, many people are becoming more affluent while their lifestyles and dietary habits are changing. These varied have affected the prevalence of urinary tract infections: state studies have reported an move upward from 1.61% to 20.45%[6]. The huge difference in prevalence rate probably due to geographical features of the area, research time and different

population groups.At present, the research on the prevalence and influencing factors of urinary stones in towns (counties) at all levels in Wuwei, China remains to be expanded.

In order to evaluate the burden of patients with urinary stones in Wuwei, we performed demographic characteristics, time and spatial epidemiology of urinary stones in 12 hospitals in Wuwei from 1995 to 2016, and investigated the prevalence of urinary stones and its influencing factors. And supply a fundamental foundation for prevent and treating urinary stones. To make a contrast the disease feature and temporal and spatial differences of patients betweenMinqin County, Liangzhou County, Tianzhu County and Gulou County, and determine the change of urinary calculi prevalence rate. Objective of this research is to make recommendations on the allocation of healthcare resources and develop appropriate strategies to improve the awareness of urinary stones in deserve attention group.

## 2. Methods

### 2.1 Data Source and Quality Control

The data sources for this study were patients admitted to the lithangiuria ward of 12 hospitals in Wuwei City(1995-2016). In the event of the patient is diagnosed at the same time or in multiple consecurinary stones hospitals, we will only screen one medical record for inclusion. Patients outside the UWI region were excluded. In all hospitals, it is common practice to collect 10% of missing records daily to control for quality. By comparing this 10% sample data with the original records, errors, if any, will be corrected.

### 2.2 Statistical Methods

Data on demographic, morbidity, and treatment characteristics were analyzed using SAS v9.4. Continuous variables are expressed as mean ± standard deviation (SD), and categorical variables are expressed as number, composition proportion, and frequency. Pairwise comparisons between data were performed using the chi-square test or Fisher's exact test, and P value <0.05 was considered statistically significant. The standardized prevalence rate is based on the standardized population composition of the sixth census in 2010.

Using Joinpoint v10.0 software, the standardized morbidity rate, morbidity rate by age group and gender and the changing trend of wuwei from 1995 to 2016 was analyzed.The annual percent change (APC) and 95% CI for the corresponding years were calculated by Z-test, assuming cut points and model fitting by Joinpoint regression model [7] using the Joinpoint software. Overall temporal trends in urinary stones morbidity were determined using average annual percent changes (AAPCs), applying weighted average annual growth rates, and direct comparisons across age groups. “Increasing” and “declining” are used to describe statistically significant trends while “dots” are used to describe stable, i.e., non-significant trends[8]. And construct the distriburinary stoneson map of urinary stones.

## 3. Results

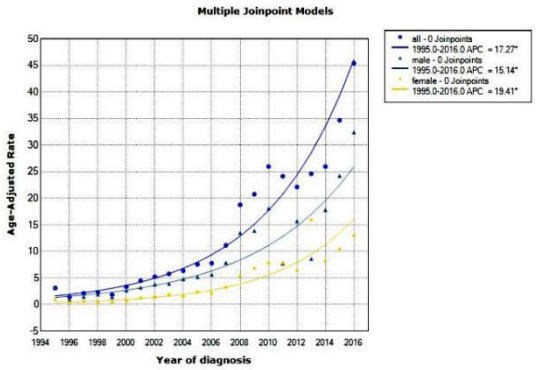
From January 1, 1995 to December 31, 2016, there were 5,497 inpatients with urinary stones in 12 hospitals. The average age was (43.07 ±15.95) years old, and the female accounted for 30.1%. There was a significant difference in the incidence of urinary stones between men and women ($p<0.001$).In this study, there were 4 771 married patients (86.7%) , and only 11 cases were divorced or widowed. By region, Liangzhou District has the highest number of 3176 cases (57.7%), and Tianzhu County has the lowest number of 242 cases (4.4%). The occupations are mainly

farmers (49.5%) and workers (16.7%). In addition, there are significant differences in the incidence of urinary stones among different regions and nationalities (P < 0.001) (Table 1).

Table 1 Demographic Characteristics Of Patients with Urinary Stones in 12 Hospitals of Wuwei City from 1995 to 2016 (n = 5 497)

| Category | Group | Number | Percentage |
|---|---|---|---|
| Age | 0–29 | 1 144 | 20.8 |
| | 30–59 | 2 121 | 62.3 |
| | 60–79 | 750 | 14.6 |
| | ≥80 | 33 | 0.6 |
| Sex | Male | 3 843 | 69.9 |
| | Female | 1 653 | 30.1 |
| Nationality | Han | 5 462 | 99.3 |
| | Mongolian | 71 | 1.2 |
| | Hui | 13 | 0.2 |
| | Tibetan | 11 | 0.1 |
| | Ciao | 3 | <0.1 |
| Marriage | Married | 4 771 | 86.7 |
| | Unmarried | 674 | 12.2 |
| | Divorced | 6 | 0.1 |
| | Widowed | 5 | <0.1 |
| | Other | 35 | 1.4 |
| Area | Guangzhou | 3 176 | 57.7 |
| | Gulang | 1 065 | 19.3 |
| | Minqin | 883 | 16.0 |
| | Tianzhu | 242 | 4.4 |
| Occupation | Farmer | 2 494 | 49.5 |
| | Worker | 921 | 16.7 |
| | Cadre | 647 | 11.7 |
| | Student | 311 | 5.6 |
| | No business | 267 | 4.8 |
| | Self-employed | 114 | 2.0 |
| | Other | 395 | 7.1 |
| | Not detailed | 103 | 1.8 |

Join point regression analysis that the morbidity of urinary stones in men growth significantly between 1995 and 2016, APA was 15.1% (95% CI: 12.3%-18.1%) (P < 0.01, Figure 1). In addition, consistent with the AAPC results, there was an increased morbidity of urinary stones. urinary stones rates also increased in women between 1995 and 2016, with APC of 19.41% per year (P < 0.01) =AAPC of 19.4% (95% CI: 16.4%-22.5%, P < 0.01).




Note: APC/AAPC is significantly varied from zero at the alpha = 0.05 level. AAPC = average annual percent change; APC = annual percentage change; CI = confidence interval.

Figure 1 Morbidity of Urinary Stones of Different Gender in Wuwei Area from 1995 to 2016

From 1995 to 2016, the average annual morbidity rate of urinary stones in Tianzhu was the lowest, and Minqing has the average annual morbidity rate (With maximum fluctuation).The

morbidity of urinary stones was generally on the rise, with the highest rate in Gulan in 2009, and the highest rate in Liangzhou (39.39/100,000) in 2007-2008 and 2016 (Figure 2).

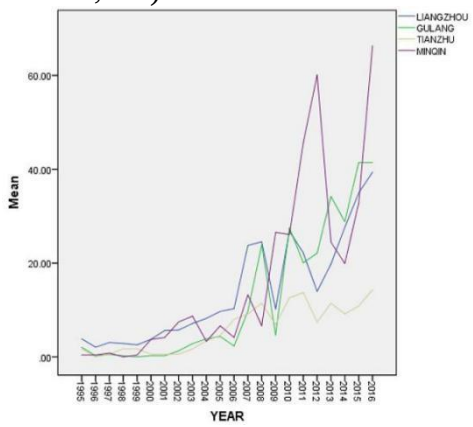



Figure 2 From 1995 to 2016, the Morbidity of Urinary Stones in Four Districts of Wuwei City (1/100,000)

The standardized mean annual morbidity of urinary stones in 102 medical facilities in Wuwei city was segmentedinto six ranks, and the trend of morbidity from high to low are distinguished by different shades of color, as shown in Fig. 3. The distriburinary stones of morbidity rates among facilities shows that the maximal annual morbidity rate (1656.31/100,000) was found in Hongshangang City (Minqin). The average annual morbidity rate section from 0.86/100,000 (Tianzhu City) to 298.01/100,000 (Hongshangang, Minqin). Dongping (1.29/100,000), Danma (1.40/100,000), and Zhushuilong (2.18/100,000) areas in Tianzhu had relatively low mean annual morbidity rates.

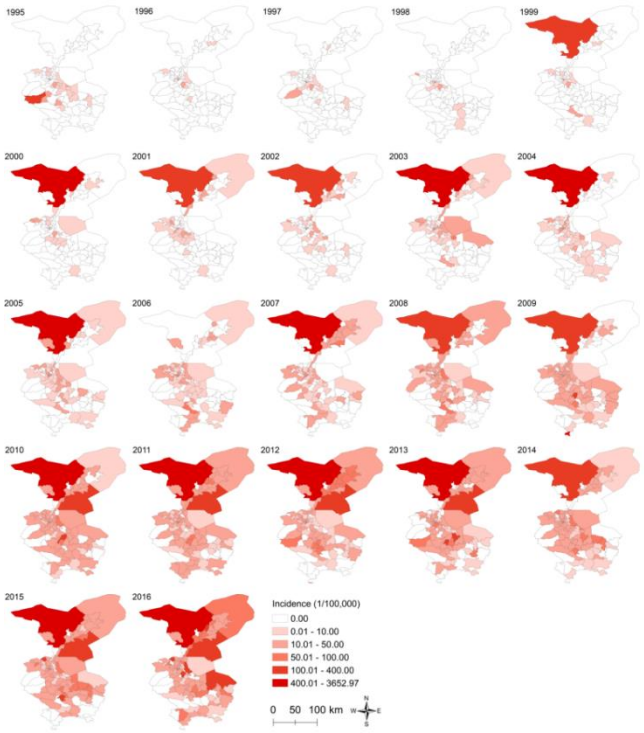



Figure 3 Analysis on the Morbidity of Urinary Stones in Different Towns in Wuwei Area from 1995 to 2016

Analysis of SaTScan results showed that the period from 1995 to 2016 was divided into four

clusters: the first cluster was located in Wu Nan town (Liangzhou) from 1997 to 2014 (RR = 25.02, P < 0.000); Secondly, the cluster was located in Jixin Village Street (Liangzhou) from 1995 to 2012 (LLR=35.00, RR = 16.31, P < 0.000); The third group was located in Hongshagang Town (Minqing) from 1999 to 2014 ( LLR=21.81, P < 0.000); Fourth cluster was located in Maoshan Town (Tianzhu) from 1995 to 2010 ( RR=16.60, P<0.000) (Table 2 and Fig 4).

Table 2 Temporal and Spatial Hotspots of Urinary Stones in Wuwei, China from 1995 to 2016

| Hotspots | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Time period | 1997/1/1 to 2014/12/31 | 1995/1/1 to 2012/12/31 | 1999/1/1 to 2014/12/31 | 1995/1/1 to 2010/12/31 |
| No. obs | 290 | 19 | 8 | 6 |
| No. exp | 17.79 | 1.19 | 0.20 | 0.36 |
| RR | 25.02 | 16.31 | 40.71 | 16.60 |
| LRR | 591.402335 | 35.005636 | 21.809136 | 11.197883 |
| Annual morbidity | 30.8 | 30.1 | 76.1 | 31.1 |
| No. counties | 1 | 1 | 1 | 1 |
| Population | 52 352 | 3 506 | 657 | |

Note: LLR, log likelihood ratio; RR, relative risk;

No. counties, number of counties within hotspot; No. exp, number of expected cases; No. obs, number of observed cases; Population size, population within hotspot;

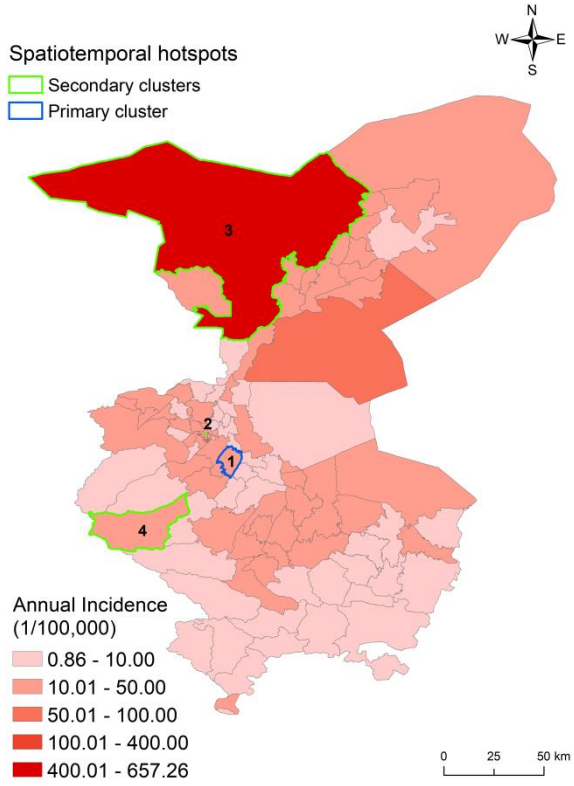



Figure 4 Spatiotemporal Clustering of the Morbidity of Urinary Stones At the Township Level in Wuwei, China, from 1995 to 2016

## 4. Discussion

Study showed that the morbidity of urinary stones in Wuwei County, the overall situation became higher, which was coincided with the global epidemic changes of urinary stones from 1995 to 2016[9], [10]. Growing trends in the widespread of urinary stones in Wuwei County can be

partition into internal and external causes. Including sexual distinction, age and family environment, while the latter includes socio-economic factors, dietary habits, geography and climate[11].

Results of the study showed that the morbidity of urinary stones in males was higher than that in females, with a sex ratio of 2.32:1. This is consistent with previous studies showing a male to female ratio of 1.7–3.0:1 for urinary stones [12]. A great deal of factors can expedite the development of urinary stones in men, one of them is that when the body mass index [13]> 30, it is related to urinary stones and growth positively. Our study showed a higher prevalence of urinary stones (62.32%) in the 30-59-year-old population, which is alike to the research finding in Europe and America[14], [15]. The reasons for the greater susceptibility to urinary stones in middle-aged group population perhaps because hard work leading to decreased fluid intake and increased dehydration [16], as well as an unhealthy lifestyle. And unhealthy lifestyle and living pressure [17].Among these patients, 49.5 % are farmers, and the occupation diversity between regions (P <0.001).From 1995 to 2016, the urbanization process changed rapidly and the proportion of migrant workers gradually increased [18].Therefore, adjusting emotions and reducing bad habits can help reduce the possibility of stones [19].

In this research, the trend of increasing urinary stones was more pronounced in women. The APC alteration in the morbidity of urinary stones in women were statistically significant. In addition, the APC change inthe morbidity of urinary stones in women was statistically significant during this period. Based on national inpatient data from 1997 to 2002, the overall morbidity of urinary stones decreased from 1.7 to 1.3 in both men and women. This change may be due to various reasons, for example, obesity is associated with an growth hazard of urinary stones, which is more usual in women[20]. By calculating the distribution of urinary stones in different locality, the annual morbidity rate is the highest in Hongshagang desert area in northwest Wuwei, which is often short of potable water and has high mineral substance content. Some investigation have found that the quality of potable water is interconnected to the formation of urinary stones[21]. The main population of Tianzhu is Tibetans where local drinking water from snowmelt and groundwater is rich in minerals, and in addition, the majority Tibetan population has a relatively high intake of high cholesterol foods such as animal offal, fat, oil and tea [22].

SaTScan outcome identified tetrad spatial and temporal clusters of urinary stone morbidity in Wuwei that were nonrandom and spatial aggregation. The results of spatial scan, spatial distribution of urinary stones calculation, time clustering and trend analysis are congruoust. On the basis of the above results, particular attention should be paid to regions with a high morbidity of urinary stones, for instance the Hongshangang district in Liangzhou. apart from the environmental circumstances in western China (e.g., At high altitude, the climate is arid, with little precipitation and long illumination), which are different from those in low-lying areas for instance Tianzhu County [23]. Given the high morbidity and frequency of urinary stones in some areas such as Nanhu Lake and Gulang, inhabitants should be urged to pay more attention to avoid drinking undressed water. In area with higher risk, local control measures should also be implemented and consideration should be given to other circumstances and social risk factors (such as water filtration equipment, smoking and drinking) [24].

Limitations exist in this study. First, we used a retrospective study design with relatively limited available data. Some clinical data may be missing, especially from the first period of collecting medical records, which may affect the analysis of certain amount of influencing factors. next in importance, the diagnosis of urinary stones may be treated in a different way due to the diagnosis of urinary stones. Beginning of the study, admissions did not constitute the majority of patients. Therefore, there may be errors between the factors and results of analysis and the actual situation. Variable not included in this study will be include in our future studies. Third, data on urinary stones from 1995 to 2016 were obtained from case history received in the sickroomof 12 hospitals

in Wuwei, which may limit the representativeness of the data. Next, this study will increase more go-aheadism to investigate the regional distribution and spatio-temporal changes of urinary stones.

## 5. Conclusions

The research showed that the prevalence of urinary stones in Wuwe has increased in recent decades. The main factors influencing the prevalence of urinary stones are gender, age, economic stress and health insurance. This shows that more attention would be provided to people living in economic backward areas (such as the countryside and mountainous district). In locality with a high morbidity of urinary stones, hazard inculcation in diet and living habits should be strengthened. It is also necessary to continuously strengthen the construction of the health care system and the awareness of health and safety to cut down and keep a check on the happen and expand of urinary stones. That study supply  a rationalel basis for suitable policy formulation.

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## References

*[1] Bryant M., Angell J., Tu H., et al. "Health related quality of life for stone formers". J Urol, vol. 188, no. 2, pp. 436-40, 2012.*
*[2] Talwar R. and Ziemba J. "Validated Methods of Assessing Quality of Life in Stone Disease". Curr Urol Rep, vol. 19, no. 4, pp. 25, 2018.*
*[3] Hyams E. S. and Matlaga B. R. "Economic impact of urinary stones". Transl Androl Urol, vol. 3, no. 3, pp. 278-83, 2014.*
*[4] Kittanamongkolchai W., Vaughan L. E., Enders F. T., et al. "The Changing morbidity and Presentation of Urinary Stones over 3 Decades". Mayo Clin Proc, vol. 93, no. 3, pp. 291-299,2018.*
*[5] Sakamoto S., Miyazawa K., Yasui T., et al. "Chronological changes in epidemiological characteristics of lower urinary tract urinary stones in Japan". Int J Urol, vol. 26, no. 1, pp. 96-101,2019.*
*[6] Wu J., Lin Z., Liu Z., et al. "Secular trends inthe morbidity of eating disorders in China from 1990 to 2017: a joinpoint and age-period-cohort analysis". Psychol Med, vol. no. pp. 1-11,2020.*
*[7] Lee S. U., Park J. I., Lee S., et al. "Changing trends in suicide rates in South Korea from 1993 to 2016: a descriptive study". BMJ Open, vol. 8, no. 9, pp. e023144,2018.*
*[8] Park R., O'Brien T. F., Huang S. S., et al. "Statistical detection of geographic clusters of resistant Escherichia coli in a regional network with WHONET and SaTScan". Expert Rev Anti Infect Ther, vol. 14, no. 11, pp. 1097-1107,2016.*
*[9] Tundo G., Vollstedt A., Meeks W., et al. "Beyond Prevalence: Annual Cumulative morbidity of Kidney Stones in the United States". J Urol, vol. 205, no. 6, pp. 1704-1709,2021.*
*[10] Rule A. D., Lieske J. C. and Pais V. M., Jr. "Management of Kidney Stones in 2020". Jama, vol. 323, no. 19, pp. 1961-1962, 2020.*
*[11] Thongprayoon C., Krambeck A. E. and Rule A. D. "Determining the true burden of kidney stone disease". Nat Rev Nephrol, vol. 16, no. 12, pp. 736-746, 2020.*
*[12] Wang S., Zhang Y., Zhang X., et al. "Upper urinary tract stone compositions: the role of age and gender". Int Braz J Urol, vol. 46, no. 1, pp. 70-80, 2020.*
*[13] Polat E. C., Ozcan L., Otunctemur A., et al. "Relation of urinary stone disease with androgenetic alopecia and serum testosterone levels". Urinary stones, vol. 44, no. 5, pp. 409-13,2016.*
*[14] Huang H., Li M., Fan H., et al. "Temporal Trend of urinary stones morbidity in China: An Age-Period-Cohort Analysis". Int J Gen Med, vol. 14, no. pp. 2533-2539,2021.*
*[15] Najem G. R., Seebode J. J., Samady A. J., et al. "Stressful life events and risk of symptomatic kidney stones". Int J Epidemiol, vol. 26, no. 5, pp. 1017-23,1997.*
*[16] Lundeen C., Lim J. R. Z., Scotland K. B., et al. "What is the relationship of stress to patients' kidney stone-related quality of life?" Can Urol Assoc J, vol. 15, no. 5, pp. E256-e260, 2021.*
*[17] Goldfarb D. S. and Hirsch J. "Hypothesis: Urbanization and exposure to urban heat islands contribute to increasing prevalence of kidney stones". Med Hypotheses, vol. 85, no. 6, pp. 953-7, 2015.*

*[18] Inoue Y., Qin B., Poti J., et al. "Epidemiology of Obesity in Adults: Latest Trends". Curr Obes Rep, vol. 7, no. 4, pp. 276-288, 2018.*
*[19] Borghi L., Meschi T., Amato F., et al. "Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study". J Urol, vol. 155, no. 3, pp. 839-43, 1996.*
*[20] Stoots S. J. M., Kamphuis G. M., Geraghty R., et al. "Global Variations in the Mineral Content of Bottled Still and Sparkling Water and a Description of the Possible Impact on Nephrological and Urological Diseases". J Clin Med, vol. 10, no. 13, pp. 2021.*
*[21] Ansari M. S. and Gupta N. P. "Impact of socioeconomic status in etiology and management of urinary stone disease". Urol Int, vol. 70, no. 4, pp. 255-61, 2003.*
*[22] Peng W., Wang S., Han S., et al. "Double burden of malnutrition in urbanized settled Tibetan communities on the Tibetan plateau". Asia Pac J Clin Nutr, vol. 29, no. 1, pp. 161-165, 2020.*
*[23] Dai M., Zhao A., Liu A., et al. "Dietary factors and risk of kidney stone: a case-control study in southern China". J Ren Nutr, vol. 23, no. 2, pp. e21-8, 2013.*
*[24] Bao Y., Tu X. and Wei Q. "Water for preventing urinary stones". Cochrane Database Syst Rev, vol. 2, no. 2, pp. Cd004292, 2020.*