The Association between Self-reported Osteoporosis and Chinese Medicine-Constitution Questionnaire – A Cross-Sectional Taiwan Biobank Study

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Research

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Abstract

Background: Constitutional medicine was as an example of earlier medicine evidence of Chinese Medicine (CM). CM-Constitutional Questionnaire (CM-CQ) commonly considered as the observed various phenotypes as phenome. However, the comprehensive associations between self-reported disease outcomes and questionnaires of CM-CQ remained uncertain.

Methods: Taiwan Biobank has begun the collection of these cancer-free volunteers, aged 30-70 with these questionnaires, self-reported disease history, clinical examinations, and genetic information from 2012 as baseline enrollment. This community-, cross-sectional study was conducted by part of Taiwan Biobank and compared the associations among CM-CQ, which reflect these constitutional variables as individual markers.

Results: The present study conducted by using 1,998 volunteers (2 withdraw) from Taiwan Biobank. Which separately assessed the associations among 32 diseases and 44 items of CM-CQ questions using the binomial logistic regression model. There were 6 CM-CQ questions with a significant association of self-reported osteoporosis in all CM-CQ. Interestingly, we found that these 6 CM-CQ questions shown a significant association with osteoporosis, even which adjusted with false discovery rate (adjusted p <0.05). The Q1, Q22, and Q37 demonstrated with considerably adjusted p-value and the other CM-CQ, which involved in Q14, Q16, and Q21 shown borderline relation to self-reported osteoporosis, which was existed less residual effect with smoking and drinking habits.

Conclusion: This study generated real-world evidence of national biobank for clarified associations between clinical symptom and self-reported diseases. The exploration of self-reported disease-related CM-CQ for further companion diagnostic indicators via comprehensive community-based Taiwan Biobank study should be a possibility.

Background: There is a growing literature that recognizes the importance of the Chinese Medicine constitution study [1–3]. Studies of the Chinese Medicine constitution showed the importance of various chronic diseases in the clinic [4–7], and it played a pivotal role in various phenotypes of the classification of Chinese Medicine [1, 8]. It is now well established that the Chinese Medicine constitution can promote disease classification [9]. However, observations have indicated a considerable change in the Chinese Medicine constitution questionnaire (CM-CQ) predict the disease outcomes via various phenotypes in biobank resources remain unclearly [10].

The previous study demonstrated general Traditional Chinese Medicine treatment strategy would follow the patient's constitution changes [11]; therefore, these risk factors might also involve in age, diet, smoking, and drinking habits, even the various phenotypes present should predict the changes of
osteoporosis risk [12]. The other study focused on that the CM-CQ possibly reflected the novel earlier markers as prevention and diagnosis surrogate factors for clinical use in Chinese Medicine [8]. The present community-based case-control study purpose of proving the CM-CQ importance for osteoporosis and the partial phenotypes changes may associate with the etiology or progress of the illness in Chinese Medicine. This study was the first Taiwan Biobank and community-based case-control designed study for earlier medicine applications.

Taiwan Biobank briefly conducted and collected from Taiwan's population with national health insurance and healthcare system, which mentioned that Taiwan Biobank is the largest national biobank, which consists of the subpopulation-based healthy cohort [13, 14]. The national biobank collected the health data and biological specimens of biobanks and released by de-identified personal information, which followed the "Human Subjects Research Act." Furthermore, the institutional review broad could be docketed for expedited review Executive order No 1010265098 from the Ministry of Health and Welfare of Taiwan since 2012 [15]. Although the full regulations lead the legal and privacy policy of biobanks, the present legal framework, and data sharing between biobanks in Taiwan still faced the challenge. In the related issue of biobank study, the risk assessment for osteoporosis was considered to be commonly used in the clinic, such as "Osteoporosis Risk SCORE," which demonstrated calculated osteoporosis risk estimation including age, race, morbidities, weight, estrogen replacement use, and fracture history [16, 17]. However, the present symptoms should include for consideration of following osteoporosis risk, the CM-CQ was aimed to play as the further predictors and generated the novel supervised simple questionnaire for assessed osteoporosis. The standard questionnaire of CM-CQ generated by the clinical phenotypes and collected in a community-based cohort. The specific aims of the current study were designed to face the challenge of an increased sample size of CM-CQ through the national biobank and demonstrated the supervised predictive model of CM-CQ-based risk scoring. The traditional CM-CQ applied to the disease classification for searching for suitable treatments in Traditional Chinese Medicine. However, the CM-CQ phenotypes should clue in the present study for proven the association and generated the possibility of clinical use in biobank research.

Methods:

Study Samples of CM-CQ from Taiwan Biobank

Taiwan Biobank has begun the collection of these cancer-free volunteers (200,000 participants) aged 30–70 with these questionnaires, self-reported diagnoses, clinical examinations, and genetic information from 2012 to 2024 as baseline enrollment. This community-, case-control study was conducted by part of Taiwan Biobank and compared the associations among CM-CQ (Supplemental Table 1), which reflect these constitutional variables as individual earlier medicine markers. The most population of Taiwan was Han Chinese population, this Taiwan Biobank study conducted with 104 volunteers with self-reported osteoporosis and 1,890 volunteers without self-reported osteoporosis, and this study was both approvals by the Institutional Review Board of the China Medical University Hospital (CRREC-105-068-CR3) and Ethic Governance Committee of Taiwan Biobank (TWBR10512-01).
**Statistical Analysis**

Data analyzed in February 2020, and the preferred statements followed the reporting items of the STROBE statement of cross-sectional study are available as supplemental materials (Supplemental Table 2). The t-test estimated the continuous variables, and the category variables were by the Chi-square test in fundamental characteristics. The further analyses of the association between CM-CQ and osteoporosis were used forward stepwise ordinal logistic regression and estimated the false discovery rate adjusted LogWorth and p-value as multiple comparisons, which reflected the response screening status. Moreover, the self-reported osteoporosis risk estimated by these 44 items of CM-CQ using forward stepwise ordinal logistic regression and estimated the significance univariates for AUROC using neural networks. Data management and statistical analysis were used by SAS JMP Pro 14.3 [18] (SAS Institute, Cary, NC, USA). The statistical significance was set as p < 0.05.

**The odds ratio estimated by nominal logistic regression for self-reported osteoporosis**

The further odds ratios of association between CM-CQ and osteoporosis used nominal logistic regression. They calculated the odds ratios and p-values, which present that the related risk of CM-CQ for osteoporosis in case-control biobank study from a community-based cohort by SAS JMP Pro 14.3 (SAS Institute, Cary, NC, USA). The statistical significance was set as p < 0.05.

**Results:**

*The Simple Characteristic of With and Without Self-reported Osteoporosis*

The community-based cross-sectional study of a subset Taiwan Biobank healthy cohort demonstrated that these participants with (n=104) and without self-reported osteoporosis (n=1890). Moreover, these univariate analyses of age, gender, education level, and self-reported arthritis and GERD had shown the primary significance difference in the simple comparison between these two groups. However, the previous consideration risk factor, like smoking habits, was present as a borderline considerably different. The mean ages of with and without self-reported osteoporosis were 56.55 ± 9.01 and 47.95 ±10.65 years-old (p<0.0001). The female ratio was present between with and without self-reported osteoporosis as 65.38% and 49.00% (p = 0.0012). The education level difference had also shown a considerable difference; however, approximately 80% of people were attributable to high school and undergraduate level. The married status and dependency were both demonstrated without significant difference between with and without self-reported osteoporosis groups. Interestingly, smoking habits had not shown as one of these critical factors in osteoporosis (p=0.0787); however, smoking habits could reflect in powerful health management. Furthermore, the drinking habits had also shown without insignificance difference between with and without self-reported osteoporosis in the national community-based cohort (p=0.2555). The related co-morbidities had shown that the comprehensive co-morbidities were mostly shown with insignificance among these self-reported illnesses, like gout (p=0.4896), hyperlipidemia (p=1.0000),
hypertension \((p=0.3390)\), apoplexies \((p=0.3126)\), diabetes \((p=0.2998)\), peptic ulcer \((p=0.7765)\), and irritable bowel syndrome (IBS, \(p=0.5289\)), except arthritis \((p=0.4896)\) and gastro-esophageal reflux disease (GERD, \(p=0.0379\)) in Table 1.

The Difference Between With and Without Self-reported Osteoporosis Using Multiple Comparison

The differential associations among CM-CQ questionnaires and self-reported osteoporosis analyzed by using ordinal logistic regression for self-reported osteoporosis. After adjusted by the false discovery rates as one of multiple comparison methodology, these adjusted p-values and LogWorth values for assessing the significance difference, like the age (FDR \(p<0.0001\)), gender (FDR \(p<0.005\)), Q1 (FDR \(p<0.05\)), Q22 (FDR \(p<0.05\)), and Q37 (FDR \(p<0.05\)). The other orders of questionnaires, like Q21, Q16, and Q14, were showed the borderline considerable associations with self-reported osteoporosis. The LogWorth values had also reflected the significant difference in Table 2.

The Multiple Regression Analysis of Considerable Factors

The multiple regression has assessed for adjustment of these covariates interference in further analyses, which demonstrated that the alcohol drinking and smoking habits were both adjusted in multivariate, logistic ordinal regression model. The pivotal results had shown that these covariates, like age, gender, smoking habits, and alcohol drinkings all had adjusted in ordinal modeling, demonstrated the age and gender had shown the less correlation coefficient \((r=-0.09, p<0.001; r=0.44, p<0.001)\), and these CM-CQ questions were present as fewer correlation coefficients (-0.02- 0.02). Thus the Q1 \((p=0.0092)\), Q13 \((p=0.0466)\), Q14 \((p=0.0258)\), Q16 \((p=0.0360)\), Q21 \((p=0.0400)\), Q22 \((p=0.0045)\), and Q37 \((p=0.0054)\) were showed these significance association with self-reported osteoporosis after adjusted these covariates, like age, gender, drinking and smoking habits (in Table 3).

The Area Under the Receiver Operating Characteristics (AUROC) for comparison of differential modeling

The Area under the receiver operating characteristic curve of self-reported osteoporosis, 1) which involved in age, gender, smoking habits, drinking habits, and the Q1, Q13, Q14, Q16, Q21, Q22, Q25, Q32, Q34, and Q37 of CM-CQ. The AUROC of self-reported osteoporosis was approximately 0.7899 (Figure 1A), 2) which involved in these Q1, Q13, Q14, Q16, Q21, Q22, Q25, Q32, Q34, and Q37 of CM-CQ. The AUROC of self-reported osteoporosis has demonstrated as 0.6729 (Figure 1B). Thus these two models were present the valuable associations between physiological covariates and CM-CQ factors. After these adjusted for conventional risk factors, the AUC has reduced from 0.7899 to 0.6729, which has reflected that the classical risk factor combined with CM-CQ should be interpreted more self-reported osteoporosis-related risk for clinical consideration in the setting of a community-based study.
The Odds Ratio of CM-CQ Questionnaire for Self-reported Osteoporosis

The CM-CQ related odds ratios were listed as Q1, 0.20 (95% CI, 0.06-0.61, p=0.0048); Q13, 3.96 (95% CI, 1.08-14.48, p=0.0377); Q14, 1.12 (95% CI, 0.47-2.64, p=0.8045); Q16, 0.31 (95% CI, 0.09-1.10, p=0.0707); Q21, 0.35 (95% CI, 0.08-1.52, p=0.1596); Q22, 4.19 (95% CI, 1.72-10.19, p=0.0016); Q25, 0.17 (95% CI, 0.02-1.19, p=0.0749); Q25, 0.17 (95% CI, 0.02-1.19, p=0.0749); Q32, 5.04 (95% CI, 1.89-13.42, p=0.0012); Q34, 1.84 (95% CI, 0.45-7.58, p=0.3972); Q37, 3.24 (95% CI, 1.00-10.52, p=0.0507) in Table 4. These Q1, Q13, Q22, Q32 were showed as p<0.05 as significance association of osteoporosis, the other ordering of CM-CQ, Q16, Q25, Q25, 37 were present borderline significance, which mentioned the CM-CQ questionnaire should be played varying roles in osteoporosis in assessed related risk.

Discussion:

The present study has focused on the associations between CM-CQs and self-reported diseases as the possible related risk in an elevated sample size of community-based biobank study. The majority results had demonstrated that the 44 CM-CQs should exist differential trends for assessed self-reported osteoporosis in TCM clinic, especially in the clinic without Achilles bone ultra-sonometer. However, the AUROC was about 0.8 and should companion for classical risk factors as one of the improvements of the assessment of osteoporosis in patients with TCM varies phenotypes as one of possibility in the clinical examination for TCM physicians. Furthermore, the related risk score should approach in the separately CM-CQ for generated the novel and new risk calculator. Such as the odds ratios of parts of CM-CQ showed that the partial CM-CQs demonstrated higher odds ratios for associated with self-reported osteoporosis, the classical scoring types should be re-considered using the scoring type as Framingham study like scoring system. Thus, there were several limitations in the current study, 1) The present study was using the community-based, biobank resources for clarified the relationship between questionnaires and diseases. The trustworthy validation should be necessary for the hospital, even more external validations. 2) The CM-CQ of biobank was different with the original types of body constitution questionnaire (BCQ) of TCM, there were several questions with revised in Taiwan Biobank, which should be possible to inference the comparison of previous studies of BCQ in Taiwan, Hong Kong, even Korea. 3) The ethnic difference should clarify in further study, which like the Taiwan Biobank, has mostly attributed to the Han Chinese-related population. The other western country should be one of the critical issues of CM-CQ study in Taiwan Biobank. The Taiwan Biobank also tried to collect the naturalization citizen from other countries, although the sample size was less, which should improve the clarification in further analyses for different ethnic problems in CM-CQ. 4) The pivotal exploration of the current study was that the attributed related risks had also reflected in the odds ratios estimation, which showed that the separately CM-CQs would be the lead differential level of proportion for self-reported osteoporosis. These difference should be possible to consider the CM-CQ-related osteoporosis scoring system via odds ratio changes, and further validation remain essential and vital. 5) The other limitation was the larger sample size for the validation set, which might play an important role in relationship proving and predictive modeling. 6)
The actual statistical difference should also be considered the type 1 error in exploratory study design, which we have reduced the false discovery rate adjusted p-value estimations.

The previous studies demonstrated that respiratory illnesses were associated with osteoporosis risk [19, 20]. The CM-CQ showed that the links among respiratory symptoms and osteoporosis remained its relationship unclearly. However, the phlegm-dampness constitution [21, 22] should be one of the possible associations between traditional Chinese medicine and modern medicine in the clinic of TCM, which has reflected in one real-world evidence of TCM in the links between modern medicine and Chinese medicine viewpoints [23–25]. The current study showed the TCM CM-CQs should attribute as the parts of phenotypes for considered the disease-related risk for classification of osteoporosis.

**Conclusion:**

This community-based cross-sectional study of Taiwan Biobank and compared the associations among CM-CQ, which reflect these constitutional variables as individual markers. This study generated real-world evidence of national biobank for clarified associations between clinical symptom and self-reported diseases. The exploration of self-reported disease-related CM-CQ for further companion diagnostic indicators via comprehensive community-based Taiwan Biobank study should be a possibility.

**Abbreviations**

Area Under the Receiver Operating Characteristics, AUROC; Body Constitution Questionnaire, BCQ; 95% Confident Interval, CI; Chinese Medicine constitution questionnaire, CM-CQ; False Discovery Rate, FDR; Odds Ratio, OR; Traditional Chinese Medicine, TCM

**Declarations**

**Ethics approval and consent to participate**

The participants were informed that all information of participation would be used for research use only and that data would be anonymized. This study was both approvals by the Institutional Review Board of the China Medical University Hospital (CRREC-105-068-CR3) and Ethic Governance Committee of Taiwan Biobank (TWBR10512-01).

**Consent for publication**

Not applicable.

**Availability of data and material**

Access to Data of Taiwan Biobank granted to researchers with an approved project who have undergone the scientific and ethical reviewing. More details about the Taiwan Biobank application process and guidelines are available at [https://www.twbiobank.org.tw/new_web/about-export.php](https://www.twbiobank.org.tw/new_web/about-export.php) (in Chinese).
Competing interests

All authors declare without any conflicts of interest.

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Authors’ contributions

HH Yang, CS Chen, and TY Yang analyzed the data. All of the authors contributed substantially to the conception and design of the study, drafted and revised it critically for important intellectual content, gave final approval of the manuscript, and agreed to be responsible for all aspects of the contribution.

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Tables
|                        | With Self-reported Osteoporosis (n=104) | Without Self-reported Osteoporosis (n=1890) | P value$^a$ |
|------------------------|----------------------------------------|---------------------------------------------|-------------|
| **Age**                |                                        |                                             |             |
| Mean (Std Dev)         | 56.55 (9.01)                           | 47.95 (10.65)                               | <0.0001     |
| **Gender**             |                                        |                                             |             |
| Female                 | 68 (65.38%)                            | 928 (49.00%)                                | 0.0012      |
| Male                   | 36 (34.62%)                            | 966 (51.00%)                                |             |
| **Education level**    |                                        |                                             |             |
| Illiterate             | 0 (0.00%)                              | 3 (0.16%)                                   | 0.0011      |
| literate               | 1 (0.96%)                              | 0 (0.00%)                                   |             |
| Elementary             | 12 (11.54%)                            | 69 (3.64%)                                  |             |
| Junior                 | 8 (7.69%)                              | 129 (6.81%)                                 |             |
| Senior                 | 34 (32.69%)                            | 580 (30.62%)                                |             |
| Undergraduate          | 45 (43.27%)                            | 926 (48.89%)                                |             |
| Graduate               | 4 (3.85%)                              | 185 (9.77%)                                 |             |
| Unknown                | 0 (0.00%)                              | 2 (0.11%)                                   |             |
| **Marriage**           |                                        |                                             |             |
| Single                 | 7 (6.73%)                              | 244 (12.88%)                                | 0.2082      |
| Married                | 86 (82.69%)                            | 1456 (76.87%)                               |             |
| Separated/Divorced     | 6 (5.77%)                              | 126 (6.65%)                                 |             |
| Widowed                | 5 (4.81%)                              | 66 (3.49%)                                  |             |
| Unknown                | 6 (5.77%)                              | 2 (0.11%)                                   |             |
| **Dependency**         |                                        |                                             |             |
| No                     | 98 (94.23%)                            | 1746 (92.19%)                               | 0.5716      |
| Yes                    | 6 (5.77%)                              | 148 (7.81%)                                 |             |
| **Smoking Habits**     |                                        |                                             |             |
| No                     | 81 (77.89%)                            | 1318 (69.59%)                               | 0.0787      |
| Yes                    | 23 (22.11%)                            | 576 (30.41%)                                |             |
| **Alcohol Habits Drinking** |                                        |                                             |             |
| No                     | 98 (94.22%)                            | 1708 (90.18%)                               | 0.2555      |
| Ever, Stop drinking    | 3 (2.89%)                              | 52 (2.74%)                                  |             |
| Yes                    | 3 (2.89%)                              | 134 (7.08%)                                 |             |
| **Self-reported Arthritis** |                                        |                                             |             |
| No                     | 91 (87.50%)                            | 1811 (95.62%)                               | 0.0010      |
| Condition                                      | Yes                  | No                  |
|-----------------------------------------------|----------------------|---------------------|
| **Self-reported Gout**                        | 83 (4.38%)           | 1798 (94.93%)       |
|                                               | 13 (12.50%)          | 97 (93.27%)         |
| **Self-reported Hyperlipidemia**              | 96 (5.07%)           | 1783 (94.14%)       |
|                                               | 7 (6.73%)            | 98 (94.23%)         |
| **Self-reported Hypertension**                | 111 (5.86%)          | 1682 (88.81%)       |
|                                               | 6 (5.77%)            | 89 (85.58%)         |
| **Self-Reported Apoplexies**                  | 212 (11.19%)         | 1888 (99.68%)       |
|                                               | 15 (14.42%)          | 103 (99.04%)        |
| **Self-Reported Diabetes**                    | 276 (14.57%)         | 1618 (85.43%)       |
|                                               | 19 (15.38%)          | 88 (84.62%)         |
| **Self-Reported Gastro-Esophageal Reflux Disease (GERD)** | 1684 (88.91%)       | 1684 (88.91%)       |
|                                               | 85 (81.73%)          | 85 (81.73%)         |
| **Self-Reported Irritable Bowel Syndrome (IBS)** | 210 (11.09%)         | 210 (11.09%)        |
|                                               | 19 (18.27%)          | 19 (18.27%)         |
|                                               | 51 (2.69%)           | 51 (2.69%)          |

*The p value was estimated by using Fisher’s exact test.*
Table 2. The Multiple Comparison of Ordinal Logistic Regression for Self-reported Osteoporosis.

| Variables       | FDR LogWorth<sup>a</sup> | FDR PValue<sup>b</sup> |
|-----------------|---------------------------|------------------------|
| Age             | 15.215                    | 0.00000                |
| Gender          | 2.305                     | 0.00495                |
| Q1              | 1.685                     | 0.02067                |
| Q22             | 1.685                     | 0.02067                |
| Q37             | 1.624                     | 0.02379                |
| Q21             | 1.279                     | 0.05261                |
| Q16             | 1.279                     | 0.05261                |
| Q14             | 1.279                     | 0.05261                |
| Q13             | 1.059                     | 0.08739                |
| Q25             | 0.751                     | 0.17739                |
| Q32             | 0.680                     | 0.20885                |
| Q34             | 0.538                     | 0.29000                |
| Smoking Habits  | 0.119                     | 0.76012                |
| Drinking Habits | 0.084                     | 0.82336                |

<sup>a</sup> The FDR LogWorth was reflected the effect size of Age, Gender, and CM-CQ, and the FDR LogWorth was equal to 2 as blue line which meant the FDR p value was 0.01.

<sup>b</sup> The FDR p value was estimated the FDR adjusted p value for controlling the multiple comparison.

Table 3. The Ordinal Logistic Regression of Self-reported Osteoporosis.

| Term                          | Estimate<sup>a</sup> | 95% Confidence Interval | Std Error | ChiSquare | P value |
|-------------------------------|-----------------------|--------------------------|-----------|-----------|---------|
| Intercept                     | 8.30                  | ( - - - )                | 0.77      | 115.42    | 0.0000  |
| Age                           | -0.09                 | ( -0.12 -0.07 )         | 0.01      | 59.34     | 0.0000  |
| Gender [Male]                 | 0.44                  | 0.18 - 0.71             | 0.13      | 10.70     | 0.0011  |
| I_1                           | 0.02                  | 0.00 - 0.03             | 0.01      | 6.79      | 0.0092  |
| I_13                          | -0.01                 | (-0.03 0.00 )          | 0.01      | 3.96      | 0.0466  |
| I_14                          | -0.01                 | (-0.02 -0.00 )         | 0.00      | 4.97      | 0.0258  |
| I_16                          | 0.01                  | 0.00 - 0.03             | 0.01      | 4.40      | 0.0360  |
| I_21                          | 0.02                  | 0.00 - 0.03             | 0.01      | 4.22      | 0.0400  |
| I_22                          | -0.01                 | (-0.02 -0.00 )         | 0.00      | 8.06      | 0.0045  |
| I_25                          | 0.02                  | (-0.01 0.05 )          | 0.01      | 2.02      | 0.1554  |
| I_32                          | -0.01                 | (-0.02 0.00 )          | 0.01      | 2.03      | 0.1546  |
| I_34                          | -0.01                 | (-0.02 0.01 )          | 0.01      | 1.41      | 0.2344  |
| I_37                          | -0.02                 | (-0.03 -0.00 )         | 0.01      | 7.75      | 0.0054  |
| Drinking Habits [No]          | -0.18                 | (-0.86 0.38 )          | 0.31      | 0.34      | 0.5580  |
| Drinking Habits [Stop]        | 0.04                  | ( -0.82 1.08 )         | 0.47      | 0.01      | 0.9377  |
| Smoking Habits [No]           | 0.06                  | (-0.25 0.35 )          | 0.15      | 0.14      | 0.7049  |

<sup>a</sup> The “Estimate” was meant the beta correlation coefficient.

Table 4. The Odds Ratio Estimation by Nominal Logistic Regression for Self-reported Osteoporosis
| Variables | Odds Ratio<sup>a</sup> | Lower 95% | Upper 95% | Wald ChiSquare | P value  |
|-----------|----------------------|-----------|-----------|----------------|---------|
| Q1        | 0.20                 | 0.06      | 0.61      | 7.9479         | 0.0048  |
| Q13       | 3.96                 | 1.08      | 14.48     | 4.3173         | 0.0377  |
| Q14       | 1.12                 | 0.47      | 2.64      | 0.0613         | 0.8045  |
| Q16       | 0.31                 | 0.09      | 1.10      | 3.2661         | 0.0707  |
| Q21       | 0.35                 | 0.08      | 1.52      | 1.9780         | 0.1596  |
| Q22       | 4.19                 | 1.72      | 10.19     | 9.9352         | 0.0016  |
| Q25       | 0.17                 | 0.02      | 1.19      | 3.1720         | 0.0749  |
| Q32       | 5.04                 | 1.89      | 13.42     | 10.4832        | 0.0012  |
| Q34       | 1.84                 | 0.45      | 7.58      | 0.7167         | 0.3972  |
| Q37       | 3.24                 | 1.00      | 10.52     | 3.8176         | 0.0507  |

<sup>a</sup>Test and confidence intervals on odds ratio were estimated by Wald test.

**Figures**

![Figure 1](image1.png)

**Figure 1**

The Receiver Operating Characteristic Curve of Self-reported Osteoporosis. (A) involved in Age, Gender, Smoking Habits, Drinking Habits, and these Q1, Q13, Q14, Q16, Q21, Q22, Q25, Q32, Q34, and Q37 of Chinese Medicine-Constitution Questionnaire. The AUROC (Area Under the Receiver Operating Characteristics) of self-reported osteoporosis was 0.7899, (B) involved in these Q1, Q13, Q14, Q16, Q21, Q22, Q25, Q32, Q34, and Q37 of Chinese Medicine-Constitution Questionnaire. The AUROC (Area Under the Receiver Operating Characteristics) of self-reported osteoporosis was 0.6729.

**Supplementary Files**
This is a list of supplementary files associated with this preprint. Click to download.

- SupplementalTable2.docx
- SupplementalTable1.docx