

The relations between perceived susceptibility, perceived severity, and preventive behavior to osteoporosis of high-risk persons in five provinces in North-Eastern Thailand

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Background : *Osteoporosis is a preventable condition among the elderly population, but inadequate information is related to people's perceived susceptibility and severity of the disease by the people, this can promote preventive behavior among the Thai population. This study aimed to investigate perceived susceptibility, perceived severity, and preventive behavior of high-risk persons regarding osteoporosis in North-Eastern Thailand.*

Methods : *A cross-sectional survey involved five hundred and thirty-two participants who completed a questionnaire using a rating scale. The relationships between variables were statistically analyzed including frequencies, percentages, standard deviations, One-way ANOVA, Pearson's product moment correlation coefficient, and stepwise multiple regression analysis.*

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Results : *The results showed that most participants were female (62.2%); 90% were financially comfortable; 87.9% had a low level of education; and 64.5% had no history of underlying diseases. The participants had a low level of perceived susceptibility, but high level in perceived severity, and intermediate level in preventive behavior to osteoporosis. Noticeably, income, received information, perceived susceptibility, and perceived severity factors were significantly related to preventive behavior in relation to osteoporosis ($p = .001$).*

Conclusion : *It can be concluded that the four variables: income, received information, perceived susceptibility, and perceived severity; they played important roles in the promotion of preventive behavior of the participants in North-Eastern Thailand in relation to osteoporosis.*

Keywords : *Perceived susceptibility, osteoporosis, perceived severity, preventive behavior.*

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ระหว่างระดับความรู้ของผู้ป่วยเกี่ยวกับภาวะเสี่ยง และความรุนแรงของโรคกระดูกพรุนกับ
พฤติกรรมป้องกันภาวะกระดูกพรุนในกลุ่มเสี่ยงพื้นที่ 5 จังหวัดภาคตะวันออกเฉียงเหนือ.
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- บทนำ** : โรคกระดูกพรุนเป็นโรคที่ป้องกันได้ ซึ่งพบได้บ่อยในผู้สูงอายุ อย่างไรก็ตาม
ข้อมูลด้านการรับรู้ภาวะเสี่ยง การรับรู้ความรุนแรงของโรคกระดูกพรุนที่ช่วย
ส่งเสริมพฤติกรรมป้องกันโรคดังกล่าวยังไม่เพียงพอ ดังนั้น การศึกษามีวัตถุประสงค์
ประสงค์เพื่อสำรวจการรับรู้ภาวะเสี่ยง การรับรู้ความรุนแรงและพฤติกรรมป้องกัน
โรคกระดูกพรุนใน 5 จังหวัดภาคตะวันออกเฉียงเหนือ
- วิธีการศึกษา** : เป็นการสำรวจแบบภาคตัดขวาง มีจำนวนกลุ่มตัวอย่างทั้งสิ้น 532 คนที่ตอบ
แบบสอบถาม โดยใช้มาตรฐานค่าความสัมพันธ์ระหว่างตัวแปรทั้งหมด
ใช้สถิติในการวิเคราะห์ เช่น ความถี่ ร้อยละ ส่วนเบี่ยงเบนมาตรฐาน
ค่าความแปรปรวนทางเดียว ค่าสัมประสิทธิ์เพียร์สัน และการวิเคราะห์ถดถอย
พหุคูณ
- ผลการศึกษา** : พบว่ากลุ่มตัวอย่างส่วนใหญ่เป็นผู้สูงอายุเพศหญิง (62.2%) มีฐานะปานกลาง
(90%) การศึกษาน้อย (87.9%) ไม่มีโรคประจำตัว (64.5%) กลุ่มตัวอย่างมีระดับ
การรับรู้ของภาวะเสี่ยงต่ำ ความรุนแรงของโรคสูง และพฤติกรรมป้องกันโรค
กระดูกพรุนอยู่ในระดับปานกลาง นอกจากนี้ ปัจจัยด้านรายได้, ข้อมูลที่ได้รับ,
การรับรู้ภาวะเสี่ยงและการรับรู้ความรุนแรงของโรคกระดูกพรุน มีความสัมพันธ์
กับพฤติกรรมป้องกันโรคกระดูกพรุน ($p = .001$)
- สรุป** : การศึกษาครั้งนี้พบว่าปัจจัยรายได้ ข้อมูลที่ได้รับ การรับรู้ภาวะเสี่ยง การรับรู้
ความรุนแรงของโรคมีบทบาทสำคัญในการช่วยส่งเสริมพฤติกรรมป้องกันภาวะ
กระดูกพรุนในพื้นที่ภาคตะวันออกเฉียงเหนือ
- คำสำคัญ** : การรับรู้ภาวะเสี่ยง, การรับรู้ความรุนแรงของโรค, พฤติกรรมป้องกัน, ภาวะ
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Osteoporosis, often referred to as the 'silent disease', is a skeletal condition characterized by low bone mass and micro-architectural deterioration of the bone tissue, leading to bone fragility and increased risk of fractures.⁽¹⁾ With the aging global population, osteoporosis has quickly become a worldwide concern because of its association with age, exponentially increased prevalence, costs, morbidity, and mortality.⁽²⁾ The balance of bone turnover shifts in favor of bone re-absorption through adulthood until late in life^(3, 4) and, with the increase in aging population, the number of the elderly with osteoporosis-related fractures has increased substantially.

In Thailand, a civil registration report from the Ministry of Public Health suggested that the country has become an 'aging society'. Most of the elderly live in North - Eastern Thailand, a region that accounts for approximately one-third of the nation's population.⁽⁵⁾ Reports estimated that 13 - 18% of women aged 50 and over and 70% aged over 80 had osteoporosis.⁽⁶⁾

The hallmark of osteoporosis is fractures, sustained with little or no antecedent trauma. The consequences of osteoporotic hip fractures are often severe and the mortality rate during hospitalization was found to be 2.1%, increasing to 9%, 12%, and 17% for 3, 6, and 12 month durations, respectively.⁽⁷⁾ Studies showed severe effects on the patients' quality of life after hip, vertebral, or forearm fractures.^(8 - 18) A study involving the Thai population clearly demonstrated deterioration in quality of life after a fracture. All patients suffered certain degrees of deficiency in health perception, mental health, emotional, physical, and social functions, and bodily pain measured by a modified SF-12 health survey.⁽¹⁹⁾

A Khon Kaen study demonstrated that the quality of life in surviving hip-fractured patients was disturbed (60%) and less than 5% of patients remained healthy.⁽²⁰⁾ The cost of treatment of patients with osteoporosis in Thailand was reported to be approximately 36,500 baht per person, much higher than the average cost for common diseases.⁽²¹⁾

The application of the constructs of the Health Belief Model (HBM)⁽²²⁾ can be valuable in the understanding of health behavior, avoidance of the impairment of quality of life, and planning for the prevention of osteoporosis. HBM addresses four major components, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers related to osteoporosis. This study concentrated on the first two components as they are intellectual factors that cause people to perceive threats and lead them to comply with preventive behavior regarding the disease.^(22 - 23) Also, there is inadequate information related to the perceived susceptibility and perceived severity of osteoporosis among the elderly in North-Eastern Thailand. As a result, the authors aimed to investigate perceived susceptibility, perceived severity, and preventive behavior of high-risk people in this region. The study also evaluated the relations between the two HBM components and preventive behavior; and, the capability of HBM component prediction related to preventive behavior was assessed.

Materials and Methods

Study design

This cross-sectional survey was conducted from June to December 2013.

Population and sampling

The target population was people aged 60 and over living in North - Eastern provinces of Thailand. Approximately, there were 2,404,000 elderly people living in nineteen provinces, 322 districts, 2,678 sub-districts, and 33,099 villages. The sample size was calculated via Leme show equation⁽²³⁾ (below).

$$n = Z_{\alpha/2}^2 \sigma^2 / d^2$$

n = sample size

α = Pr of Type I error 0.05 (2-sided)

$Z_{0.2}$ = 1.96

σ^2 = estimated portion of preventive behavior of elderly from a pilot study = 34.63

D = Margin of error in estimating = 0.50

n = $(1.96 \times 1.96) (34.63) / (0.50 \times 0.50)$

n = 532.13

A total of 532 participants were enrolled in the study and they were randomly selected from five of the nineteen provinces (~25%) via multi-stage random sampling⁽²⁴⁾ (Table 1) including;

Step 1: Divide the elderly population from 19 provinces into clusters and selected only five provinces via simple random sampling including, Ubon Ratchathani, Sri-Sa-Ket, Mook-Da-Harn, Sakonakorn, and Roi-Et.

Step 2: Use districts as sampling unit, selected elderly volunteers based on each sub-district and village consecutively via population ratio estimation

Step 3: Select elderly volunteers from name list of each village via Quota sampling

Research tool

The questionnaire used in this study was based on a review of previous literature.^(25 - 26)

It contained five sections: a) background; b) osteoporosis risk; c) perceived susceptibility to osteoporosis; d) perceived severity of osteoporosis; and e) preventive behavior. Content validity and reliability tests were conducted prior to the production of the final version of the questionnaire. The content validity index was equal to 0.95. Changes were made based on the reviewer's recommendations. As for

Table 1. Numbers of participants, districts, and provinces.

Province(s)	Elderly population	District(s)	Elderly volunteers in each district	Sample size (n)	%
Sri-Sa-Ket	150,007	Kantralak	17,472	248	47
Mook-Da-Harn	25,612	Wan-Yai	1,817	26	5
Sakonakorn	73,723	Muang	10,619	150	28
Roi-Et	104,775	Pho-Chai	4,990	71	13
Ubon-Ratchathani	164,698	Lao-Seu-Kok	2,648	38	7
Total	518,815		37,546	532	100

Note: Participants were assessed regarding cognitive, speech, and hearing ability by the researchers prior to the study. Those with any difficulties and/or disabilities were excluded from the study.

reliability, an average Alpha Cronbach-Coefficient (α) value was equal to 0.810.

The background section included details of gender, age, career, marital status, income, education, underlying diseases, weight/height, and information resources of osteoporosis. The osteoporotic risk history section contained a series of questions related to age, nationality, post-menopause and ovariectomy experience, fracture history, immobility experience of at least one month duration, sunlight exposure, decrease in height, humpback, and tooth loss. Participants answered these questions by the use of ratings on 12 subscales (1 to 12). The accumulated scores were divided into three levels, 0 - 3 (low), 4 - 10 (intermediate), and 11 - 12 (high).

There was one question in the perceived susceptibility section, and this was answered by participants using a four-point rating scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*. The results were interpreted into three levels, namely: 1 - 2, (low), 2.01 - 3 (intermediate) and 3.01 - 4 (high).

The perceived severity of osteoporosis contained ten questions related to four aspects including, mindset, attitude, society, and economy of the elderly. Participants used the same four-point rating scale used in the perceived susceptibility section and the total score was equal to forty.

Finally, there were ten questions related to the participants' preventive behavior regarding osteoporosis. A four-point rating scale similar to those used in the two previous sections was employed, this one consisted of 1 (*never do*), 2 (*sometimes do*), 3 (*often do*), and 4 (*usually do*) to assess participants'

preventive behavior of osteoporosis. Scores were divided into three levels: 1 - 2 (low), 2.01 - 3 (intermediate), and 3.01 - 4 (high).

Process and data collection

The authors sent official letters to each of the five provincial health directors to receive permission to conduct the survey. All the details and steps of the data collection were described in these letters. Then the authors met the directors of each of the health promoting hospitals and heads of the villages to explain the objectives of the study and to gather lists of potential participants in each area. Appointments were made to meet and introduce the study, objectives, and steps of data collection to the participants. Each participant was informed of the patient's rights protection before signing a consent form. The questionnaires were distributed and completed by the participants in approximately 30 minutes. Any participant that wished to cease completing the questionnaire was free to do so.

Statistical analysis

Descriptive statistics, including frequencies, percentages, and standard deviations (SD), were used in the analysis of the demographic data, perceived susceptibility, perceived severity, and preventive behavior. Comparisons of the demographic data and preventive behavior were analyzed via *t* - test, and One way ANOVA. The relationships between personal risk and perceived susceptibility and between perceived severity and preventive behavior were assessed via Pearson's product moment correlation coefficient. The predictions of preventive behavior from both perceived susceptibility

and severity variables were analyzed via Stepwise Multiple Regression Analysis. The level of significance was equal to 0.05.

The study protocol was reviewed and approved by Ubon Ratchathani University with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans.

Results

The results showed that there were 532 participants in the study. Sixty - two percent were female, aged between 60 and 75; 67.3% were married; 90% had adequate income; 87.9% had education level at primary school or below; and 64.5% had no underlying diseases. The average body mass index (BMI) value was between 18.5 and 24.9 (76.1%) which was normal. It was found that 91.4% had not received information about osteoporosis.

The study revealed that the participants had a high level of perceived severity of osteoporosis ($\bar{X} = 3.03$) while the levels of osteoporosis risk and preventive behavior regarding osteoporosis were

intermediate ($\bar{X} = 4.00$ and 2.70 respectively). The level of perceived susceptibility was low ($\bar{X} = 1.96$) (Table 2).

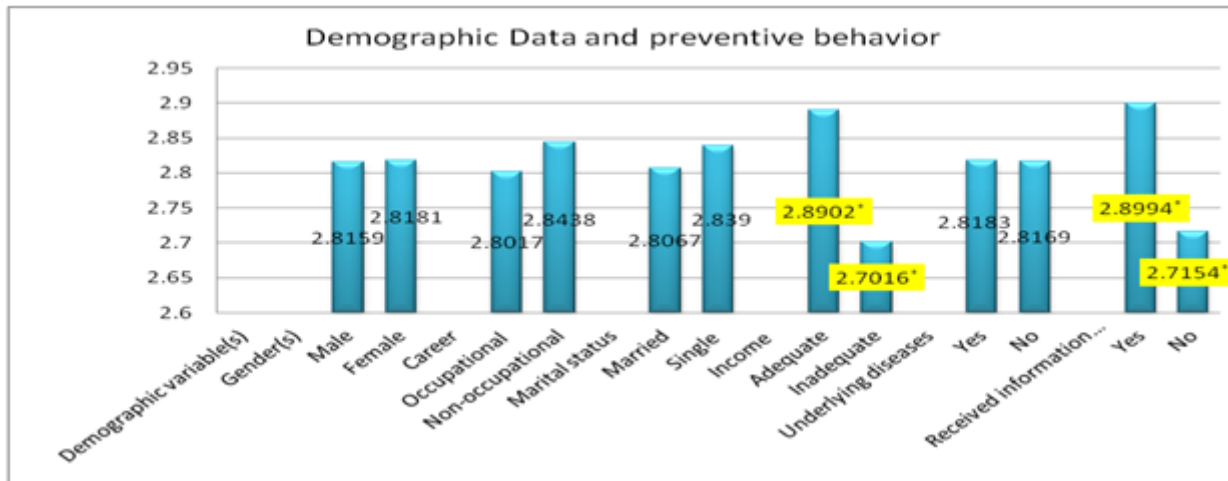
Consideration of demographic information and preventive behavior showed that preventive behavior regarding osteoporosis was statistically significantly different in relation to income and information resource of osteoporosis ($p = .001$) (Table 3.1). This infers that participants with adequate income and information about osteoporosis had better preventive behavior compared to those who did not.

The results also revealed that most participants (468 out of 532) had primary school education level or below and the overall level of preventive behavior was intermediate. There was no statistically significant difference between those who had different levels of education and preventive behavior ($p = .547$). Most participants (405 out of 532) had BMI between 18.5 and 24.9. It was found that there was no statistically significant difference between different BMI values and preventive behavior ($p = .436$).

Table 2. Variables related to osteoporosis.

Variable(s)	\bar{X}	S.D	Level (s) of perception
Independent variables			
- Osteoporotic risk (X1)	4.00	1.551	Intermediate
- Perceived susceptibility to osteoporosis (X2)	1.96	.697	Low
- Perceived severity of osteoporosis (X3)	3.03	.508	High
Dependent variables			
- Preventive behavior regarding osteoporosis (Y)	2.70	.598	Intermediate

Table 3.1 Demographic data and preventive behavior.



Note: data was analyzed via t-test *Significant difference ($p < .05$)

The findings indicated there was a significantly low positive relationship between osteoporotic risk and perceived susceptibility ($r = .348, p = .05$). Perceived susceptibility of osteoporosis had a significantly highly positive relationship with preventive behavior whereas perceived severity had a low positive relationship to preventive behavior ($r = .633, .368, p = .05$

respectively). There was a statistically low positive relationship between perceived susceptibility and perceived severity of osteoporosis ($r = .249, p = .05$). Additionally, it was found that perceived susceptibility and perceived severity variables had significant linear correlation capable of predicting participants' preventive behavior (Table 4).

Table 4. Prediction of preventive behavior via perceived susceptibility and severity of osteoporosis.

Variable (s)	β	Beta	t - value	p
Constant value	.628		4.866	<.001
Perceived susceptibility (X2)	.541	.485	9.649	<.001
Perceived severity (X3)	.194	.173	4.329	<.001
R = .733 R ² = .537 Adj R ² = .536 F-test = 70.682 p-value <.001				

Note: β : Regression Coefficient Beta: Standard Regression Coefficient
 R: Multiple R R²: R square Adj R²: Adjusted R square

A linear regression equation was conducted by using the following equation

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

$$Y = .628 + .541 (\text{perceived susceptibility}) + .194 (\text{perceived severity})$$

A linear regression equation based on Z-score

$$Z = .485 (\text{perceived susceptibility}) + .173 (\text{perceived severity})$$

This meant that if the score of perceived susceptibility (risk) was increased by 1 point, the score of preventive behavior would increase by .485 points. Similarly, if the score of perceived severity was increased by 1 point, the score of preventive behavior increased by .173 point (Figure 1).

Discussion

According to the demographic data, there were only two factors, namely: income and information resources regarding osteoporosis that are related to participants' preventive behavior. Participants with lower economic status faced an increased risk of the

development of the disease due to financial difficulty, poor diet, and not being able to access health care services. In this study, most volunteers had adequate income and were able to afford food, clothing, and involvement in social activities. They were able to select healthy food, undertake exercise, and talk to the dietitians for advice: all factors that result in a reduced incidence of osteoporosis compared to those who have lower income.⁽²⁷⁾

Moreover, as we all know that poverty is the priority after which people will start to consider health and quality of life. To try to initiate a health program to induce 'preventive behavior related to osteoporosis' should be expanded to "inter-health" which includes all the common non-communicable diseases particularly those related to aging such as cardiovascular diseases, stroke, diabetes, etc. For instance, trying to figure out proper nutrition, appropriated physical activity program, avoidance of health risk behaviors which could get along with regional lifestyle, culture, community value may be worth in prevention and reduction of all the aging related diseases particularly osteoporosis.

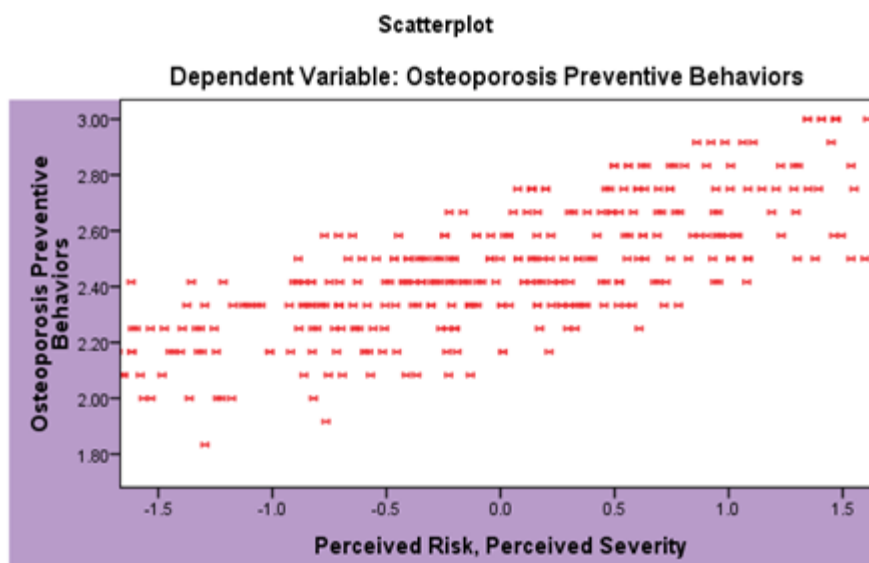


Figure 1.

The study indicates that most participants did not receive information about osteoporosis, especially from health providers. A previous study indicated that health care providers' counseling about osteoporosis was a major determinant of osteoporosis prevention behavior.^(28 - 29) This suggests that basic information related to osteoporosis prevention needs to be distributed to the target population so they will be able to help themselves and look for resources when necessary.

Previous studies revealed low education leads to misleading preventive behavior due to lack of knowledge and misperception of the disease.⁽³⁴⁾ However, the result of this study showed most participants with low class room education had high perceived severity and intermediate preventive behavior, suggesting that knowledge of osteoporosis can be found outside the class room education. Therefore, the participants might have gained some knowledge regarding the dangers, susceptibility and severity of osteoporosis from other sources including, mass media (e.g, television, internet, public advertisement), past experience from family and relative members. As a result, they were aware of the disease and learnt how to prevent themselves from osteoporosis. Also, underlying disease was not related to preventive behavior as most participants indicated they were in healthy condition and did not focus on lifestyle modification.

Perceived susceptibility of osteoporosis of the participants was low. This may be explained by most people's underestimation of their perceived susceptibility of disease.⁽³⁰⁾ Osteoporosis progresses slowly without significant symptoms and many individuals may not recognize the condition until active

symptoms occur.⁽³¹⁾ Furthermore, most patients with osteoporosis would perceive the osteoporosis risk unless they were diagnosed by the physician.

The study found that the level of perception of osteoporosis risk was intermediate. As 62.2% of the participants were female and post - menopausal, the research sample was at high risk of osteoporosis. Normally, post-menopausal females lose bone mass 2 - 3 times more than males.⁽³²⁾

The relationship between perceived susceptibility and preventive behavior in regard to osteoporosis was highly positive ($r = .633$, Table 4). Previous research indicated that people with osteoporosis perceived the risk of the condition, feeling that their lives were threatened and needed to be changed.⁽³³⁾ The participants in this study were mostly healthy during the study time and, as a result, their perceived susceptibility of osteoporosis was low as described in Table 2. In contrast, preventive behavior had a low positive relationship with perceived severity of osteoporosis ($r = .38$, Table 4). Despite the participants' high level of perceived severity (Table 2), a previous study suggested they may not pay attention to their preventive behavior.⁽³⁴⁾ The participants were healthy and may have thought osteoporosis was not a serious present issue, and they were not concerned about modification of their lifestyle. This issue suggests that health care providers need to consider how to encourage high-risk people to realize the seriousness of the condition, the risk, and the importance of disease prevention.

As mentioned earlier, both osteoporosis susceptibility and severity were the most influential variables that affected preventive behavior (Table 5). This indicates that health policy needs to concentrate

increasingly on these two variables. It is suggested that a proactive approach including osteoporosis basic screening in local communities should be initiated in all areas. Also, the provision of knowledge and information related to osteoporosis prevention is needed. Health promotion in the form of sports equipment and space in local communities is required. Furthermore, health care providers need more skills in the assessment of the possibility of osteoporosis development in at-risk populations. The provision of an adequate budget to address these approaches is crucial. Finally, the elderly living allowance should be a life-long health policy to enhance their living standards.

A further study is suggested to focus on various issues, including: 1) types of health promoting activities relevant to osteoporosis; 2) the differences of osteoporosis prevention behavior between urban and rural at-risk populations; and 3) the expansion of target areas to other provinces to provide an overall picture of osteoporosis, susceptibility, severity, and preventive behavior.

Conclusion

Most of the participants in this study were females, aged 60 or over, and at risk of developing osteoporosis. It was found that income and information resources were positively related to preventive behavior in relation to osteoporosis. The perceived susceptibility and perceived severity variables played an important role in the enhancement of preventive behavior in the study group. Further investigations focusing on types of health promotion related to osteoporosis need to be started.

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Annex

1. Questionnaire paper of Perceived Susceptibility of osteoporosis

Item(s)	Content	Strongly agree	Agree	Disagree	Strongly disagree
1	When comparing with a similar age and gender of elderly, you consider yourself having the osteoporotic risk.				

2. Questionnaire paper of Perceived Severity of osteoporosis

Item(s)	Content	Strongly agree	Agree	Disagree	Strongly disagree
1	Osteoporotic person could have chronic pain				
2	Osteoporotic person might easily have either broken bones or joint disabilities				
3	Osteoporotic person might have some clinical symptoms including, deformed bone structure, humpback, and decrease in height				
4	A deformed bone structure could result in the abnormal lung functions including, breathless				
5	Osteoporosis could minimize self-abilities and social activities				
6	Osteoporotic treatment could be expensive				
7	Osteoporotic person with some repeated experience of broken bones would be anxious				
8	Osteoporotic person with humpback might feel uncomfortable and ashamed of his or her physical appearance.				
9	Osteoporotic person with a history of broken bones and/or chronic pain might have mood swing and depression.				
10	Osteoporosis can be fatal, unless the patient receives an appropriate treatment.				