The Influence of Pain on Frailty among the Elderly: Based on Korea Health Panel

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Abstract

Background: Interests between pain and frailty have been increasing in aging or aged societies. This study aimed to identify the prevalence of pain and frailty and to find the influence of pain on frailty.

Methods: Subjects were selected with aged 65 yr or older among pooled Korea Health Panel data from 2009 to 2013. The prevalence of pain was determined by combining some pain and extreme pain and also, frailty was defined when subjects had at least one of the following 6-domain frailty: physical inactivity, mobility reduction, dependence of daily life, depression, multimorbidity, and disability.

Results: The prevalence of pain and frailty was 56.1% and 59.8%. It was significantly higher in female (66.1% and 65.2%) and the oldest-old (69.4% and 71.8%). After adjusting for gender, age group, spouse, illiteracy, and economic activity, odds ratios of frailty for some pain and extreme pain were 2.8 (95% CI 2.6-3.0) and 10.5 (95% CI 8.0-13.8) in total subjects. The odds ratios of each 6-domain frailty for some and extreme pain were also significant. Among them, mobility reduction was 5.1 (95% CI 4.5-5.8) and 16.5 (95% CI 13.6-20.1), and dependence of daily life was 3.9 (95% CI 3.5-4.5) and 12.4 (95% CI 10.2-15.1).

Conclusion: Among the elderly, prevalence of frailty (59.8%) was somewhat higher than that of pain (56.1%). Female and oldest-old had higher prevalence of pain and frailty. In addition, some pain and extreme pain had a decisive influence on frailty and each 6-domain frailty. Therefore, pain control is essential to prevent or manage frailty.

Keywords: Elderly; Pain; Frailty; Prevalence; Odds ratio

Introduction

Along with aging trend in most countries, interests in pain and frailty have been increasing. Healthy aging is not just a disease-free state, but also a state without frailty in the physical and mental functions. Traditionally, old people are 65 yr or older. They usually have characteristics of daily life limitations, multimorbidity, pain, and poly-pharmacy (1-4). They finally required social intervention to manage their pain and frailty.

Pain brings frailty by various mechanisms (5). It can limit daily life in the workplace and home, and reduce physical mobility. So, pain is used as an indicator to measure the quality of life (4). Studies suggested 25% to 50% of dwelling elders had pain (6-8). Especially in the elderly population, pain linked to frailty, and old people who already have chronic pain may become vulnerable to frailty (9, 10).

Frailty refers to the interaction of physiological capabilities with medical conditions (11). The dependence is increased due to the degradation of function and restriction of homeostasis (12). In

addition, it is not only to speed up illness, but also to develop complex syndromes such as low physical function, loss of independence, and the increase of depression (13, 14). The prevalence of frailty among the elderly in the community varied from 4.0% to 59.1% (15).

The previous study identified frailty through various factors. It was measured 5-domain of physical phenotype: weight loss, exhaustion, slowness, low activity level, and weakness (16). Another study measured the frailty index by means of the scale of various failures: disabilities, symptoms and signs, and diseases (17). In the other study, frailty was scored by cognitive functions, moods, communication, mobility, balance, intestinal and bladder functions, nutrition, overall functions, social factors, and accompanying diseases (18). Recently, the definition of frailty also includes psychological and sociological factors, and physical factors (19, 20).

In most Asia countries, managing pain and frailty is important in terms of new health policy development because there would be facing the aging of the baby boomers' generation. However, few studies have identified not only the relationship between pain and frailty but also the prevalence of them in the elderly, especially in Korea. Therefore, this study aimed to investigate the prevalence of pain and frailty and to determine the influence of pain on frailty and 6-domain frailty.

Materials and Methods

Design
This study was a cross-sectional epidemiological study using five years of Korea Health Panel (KHP) pooled data in which the pain variable was continuously investigated from 2009 to 2013.

Subjects
Subjects were 13,484 people aged 65 yr or older out of 58,151 surveyed by the interviewer of KHP over the 5-year from 2009 to 2013. Among them, males were 5,833 (43.3%) and females were 7,651 (56.7%), and the young-olds (65-74 yr old) were 9,092 (67.4%), the middle-olds (75-84 yr

old) were 3,980 (29.5%), and the oldest-olds (85 yr or older) were 412 (3.1%).

Data
This study used data (beta version 1.4) from the KHP jointly organized by the Korea Institute for Health and Social Affairs (KIHASA) and the National Health Insurance Corporation. The KHP is a government-approved statistical survey that can represent Koreans. This data was approved from the IRB (KIHASA IRB No. 2016-01).

Variables
The major variables used in this study were pain, frailty, 6-domain frailty and demo-socioeconomic characteristics as covariates. Explanations are as follows.

Pain
To find out the presence of pain, the KHP survey asked, 'What do you think about your pain or discomfort today?' Respondents said 'no', 'some', and 'extreme' pain. In this study, the prevalence of pain included some pain and extreme pain.

Frailty and Six-domain frailty
The author selected the 6-domain frailty: physical inactivity, mobility reduction, the dependence of daily life, depression, multimorbidity, and disability (16-20). Each 6-domain frailty was rated 'yes' and 'no', and if they had at least one 'yes', the author defined it as frailty.

- Physical inactivity was identified as 'yes' when subjects did not do strenuous activity nor a little breathless activity, and nor walking for at least 10 min.
- Mobility reduction was identified as 'yes' when the subject was lying down all day due to illness or was restricted from work, social activities, leisure, and family activities in last month.
- Dependence of daily life was divided into 'yes' if there are physical and mental problems that require help from

others for at least three months. Examples include meal preparation, outings, transportation use, buying things, managing money, medicine, phone dialing, dressing, laundry, bathing, bathroom use, and urination and defecation.

- Multimorbidity was a case in which have six or more chronic diseases needed care one year or more. For example, hypertension, diabetes, dyslipidemia, arthritis, tuberculosis, ischemic heart disease, cerebrovascular disease, and other chronic diseases.

- Depression was divided into 'yes' if there are one or more of the following three cases in the last year. The first case was that the person felt sad or unhappy for two or more consecutive weeks. The second case was that the person wanted to die. The third case was that the person used anti-depressants, tranquilizers, or sleeping pills for the relief of depression, insomnia or stress.

- Disability was classified as 'yes' when there was one or more registered disability according to Korea Disability Act, including body, brain lesions, vision, hearing, language, kidneys, heart, respiratory-organ, and liver after excluding three congenital disability (intellectual, developmental, and mental disability).

Demo-socioeconomic status

This study classified the age group as young-old (65-74 yr old), middle-old (75-84 yr old), and the oldest-old (85 yr or older). Demo-socioeconomic variables such as gender, education, economic activity, and marital status were used as covariates. Illiteracy was a case of an uneducated and unable to read texts. Literacy was not only a case of primary school or higher but also able to read the text. The economic activity was divided into 'yes' (presence) and 'no' (absence). A spouse was a case of married, including a true marriage, while no spouse was a case of separated, bereavement, missing, and divorced.

Data analysis

The prevalence of pain, frailty, and each 6-domain frailty were identified by chi-square, and the influence of pain on frailty and on each 6-domain frailty was investigated by multiple logistic regression model. Covariates such as gender, age group, spouse, literacy, and economic activity were put in each model. SAS 9.4 (SAS Institute Inc., Cary, NC, USA) was used for analysis after excluding missing values for each variable. All significant tests were two-tailed and interpreted significant when the *P*-value was less than 0.05.

Results

The prevalence of pain and frailty by gender

Subjects were 13,484 people; 43.3% male and 56.7% female; 67.4% young-old, 29.5% middle-old and 3.1% the oldest-old. The prevalence of pain was 56.1%, among them, some pain was 51.4% and of extreme pain was 4.7%.
The prevalence of frailty was 59.8%. In each 6-domain frailty, the physical inactivity was 20.3%, mobility reduction 18.0%, the dependence of daily life 18.3%, depression 20.2%, multimorbidity 21.5%, and disability 14.8% (Table 1).

The prevalence of pain and frailty by age group

The prevalence of pain and frailty was higher in the oldest-old (69.4% and 71.8%) than others (*P*<0.0001). Nevertheless, extreme pain was higher in middle-old (6.8%) than others (*P*<0.0001).
Among 6-domain frailty, the prevalence of physical inactivity, mobility reduction, and the dependence of daily life were high in the order of oldest-old, middle-old, and young-old. However, the prevalence of multimorbidity and depression were high in the order of middle-old, young-old, and the oldest-old (*P*<0.0001) (Table 2).

Table 1: The prevalence of pain and frailty by gender

Classification		Total		Male		Female		X^2 or t	P value
Total		13,484	(100)	5,833	(100)	7,651	(100)		
Age group	Young-old (65-74 yr)	9,092	(67.4)	4,039	(69.2)	5,053	(66.0)	18.7	<0.0001
	Middle-old (75-84 yr)	3,980	(29.5)	1,643	(28.2)	2,337	(30.6)		
	The oldest-old (>=85yr)	412	(3.1)	151	(2.6)	261	(3.4)		
Age	Mean ± SD	72.5±5.5		72.3±5.4		72.7±5.6		-4.65	<0.0001
No Spouse		4,316	(32.0)	504	(8.6)	3,812	(49.8)	2,579.30	<0.0001
Illiteracy		942	(7.0)	80	(1.4)	862	(11.3)	498.7	<0.0001
Economic activity		4,987	(37.0)	2,734	(46.9)	2,253	(29.5)	431.1	<0.0001
Pain	Total	7,570	(56.1)	2,517	(43.1)	5,053	(66.1)	708.1	<0.0001
	Some	6,933	(51.4)	2,328	(39.9)	4,605	(60.2)		
	Extreme	637	(4.7)	189	(3.2)	448	(5.9)		
Frailty	At least one among 6-domain frailty	8,057	(59.8)	3,063	(52.5)	4,994	(65.2)	224.1	<0.0001
Six-domain of frailty	Physical inactivity [1]	2,735	(20.3)	968	(16.6)	1,767	(23.1)	86.5	<0.0001
	Mobility reduction [2]	2,425	(18.0)	832	(14.3)	1,593	(20.8)	96.4	<0.0001
	Dependence of daily life [3]	2,468	(18.3)	851	(14.6)	1,617	(21.1)	94.8	<0.0001
	Depression [4]	2,726	(20.2)	893	(15.3)	1,833	(24.0)	153.5	<0.0001
	Multimorbidity [5]	2,894	(21.5)	886	(15.2)	2,008	(26.2)	240	<0.0001
	Disability [6]	1,994	(14.8)	993	(17.0)	1,001	(13.1)	40.8	<0.0001

[1] Lack of walking, and of moderate and strenuous physical activity
[2] Restricted activity, such as lying down or absence from work by disease or injury
[3] Three months or more of assistance from others in daily life and physical activities
[4] Depression, sadness, thoughts of suicide, or taking antidepressants
[5] Having six or more chronic diseases
[6] Registered disabled person except for intellectual, developmental and mental disability

Table 2: The prevalence of pain and frailty by age group

Classification		Young-old		Middle-old		The oldest-old		X^2 or t	P value
Total		9,092	(100.0)	3,980	(100.0)	412	(100.0)	18.7	<0.0001
Gender	Male	4,039	(44.4)	1,643	(41.3)	151	(36.7)		
	Female	5,053	(55.6)	2,337	(58.7)	261	(63.4)		
Age	Mean ± SD	69.4±2.8		78.1±2.6		87.6±2.6		20803.4	<0.0001
No spouse		2,243	(24.7)	1,785	(44.9)	288	(69.9)	798.4	<0.0001
Illiteracy		402	(4.4)	429	(10.8)	111	(26.9)	432.6	<0.0001
Economic activity		3,982	(43.8)	976	(24.5)	29	(7.0)	604.8	<0.0001
Pain	Some or Extreme	4,741	(52.2)	2,543	(63.9)	286	(69.4)	212.5	<0.0001
Type of Pain	Some	4,398	(48.4)	2,272	(57.1)	263	(63.8)		
	Extreme	343	(3.8)	271	(6.8)	23	(5.6)		
Frailty	At least one among 6-domain frailty	5,008	(55.1)	2,753	(69.1)	296	(71.8)	254.3	<0.0001
Six domain of frailty	Physical inactivity [1]	1,522	(16.7)	1,055	(26.5)	158	(38.4)	249.1	<0.0001
	Mobility reduction [2]	1,367	(15.0)	945	(23.7)	113	(27.4)	168.0	<0.0001
	Dependence of daily life [3]	751	(8.3)	789	(19.8)	140	(34.0)	519.9	<0.0001
	Depression [4]	1,720	(18.9)	931	(23.4)	75	(18.2)	35.4	<0.0001
	Multimorbidity [5]	1,761	(19.4)	1,071	(26.9)	62	(15.1)	103.8	<0.0001
	Disability [6]	1330	(14.6)	615	(15.5)	49	(11.9)	4.3	0.12

[1] Lack of walking, and of moderate and strenuous physical activity
[2] Restricted activity, such as lying down or absence from work by disease or injury
[3] Three months or more of assistance from others in daily life and physical activities
[4] Depression, sadness, thoughts of suicide, or taking antidepressants
[5] Having six or more chronic diseases
[6] Registered disabled person except for intellectual, developmental and mental disability

Influence of pain on frailty

The odds ratios (ORs) of frailty for some pain and extreme pain were significantly higher than for no pain in total subjects, in males, in females, and in young-olds and middle-olds. However, in the case of the oldest-olds, the OR of frailty could not be calculated because all of them had extreme pain (Table 3).

Table 3: The odds ratios of some or extreme pain on frailty by multiple logistic regression model

Variables		Ref.	Odds ratios of frailty (95% Confidence interval)					
			Total n=8,057	Male n=3,063	Female n=4,994	Young-old n=5,008	Middle-old n=2,753	Oldest-old n=296
Gender	Female	Male	1.2 (1.1-1.3)	-	-	1.1 (1.1-1.3)	1.2 (1.0-1.5)	1.6 (0.8-3.1)
Age group	Middle-old	Young-old	1.5 (1.3-1.6)	1.5 (1.3-1.6)	1.5 (1.4-1.7)	-	-	-
	The oldest-old		1.4 (1.1-1.7)	1.1 (0.8-1.4)	1.7 (1.3-2.3)	-	-	-
Spouse	No	Yes	1.2 (1.1-1.3)	1.4 (1.2-1.8)	1.1 (1.0-1.2)	1.2 (1.1-1.4)	1.0 (0.9-1.2)	1.0 (0.5-1.9)
Illiteracy	Yes	No	1.4 (1.1-1.6)	1.6 (1.0-2.7)	1.3 (1.1-1.6)	1.2 (0.9-1.5)	1.6 (1.2-2.1)	1.6 (0.9-2,9)
Economic activity	No	Yes	1.4 (1.3-1.5)	1.4 (1.3-1.6)	1.4 (1.2-1.5)	1.3 (1.2-1.5)	1.5 (1.3-1.8)	3.0 (1.3-6.9)
Pain	Some	No	2.8 (2.6-3.0)	2.8 (2.6-3.2)	2.8 (2.5-3.1)	2.7 (2.5-3.0)	3.0 (2.6-3.5)	3.1 (1.9-5.0)
	Extreme	No	10.5 (8.0-13.8)	12.9 (7.9-21.1)	9.4 (6.8-13.1)	10.2 (7.3-4.3)	10.4 (6.1-16.7)	- [1]

[1] OR of extreme pain could not be calculated because all the oldest-old (n=23) had extreme pain

The influence of pain on each 6-domain frailty

ORs of physical inactivity, mobility reduction, dependence of daily life, depression, and multimorbidity significantly higher when there was some pain and severe pain than when there was no pain (Table 4).

Table 4: The odds ratios of some and extreme pain on each 6-domain frailty by multiple logistic regression model

Classification		Ref.	Odds ratio of each 6-domain frailty (95% Confidence interval)					
			Physical inactivity [1] n=2,735	Mobility reduction [2] n=2,425	Dependence of daily life [3] n=2,468	Depression [4] n=2,726	Multimorbidity [5] n=2,894	Disability [6] n=1,994
Gender	Female	Male	1.3 (1.2-1.5)	0.9 (0.8-1.1)	0.9 (0.8-1.1)	1.2 (1.1-1.3)	1.6 (1.4-1.8)	0.5 (0.5-0.6)
Age group	Middle-old	Young-old	1.7 (1.5-1.8)	1.3 (1.2-1.4)	2.0 (1.8-2.3)	1.0 (0.9-1.1)	1.3 (1.2-1.4)	0.8 (0.8-0.9)
	The oldest-old		2.8 (2.2-3.5)	1.3 (1.0-1.7)	3.9 (3.1-4.9)	0.6 (0.5-0.8)	0.6 (0.4-0.7)	0.5 (0.4-0.7)
Spouse	No	Yes	0.9 (0.8-1.0)	1.2 (1.1-1.3)	1.1 (0.9-1.2)	1.3 (1.2-1.4)	1.0 (0.9-1.1)	1.1 (1.0-1.3)
Illiteracy	Yes	No	1.4 (1.2-1.6)	1.3 (1.1-1.5)	2.6 (2.3-3.1)	0.9 (0.8-1.1)	0.7 (0.6-0.8)	1.2 (1.0-1.5)
Economic activity	No	Yes	1.0 (0.9-1.1)	1.7 (1.5-1.9)	1.4 (1.2-1.5)	1.5 (1.3-1.6)	1.8 (1.6-2.0)	1.9 (1.7-2.1)
Pain	Some	No	1.7 (1.6-1.9)	5.1 (4.5-5.8)	3.9 (3.5-4.5)	2.4 (2.2-2.7)	2.1 (1.9-2.3)	1.9 (1.7-2.2)
	Extreme	No	4.7 (3.9-5.6)	16.5 (13.6-20.1)	12.4 (10.2-15.1)	5.6 (4.7-6.7)	3.5 (2.9-4.2)	4.1 (3.3-4.9)

[1] Lack of walking, and of moderate and strenuous physical activity
[2] Restricted activity, such as lying down or absence from work by disease or injury
[3] Three months or more of assistance from others in daily life and physical activities
[4] Depression, sadness, thoughts of suicide, or taking antidepressants
[5] Having six or more chronic diseases // [6] Registered disabled person except for intellectual, developmental and mental disability

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Discussion

To know the prevalence of pain and frailty is important along with the rapid increase of the elderly population. In 2018, the proportion of elderly aged 65 or older in Korea was 14.8%, and from 9.3% to 21.9% depending on the area (21). This study used KHP to identify the prevalence of pain and frailty of the elderly in Korea. As a result, the prevalence of pain and frailty was 56.1% and 59.8% among aged 65 or older Koreans. The prevalence of pain was somewhat lower than that of frailty. However, the pain is possible to underreport due to a misconception that pain is a normal process along with age and due to the increased threshold of pain perception (8, 9).

Other studies suggested that 25% to 50% of the elderly have pain (6-8). The prevalence of frailty varied to 4.0%-59.1% (15). However, there was a limit to the comparison because tools of each study were not the same to measure pain and frailty. For example, although the prevalence of pain was 56.1% in this study, the prevalence of some pain was 51.4%, and extreme pain was only 4.7%. In addition, the prevalence of each 6-domain frailty was 20.3% in physical inactivity; 18.0% in mobility reduction; 18.3% in the dependence of daily life; 20.2% in depression; 21.5% in multimorbidity; and 14.8% in disability. These results have shown that health policy for frailty will be important more and more for preparing aged society.

It is necessary to find gender disparity of pain and frailty in terms of health policy. The prevalence of pain and frailty was higher in female because of differences in physiology, mental and social factors (15, 22). In this study, the prevalence of pain and frailty was significantly higher in female (66.1% and 65.2%) than male (43.1% and 52.5%) ($P<0.0001$). In addition, among 6-domain frailty, 5-domain was higher in female than male: physical inactivity (23.1% vs. 16.6%); mobility reduction (20.8% vs. 14.3%); the daily life dependence (21.1% vs. 14.6%); depression (24.0% vs. 15.3%); multimorbidity (26.2% vs. 15.2%). Nevertheless, disability was higher in male (17.0%) than female (13.1%) ($P<0.0001$).

The prevalence of pain and frailty were higher with an increase in age (22). Even in this study, the higher the age group, the higher the prevalence of pain and frailty: in the oldest-old (69.4% and 71.8%); in middle-old (63.9% and 69.1%); in young-old (52.2% and 55.1%). Among 6-domain frailty, the prevalence of 3-domain frailty was high in the order of the oldest-old, middle-old, and young-old: In physical inactivity (38.4% vs. 26.5% vs. 16.7%); in mobility reduction (27.4% vs. 23.7% vs. 15.0%); in the dependence of daily life (34.0% vs. 19.8% vs. 8.3%). However, the prevalence of depression (23.4% vs. 18.9% vs. 18.2%) and multimorbidity (26.9% vs. 19.4% vs. 15.1%) were high in the order of middle-old, young-old, and the oldest-old ($P<0.0001$).

The pain brought frailty (10, 11, 22), which was caused by interactions with physiological capabilities, and medical conditions (11, 23). In this study, the significant ORs of frailty were 2.8 for some pain and 10.5 for extreme pain. In addition, the ORs of frailty were significantly higher when there was no spouse, illiteracy, and no economic activity. These results show that pain and comprehensive views such as marital, educational, and economic status are needed to manage frailty.

Although the prevalence of pain and frailty was higher in females, the influence of pain on frailty was significant in both males and females in this study: the ORs of frailty for some pain were 2.8 in males as well as females; the ORs of frailty for extreme pain were 12.9 in males and 9.4 in females. By age group, the significant ORs of frailty for some pain were 2.7 in young-olds, 3.0 in middle-olds, and 3.1 in the oldest-olds; those for extreme pain were 10.2 in young-olds, 10.4 in middle-olds.

In other studies, pain was related to the frailty of mobility limitations, increased dependency, anxiety, and depression (10, 24). Even in this study, the influence of pain on each 6-domain frailty were identified. The significant ORs of 6-domain frailty for some pain and extreme pain were 1.7 and 4.7 in physical inactivity; 5.1 and 16.5 in mobility reduction; 3.9 and 12.4 in the dependence of daily life; 2.4 and 5.6 in depression; 2.1 and 3.5 in multimorbidity; 1.9 and 4.1 in disability.

To sum up, first, the prevalence of pain and frailty were 56.1% and 59.8% in the elderly population in Korea. Pain and frailty prevalence were higher in female, and in the oldest-old. It was in line with previous studies (6-8, 15-22). However, it is difficult to make a clear comparison because the measuring instruments of pain and frailty vary from study to study. Second, the significant variables affecting frailty were no spouse, illiteracy, non-economic activity, and the pain. Among them, the pain had the highest influence on frailty; the OR 2.8 in some pain and the OR 10.5 in extreme pain. Third, the influence of pain on frailty was in both genders, all age groups, and each 6-domain frailty. In addition, extreme pain had more affected frailty than some pain. Thus, managing frailty requires a multidimensional aspect, but pain control will need to be considered as a priority goal.

The limitations and significance of this study were as follows. The first, this study was a cross-sectional analysis by pooled 5-year KHP. Therefore, this study was not able to explain the causal relationship between pain and frailty. However, it was a meaningful result based on KHP for 5-year using the same survey tools. Second, this study was not an investigation using the only frailty-measuring tool, so comparison with preceding research was not easy. In fact, in prior studies, the concept of frailty was diverse and measurement was not standard practice (19, 20). However, it is efficient to identify the characteristics of pain and frailty through secondary big data.

Conclusion

In the age of 65 or older, the prevalence of frailty (59.8%) was somewhat higher than pain (56.1%). The prevalence of pain and frailty were significantly higher in female (66.1% and 65.2%), and the oldest-old (69.4% and 71.8%). Also, some pain and extreme pain had a decisive influence on frailty in total subjects, both genders, all age group, and on each 6-domain. In addition, the more serious pain had the more influential on frailty. Therefore, pain control is essential to prevent or manage frailty.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the author.

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Conflict of interest

The author declares that there is no conflict of interest.

References

1. Zunzunegui MV (2011). Evolution of disability and dependency. An international perspective. *Gac Sanit*, 25 Suppl 2:12-20

2. Flores-Mateo G, Grau M, O'Flaherty M, et al (2011). [Analyzing the coronary heart disease mortality decline in a Mediterranean population: Spain 1988-2005]. *Rev Esp Cardiol*, 64(11): 988-96.

3. Haider SI, Johnell K, Thorslund M, et al (2008). Analysis of the association between polypharmacy and socioeconomic position among elderly aged > or =77 years in Sweden. *Clin Ther*, 30(2): 419-27.

4. Shin SM (2017). Prevalence and trends of pain associated with chronic diseases and personal out-of-pocket medical expenditures in Korea. *Korean J Pain*, 30(2): 142-150.

5. Shega JW, Dale W, Andrew M, et al (2012). Persistent pain and frailty: a case for homeostenosis. *J Am Geriatr Soc*, 60(1): 113-7.

6. Maxwell CJ, Dalby DM, Slater M, et al (2008). The prevalence and management of current daily pain among older home care clients. *Pain*, 138(1): 208-216.

7. Kaye AD, Baluch A, Scott JT (2010). Pain management in the elderly population: a review. *Ochsner J*, 10(3): 179-187.
8. Donald IP, Foy C (2004). A longitudinal study of joint pain in older people. *Rheumatology*, 43(10): 1256–1260.
9. Bicket MC, Mao J (2015). Chronic Pain in Older Adults. *Anesthesiol Clin*, 33(3): 577-590.
10. Rudy TE, Weiner DK, Lieber SJ, et al (2007). The impact of chronic low back pain on older adults: A comparative study of patients and controls. *Pain*, 131(3): 293–301.
11. Zaslavsky O, Cochrane BB, Thompson HJ, et al (2013). Frailty: A review of the first decade of research. *Biol Res Nurs*, 15(4): 422–32.
12. Fried LP, Ferrucci L, Darer J, et al (2004). Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. *J Gerontol A Biol Sci Med Sci*, 59(3): 255-63.
13. Hao Q, Zhou L, Dong B, et al (2019). The role of frailty in predicting mortality and readmission in older adults in acute care wards: a prospective study. *Sci Rep,* 9(1): 1207.
14. Clegg A, Young J, Iliffe S, et al (2013). Frailty in elderly people. *Lancet*, 381(9868): 752–62.
15. Collard RM, Boter H, Schoevers RA, et al (2012). Prevalence of frailty in community-dwelling older persons: A systematic review. *J Am Geriatr Soc*, 60(8): 1487–92.
16. Fried LP, Tangen CM, Walston J, et al (2001). Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*, 56(3): M146-56.
17. Rockwood K, Mitnitski A (2007). Frailty in relation to the accumulation of deficits. *J Gerontol A Biol Sci Med Sci*, 62(7): 722–7.
18. Jones D, Song X, Mitnitski A, et al (2005). Evaluation of a frailty index based on a comprehensive geriatric assessment in a population based study of elderly Canadians. *Aging Clin Exp Res*, 17(6): 465-71.
19. Markle-Reid M, Browne G (2003). Conceptualizations of frailty in relation to older adults. *J Adv Nurs*, 44(1): 58–68.
20. Sternberg SA, Wershof Schwartz A, Karunananthan S, et al (2011). The identification of frailty: A systematic literature review. *J Am Geriatr Soc*, 59(11): 2129–38.
21. Statistics Korea (2019). Web site. http://kosis.kr/search/search.do. updated May 11, 2019. Accessed May 11, 2019.
22. Coelho T, Paúl C, Gobbens RJJ, Fernandes L (2017). Multidimensional Frailty and Pain in Community Dwelling Elderly. *Pain Med*, 18(4): 693-701.
23. Avila-Funes JA, Helmer C, Amieva H, et al (2008). Frailty among community-dwelling elderly people in France: The three-city study. *J Gerontol A Biol Sci Med Sci*, 63(10): 1089–96.
24. Weiner DK, Hanlon JT (2001). Pain in nursing home residents: Management strategies. *Drugs Aging*, 18(1): 13–29.