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Fracture Risk Assessment in a Tertiary Centre Memory Clinic

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Abstract

Aims: The aim of the study was to identify the proportion of patients presenting to the memory clinic at a high risk of fracture based on the FRAX and Garvan fracture risk calculators. Of those identified as being at high risk, we aimed to identify whether this issue was addressed either at baseline review or at their previous review. *Methodology*: One hundred consecutive patients attending clinic in 2012 were audited over a 6 month period. A mixed method methodology was utilised for data collection. Subsequently the FRAX and Garvan score was calculated for all 71 patients. Fracture risk calculator scores were categorised into low and high risk according to the classification system followed by the Gairdner densitometry department at SCGH. *Results*: The study sample had a mean age of 81.20 with a range from 64 to 91 years of age. The average MMSE score was 23.75 with a range from 10 to 30 points. It was found that 64.8% of the participants received no form of first line bone health specific therapy. Despite the study sample having a mean FRAX and Garvan scoring that indicated high risk for fractures (except with FRAX major) just 35.2% of patients were on any form of first line therapy and only 9.9% were on specific ART. *Conclusion*: A significant proportion of people attending the tertiary centre memory clinic were identified as being at high fracture risk. The overriding observation of the lack of bone specific treatment in individuals at high fracture risk becomes important given the increased vulnerability of the population being studied here. This could have a significant impact not only on reduction in osteoporotic fracture disease burden but also on the associated health costs therein.

Keywords

Fracture Risk, Dementia, Osteoporosis, FRAX Score, Garvan Score

1. Introduction

Dementia often co-occurs with osteoporosis and both these conditions are found to be strongly related to old age [1]. Dementia is also associated with a greater risk of falls and hence subsequent fractures [2]. In spite of osteoporotic fractures being more common in demented people, population based studies have demonstrated that people with dementia did received less preventive treatment for osteoporosis when compared to people without dementia [3]. This would suggest that osteoporosis is an under recognised condition in dementia until after a fracture has already occurred [3].

2. Background

When considering factors as to why osteoporosis is undertreated in a demented population a few reasons have been studied in existing literature. The fear of polypharmacy in the frail elderly is one of the reasons [3]. Physical inactivity and tendency to fall are more common in people with dementia, both of which are well established risk factors for osteoporotic fractures [4].

Dementia tends to dominate the attention of the treating practitioner which could also lead to under recognition of other conditions such as osteoporosis [5]. It is well established is that bone mineral density testing is not frequently performed on patients in residential care facilities where many demented patients reside. This is related to the inherent difficulties in completing this assessment in such a population [6].

A study of 136 post menopausal women residing in nursing homes not only showed a high prevalence of both osteoporosis and dementia, but also established a low prevalence of measurement of bone mineral density as well

as the underuse of calcium and vitamin D supplements and other antiresorptive therapies [6]. We are aware of how the presence of dementia can alter the risk-benefit ratio of treatment of a common medical problem. We also know that the presence of dementia should influence any decision making process in treatment of medical conditions in this population [5].

However there is an independent relationship between dementia and fractures [1]. Studies show that individuals with dementia are thrice as likely to sustain a hip fracture than a cognitively intact older adult [7]. This reinforces the need to identify those at a high risk of fracture in this vulnerable population and consider management of the same accordingly. Fracture risk can be calculated using fracture risk calculators including the Fracture Risk Assessment tool (FRAX) of the World Health Organization (WHO) and the Garvan institute fracture risk calculator. The Garvan model was developed from data and acquired from the Dubbo Osteoporosis Epidemiology Study and unlike FRAX is validated in an Australian population [8].

3. Setting

The Sir Charles Gairdner Hospital (SCGH) memory clinic sees approximately 5 patients in a week. These patients represent a mixed population either living at home or in a residential care facility, who have been identified as having memory related concerns that have led to their referral to the tertiary centre memory clinic service. In the year prior to the undertaking of this data collection the total number of cases seen in 2011 were 225.Of these 41.3% were new cases and 58.6% were follow up cases. The patients are often accompanied by a health care proxy who may be a friend, a family member or a carer from their residential care facility. It represented a suitable population for assessment of fracture risk in people with concerns regarding cognitive impairment.

4. Aim

The aim of the study was to identify what proportion of patients presenting to the memory clinic were at a high risk of fracture based on the FRAX and Garvan fracture risk calculators. Of those identified as being at high risk, we aimed to identify whether this issue was addressed either at baseline review or at their previous review. We also calculated what proportion of the high fracture risk cohorts were on bone health specific treatment. We thereby aimed to establish that the memory clinic visit is a potential window of opportunity to screen for and address fracture risk.

5. Methodology

One hundred consecutive patients attending clinic in 2012 were audited over a 6 month period. A mixed method methodology was utilised for data collection. In the first phase this included structuring a questionnaire incorporating questions that would permit calculation of fracture risk using both the FRAX and Garvan calculators.

There was also the opportunity to interview the patient and the attending health care proxy to attain additional information as required. In the second phase there was access to previous memory clinic letters, general practitioner letters sent to the memory clinic service, blood tests and imaging reports available on the hospital computer system or in the patients memory clinic file.

74 completed performas were available for analysis at the end of the audit period. The information was serially entered into an excel spreadsheet to enable statistical analysis. Subsequently the FRAX and Garvan score was calculated for all 74 patients. Fracture risk calculator scores were categorised into low and high risk according to the classification system followed by the Gairdner densitometry department at SCGH. High risk factor categories were generated using the percentage cut off of >3% for the 10 year risk of hip fracture and >20% for other major osteoporotic fractures using the FRAX calculator. With the Garvan calculator the percentage cut off for high risk was >10% for 5 year fracture risk and >20% for 10 year fracture risk at hip and other sites.

The diagnosis of dementia in all cases was made by the reviewing physician in memory clinic. The cognitive assessments incorporated a multitude of cognitive tests and input from a multidisciplinary team. Only the mini mental state examination (MMSE) scores were incorporated into the performa used for the purpose of this audit. The division in to demented versus non demented groups was based on the reviewing clinicians' diagnosis as documented in the clinic letter. We conducted independent t-tests and Z-test of proportions for differences in variables between the cognitive status groups.

There were 3 patients excluded as outliers due to their age being under 50. As a result the number included in the final analysis was 71.

Measurements included calculating the proportion of the cohort identified as being at high fracture risk. The pattern of bone health specific treatment in the form of first line therapy was taken as the use of calcium and vitamin D in combination or either of these taken individually. The other consideration was use of specific anti resorptive therapy (ART). Also assessed was whether or not fracture risk had been addressed either at baseline or at the review immediately prior, in those who were follow-up cases.

Individualised data for six fracture risk calculator scores. (2 FRAX Fracture Risk Scores and 4 Garvan Fracture Risk Scores) were computed to define fracture risk. We then stratified groups into high and low fracture risk groups and studied treatment patterns relevant to bone health across these groups.

Data analysis on the included participants was carried out on IBM SPSS (Statistical Package for the Social Sciences) Version 22. Frequencies and percentages were calculated for categorical variables, comparisons of categorical variables were made with Z-test of proportions for normally distributed data.

Association was measured between categorical variables by using Pearson Chi-square or Fisher's exact tests. Mean, standard deviation, and range were calculated for continuous variables with a normal distribution, continuous variables were compared across groups using independent t-tests.

6. Results

Table 1 shows the demographic characteristics. The study sample had a mean age of 81.20 with a range from 64 to 91 years of age. The average MMSE score was 23.75 with a range from 10 to 30 points.

Eleven participants did not have a diagnosis of dementia at the time of data collection whilst sixty of them had a clinical diagnosis of dementia.

It was found that 64.8% of the participants received no form of first line bone health specific therapy. And despite the study sample having a mean FRAX and Garvan scoring that indicated high risk for fractures (except with FRAX major) just 35.2% of patients were on any form of first line therapy and only 9.9% were on specific ART.

Fracture risk was discussed in only 4.2% of cases of the 71 patients at either baseline visit or previous review.

Table 1. *Sample demographics.*

Basic Demographics Table		**Mean (StDev) Range**	**n (%)**
Age		81.20 (6.29) 64.00-91.00	
MMSE Score		23.75 (4.73) 10.00-30.00	
Dementia	Not Demented		11 (15.5%)
	Demented		60 (84.5%)
First line treatment for osteoporosis	None		46 (64.8%)
	Calcium & Vitamin D		14 (19.7%)
	Calcium only		2 (2.8%)
	Vitamin D only		9 (12.7%)
Antiresorptive Therapy[a]	None		64 (90.1%)
	Antiresorptive Therapy		7 (9.9%)
FRAX Hip Score		14.77 (8.21) 2.00-39.00	
FRAX Major Score		8.03 (5.25) 0.50-27.00	
Garvan Hip Score (5yr)		13.52 (13.79) 0.50-65.50	
Garvan Hip Score (10yr)		24.00 (20.72) 1.00-87.50	
Garvan Any Score (5yr)		24.73 (14.48) 3.50-68.40	
Garvan Any Score (10yr)		41.61 (19.76) 6.60-91.50	
Fracture Risk	Not Discussed		68 (95.8%)
	Discussed		3 (4.2%)

[a]Antiresorptive therapies include: Bisphosphonates, Strontium Ranelate, Raloxifene and Denosumab

Table 2. *Sub-sample demographics, shows the comparison of the participant characteristics for cognitive status.*

		Dementia Diagnosis				**T-test**	**Z-test**
		Not Demented (n=11)		**Demented (n=60)**			
		Mean (StDev) Range	**n (%)**	**Mean (StDev)Range**	**n (%)**	**p-value**	**p-value**
Age		79.27 (6.87) 68.00-89.00		81.55(6.18)64.00-91.00		0.27	
MMSE Score		27.09 (3.33) 19.00-30.00		23.13(4.71)10.00-30.00		0.01	
Calcium/ Vit D Treatment	Nil		6 (54.5%)		40 (66.7%)		0.441
	Ca and Vit D		2 (18.2%)		12 (20.0%)		0.89
	Ca only		1 (9.1%)		1 (1.7%)		0.17
	Vit D only		2 (18.2%)		7 (11.7%)		0.55
Antiresorptive Therapy	Nil		10 (90.9%)		54 (90.0%)		0.93
	ART		1 (9.1%)		6 (10.0%)		0.93
FRAX Hip Score		16.30 (7.48) 7.80-27.00		14.49 (8.36) 2.00-39.00		0.51	
FRAX Major Score		8.01 (3.57) 4.60-15.00		8.04 (5.52) 0.50-27.00		0.99	
Garvan Hip Score(5y)		12.94 (11.21) 2.50-32.00		13.63 (14.29) 0.50-65.50		0.88	
Garvan Hip Score (10y)		22.84 (18.74) 4.80-53.90		24.21 (21.20) 1.00-87.50		0.84	
Garvan Any Score(5y)		23.75 (13.87) 7.30-44.50		24.91 (14.70) 3.50-68.40		0.81	
Garvan Any Score (10yr)		39.38 (20.30) 13.60-71.80		42.02 (19.80) 6.60-91.50		0.69	
Fracture risk addressed at previous visit	No		11 (100.0%)		57 (95.0%)		0.45
	Yes		0 (0.0%)		3 (5.0%)		0.45

Table 2 shows the division of the cohort into those with or without a formal diagnosis of dementia. An independent t-test inferred that the mean age was similar for both non-demented and demented groups ($p<0.27$). As expected the MMSE score was higher in the not-demented group with a mean score of 27.09 compared to the demented group mean of 23.13. This was significant at the 5% level, $p=0.01$.

The proportions of bone health specific first-line supplementation used were similar between the non-demented and demented participants. On analysis of FRAX and Garvan scores between the groups there was no statistically significant difference in fracture risk between

groups.

With regards to measures of calcium and/or vitamin D supplementation as well as the use of ART there was no difference in bone specific treatment patterns observed.

Notably fracture risk and its implications had only been discussed with 3 patients out of the 71. This demonstrated that in 95% of the demented participants, and in 100% of the non-demented participants, high fracture risk had not been addressed prior to baseline.

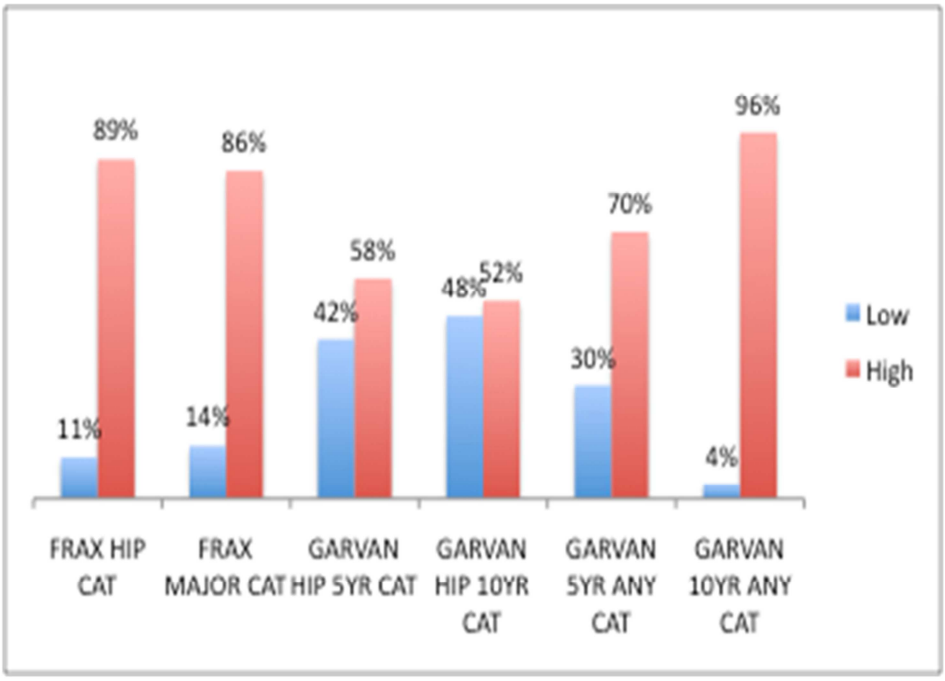

Figure 1. *Proportion of cohort at high fracture risk.*

Figure 1 demonstrates that a large proportion of the study cohorts were at a high risk of fracture across all six of the utilised fracture risk calculator cut off scores.

In table 3 when stratifying the groups based on their dementia status a Fisher's exact chi-square analysis of the data showed similar patterns of bone health specific treatment used across both demented and non-demented groups.

All applied tests showed that the bone health specific treatment patterns were similar across all six fracture risk groups irrespective of the score reflecting high or low risk.

An independent t-test found no statistically significant difference for any of the six Fracture Risk Calculator scores for dementia status

Importantly there were similarly high proportions of patients on no form of bone health specific treatment in the high fracture risk categories across both groups (highlighted in red).

Table 3. *Cross-tabulation of dementia diagnosis, fracture risk calculator ratings and bone specific treatment pattern.*

		DEMENTIA DIAGNOSIS						
		Not Demented (n=11)			**Demented (n=60)**			
		Any first line bone health treatment			**Any first line bone health treatment**			
		No (n=6)	**Yes (n=5)**		**No (n=40)**		**Yes (n=20)**	
		ART	**ART**		**ART**		**ART**	
		No (n=6)	**No (n=4)**	**Yes (n=1)**	**No (n=39)**	**Yes (n=1)**	**No (n=15)**	**Yes (n=5)**
		n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
FRAX Major	Low	0 (0.0%)	0 (0.0%)	0 (0.0%)	8 (20.5%)	2 (2.8%)	0 (0.0%)	0 (0.0%)
Category	High	6 (100%)	4 (100%)	1 (100%)	31 (79.5%)	13 (18.3%)	1 (1.4%)	5 (7.0%)
FRAX Hip Category	Low	0 (0%)	0 (0.0%)	0 (0.0%)	7 (17.9%)	1 (1.4%)	0 (0.0%)	0 (0.0%)
	High	6 (100%)	4 (100%)	1 (100%)	32 (82.5%)	14 (19.7%)	1 (1.4%)	5 (7.0%)
Garvan Hip 5yr	Low	4 (60%)	2 (50%)	0 (0.0%)	17 (43.5%)	4 (5.6%)	0 (0.0%)	3 (4.2%)
Category	High	2 (40%)	2 (50%)	1 (100%)	22 (56.5%)	11 (15.5%)	1 (1.4%)	2 (2.8%)
Garvan Hip 10yr	Low	4 (60%)	2 (50%)	0 (0.0%)	19 (48.7%)	6 (8.5%)	0 (0.0%)	3 (4.2%)
Category	High	2 (40%)	2 (50%)	1 (100%)	20 (51.2%)	9 (12.7%)	1 (1.4%)	2 (2.8%)
Garvan ANY 5yr	Low	4 (60%)	1 (25%)	0 (0.0%)	12 (16.9%)	2 (2.8%)	0 (0.0%)	2 (2.8%)
Category	High	2 (40%)	3 (75%)	1 (100%)	27 (38.0%)	13 (18.3%)	1 (1.4%)	3 (4.2%)
Garvan Any 10yr	Low	1 (20%)	0 (0.0%)	0 (0.0%)	2 (2.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Category	High	5 (80%)	4 (100%)	1 (100%)	37 (52.1%)	15 (21.1%)	1 (1.4%)	5 (7.0%)

Table 4. *Correlation between risk of fracture and type of treatment.*

		First line Treatment					ART					First line+ART		
		No Tx	Tx	Chi-Square Test			No Tx	Tx	Chi-Square Test			No Tx	Tx	Chi-Square Test
		n	n	p-value			n	n	p-value			n	n	p-value
FRAX Major	Low	8	2	.277	FRAX Major Category	Low	10	0	.259	FRAX Major Category	Low	10	0	.300
	High	38	23			High	54	7			High	55	6	
FRAX Hip	Low	7	1	.153	FRAX Hip Category	Low	8	0	.321	FRAX Hip Category	Low	8	0	.362
	High	39	24			High	56	7			High	57	6	
Garvan Hip 5y	Low	21	9	.432	Garvan Hip 5yr Category	Low	27	3	.973	Garvan Hip 5yr Category	Low	27	3	.688
	High	25	16			High	37	4			High	38	3	
Garvan Hip 10y	Low	23	11	.629	Garvan Hip 10yr Category	Low	31	3	.779	Garvan Hip 10yr Category	Low	31	3	.914
	High	23	14			High	33	4			High	34	3	
Garvan ANY 5y	Low	16	5	.192	Garvan ANY 5yr Category	Low	19	2	.951	Garvan ANY 5yr Category	Low	19	2	.833
	High	30	20			High	45	5			High	46	4	
Garvan ANY 10y	Low	3	0	.192	Garvan Any 10yr Category	Low	3	0	.558	Garvan Any 10yr Category	Low	3	0	.591
	High	43	25			High	61	7			High	62	6	

In Table 4 we see that both patients at low risk of fractures as well as patients at high risk of fractures were on similar patterns of bone health treatment. No statistically significant chi-square results were found to suggest that fracture risk rating and bone health specific treatment were correlated. Both a and b relate to validity of the chi square test.

7. Discussion

This study aimed at assessing fracture risk in a vulnerable population attending a tertiary centre memory clinic. Although the cohort has been divided into two groups for certain areas of sub analysis, we remained mindful that all reviewed patients had shown certain concerning features with regards to cognition.

A notable observation was that a high proportion of participants were on no form of bone health specific therapy whatsoever in spite of being at high fracture risk. This was the case across both groups.

Despite the dearth of non-demented participants the proportions in Table 3 highlight the potential of the dementia diagnosis dominating the clinicians' attention with fracture risk treated as a lesser morbidity or ignored altogether [9]. Practitioners are liable to under treat osteoporosis in this population, as well as other age-related morbidities [9].

During the period of this study, it was also noted that the inclusion of a bone health performa, did not prompt discussion regarding fracture risk or osteoporosis.

There was also no correlation between the fracture risk of an individual and the type of bone health specific treatment they were on. A more ideal situation would be that those at high fracture risk be on some form of bone health specific treatment. However it needs to be acknowledged that choice of treatment is known to be dependent on complex risk-benefit consideration and importantly, an individual's perception of risk which would in particular be limited in a demented population [10].

In the context of a vulnerable population such as this cohort, it would be logical that individuals at high fracture risk, regardless of their BMD levels (which was either unavailable or not performed in most cases of these patients) should be considered for some form of bone health specific treatment because of evidence showing that treating such individuals can yield clinical benefit with a reduction of fracture risk by 35-50% [10, 11].

8. Limitations

The study is limited by a degree of observer bias as the data collector was also the main researcher. Observer bias existed in that the observer was not blinded to the patient and the hypothesis. Responder bias is a concern for any population with cognitive impairment.

Given that this population is attending a memory clinic – the questions of 'have you discussed Osteoporosis prior to baseline' might not have been answered accurately. Although bearing in mind that clinic letters were reviewed where the bone health aspect not being documented was considered as a lack of discussion in this regard.

A common recall bias in aging groups is a confusing aspect surrounding investigations and diagnosis of conditions like osteoporosis. The study attempts to remedy responder bias through the use of medical records, however, even medical records have missing information or poor documentation/correspondence between a patient's community practitioner and the hospital's outpatient services and even the clinic notes and letters.

Instrument bias would be minimised through the use of the fracture risk calculators and the MMSE score as they are used widely in geriatric populations. However, recall bias is probable for the exposure to calcium and vitamin D supplementation, where prescriptions are not required; hence

the documentation might not be included in the medical history or even in GP or clinic letters.

Selection bias occurs in this study due to the limited number of patients seen in the memory clinic each week. Consequently only approximately 5 patients per week are seen in the memory clinic. The re-shuffling of the most 'critical' or 'at-risk' patients introduces a form of selection bias. Prioritising older, frailer and more senile patients would naturally correlate to higher Fracture Risk Calculator scores in this population, as cognitive impairments and fracture risk are concomitant age-related issues.

Furthermore, the non-demented cohort is too small a sample to provide an appropriate age-matched cohort for comparison to our demented group for the purposes of generalising the results to a wider population.

Also generalisability of the results is impaired for a number of methodological reasons. Firstly, all participants were recruited from memory clinic where the patients are all under investigation for potential cognitive impairment. Secondly, we assumed that patients could be grouped, based on clinical judgement, without cross-contamination of cognitive impairment between groups for the purpose of analysis.

Therefore the study lacks a robust comparator for the extrapolation of findings related to the under-treatment of osteoporosis for cognitive ability in this at-risk population. Findings herein can be used to highlight the potential for a correlation to exist between the under treatment of osteoporosis in demented populations. A more rigorous study is required to investigate the widely reported association between the under treatment of osteoporosis in demented populations.

9. Conclusion

The objective was to identify whether there is under recognition of fracture risk in a population where there are concerns regarding cognition. This has been established on analysis of the data gathered. There were a significant proportion of people at high fracture risk. The large majority had not had their fracture risk addressed at baseline or the immediately prior visit. The overriding observation of the lack of bone specific treatment in individuals at high fracture risk becomes important given the increased vulnerability of the population being studied here. Also was noted when assessing bone health specific treatment patterns was the lack of correlation with either fracture risk percentage or dementia status within the limitations of this study.

The quality improvement aspect of the audit includes that it was a risk free process with no additional onus to the patient or the attending health care proxy. There was no additional cost to the health care system and at time of assessment of data the information obtained has not been used to instigate any further investigations or intervention.

The information obtained raises the possibility of utilising this "window of opportunity" during a patient's attendance to memory clinic to also address their fracture risk. Subsequently those identified as being at high risk can have measures initiated for individualised management of the same. This could translate into substantial health benefits in this vulnerable population where diagnosis and treatment of osteoporosis is currently mostly only established after a fracture has occurred. This could have a significant impact not only on reduction in osteoporotic fracture disease burden but also on the associated health costs therein.

References

[1] Weller, I. and J. Schatzker, Hip fractures and Alzheimer's disease in elderly institutionalized Canadians. Ann Epidemiol, 2004. 14(5): p. 319-24.

[2] Kose, N., et al., The risk factors of fall and their correlation with balance, depression, cognitive impairment and mobility skills in elderly nursing home residents. Saudi Med J, 2005. 26(6): p. 978-81.

[3] Haasum, Y., et al., Undertreatment of osteoporosis in persons with dementia? A population-based study. Osteoporosis International, 2012. 23(3): p. 1061-1068.

[4] The Swedish Council on Technology Assessment in Health Care, Osteoporosis - Prevention, Diagnosis and Treatment. 2003, The Swedish Council on Technology Assessment in Health Care.

[5] Brauner, D.J., J.C. Muir, and G.A. Sachs, Treating nondementia illnesses in patients with dementia. Jama, 2000. 283(24): p. 3230-5.

[6] Gupta, G. and W.S. Aronow, Underuse of procedures for diagnosing osteoporosis and of therapies for osteoporosis in older nursing home residents. J Am Med Dir Assoc, 2003. 4(4): p. 200-2.

[7] Friedman, S.M., et al., Dementia and hip fractures: development of a pathogenic framework for understanding and studying risk. Geriatr Orthop Surg Rehabil, 2010. 1(2): p. 52-62.

[8] Nguyen, T.V., J.R. Center, and J.A. Eisman, Osteoporosis: underrated, underdiagnosed and undertreated. Medical journal of Australia, 2004. 180(5): p. S1.

[9] Pasoto, S.G., et al., Osteoporotic hip fractures in non-elderly patients: relevance of associated co-morbidities. Rheumatol Int, 2012. 32(10): p. 3149-53.

[10] Cranney, A., et al., Meta-analyses of therapies for postmenopausal osteoporosis. IX: Summary of meta-analyses of therapies for postmenopausal osteoporosis. Endocr Rev, 2002. 23(4): p. 570-8.

[11] Lentle, B., et al., Osteoporosis Canada 2010 guidelines for the assessment of fracture risk. Can Assoc Radiol J, 2011. 62(4): p. 243-50.