Examining the impact of reimbursement on referral to bone density testing for older adults: Eight years of data from the Barwon Statistical Division, Australia

SL Brennan[1,2,3], MA Kotowicz[1,2], B Sarah[4], WD Leslie[5], PR Ebeling[1,3], CJ Metge[6], AG Dobbins[2], JA Pasco[1,2]

[1]*NorthWest Academic Centre, The University of Melbourne, Sunshine Hospital, 176 Furlong Road, St Albans, VIC 3021, Australia*
[2]*School of Medicine, Deakin University, PO Box 281, Geelong, VIC 3220, Australia*
[3]*Australian Institute for Musculoskeletal Science, Sunshine Hospital, 176 Furlong Road, St Albans, VIC 3021, Australia*
[4]*Department of Medicine, Clinical Trials, Barwon Health, PO Box 281, Geelong, VIC 3220, Australia*
[5]*Department of Medicine, University of Manitoba, 409 Tache Avenue, Winnipeg, Canada, R2H 2A6*
[6]*Winnipeg Regional Health Authority, 200-1155 Concordia Ave., Winnipeg, Canada, R2K 2M9*

Corresponding author:
Dr Sharon L Brennan,
NorthWest Academic Centre,
The University of Melbourne, C/- Sunshine Hospital,
176 Furlong Road,
St Albans, Victoria, Australia 3021
Ph: +61 4215 3334 Fax: +61 3 4215 3491
sbrennan@unimelb.edu.au

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Mini Abstract (49 words)

In 2007 Medicare Australia revised reimbursement guidelines for dual energy x-ray absorptiometry (DXA) for Australians aged ≥70yr; we examined whether these changes increased DXA referrals in older adults. Proportions of DXA referrals doubled for men and tripled for women from 2003 to 2010, however, rates of utilization remained low.

Abstract

Objectives: On April 1st 2007 Medicare Australia revised reimbursement guidelines for dual energy x-ray absorptiometry (DXA) for Australians aged ≥70yr; changes that were intended to increase the proportion of older adults being tested. We examined whether changes to reimbursement increased DXA referrals in older adults, and whether any sex-differences in referrals were observed in the Barwon Statistical Division (BSD).

Design: Proportions of DXA referrals 2003-10 based on the population at-risk, ascertained from Australian Census data, and annual referral rates and rate ratios stratified by sex, year of DXA and 5-year age groups.

Participants: Persons aged ≥70yr, referred to the major public health service provider, for DXA clinical purposes (n=6,096; 21% men).

Main outcome measures: DXA referrals.

Results: Proportions of DXA referrals for men doubled from 0.8% (2003) to 1.8% (2010), and tripled from 2.0% to 6.3% for women (all $p<0.001$). For 2003-6, referral ratios of men:women ranged between 1:1.9 to 1:3.0, and for 2007-10 were 1:2.3 to 1:3.4. Referral ratios <2007:≥2007 were 1:1.7 for men aged 70-79yr ($p<0.001$), 1:1.2 for men aged 80-84yr ($p=0.06$) and 1:1.3 for men 85+yr ($p=0.16$). For women, the ratios <2007:≥2007 were 1:2.1 (70-79yr), 1.1.5 (80-84yr) and 1:1.4 (85+yr) (all $p<0.001$).

Conclusions: DXA referral ratios were 1:1.6 (men) and 1:1.8 (women) for 2007-10 *vs*. 2003-6; proportions of referrals doubled for men and tripled for women from 2003 to 2010. Overall, rates of DXA utilization remained low. Policy changes may have had minimal influence on referral, thus ongoing evaluation over time is warranted.

Introduction

Osteoporosis is a systemic skeletal disease characterized by low bone mineral density (BMD), and micro-architectural deterioration of bone tissue, with a consequent increase in susceptibility to fracture (1). BMD is a surrogate for bone strength, and a reduction in BMD is associated with an increased fracture risk (1, 2). Fragility fractures at the spine, hip, forearm and proximal humerus are a major public health problem for both sexes, and annually cost the Australian community $1.9 billion in direct costs, and $7.4 billion when indirect costs are also considered (3). The short- and long-term impact of fracture on mobility and lifestyle may be extensive, and may also depend on the fracture site, mediated by frailty and other co-morbidities (4). Furthermore, there is an increased likelihood of morbidity and mortality following hip fracture, especially in elderly persons (5). In Australia, hip fractures have been predicted to increase from 15.2 thousand per year in 1996 to 33.9 thousand per year by 2025, rising to 60 thousand per year in 2051 (6). Although recent data show that hip fracture rates are declining over time (7), nevertheless fracture risk continues to increase by 3% for every year of age (2). This increasing burden of chronic disease is a critical issue facing Australia's health system, and will increase in absolute terms due to our ageing population (6, 8), unless greater effort is put into effective management and prevention.

Measurement of BMD using dual energy x-ray absorptiometry (DXA) is currently one of the key strategies to identify low BMD and, thus, inform the decision making regarding anti-fracture treatment to reduce the burden of fracture (9, 10). There is a sturdy body of evidence indicating strong associations between osteoporotic fractures and low BMD, including BMD within the low or osteopenic range (2). Data indicate that the risk of fracture is increased approximately 1.5 fold for every 1 standard decrease in BMD for men and women (11). Furthermore, individuals are more likely to be treated for osteoporosis following a bone density scan, measured by DXA (1), and treatment programs following prior DXA are far more cost effective than those where a prior scan was not performed (12).

Bone loss in men is often overshadowed by its effects in women, although men also incur substantial bone loss with aging (13, 14). One in three men develop osteoporosis compared with

one in two women, however mortality risk is greater among men following hip fracture compared to women (15). Men are believed to be more likely to have osteoporosis due to secondary causes, for instance hypogonadism (16), and decreases in total and free testosterone levels are associated with ageing (17). Importantly, research suggests that non-treatment in men remains a concern (18); a phenomenon seen in many countries.

On April 1st 2007, changes to national health policy were introduced Australia-wide in order to increase the utilization of DXA in men and women aged 70 years and older in efforts to delay or avoid incident fractures. In the context of patient care, that policy change paved the way for equal access (pending referral) to DXA between sexes, and reduced out-of-pocket expenses for the patient. To date, the impact of those changes remains unknown. Thus, the aim of this study is to examine the impact of reimbursement for DXA introduced by Medicare Australia in 2007 for men and women aged 70 years and older.

Methods

Subjects

Data were derived from the electronic records of the Geelong Bone Densitometry Service, Geelong Hospital, Victoria, for all Barwon Statistical Division (BSD), Victoria, Australia, residents who underwent a DXA test during the period 2003-10. The Geelong Bone Densitometry Service is the major DXA service provider for the BSD with two DXA machines serving a population of approximately 250,000. It is estimated that approximately 95% of the DXA examinations in the region are undertaken by this service. The Barwon Health Human Research Ethics Committee approved this study.

Ascertainment of DXA utilization

We identified persons referred to DXA for osteoporosis-related reasons (non-research purposes) during 2003-10 (21.2% men) by use of Medicare item numbers recorded in the patient database. Medicare item numbers were: 12306 (minimal trauma fracture or monitoring of low BMD as detected by a previous scan); 12312 (prolonged glucocorticoid therapy, excess glucocorticoid secretion or hypogonadism in both sexes); 12315 (secondary osteoporotic conditions such as

chronic liver or kidney disease, primary hyperparathyroidism, malabsorption disorders, rheumatoid arthritis or excess thyroxine excess); and 12321 (changes in class of drug therapy). Persons were identified by postcode of residence, and those not resident within the BSD were excluded. The first referral date for each DXA scan performed during 2003-10 was ascertained for each patient aged 70 years and older.

Statistical analysis

Absolute numbers of those referred to DXA during the period 2003-10 were stratified by 5-year age groups, sex and year of referral. Referral rates for men and women were calculated, based on the population at risk for each year using annual population-specific data from the Australian Bureau of Statistics Census data (19), and rate ratios between the sexes were calculated. Referral rates for men and women in each 5-year age group were calculated separately for 2003-6 (<2007) and 2007-10 (≥2007), and rate ratios calculated to compare DXA referrals pre- and post-2007. All statistical analyses were performed using MINITAB (Version 15.0, Minitab, State College, PA) software.

Results

Overall, 6,096 individuals (21.2% men) were referred for DXA in the age range of interest during the eight-year study period. Table 1 show that the proportions of DXA referrals increased from 2003 to 2010 for both sexes; for men, there was a doubling of proportions, from 0.8% to 1.8%, whereas for women the proportions tripled from 2.0% to 6.3% (all $p<0.001$). The ratio of referrals (men:women) ranged between 1:1.9 to 1:3.0 in the years 2003-6, and 1:2.3 to 1:3.4 in the years 2007-10 (overall 1:1.6 for men, and 1:1.8 for women).

Table 2 presents DXA referrals according to whether they were performed 2003-6 (pre-2007) or 2007-10 (post-2007), stratified by sex, and 5 year age groups. For DXA referrals performed pre-2007, rates for both sexes were lowest for those aged 85+yr (0.81% for men and 1.65% for women) and greatest for those aged 80-84yr (1.12% for men and 2.88% for women); the *p* value for linear trend for 2003-6 was $p=0.33$ for men and $p=0.002$ for women. For DXA referrals performed post-2007 for men, the greatest rate of 1.87% was observed in the age group of 75-

79yr after which a negative relationship between advancing age and DXA referrals was observed (p for linear trend =0.03). For women, a consistent negative relationship between advancing age and DXA referrals was observed, with the greatest referral rate being 5.26% (p for linear trend<0.001). A comparison of DXA referrals between the two time periods (pre-2007:post-2007) resulted in rate ratios for men of 1:1.7 and 1:1.8 for those aged 70-74yr and 75-79yr, respectively (both p<0.001), 1:1.2 for those aged 80-84yr (p=0.06) and 1:1.3 for the oldest age group of 85+yr (p=0.16). Ratios for pre-2007:post-2007 were 1:2.1 in women aged 70-79yr, 1.1.5 in 80-84yr olds, and 1:1.4 in those aged 85+yr (all p<0.001).

Discussion

We observed a doubling of proportions of men and a tripling of women referred to DXA from 2003 to 2010. Given the increase in DXA referrals observed in both sexes that was occurring before the 2007 introduction of reimbursement by Medicare Australia, we speculate that the change in policy is unlikely to have influenced the increase in DXA referrals observed post-2007 in the BSD. Importantly, the utilization of DXA testing in older individuals remained very low despite the nation-wide availability of reimbursement for testing in this high-risk group. Furthermore, women were commonly three times more likely than men to be referred for a DXA test during the eight-year study period.

In order to examine the impact of DXA reimbursement on the most at-risk population at whom the policy was directed, there is a need for summary measures to assist in elucidating the different dimensions that may influence the impact (20). To evaluate reimbursement for DXA we must be able to determine whether interventions had an impact, whether the impact was sufficient and equitable across groups, and whether those changes are sustainable in the real-world setting. For purposes such as this, the RE-AIM (Reach, Efficacy, Adoption, Implementation, and Maintenance) framework provides a useful tool to assess five dimensions of policy implementation or change (21, 22); it is a framework often used to assess the public health impact of policies (22) and is suggested as appropriate within the necessary recurring process of policy evaluation (23).

The first dimension of RE-AIM is ‘Reach’, a dimension that is concerned with the percentage and characteristics of individuals affected by the policy, and therefore assesses how the policy has differentially impacted on the target population. In this context, ‘Reach’ examines the extent to which older Australians aged 70 years and older are referred to DXA and undergo the testing (21, 22). The small proportion (3.1%) of individuals aged 70 years and older who underwent DXA testing by the end of 2010 reflects a limited reach of this policy change in the BSD. To increase the reach of this policy, it should be considered whether broadening the reach of care would be a suitable amendment to current policy, and whether targeting practitioners would increase the proportion of the overall population being tested. Given that we observed no difference in the sex-distribution post-policy change, it is plausible that men were either not sufficiently ‘reached’ or perhaps not willing or uncomprehending of the need to follow up the referral with the DXA service provider. However, the limited number of DXA providers in the BSD may further influence the reach of this policy, resulting in lower testing than ideal in both sexes. Although recommendations regarding the ideal ratio of DXA machines to population numbers do not exist, European data that predate the development of FRAX tools suggested the requirements for DXA in assessment varied between 4.21 to 11.21 units per million persons, and when clinical risk factors were considered with the selective use of BMD, 10.6 units per million would be needed to monitor treatment (24). With a BSD population of approximately 250,000 and two clinical DXAs at the Geelong Bone Density Service we would be included in the lower to middle range of estimated DXA requirements. Given that approximately 20% of the BSD population resides at some distance from the service, this may limit access to some extent.

‘Effectiveness’ is the second dimension of RE-AIM, an aspect concerned with describing the impact of an intervention or policy (21, 22). The underlying premise to reimburse DXA for Australians aged 70 years and older was to identify fracture risk in a high risk group, and where osteoporosis was identified monitor or treat the individual, thereby reducing incident fracture and the associated morbidity and mortality. Undergoing DXA increases the level of information a practitioner has at hand, and thus may theoretically increase the likelihood that treatment may be initiated for pre- or post-fracture care, where such a need was warranted. To date, the policy change introduced by Medicare Australia seems to have had limited effectiveness in reaching

those at greatest risk of fracture - Australian men and women aged 70 years and older. Limited effectiveness will result in sustained, and possibly increased, public health expenditure on incident fractures. Whilst osteoporosis is more common in women, men have excess morbidity and mortality post-fracture compared with women (25, 26), and thus it is imperative that neither sex remains untreated where risk is identified.

'Adoption', the third dimension of RE-AIM, occurs at the organizational level and considers whether policy execution occurred as intended (21, 22). The adoption of changes to policy may be thwarted by barriers including organizational impediments to inter- and intra-agency collaboration and service delivery, political debates, or competing concerns related to the provision of health care. Given that the doubling of proportions observed for undergoing a DXA test post-April 1st 2007 compared to pre-April 1st 2007 was similar to the linear increase observed in DXA referrals before 2007, it is plausible that changes to Medicare Australia reimbursement policy may have had little impact on physician behaviors in referral practices. Importantly, under-diagnosis in both sexes remains a problem. However, taking into consideration the expected lag between policy change and practices, it is possible that the largest proportion of DXA referrals seen in 2010 (1.8% for men, and 6.3% for women) could be a reflection of increased adoption. Given that possibility, it is imperative that ongoing evaluation of this policy be conducted to determine whether significant increases in DXA utilization are seen post-2010, as these proportions of DXA utilization in the population at highest-risk is highly unlikely to have much impact on reducing fracture risk.

The fourth dimension 'Implementation' assesses the consistency with which the policy was delivered as intended at the organizational level; also referred to as the internal validity (21, 22). The policy decree that saw changes to DXA reimbursement suggests that the implementation should have occurred automatically. However, whilst those who did undergo a DXA were reimbursed according to policy, the actual changes to policy did not influence consistency in referral to DXA for osteoporosis; our data show a consistently low uptake of DXA in the target population group. Whether it is the practitioner who fails to refer, or the patient who fails to

undergo DXA despite referral and potential benefits, the low rate of DXA utilisation for both sexes in this high-risk age group remains a public health concern.

'Maintenance' in the RE-AIM framework assesses the potential for long-term sustainability; an issue determined by the extent that the policy becomes encompassed in routine organizational practice and individual behavior (21, 22). Given that the maintenance of a policy hinges on its adoption over the ensuing years (22), we examined a six-year period following the introduction of this policy change. However, this analysis suggests that, in the BSD, the impact on DXA uptake in older Australians as a result of changes to Medicare Australia reimbursement has been minor. Importantly, the low impact of this policy to date may be related to a combination of the interdependent dimensions considered within the RE-AIM framework, rather than one dimension alone.

Use of the RE-AIM framework enables an evaluative reflection on the five dimensions of successful policy implementation and identification of areas where further work is needed. For example, we speculate that a targeted approach is required to increase the utilization of DXA subsidization for those groups at most risk of under-treatment for fracture, specifically men. These approaches could include increased efforts from practitioners to employ equitable referral practices to DXA testing, raising population health literacy to increase the likelihood of initiating a DXA test, and further evaluation of health policy changes on a cyclical basis to evaluate impact and thus inform policy makers in efforts to enhance care. Furthermore, it is important to examine whether the low utilisation of DXA is influenced by practitioner referrals and potentially their own beliefs about the salience of osteoporosis (27), patient unwillingness, or a combination. Further evaluation regarding the impact over time of DXA reimbursement can only enhance the original goals of the health policy--that is, to reduce the likelihood of a first or subsequent fracture in our older Australians.

This study has some strengths. First, the BSD is an excellent base for epidemiological research because there are clear geographic boundaries, a mixture of rural and urban populations, a representative range of multicultural groups, and one centralized public health provider located

at the hub of the region in Geelong. These are the first data to examine whether health policy changes regarding reimbursement increased the referral to DXA testing in the elderly. Our data span an eight-year period, enabling us to examine four years of data pre- and post-2007; the year in which changes to reimbursement policy were introduced by Medicare Australia. Our study also has some limitations. Some individuals may have undergone a DXA scan in an alternative geographical region resulting in missing health service utilization data and therefore potentially under-reported data. We examined DXA utilization provided by the major service provider for the BSD region, and thus data pertaining to persons who had undergone a DXA at the smaller private health service provider would not have been included. However, we have previously estimated that only 5% of required DXA services for the BSD would not be provided by the Geelong Bone Density Service (28). We were unable to examine the role played by ethnicity in the uptake of DXA testing, although acknowledge the role that this important factor may play (29).

Despite public health awareness campaigns, low uptake and a sex-bias in bone densitometry presents major public health challenges; indicating the need to correct the balance between health policies and predisposing factors which influence referral practices and patient initiation of testing. These data provide a conceptual advance in our knowledge regarding the referral of older adults to DXA testing for preventive health care related to osteoporosis and osteoporotic fracture, which is critical from a preventive and treatment standpoint but also from an economic and public health perspective. Furthermore, these data provide a better understanding of the impact of policy changes introduced by Medicare Australia; the overall low referral rate to DXA indicates a concerning situation that is likely to impact upon the burden of chronic disease, especially for men.

Conflict of interest

SL Brennan, B Sarah, PR Ebeling, CJ Metge, AG Dobbins, JA Pasco: None

MA Kotowicz: Is Director of the Geelong Bone Density Service, Australia.

WD Leslie: Is Director of the Manitoba Bone Density Service, Canada. Speaker Bureau: Amgen, Eli Lilly, Novartis. Research Grants: Novartis, Amgen, Genzyme.

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Table 1: Sex-specific numbers (total n=6,096), proportions (±SE), and ratio (men:women) of all individuals aged 70 years and older from the Barwon Statistical Division referred to DXA, stratified by year of referral.

	Men			Women				
Year	**Population at risk†**	**Absolute n**	**% referred (±SE)**	**Population at risk†**	**Absolute n**	**% referred (±SE)**	**% Ratio (men:women)**	***p* value**
2003	12,368	98	0.79% (0.08%)	16,629	338	2.03% (0.11%)	1:2.6	**<0.001**
2004	12,530	91	0.73% (0.08%)	16,968	376	2.22% (0.11%)	1:3.0	**<0.001**
2005	12,695	163	1.28% (0.10%)	17,200	417	2.42% (0.12%)	1:1.9	**<0.001**
2006	12,934	111	0.89% (0.08%)	17,318	437	2.52% (0.12%)	1:2.8	**<0.001**
2007 *	13,293	196	1.47% (0.10%)	17,651	596	3.38% (0.14%)	1:2.3	**<0.001**
2008	13,621	187	1.37% (0.10%)	17,906	678	3.79% (0.14%)	1:2.8	**<0.001**
2009	14,048	180	1.28% (0.09%)	18,179	790	4.35% (0.15%)	1:3.4	**<0.001**
2010	14,457	266	1.84% (0.11%)	18,520	1,172	6.33% (0.18%)	1:3.4	**<0.001**

* Changes to Medicare Australia were introduced part way through 2007 on April 1st, however, the numbers, proportions and ratios are presented for the entire 12 month period of 2007

† Population aged 70 years and older resident in the Barwon Statistical Division, population-specific data for each year ascertained from the Australian Bureau of Statistics (19).

Table 2: Absolute numbers and proportions (±SE) of persons aged 70 years and older in the population at risk referred to DXA (<2007 and ≥2007) in the Barwon Statistical Division, stratified by sex and 5 year age groups.

	2003-2006			2007-2010				
	Population at risk†	**Absolute n**	**% referred**	**Population at risk†**	**Absolute n**	**% referred**	**% Ratio (<2007:≥2007)**	***p* value**
Men								
70-74yr	18,356	152	0.83% (0.07%)	19,767	273	1.38% (0.08%)	1:1.7	**<0.001**
75-79yr	15,652	161	1.03% (0.08%)	15,762	294	1.87% (0.11%)	1:1.8	**<0.001**
80-84yr	10,212	114	1.12% (0.10%)	11,630	162	1.39% (0.11%)	1:1.2	0.066
85+yr	6,307	51	0.81% (0.11%)	8,260	85	1.03% (0.11%)	1:1.3	0.164
Total	50,527	478	0.95% (0.04%)	55,419	814	1.47% (0.05%)	1:1.6	**<0.001**
Women								
70-74yr	20,650	509	2.46% (0.11%)	21,600	1,136	5.26% (0.15%)	1:2.1	**<0.001**
75-79yr	19,629	491	2.50% (0.11%)	19,057	993	5.21% (0.16%)	1:2.1	**<0.001**
80-84yr	15,082	434	2.88% (0.14%)	16,112	680	4.22% (0.16%)	1:1.5	**<0.001**
85+yr	12,754	210	1.65% (0.11%)	15,487	351	2.27% (0.12%)	1:1.4	**<0.001**
Total	68,115	1,644	2.41% (0.06%)	72,256	3,160	4.37% (0.08%)	1:1.8	**<0.001**

† Population aged 70 years and older resident in the Barwon Statistical Division, population-specific data for each year ascertained from the Australian Bureau of Statistics (19).

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Author/s:
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