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Title	Impact of a reimbursement change on bone mineral density testing on quality of osteoporosis care in Ontario, Canada
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Reviewer 1	Suzanne Morin MD
Institution	Internal Medicine, Montreal General Hospital, Montréal, Que.
General comments	The purpose of this analysis is to evaluate the impact of a reimbursement fee schedule change in BMD testing in Ontario, Canada on screening for osteoporosis in low and high risk (for fracture) populations. The authors used data from administrative databases including physician billings, hospital discharges and ED visits. They demonstrate that following the implementation of this new fee schedule the rates of BMD testing are reduced in low risk women but also in high risk men and women, potentially leading to a negative impact on the quality of osteoporosis care. Comments: (from intro to discussion) 1. Introduction: Minor: ...The objectives of this study were to examine the impact of the Canadian policy change.... Please use Ontario, as this policy change is only relevant for Ontario residents. 2. Methodology: Minor: suggest to move earlier in the text the description of the fee schedule change, provide more details and clearly contrast it with the previous policy. For example, do physicians need to fill out extra forms if a patient is to be considered eligible for a BMD every year. If yes, this burden of extra clerical work could then explain in part why BMD tests are being requested less frequently 3. Methodology: Minor: From the description provided of the policy change, I understand that fee codes that clearly identify a BMD test as baseline only appeared in 2008. Please correct this sentence: "The fee code in each claim allowed tests to categorized as baseline, provided to a low-risk patient, or provided to a high risk patient." 4. Methodology: Minor: Please clarify the time period for examination of the health records of individuals for the presence of a recent fracture- 12 months? How were individuals with recurrent fractures within your study period dealt with? Please specify, for the non-expert reader, the reasons why you chose these specific fracture sites (hip, forearm, spine, shoulder and pelvis). Please consider that "vertebral fractures" should be referred to as CLINICAL vertebral fractures as you know that the vertebral fractures identified in administrative databases are only those that come to clinical attention. Finally please clarify if you tried to limit fracture selection to those that were not associated with trauma- in individuals less than 50 years old, many fractures would be related to a significant trauma, particularly in men. 5. Methodology: Minor: Please rephrase, as it is difficult to understand: "The percentage of individuals who received a DXA test in the three to five years after turning age 65 who were eligible for a DXA test after they turned 65 years old who had in fact been tested was then calculated for each fiscal year." 6. Results: Minor: suggest you keep the same frame throughout the sections: women results, then men. 7. Interpretation: Minor: For the non-expert reader, you may wish to expand on the Canadian clinical osteoporosis management guidelines as it pertains to BMD testing and treatment. 8. Interpretation: Major: In order for a patient to undergo a BMD test within 6 months of having sustained a fracture, he/she has to have been assessed by their primary care MD or been part of a systematic osteoporosis management program. We are not provided with data that tell us that the patient with a recent fracture had access to healthcare professionals during that interval and hence cannot judge whether the problem lies with access to healthcare or with the primary care MD who does not order the test. 9. General: Major: As the authors point out in the limitation section, predictors of high fracture risk also include other clinical variables. Although not all are available in administrative databases, many are: use of glucocorticoids, previous and recurrent fragility fractures -over a longer horizon than the authors have chosen-, inflammatory conditions such as rheumatoid arthritis and use of anti-osteoporosis treatment. It would have been pertinent in this analysis, since the authors have access to these databases (including the prescription database) to have looked at more complex scenarios than the 2 that were tested. 10. Conclusion: Major: In your analysis you have not provided clear evidence to support the fact that the quality of care is significantly compromised by the decrease in BMD testing rates; for example we have no data on prescription rates and although I realize this is too short an horizon, no data on fracture rates. Hence I think the conclusion

	might be more appropriate if softened.
Reviewer 2	Alun Edwards
Institution	Division of Endocrinology and Metabolism, University of Calgary, Calgary, Alta.
General comments	The paper is clearly written and the methodology and reasons behind it are clear. The limitations of dealing with administrative databases are noted and recognized - and the efforts taken to try and provide some clinical enrichment in defining the high risk group is appreciated. The approach to understanding utilization of BMD and its appropriateness is an important one. There are two questions that I think the manuscript needs to address in more detail - both fall into the interpretation of the data (and one perhaps needs to be considered in the definition of the problem in the 'background'). CPG are used to determine the 'appropriateness' of BMD testing - but this leaves question about the level of evidence supporting CPG recommendations. How good is the evidence that ordering a BMD translates into better care of osteoporosis in high risk patients? Is fracture rate reduced as a result of screening? Is it possible to manage high risk patients effectively without BMD measurement? The other issue is more difficult and relates to the complexity of influences on clinical practice. Why would this reimbursement policy have an effect that counteracts recommendations of CPG? As you point out - even when the ability to perform BMD was completely unrestricted, the rate at which it was used in high risk populations was well below what CPG might deem desirable. The impact of this policy implementation seems relatively modest and it seems that it is a failure of education or KT to influence physician assessment of osteoporosis risk that seems to be the major barrier. Given that you cite National CPG for Canada, released in 2010, (after the restrictions on BMD testing) is this not a larger issue? Perhaps a combined joint point analysis incorporating the date of release of the CPG might be worthwhile?
Author response	**Reviewer 1 comments:** 1. In response to this suggestion, please note that in the objective, we have made the change to the "Ontario" policy change (page 4). 2. The following additional details on the current and previous policy have been added to the Introduction (i.e., in an effort to present this information "earlier" as requested by this Reviewer): In an effort to curb testing among low risk patients, as of April 1, 2008 the fee schedule was changed to limit DXA tests for low risk patients to once every 36 months. Previously (from October 1, 1999 to March 31, 2008), DXA testing of patients at low risk was allowed at 24 month intervals. In addition, a new fee code for a 'baseline' test was added and patients were limited to one baseline test in their lifetime.[6] Both before and after 2008, high risk individuals were allowed a BMD test annually. Referral practice on the part of referring physicians, then, was subject to modification for low, but not high, risk patients (pages 3-4). If a patient is considered eligible for a yearly test the referring physician would simply complete a requisition to have the bone mineral density (BMD) test ordered. On many requisitions, this simply involves the referring physician checking a check box to order the BMD test, and in some cases, including a few clinical details (i.e., factors that may modify fracture risk assessment such as previous fragility fracture). 3. This sentence has been changed in the manuscript to the following for clarification: The fee code in each claim allowed all tests to be classified as a low or high-risk patient; tests after 2008 were allowed to be categorized as baseline (i.e., distinct from the risk level code) (page 5). 4. Please note that we indicate "Finally, the OHIP database was searched for incidents of 2 physician claims with a diagnosis of wrist fracture that were dated within 3 months of each other in order to identify patients treated for fractures in physicians' offices… A similar procedure was followed for spine, shoulder and pelvis fractures, using the following ICD-10 codes: S22.0, S22.1, S32.0, S32.7, S32.8 (spine); S42.2 (shoulder); and S32.1, S32.3, S42.4, S32.5, S32.7, S32.8 (pelvis)" (page 5-6).

	To address Reviewer 1's comment regarding "*…the reasons why you chose these specific fracture sites (hip, forearm, spine, shoulder and pelvis)",* we have indicated that "These types of fractures were selected as they are commonly associated with osteoporosis" (page 5). Please also note that we have added the word "clinical" to vertebral fracture throughout the manuscript. Lastly, to address the issue of fractures due to trauma, we inserted the following sentence on page 6: Fractures due to multi-trauma were excluded as we only included records of patients with isolated fractures and no other diagnostic codes. 5. Please note that this sentence has been changed to "The percentage of eligible individuals who received at least one DXA test in the three to five years after turning age 65 was then calculated for each fiscal year" (page 7). 6. Throughout the Results section, we have presented the data as the "women results" followed by the results for the men (not bolded in manuscript). 7. It should be noted that further details on the Canadian clinical osteoporosis management guidelines as it pertains to BMD testing and treatment were added in the Introduction section: "The management model recommended by guidelines is based on fracture risk assessment, which is derived in part from measured BMD and appears on BMD reports for most patients over age 50. For patients assessed at high risk, guidelines indicate that there is good evidence of benefit from pharmacotherapy; for those assessed as low risk, guidelines state that patients are unlikely to benefit from pharmacotherapy and should be reassessed in 5 years.[3] Thus, BMD testing, as well as knowledge of clinical risk factors that can modify fracture risk assessment, are important components of (secondary) fracture risk prevention efforts".[1,3] (page 3). 8. We have since added the following to the Limitations section of the Interpretation section: "Also, the lack of administrative data that identify pathways of care among fracture patients makes it impossible to determine accurately where efforts to improve rates of referrals might be improved. This remains the subject of future research" (page 12). 9. While Reviewer 1's comment is well-taken that we could have looked at other clinical variables including the use of glucocorticoids and the use of anti-osteoporosis treatment, we would have only been able to look at these variables in individuals over the age 65 and so we would have been missing patients. We have added the following clarification: Instead we chose to focus on individuals ≥ 65 and individuals with recent fracture because they represent the majority of the high risk patients and are more likely to be seen in the primary care setting. Glucocorticoid and rheumatoid arthritis patients represent about 5% of high risk patients and they tend to be younger. We decided not to include a longer time horizon for previous or recurrent fracture because we hypothesized that if we saw an effect of less testing in patients with recent fractures it would probably be even lower in those with a more distant fracture. The intent being that the recent fracture should have prompted the BMD test (i.e., which is the message promoted in the guidelines). If a recent fracture does not prompt the physician to order a BMD test then this would be less likely for a fracture that occurred more than a year ago (pages 12-13). 10. To address this comment, we have altered the previous sentence of "On the negative side, DXA testing in high-risk populations was reduced, which may compromise the already suboptimal quality of osteoporosis care in Ontario" to "On the negative side, DXA testing in high-risk populations was reduced, which may further compromise the quality of osteoporosis care in Ontario.[20, 24] (page 13). Additionally, we have added the following paragraph: "The mechanism by which changes to policy has come to stand in the way of guideline implementation remains unclear. What is clear, however, is that guidelines are not consistently attended to at the point of referral. Efforts to communicate guidelines with greater clarity at this juncture, particularly as they relate to high-risk individuals, are

	worth exploration. A standardized requisition for referral, that clarifies guidelines to practitioners, is one mechanism that may help to ensure appropriate testing in the face of funding changes" (pages 13-14). **Reviewer 2 comments:** *CPG are used to…* In line with these comments/questions, we have added the following to page 3: "Together with other fracture risk factors, information gained from a BMD test can guide clinicians and patients in understanding the risk of having an osteoporosis-related fracture; it can also inform decisions aimed at mitigating these risks (i.e., initiation of bisphosphonates)".[1,2] *The other issue is more difficult…* In line with these questions/comments, we have added the following to our Conclusion section on pages 13-14: "The mechanism by which changes to policy has come to stand in the way of guideline implementation remains unclear. What is clear, however, is that guidelines are not consistently attended to at the point of referral.[25,26] Efforts to communicate guidelines with greater clarity at this juncture, particularly as they relate to high-risk individuals, are worth exploration. A standardized requisition for referral, that clarifies guidelines to practitioners, is one mechanism that may help to ensure appropriate testing in the face of funding changes".