

Development of Osteoporosis Canada's KPIs for FLSs

Osteoporosis Canada's FLS KPIs were developed to provide a standardized overview of an FLS's effectiveness for each of the individual 3i's (identification, investigation and initiation of treatment). In v1.0 released in 2017, the KPIs were analyzed by FLS type (inpatient-only, outpatient-only and combined inpatient/outpatient FLS). In v2.0 released in 2018, the KPI for the first i were updated to be analyzed by patient streams based on the fracture type (hip, non-hip non-spine or spine). Otherwise, all FLSs are analyzed together (e.g. for second and third i's).

The FLS KPIs highlight the relative strengths and weaknesses of the FLS for the purpose of continuous quality improvement through a Plan-Do-Study-Act (PDSA) process. The individual FLSs will be able to compare their patient outcomes to those of other Canadian FLSs within the context of national FLS audits.

The KPIs are intended to be used by any Canadian FLS meeting the 8 *Essential elements*, even if such FLSs are not associated with an academic or research center. It should be appreciated that OC's FLS KPIs were not developed with any intention that they should be used as a standardized common dataset for research purposes.

Osteoporosis Canada aims to close the post-fracture care gap and to see that no fragility fracture patients are ever "left behind". Clearly, that is also the intention of all FLSs. The denominators for the FLS KPIs were therefore purposefully selected to be very inclusive (e.g. include patients lost to follow up, etc.). The FLS KPIs will reflect the full impact on the healthcare system from patients being "left behind" by the FLS, no matter the logical cause or reason. The very inclusive denominators also ensure that all Canadian FLSs will be measured by the exact same tough standards.

The challenge of Canada's under-resourced FLSs:

Recognizing that most FLSs in Canada are significantly under-resourced, only a very small number of core KPIs were selected so as to minimize as much as possible the burden imposed on FLS staff's time in collecting and recording the data required to measure and monitor such outcomes. The core KPIs are deemed the most critical ones to help ensure an FLS's success and are in keeping with Osteoporosis Canada's Clinical Practice Guidelines¹ and

Essential elements of FLSs (<http://www.osteoporosis.ca/fls/wp-content/uploads/Osteoporosis-Canada-Essential-Elements-of-an-FLS.pdf>) .

The core KPIs are complemented by a more comprehensive list of supplementary KPIs which are also strongly recommended for FLSs with sufficient resources. For the time being, OC's focus will be mostly on the core KPIs.

Special challenges in the development of the denominator for the first i:

The denominator for the first i underpins the entire evaluation of an FLS's effectiveness at the system level. A patient that is "left behind" at the identification stage will never have the opportunity to receive the osteoporosis care they need. Unfortunately, this denominator is also by far the single most problematic one to determine. In Canada, as in other countries, there is relatively easy access to reliable hip fracture data, but there is very poor access to data for other fracture types.

In the UK² and New Zealand³ FLS Clinical Standards documents, the denominator for the first i is anchored to the number of hip fractures, which is then multiplied by a factor (or "multiplier"). Their multiplier is based on proportions/ratios of fracture types seen in well-established and respected FLSs within the UK with comprehensive inpatient and outpatient coverage. The recommended denominator in the UK and NZ is the "number of hip fractures multiplied by a factor of 5"^{2,3}.

There are many issues with using a multiplier of "5" for Canadian FLSs:

- The fracture types enrolled in the FLSs used to determine the multiplier for the UK and NZ FLS indicators include all fracture types, including those of hands, feet and ankles. The 2010 OC Guidelines technical report⁴ states that fragility fractures of the hands, feet and ankles should be excluded from the list osteoporotic fractures.
- The Canadian Chronic Disease Surveillance System (CCDSS) Osteoporosis Working Group of the Public Health Agency of Canada (PHAC) has recommended the following fracture types for surveillance in persons over the age of 50: hip, wrist, shoulder, pelvis and spine⁵.
- The Major Osteoporotic Fractures (MOF) typically refer to fractures of the hip, clinical spine, distal forearm and proximal humerus. These fracture types are among the most common of fragility fractures and are also known to have a high risk for future fractures⁶. In an environment where FLSs are under-resourced, it seems logical to focus the insufficient FLS resources on these commonly seen and highest risk/highest yield fracture types.

- Pelvic fractures constitute only a very small proportion of all fragility fractures (~1-3%), hence the differences between PHAC fractures and MOF is negligible in terms of absolute numbers and would require only a minor adjustment.
- There are very few comprehensive inpatient/outpatient FLSs in Canada (see the Osteoporosis Canada FLS Registry: <http://www.osteoporosis.ca/fls/canadian-fls-registry/>). The overwhelming majority of Canadian FLSs (> 80%) are restricted to inpatient-only or outpatient-only.

Similar to the UK and NZ, the denominator for the first i in Canada will be anchored to the hospital's hip fracture numbers. However, the multipliers have been adjusted to take into account the 2010 OC Guidelines^{1,4} and the PHAC recommendations⁵. Indeed, only fractures of the hip, wrist, shoulder, pelvis and spine have been kept in the denominator for the first i, in keeping with the PHAC recommendations; fractures of hands, feet and ankles have been removed from the denominator in keeping with the OC Guidelines.

In version 1.0, Osteoporosis Canada had elected to base the hip fracture multipliers for the first i for the various FLS types (inpatient-only, outpatient-only or combined inpatient/outpatient) on the 11-year data from the Osteoporosis Exemplary Care Program (OECF) of St. Michael's hospital⁷.

In version 2.0 of the OC KPIs, the first i is determined separately by fracture type (hip, non-hip non-spine and spine). As the published 11-year St. Michael's hospital data included exclusively MOF, a small adjustment was made to incorporate in a small proportion of pelvic fractures. The denominator for the first i for the patients with non-hip, non-spine fractures was determined to be hip fractures X 1.76.

IMPORTANT NEXT STEPS:

Each denominator was carefully selected and adapted, based on best available evidence at this time, in order to allow, in version 2.0, for comparison between FLSs. But the OC FLS KPIs are to be considered a work in progress. It is anticipated that improvements in the definition of the numerators and denominators (particularly in regard to the denominator for the first i) may be made after the next few national FLS audits.

It is acknowledged that the denominator for the first i has limitations. Although the multipliers were selected making many conservative assumptions, some cannot be ascertained due to limited access to Canadian fracture data.

In many cities, hip fracture surgery for an entire region is concentrated in one select hospital, hence the number of hip fractures for that hospital may not be representative of the number of fracture patients seen within that hospital's outpatient department. Osteoporosis Canada will work with such hospitals to help determine the most appropriate denominator for their first i.

More research is needed to help improve the methods of determining the very critical denominator for the first i. Osteoporosis Canada will revise/update the denominator for the first i as new evidence is obtained.

Current FLSs' (and also KPI's) main limitation: vertebral fractures

Vertebral fractures are the single most common osteoporotic fracture type. However, they are by far the most challenging to identify/capture. Very few vertebral fracture patients are ever referred to orthopaedic services hence would be missed by most FLSs. The majority of clinical (acute symptomatic) vertebral fractures typically present in the family physician's office, in the Emergency Department or in an internal medicine/osteoporosis clinic.

Over half of the vertebral fractures are asymptomatic. The latter may be discovered as an incidental finding on diagnostic imaging studies done for other purposes, e.g. diagnosing a T12 fracture on a chest x-ray done to rule out pneumonia. Unfortunately, less than half of the vertebral fractures present on chest radiographs are ever mentioned in the diagnostic imaging reports^{8,9}.

Compounding the problem, there are different methods for diagnosing vertebral fractures on radiographs, possibly leading to some confusion. It is becoming increasingly recognized that there are occasional cases where vertebral fractures are over-diagnosed (e.g. diagnosing a vertebral wedge fracture when the degree of wedging is only 10% and there is no disruption in the endplates)¹⁰. Mild spinal deformities (<25% height loss without definite end-plate fracture) are **not** strong predictors of future osteoporotic fractures or low bone density¹¹. This type of situation can make the work of an FLS even more complex.

Given the many barriers, systematic and pro-active case finding of vertebral fractures is very complex and currently very few FLSs world-wide are engaged in this work. Osteoporosis Canada will address vertebral fractures in a future iteration of KPIs, once there are more spine fracture FLSs and better evidence is available.

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