BeTTer Outcomes Workgroup Health Quality Initiative to optimize bone health for prostate cancer patients in the British Columbia Cancer System

Krista Noonan[1], Jenny J. Ko[2], Peter C. Black[3], Michael Peacock[4], Daygen Finch[5], Christian Kollmannsberger[4], Ilidio Martins[6], Alan I. So[7], Howard H. Pai[8]

[1]BC Cancer, Surrey, BC, Canada; [2]BC Cancer, Abbotsford, BC, Canada; [3]Vancouver Prostate Centre, Department of Urologic Sciences, University of British Columbia, BC, Canada; [4]BC Cancer, Vancouver Centre, BC, Canada; [5]BC Cancer, Kelowna, BC, Canada; [6]Kaleidoscope Strategic Inc., ON, Canada; [7]Department of Urologic Sciences, University of British Columbia, BC, Canada; [8]BC Cancer, Victoria, BC, Canada

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Corresponding author: Dr. Krista Noonan, BC Cancer, Surrey, BC, Canada; Knoonan2@bccancer.bc.ca

KEY MESSAGES

- Health quality improvement (HQI) has become the predominant framework to improve patient care in multidisciplinary settings.
- HQI initiatives were developed and evaluated in five centers of a large, provincial cancer center network (BC cancer).
- Referral, education, coverage, and resourcing support were the most common type of unmet needs identified.
- HQI initiatives selected by each site consisted of implementation or expansion of local multidisciplinary team meetings, referral forms and guidelines, MDT meeting report databases, and improvement charters.
- The main HQI initiative was completed in four sites and was adapted or adopted in three.

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ABSTRACT

Introduction: Bone-targeted therapies (BTTs) are integral to the management of bone metastases in metastatic castration-resistant prostate cancer (mCRPC). BTTs vary considerably in referral and drug access pathways and optimal BTT use requires multi-specialty consultation and supervision. Health quality improvement (HQI) has become the predominant framework to improve patient care in multidisciplinary settings.

Methods: HQI initiatives on use of BTT in mCRPC were developed and evaluated in five centers of a provincial cancer center network using Plan-Do-Study-Act (PDSA) methodology.

Multidisciplinary teams (MDTs) completed a common quality assessment form and an HQI template and then implemented an HQI initiative. Feedback and findings were shared and discussed at regional events. It was subsequently determined whether to adopt, adapt, or abandon initiatives.

Results: Patterns of unmet needs varied across type of BTT. Gaps in use of radium-223 were mostly referral and education issues that could be directly addressed at the local level by participating clinician teams. Conversely, most supportive BTT gaps were related to coverage and resourcing support. HQI initiatives selected by each site consisted of implementation or expansion of local MDT meetings, referral documents, databases, and improvement charters. The main HQI initiative was completed in four sites and was adapted or adopted in three. Improvements in BTT use were observed in two of three centers with data on HQI process measures.

Conclusions: Despite the overall heterogenous structure of the groups and metrics used, this study demonstrated that the PDSA framework provides the needed structure for improvements in BTT use in mCRPC across multiple sites.

INTRODUCTION

Health quality improvement (HQI) aims to improve the value, safety, standardization and quality of care for patients in both acute and chronic disease settings.[1-5] HQI initiatives use the continued collection and analyses of prespecified data to enhance patient care and disease management by eliminating errors and, improving practice standards as well as communication among caregivers.[4] HQI has therefore become the predominant framework used to improve patient outcomes and system performance in a multidisciplinary healthcare setting.[6,7]

Prostate cancer (pca) is the second most common malignancy diagnosed in men and the fifth leading cause of cancer-related mortality among men in 2020.[8] Although nearly all metastatic patients respond to initial androgen deprivation therapy (ADT), castration-resistant PCa (CRPC) invariably develops leading to disease progression. Bone is a common site of progression in metastatic CRPC (mCRPC), occurring in approximately one-third of patients within two years of castration resistance and in over 90% of patients over the course of disease.[9] This is a substantial cause of PCa-related morbidity and reduced quality of life resulting in pain, fractures, spinal cord compression and reduced mobility.[10,11]

Treatment of bone metastases from PCa can involve the use of palliative radiation therapy, anti-neoplastic, and bone protective agents with the goals of extending survival, alleviating pain and reducing risk of skeletal-related events.[12,13] Approved anti-neoplastic therapies for treatment of mCRPC irrespective of metastatic site include ADT, chemotherapy, androgen receptor pathway inhibitors (ARPI), poly (ADP-ribose) polymerase inhibitors, and

prostate-specific membrane antigen ligand targeted radiopharmaceuticals.[14] Bone-targeted therapies (BTTs) include the α-emitting radionucleotide radium-223, palliative external beam radiotherapy, and bone protective agents such as denosumab and zoledronic acid. Despite widespread guideline recommendations for BTT use in patients with bone metastases,[15-19] issues related to BTT underutilization have been reported in multiple jurisdictions.[20-24]

Management of PCa is a dynamic, multidisciplinary process involving a number of specialties including, nursing, pathology, urology, radiation oncology and medical oncology. Multidisciplinary collaboration is integral to optimally managing bone health. While bone-protective agents can generally be prescribed by urologists and oncologists, referrals to specialist centers for bone health assessment and management are recommended.[25] In our jurisdiction, radium-223 can only be prescribed by radiation oncologists and is administered in conjunction with nuclear medicine (NM) experts.[26-28] As cancer care at oncology centers can easily become siloed, multidisciplinary collaboration needed to optimally manage bone metastases can be challenging. Common issues can include a lack of coordination and communication among healthcare specialists, oncologist workload, lack of established referral pathways and a lack of access to treatments.

BC cancer is one of the largest networks of cancer centers in Canada and manages approximately 3,600 new cases of PCa per year.[29,30] The better outcomes workgroup (BOW) HQI project was initiated as a means of improving the care of mcrpc patients with bone metastases across five major BC cancer centers. The primary goals of the project were to facilitate discussions on use of btts and the development of a bone care improvement initiative in each site that, if successful, could be shared at the provincial level and adopted by other centers.

METHODS

Study design and setting

This multicenter study assessed the impact of HQI initiatives directed toward use of BTT in mCRPC in a large, provincial cancer center network – BC cancer. The study was conducted in all centers considered to have sufficient capacity to undertake a multidisciplinary HQI initiative (Surrey, Abbotsford, Kelowna, Vancouver, and Victoria). The initiative used Plan-Do-Study-Act (PDSA) methodology and workflow (Figure 1) as outlined by the institute for healthcare Improvement.[31] The project aimed to optimize BTT prescription and referral patterns in patients with mCRPC in British Columbia. Process measures included pharmacy records of drug administration, physician recommendations as well as number of bone health related specialist consultations. Balancing measures included increased workload on physicians as well as side effects from BTTs such as osteonecrosis of the jaw.

PDSA process

The Plan step involved the completion of health quality assessment and PDSA flowsheet forms (Figure S1) by multidisciplinary teams (MDTs) at all five participating sites. This was followed

by a retrospective chart review in select sites to confirm initial health quality assessments. The do step consisted of implementation of a selected HQI project by each group. In the study step, feedback and findings arising from initiatives and investigations conducted at each site were shared and discussed at regional events. In the final act step, chairs and steering committee members determined whether to adopt, adapt or abandon initiatives along with a concurrent expansion to other genitourinary (GU) disease settings such as malignancies of the kidney, bladder, and testes after review of project results. Additional details of each PDSA step, including assessments performed and tools developed are available in supplementary methods.

Analysis

In the analysis of needs assessment feedback patterns, met needs were categorized as either access and awareness, outcome measures, triage, diagnosis and follow-up process, confidence in data, MDT communication, or other. Unmet needs were categorized as patient barriers, resourcing, access/coverage, MDT communication, education, application of standards of care, or referral issues. Survey and retrospective chart audit data were summarized using descriptive statistics and are reported in the form of tables and plots (pie-charts) and in text. Assessment of HQIs was also performed descriptively, without pre-established statistical thresholds to define minimally significant improvement.

Ethics approval

Ethics board approval for the HQI initiative was not procured as no patient identifiable information was used for the purpose of the outcome evaluation. Retrospective chart audits conducted at each site were approved by the respective ethics boards.

RESULTS

Overall

The BOW workgroup was composed of 41 participants from different specialties (urology, medical oncology, radiation oncology, urologic oncology, internal medicine, endocrinology and nursing) and distributed across multiple locations in BC (Figure 2; Table S1). Participants were organized in teams, one for each BC Cancer center (n=5) and included team members, guests and community partners. The PDSA process was conducted across all sites over a period of 14 months (February 2018 to March 2019; Figure 1).

A total of 33 BOW members from working groups in Surrey, Abbotsford, Kelowna, Vancouver, and Victoria participated in a survey on patterns of BTT use as part of the initial quality assessment. A total of 190 needs assessment comments were generated from structured discussions, 42 of which were submitted as out-of-scope. Of those in scope, the comments describing unmet needs (n=82) outweighed those describing needs that were considered to be met (n=66). Met needs were most often categorized as access and awareness to treatment (34.2% and 32.1%), MDT communication (23.7% and 35.7%) and triage process (21.1% and 17.9%) for

both types of BTTs (NM and general/supportive, respectively). Referral (47.5%) and education (22.5%) issues were the most common unmet needs identified for NM BTTs while coverage (47.6%) and standards of care not followed (19.0%) were the most common for general/supportive BTTs (Figure 3).

Surrey

Unmet needs identified by Surrey participants that were actionable by the site's BOW team were related to referrals and physician education (n=6). As such, the group selected improving BTT workflow and collaboration between BC cancer and the community via MDT meetings to review mCRPC patients as their main HQI project (Table 1). The group predicted that after four to six months of meetings there would be improvements in at least one workflow and/or clinical parameter and, if successful, this would be apparent in a narrow patient population (mCRPC with bone disease) after a short test period. Bi-monthly mCRPC MDT tumor board meetings (n=20) involving team members and community partners were initiated to improve collaboration and assess proper initiation of BTTs. Patients referred for BTT by any physician in the area were eligible for discussion. An online tool was created to track outcomes from the MDT meetings (Figure s2a).

Impact of the HQI initiative in Surrey was evaluated by changes in BTT recommendation patterns from MDT case reviews after start of the project. Results of the analysis (as of June 14, 2018; after 15 meetings) showed that of the 29 patients discussed, 20 (69.0%) were mCRPC and recommendations for radium-223, denosumab, ZA, radiotherapy, and calcium/vitamin D were issued in 17 (58.6%), 14 (48.3%), 1 (3.4%), 7 (24.1%), and 9 (31.0%) of the cases, respectively. In addition, bone clinic referrals increased by 24.1% (n=7) relative to baseline. Since previous recommendations for BTT were not changed, these represented net increases in BTT recommendation rates relative to start of the HQI initiative; therefore, the conditions for a successful HQI were met. The Surrey team subsequently merged with the Abbotsford team to conduct ongoing multi-site collaborative MDTs with an expanded GU focus.

Abbotsford

Most of the unmet needs in NM BTT identified by the Abbotsford team were issues related to referrals and MDT communication (n=7, 70%) that could be potentially addressed with interventions at the local level (Table 1). In contrast, supportive BTT gaps were predominantly related to coverage/access (n=5, 63%), issues that often require changes at provincial and national levels. The Abbotsford group opted to conduct further quality assessment using an informal, retrospective chart review of all patients treated with radium-223 in the previous year (2017; n=24) and predicted that this would find a pattern of late referrals. The analysis showed that a median of three prior treatments (range, one to seven) were undertaken prior to use of radium-223 with a median time from mCRPC to radium-223 initiation of two years. Notably, radium-223 was never used as initial therapy for mCRPC in this small patient cohort and the vast

majority of patients (n=20) required palliative radiotherapy at some point but only three during or after radium-223 treatment. The results indicated that patients had more prior lines of therapy at radium-223 initiation relative to the average in the BC cancer area from September 2013 to February 2016 (median of two [range, zero to five])[32] and in the pivotal ALSYMPCA trial.[33] The group presented their audit data and sequencing insight to the Abbotsford GU oncology team to seek advice on moving forward with HQI projects.

In order to address referral and MDT communication issues, the Abbotsford group took a leading role in mCRPC case reviews in MDT meetings (n=15, at times in collaboration with the Surrey team) and instituted periodic GU meetings in the area. The team also created a triage referral document for treating physicians in order to address workflow issues and an improvement charter to track quality improvement. A 20% increase in use of both NM and supportive BTTs by the end of 2019 was predicted and set as goal for the initiative. As of July 2020, the Abbotsford team merged their MDT meetings with the Surrey site to form a multi-site collaborative MDT with an expanded GU focus.

Kelowna

Issues related to referrals, MDT communication and compliance with standards of care (n=7, 47%) were common BTT gaps identified by the Kelowna team. Other unmet needs that were identified were related to access and coverage as well as resourcing support (n=8, 53%). In particular, the group identified a need for a regional GU multidisciplinary tumor board where urologists, medical oncologists and radiation oncologists could meet to discuss genitouro-oncology cases, including patients with mCRPC. Additional quality assessment was performed by surveying medical oncologists treating mCRPC patients (n=11) to assess usage of concomitant bone health agents alongside radium-223, and to understand the knowledge level of bone health support in patients receiving radium-223 (Table 1). Results showed that 6 patients were supplementing with vitamin D, while no patients were receiving calcium, denosumab or a bisphosphonate (Table s2a). Only one patient confirmed that they had undergone bone mineral density (BMD) screening in the last three years and the majority (n=8) could not recall. The team identified the need for a systemic way to recommend supplementation with vitamin D and calcium, as well as an increase in early BMD screening. General practitioners (GPs) were identified as care providers that may be able to best address the need, however prior data demonstrated that they had been less involved. After holding six meetings the Kelowna team created an educational letter to GPs outlining information on bone health in order to address workflow and treatment recommendation issues and to increase rates of vitamin D and calcium supplementation and early BMD screening. The letter included specific recommendations for supporting bone health as well as fields for patient-specific information (Figure s2b). However, the project was subsequently cancelled due to lack of resources.

Vancouver

The initial needs assessment performed by the Vancouver project group was challenging due to a small number of BTT referrals. Gaps in use of NM BTT identified by the group were workflow issues either related to physician education (n=6) or referrals (n=6; Table 1). Conversely, most unmet needs in use of supportive BTTs were due to coverage or resourcing support (n=8, 73%) that required changes in infrastructure. The group selected as the primary project goal to prepare a radium-223 referral form/checklist to optimize the referral process and to ensure that the patients being referred met eligibility criteria. An increase in radium-223 referral rate relative to the start of the project was predicted. The checklist was finalized and implemented in July 2018 (Figure s2c) and seven new patients were referred for treatment, however, this number was not considered sufficient to perform formal analysis and draw conclusions. After five team meetings, the project was deferred to 2020 with the goal of achieving a total of 10 referrals. Although the tool was never officially adopted, the core MDT group continued to meet to discuss a spin-off multidisciplinary clinic for PCa patients called the Vancouver inter-professional clinic for advanced prostate cancer (VICAP) which was launched in late 2020.

Victoria

Gaps identified for optimal BTT treatment by the Victoria working group included both workflow challenges (n=8), such as issues related to referrals, MDT communication, physician education and compliance with standards of care; and infrastructure issues (n=6), such as barriers to drug access and resourcing support (Table 1). A retrospective chart review was performed to assess the use of concomitant bone health agents while receiving radium-223. A total of 70 patients who had received treatment between January 2015 and December 2017 were reviewed (Table s2b). Similar to the results of the chart review in Abbottsford, the degree of pre-treatment was higher than the pivotal ALSYMPCA trial[33] with nearly all patients (n=69, 99%) receiving at least one line of systemic therapy prior to radium-223. Results also showed that only 10% of patients were treated with concurrent bone health agents (denosumab or zoledronate; compared to 41% bisphosphonate use in the pivotal ALSYMPCA trial),[33] all of which were started before commencing radium-223. In patients who were receiving a bone health agent, 57% experienced a symptomatic skeletal event, compared to 76% in patients who did not receive a bone health agent.

A bone health referral network was proposed in order to streamline access to bone health consultations. It was predicted that the initiative would increase the percentage of patients receiving bone protective agents. The bone health referral network was initiated by identifying specialists from endocrinology and internal medicine with a special interest in bone health for cancer patients and establishing patterns of referral through dialogue and continuing medical education events. Referral documents were created including referral guidelines, referral forms for bone health specialists, and pre-printed order and assessment forms for bone health management (Figure s2d). A follow-up analysis performed between June 2018 and January 2019 showed that 91 cancer patients (prostate, n=56; beast, n=24; other, n=11) were referred, of whom

15 had bony metastasis. A total of 55 patients (60.4%) ultimately were prescribed bone health agents, including 29 with low-dose denosumab, 13 with high-dose denosumab, nine with zoledronic acid, and four with oral bisphosphonates in addition to conservative measures. As improvements in the referral process and increase in volume of BTT prescriptions were quite apparent, the group continued to use the referral process after the PDSA study period along with implementing process refinements.

DISCUSSION

Quality assessment is a key component of HQI projects[34-37] and it was initially performed in this study using a common needs assessment template. Although clinicians felt that their centers were doing well in addressing many BTT needs related to access and awareness, MDT communication and patient triage, use of BTT in mcrpc presents multiple, concurrent issues. Patterns of unmet needs identified by project participants varied across type of BTT. Gaps in use of NM BTTs (i.e., radium-223) were mostly referral and education issues that could be directly addressed at the local level by participating clinician teams. As a result, many of the initiatives undertaken were focused on NM-delivered BTTs. Conversely, most gaps identified for supportive BTTs were related to coverage and resourcing support. The project framework allowed for communication of these issues at provincial level in the form of comments and reports to the BC GU tumor group and to the steering committee which included provincial and Canadian Urological Association leads.

The main HQI initiative selected by each site was completed in four sites and was adapted or adopted in three (Table 1). Among the three centers with available data on process measures, improvements in BTT use were observed in two and data was not considered sufficient for formal analysis in the third site. Key challenges to implementing HQI projects of multidisciplinary nature are clinician availability, adequate center capacity and resourcing, coordination of team efforts across multiple areas of expertise and need for strong team leadership.[38-43] Limited resourcing and capacity resulted in premature cancellation of the project in one center (Kelowna) and failure to implement the main HQI initiative in another (Vancouver). Merge of MDTs from two centers (Surrey and Abbottsford) was an adaptation mechanism used that is associated with increased capacity and reductions in overall and individual participant burden.

This descriptive study also provides support for use of group discussions as a tool to facilitate multidisciplinary collaboration. Multidisciplinary meetings provide an appropriate setting where to discuss complex issues, such as those related to patient selection, treatment initiation and sequencing, optimization of lines of therapy and management of multiple morbidities.[44-46] This is especially important as management of advanced PCa patients becomes increasingly complex with new genetic testing tools and more treatment options across multiple lines of treatment.[47,48] Improvements in multidisciplinary interaction were apparent during the HQI project by the creation and expansion of MDTs and implementation of periodic meetings in

some centers. MDT discussions often addressed topics related to recurrent feedback patterns of late or absent BTT referrals, such as when to stop ARPI treatment, patient triage and follow-up, referral pathways and initiation of funding requests. Timely initiation of treatment is particularly important for BTTs in mCRPC with bone metastases as both the oncologic condition and some of its treatments threaten bone health and BTT eligibility may be affected by disease progression (e.g., radium-223). For example, late referral to radium-223 was a frequently reported unmet need and both retrospective chart reviews found relatively high number of previous lines of therapy at radium-223 initiation. Although the PDSA study did not allow to evaluate changes in timing of BTT initiation, HQI initiatives undertaken were often designed to improve MDT communication and resulted in apparent increases in BTT referral and prescription rates. Multidisciplinary collaboration continued beyond the PDSA study as evident by adoption or adaptation of project initiatives (in Surrey/Abbottsford and Victoria) or development of new ones (VICAP in Vancouver).

One of the strengths of our study was its multicenter nature, allowing for assessment of HQI initiatives in five large and diverse settings, thereby reducing the impact of site-specific bias and increasing confidence in the generalizability of the results. Network-wide meetings promoted knowledge and experience sharing which set the foundation for implementation and homogenization of bone health practices at the provincial level. Two individuals have undergone formal HQI training which proved to be very beneficial to implementing this framework in the respective centers. Moreover, HQI and bone healthcare expertise are readily applicable to disease settings other than mCRPC, including earlier PCa stages and other GU cancers. The MDT board in Surrey expanded to include BTT discussions for other GU cancers and the MDT discussions expanded to include urologists as well as radiation oncologists; many of the patients referred to bone health experts in Victoria were non-mCRPC.

Limitations

A significant limitation of the study is the overall heterogenous structure of the groups and metrics used. For example, outcome measures varied substantially across sites and data on balancing measures was only available from one site. Data collection was challenging due to the lack of centralized databases for referrals and prescriptions. We also acknowledge that there was some divergence from the initial project goals and protocols and less rigorous documentation of initiatives than had initially been planned. Our study shortcomings represent a lesson for the necessity of adaptability and empowerment of individual sites when conducting high-quality qualitative evaluations in lower resourced or geographical disparate settings.

CONCLUSIONS

Through this project, we were able to build knowledge and capacity for HQI, offering a promising strategy to address growing BTT needs from a population perspective. Insights from

this work indicate that HQI methods may be a powerful approach for development of tailored initiatives aimed at improving multidisciplinary care across cancer center networks.

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FIGURES AND TABLES

Figure 1. Visual diagram of the better outcomes workgroup plan-do-study-act (PDSA) cycle. [a]Quality improvement principles and steps. BTT: bone-targeted therapy; C: chair; GUCU event: provincial genitourinary tumor group meeting; MDT: multidisciplinary team; mCRPC: metastatic castration-resistant prostate cancer; PDSA: Plan-Do-Study-Act; SC: steering committee.

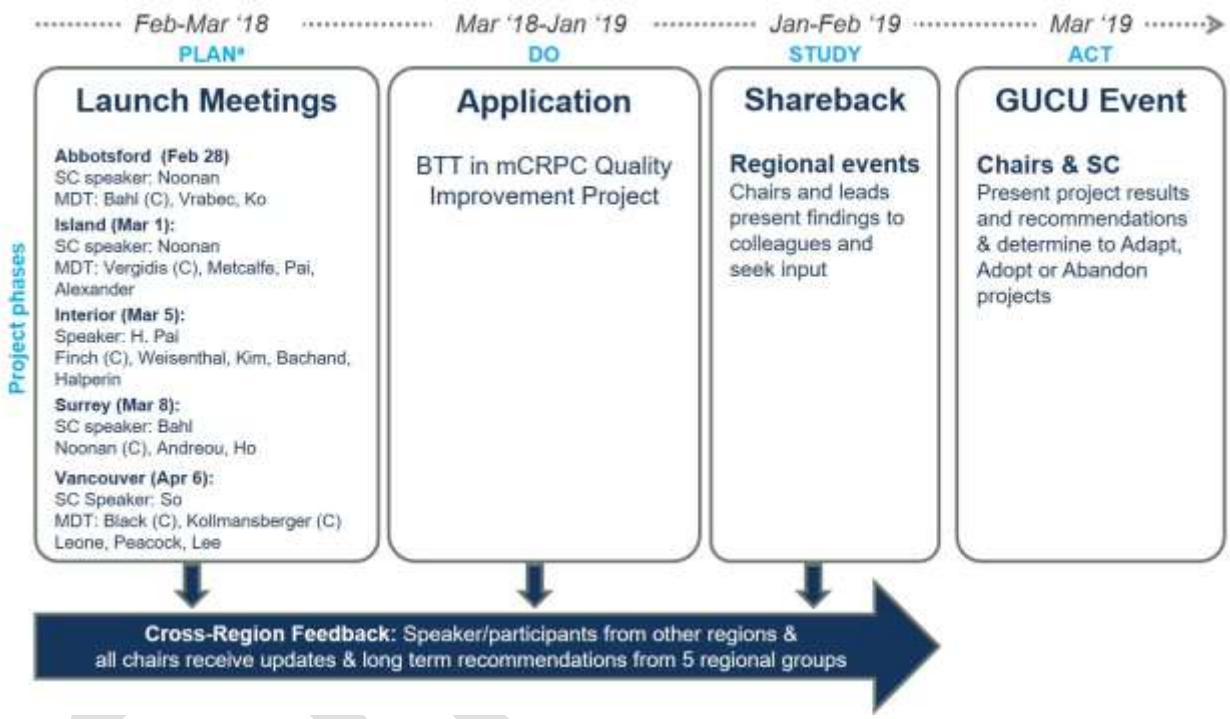

Figure 2. Composition of the better outcomes workgroup participants by specialty (top) and location (bottom).

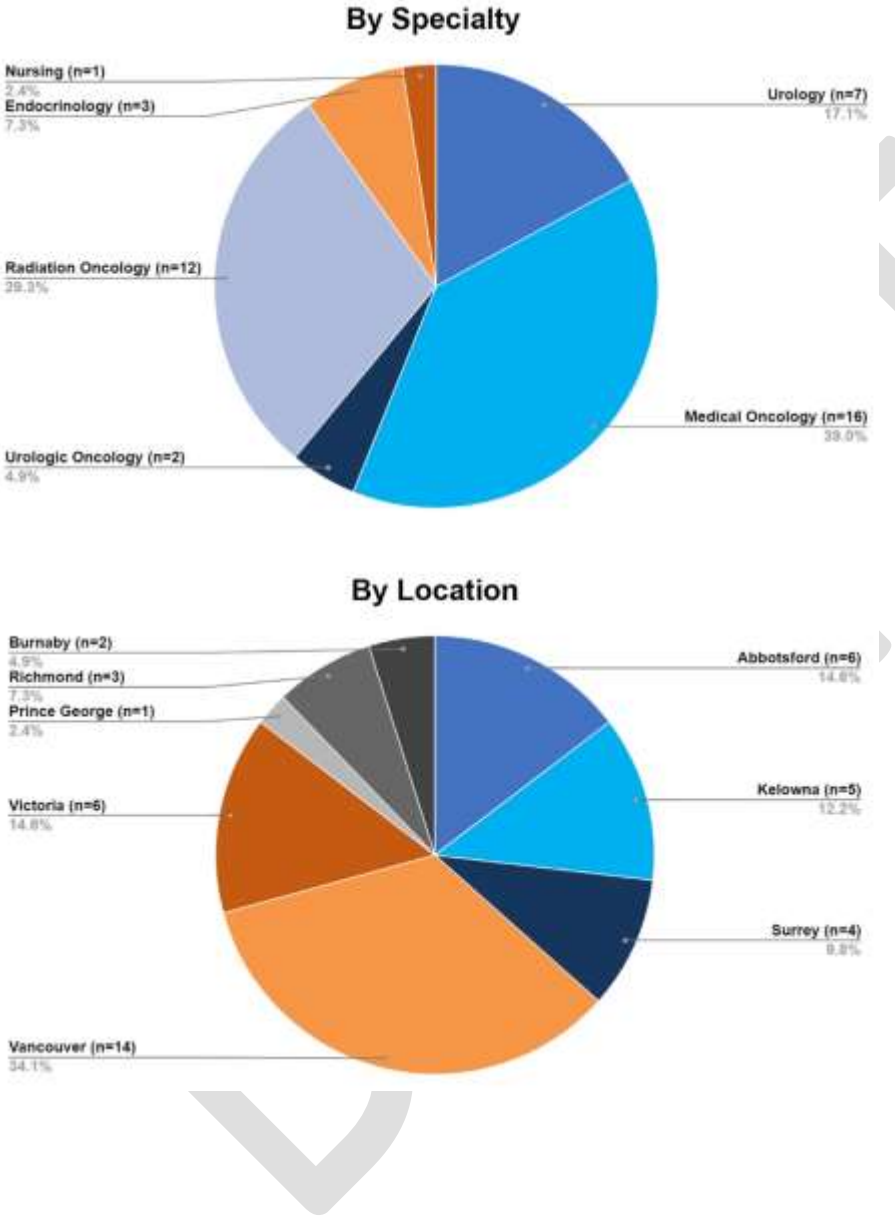

Figure 3. Feedback patterns from better outcomes working group participants on met (top panels) and unmet (bottom panels) needs regarding delivery of nuclear medicine (i.e., radium-223; left panels) and general/supportive (right panels) BTTs. BC: British Columbia; BTT: bone-targeted therapy; MDT: multidisciplinary team; NM: nuclear medicine; SOC: standard of care.

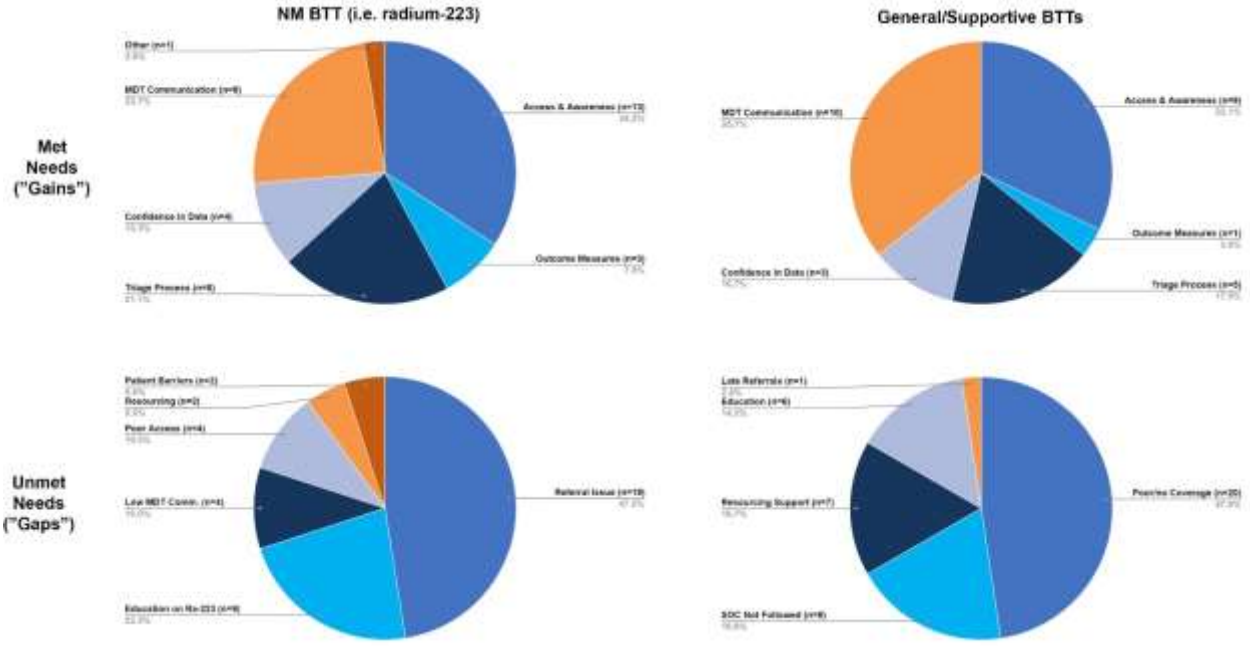

Table 1. Unmet needs, quality assessment investigations, HQI initiatives, measures and outcomes across participating BC cancer center MDTs

BC cancer center	Most frequent types of unmet needs	Additional quality assessment investigations[a]	Main HQI initiative(s)	HQI MDT meetings (n)	HQI measure and predicted outcome	Measured outcome	Adopt, adapt or abandon HQI initiative
Surrey	NM BTTs – Referral (n=3, 60%) and education (n=1, 20%) issues Supportive BTTs – Poor coverage (n=3, 43%) and resourcing support (n=2, 29%)	None	MDT mCRPC patient review meetings	20	BTT recommendation patterns Increase	Additional BTT recommendations (n=48) in 29 patients, including mCRPC patients (n=20)	Adapt by merging with Abbottsford team
Abbotsford	NM BTTs – Referral (n=5, 50%) and MDT communication (n=2, 20%) issues Supportive BTTs – poor coverage (n=5, 63%) and	Retrospective audit of all patients treated with radium-223 in 2017	MDT mCRPC case review meetings and instituted regular GU MDT meetings in the area	15	Use of BTTs Increase (≥20%)	NA	Adapt by merging with Surrey team

	education (n=25%) issues						
Kelowna	NM BTTs – Referral issues (n=3, 43%) and poor access (n=2, 29%) Supportive btts – Resourcing support (n=3, 38%) and standards of care not followed (n=3, 38%)	Prospective survey of medical oncologist on use of BTTs for mCRPC	GP mCRPC bone health letter	6	Patients on ADT starting BTT treatment Increase	NA	Abandon – project canceled due to lack of resources
Vancouver	NM BTTs – Referral (n=6, 50%) and education (n=6, 50%) issues Supportive BTTs – Poor coverage (n=7, 64%) and education (n=2, 18%) issues	None	Radium-223 community referral form and checklist	5	Radium-223 referral rates Increase	New patients referred for radium-223 treatment (n=7)[b]	Abandon[c]

Victoria	NM BTTs – Referral (n=2, 33%) and access (n=2, 33%) issues Supportive BTTs – Standards of care not followed (n=4, 50%) and poor coverage (n=3, 38%)	Retrospective audit on BTT use in radium-223 patients	Bone health referral and materials (referral guidelines and forms; bone health order and assessment forms)	6	Percentage of patients supported with bone protective agents Increase	55 patients (60.4%) prescribed with bone health agents	Adopt[d]

[a]In addition to the common PDSA needs assessment form completed by participating MDTs from all sites. [b]This number was not considered sufficient for formal analysis and conclusion by the local MDT. [b]Continued MDT collaboration beyond the PDSA study period did, however, result in development of a new initiative – the Vancouver inter-professional clinic for advanced prostate cancer (VICAP). [d]With introduction of process refinements. BC: British Columbia; BTT: bone-targeted therapies; GP: general practitioner; GU, genitourinary; HQI, health quality improvement; mCRPC: metastatic castration-resistant prostate cancer; MDT: multidisciplinary team; MO: medical oncology; NA: not available or applicable; NM BTT: nuclear medicine bone-targeted therapy (i.e., radium-223).