

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

**Successful system-wide implementation of a Choosing Wisely Canada recommendation in
Alberta: An Intervention in Vitamin D Testing.**

Christopher Naugler, Brenda Hemmelgarn, Hude Quan, Fiona Clement, Tolulope Sajobi, Roger
Thomas, Tanvir C Turin, William Hnydyk, Alex Chin, and James Wesenberg

Affiliations:
Departments of Pathology and Laboratory Medicine (Naugler, Chin), Family Medicine (Naugler,
Thomas, Turin), Community Health Sciences (Hemmelgarn, Quan, Clement, Sajobi), Cumming
School of Medicine, University of Calgary, Calgary, Alta; Alberta Medical Association (Hnydyk),
Edmonton, Alta; Red Deer Regional Hospital Centre (Wesenberg), Clinical Laboratory, Red Deer,
Alta.

Correspondence to: Christopher Naugler, Christopher.Naugler@cls.ab.ca

Footnotes

Competing interests: None declared.

Contributors: Christopher Naugler contributed substantially to data acquisition, analysis and interpretation, and drafted the article. Brenda Hemmelgarn, Hude Quan, and Tolulope Sajobi contributed substantially to data analysis and interpretation. All authors contributed substantially to study design and conception, revised the manuscript critically for important intellectual content, approved the final version to be published, and agreed to act as guarantors of the work.

Funding: This work was funded by a CIHR Foundation Scheme grant to Christopher Naugler.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Abstract

Background: In this paper we describe the implementation of an intervention in Alberta in support of the Choosing Wisely Canada (CWC) recommendation against population screening for vitamin D deficiency.

Methods: A special requisition for ordering vitamin D tests in Alberta was introduced on April 1st 2015. Using an interrupted time series model we compared predicted versus observed vitamin D test volumes for the 12 month period following the introduction of the new requisition. The primary outcome measure was the monthly change in provincial vitamin D test volume.

Results: Over the first 12 month of the intervention there was a reduction in test volume of 312,952 tests (91.4% reduction) representing a direct spending decrease of \$938,856 – \$1,564,760 per year in Alberta.

Interpretation: A provincially led implementation of a Choosing Wisely Canada recommendation resulted in a large and sustained reduction in vitamin D tests in Alberta.

Introduction

Choosing Wisely^{1,2} and Choosing Wisely Canada³ are major national initiatives respectively in the United States and Canada with the goal of helping physicians and patients engage in conversations about unnecessary tests, treatments and procedures. Although Choosing Wisely Canada recommendations are released nationally, health care delivery is a provincial responsibility, therefore implementation of specific recommendations are carried out provincially. To date there have been no published data on the effectiveness of provincial implementations of Choosing Wisely Canada recommendations.

Choosing Wisely Alberta,⁴ a physician-led committee of the Alberta Medical Association, is responsible for the coordination and promulgation of Choosing Wisely Canada recommendations. This group identified five priority recommendations for implementation in Alberta, one of which was the recommendation against population-based screening for 25-OH-vitamin D ("vitamin D") deficiency. This recommendation was jointly put forward by The Canadian Association of Pathologists⁵ and by the Canadian Medical Association's Forum on General and Family Practice Issues and the College of Family Physicians of Canada⁶ as part of the Choosing Wisely Canada Wave II recommendations on October 29th 2014. Vitamin D screening has been particularly problematic for the health system in Alberta as there has been a massive increase in test volumes over the past 10 years⁷ with evidence that testing has been preferentially directed toward low risk patients.⁸

In this paper we describe the implementation of an intervention in Alberta in support of the Choosing Wisely Canada (CWC) recommendation against population screening for vitamin D deficiency.

Methods

Intervention

In March 2014, a working group was formed in Alberta to address the massive increases in vitamin D test requests despite provincial recommendations against population screening for vitamin D deficiency.⁹ This working group consisted of representatives from Alberta Health Services (the operational arm of the provincial Department of Health), Alberta clinical laboratories, the Alberta Medical Association and the Alberta Obesity, Diabetes and Nutrition Strategic Clinical Network. Following the release of the Choosing Wisely Canada Vitamin D recommendations in October 2014, this working group joined with Choosing Wisely Alberta to design and implement a province-wide utilization management strategy for vitamin D.

The working group considered a number of strategies including education, audit and feedback of ordering practices to individual physicians and administrative restrictions on test ordering. An administrative strategy consisting of restriction of testing to specific clinical situations combined with a new provincial requisition¹⁰ for all vitamin D test requests was decided by the working group because of relative ease of implementation and because administrative interventions tend to be more effective than other types of intervention.¹¹

Under this utilization management strategy starting April 1st 2015, vitamin D tests were only available for the following clinical indications: metabolic bone disease, abnormal blood calcium, malabsorption syndromes, chronic renal disease and chronic liver disease and were only accepted if accompanied by the new provincial requisition with one of the listed indications checked off.

This initiative was accompanied by a province-wide communication strategy including an update of the provincial clinical practice guidelines aligning them with the new requisition, development of an information sheet that was provided to physicians to give to patients requesting Vitamin D testing that was not clinically indicated, and the appending of a comment describing the intervention to all reported vitamin D results for the month prior to the intervention.

Data Sources

Vitamin D tests are only performed at three laboratories in the province (Edmonton, Calgary and Medicine Hat). Total test volume data on vitamin D tests for each of these laboratories is reported monthly to Alberta Health Services as part of routine quality improvement metrics. We used this data from the period January 1 2013 – March 31 2015 to establish the pattern of seasonal variation and year over year changes to be used in the time series model, and volumes from 1 April 2015 to 31 March 2016 to test the effect of the intervention. Test volumes for both in-patient and outpatient samples were used in the analysis and the unit of analysis was the number of tests rather than the number of patients.

Statistical analysis

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Preliminary analyses showed considerable seasonal variation in the number of vitamin D tests ordered. To account for this background monthly variation, we used historic test volumes at each of the three Vitamin D testing laboratories in Alberta (in Calgary, Edmonton and Medicine Hat) and all sites combined to create interrupted time series¹² in IBM SPSS Statistics version 22. Preliminary analyses showed that Winter’s additive models gave the best model fit and therefore these were used for subsequent analyses. Comparing the predicted monthly vitamin D test volumes at each of the testing sites with the observed values allowed us to assess the effectiveness of the intervention on a monthly basis. This information was reported back to Choosing Wisely Alberta on a monthly basis.

Ethics statement

This study used only publically available test volume data and therefore did not require formal ethics approval by our organization.

Results

The utilization management initiative resulted in an immediate and dramatic reduction in vitamin D test requests. The interrupted time series analysis for all testing sites combined is shown in Figure 1. The stationary R^2 for this model was 0.86 with a Mean Absolute Percent Error (MAPE) of 2.42, with a P-value of 0.138 for the Ljung-Box Q test,¹³ indicating that the model does not exhibit autocorrelation and had a good fit to the data. In the 12 months following the intervention, the predicted provincial vitamin D test volume was 342,477 while

the observed was 29,525 equating to an overall reduction of 312,952 tests or 91.4%. This reduction was sustained over the first 12 months of the intervention. Similar reductions were seen at all three testing sites. As we used de-identified administrative data, we were not able to test if reductions varied with patient demographics. At an estimated marginal cost per test of \$3.00-\$5.00 per test, this intervention is projected to result in a direct spending decrease of \$938,856 – \$1,564,760 per year in Alberta.

Interpretation

In this paper we describe the successful implementation of a laboratory test utilization management intervention based on a Choosing Wisely Canada recommendation for reduction in Vitamin D testing. This intervention involved broad engagement of key stakeholders including clinical laboratories, Alberta Health Services and the Alberta Medical Association, along with analytics support to accurately measure the effect of the intervention. We report direct (marginal) cost savings of at least a million dollars per year in Alberta depending on the actual reagent costs in individual labs. Because the exact values are proprietary, we have instead chosen to illustrate a reasonable range of estimated costs based on our knowledge of reagent costs in a number of Canadian laboratories. Considering only marginal (reagent) costs is the most conservative way of calculating cost savings from utilization management interventions,^{14,15} however the actual savings (or at least cost avoidance) are greater in this intervention because in at least one of the testing laboratories, the large reduction in volume allowed reallocation of technical staff to other testing areas.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Discussions with laboratory medical leaders in Alberta (including several authors on this paper) revealed that there have been very few questions or concerns from physicians or the public regarding this intervention over the first 12 months of the intervention. All of the questions or concerns were assessed by the members of the working group and a factual response was sent in each case without a single instance of rebuttal. We speculate that this may be due in part to the meaningful participation of clinicians through the Choosing Wisely Alberta committee and the Alberta Medical Association. We anticipated that there may have been more questions or concerns given that a recent survey of Alberta primary care physicians showed that specialized test requisitions for certain tests were felt to be acceptable to only 45% of survey respondents.¹⁶ Clearly, while this approach may be highly effective for certain tests; laboratories cannot create separate requisitions for all laboratory tests under management.

To our knowledge, Alberta is the only jurisdiction to have implemented a policy such as this. The primary difference is that other provinces have allowed for a “patient pay” option for testing that was not clinically indicated. The Choosing Wisely Alberta group, however, felt strongly that allowing patients to pay for something that was not clinically useful was inappropriate and contrary to the ideals of the Choosing Wisely initiative.

In the current era of unsustainable increases in laboratory test volumes in Canada^{17,18} the managed exit of low value tests is necessary to ensure resources necessary for medically necessary tests. Physician education is commonly used in an attempt to reduce unnecessary laboratory testing has repeatedly been shown to have marginal effectiveness in reducing

1
2
3 medically unnecessary tests.¹¹ Interventions such as the one described in this paper will,
4
5 therefore, become increasingly important in effectively managing laboratory testing resources.
6
7
8 Choosing Wisely Canada, provincial health departments, provincial medical associations and
9
10 clinical laboratories all have a cooperative role to play in this process. It is our intention to
11
12 monitor vitamin D test requests on an ongoing basis in order to evaluate the long term
13
14 effectiveness of this intervention.
15
16
17

18 19 Acknowledgements

20
21 We wish to thank Maggie Guo for help with data analysis.
22
23
24
25
26
27
28
29
30
31
32

33 References

- 34
35
36 1. Hilborne LH (2013) When less is more for patients in laboratory testing. *Am J Clin Pathol*
37
38 139:271-2.
39
40
41
42 2. Hilsborne LH (2014) Choosing wisely: selecting the right test for the right patient at the right
43
44 time. *MLO Med Lab Obs* 46:40.
45
46
47
48 3. Leon-Carlyle M, Srivastava R, Levinson W (2015) Choosing Wisely Canada: Integrating
49
50 Stewardship in Medical Education. *Acad Med* 90:1430.
51
52
53
54 4. Edmonton: Choosing Wisely Alberta website. Available [www.albertadoctors.org/leaders-](http://www.albertadoctors.org/leaders-partners/choosing-wisely-alberta)
55
56
57
58
59
60 partners/choosing-wisely-alberta. accessed 2016 June 2

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

5. Toronto: Canadian Association of Pathologists (2014) Pathology: Five Things Physicians and Patients Should Question. Available www.choosingwiselycanada.org/recommendations/pathology/. accessed 2016 June 2.

6. Toronto: The College of Family Physicians of Canada and the Canadian Medical Association (2014) Family Medicine: Eleven Things Physicians and Patients Should Question. Available www.choosingwiselycanada.org/recommendations/family-medicine/. accessed 2016 June 2.

7. Naugler C, Zhang J, Henne D, et al. (2013) Association of vitamin D status with socio-demographic factors in Calgary, Alberta: an ecological study using Census Canada data. *BMC Public Health* 13:316.

8. de Koning L, Henne D, Woods P, et al. (2014) Sociodemographic correlates of 25-hydroxyvitamin D test utilization in Calgary, Alberta. *BMC Health Serv Res* 14:339.

9. Edmonton: Toward Optimized Practice (2014) Vitamin D Testing and Supplementation: Clinical Practice Guideline. Available www.topalbertadoctors.org/download/1304/Vitamin%20D%20Testing%20and%20Supplementation.pdf. accessed 2016 June 2.

10. Edmonton: Laboratory Services Vitamin D (25-Hydroxy) Requisition form. Available www.albertahealthservices.ca/frm-19500.pdf. accessed 2016 June 2.

11. Thomas RE, Vaska M, Naugler C, et al. (2015) Interventions at the laboratory level to reduce laboratory test ordering by family physicians: systematic review. *Clin Biochem* 48:1358-65.

12. Mohammed AA, Naugler C, Far BH. (2015) Emerging Business Intelligence Framework for a Clinical Laboratory Through Big Data Analytics. In Tran QN and Arabnia H [Eds] Emerging Trends in Computational Biology, Bioinformatics, and Systems Biology: Algorithms and Software tools. Elsevier/MK, New York, 577-602.
13. Ljung GM, Box GEP. (1978) On a Measure of a Lack of Fit in Time Series Models. *Biometrika* 65:297–303.
14. Morgen EK, Naugler C. (2015) Inappropriate Repeats of Six Common Tests in a Canadian City: A Population Cohort Study Within a Laboratory Informatics Framework. *Am J Clin Pathol*. 144:704-12.
15. MacMillan D. (2014) Calculating cost savings in utilization management. *Clin Chim Acta* 427:123-6.
16. Thommasen A, Clement F, Kinniburgh DW, et al. (2016) Canadian Family Physician Knowledge and Attitudes Toward Laboratory Utilization Management. *Clin Biochem* 49:4-7.
17. Rockey, MJ, Naugler C, Sidhu D. (2013) Laboratory test utilization trends: past and future. *Can J Pathol* 5:65-71.
18. Naugler C. (2014) A perspective on utilization management from Canada. *Clinica Chimica Acta* 427:142–144

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Figure legends

Figure 1. Time series analysis showing the effect of the Alberta vitamin D utilization management intervention. The red line is the observed monthly test volume and the blue line is the predicted volume. The dashed lines represent 95% confidence intervals for the predicted monthly volumes. There was a sustained 91.4% reduction in vitamin D requests over the first year of the intervention.

Confidential

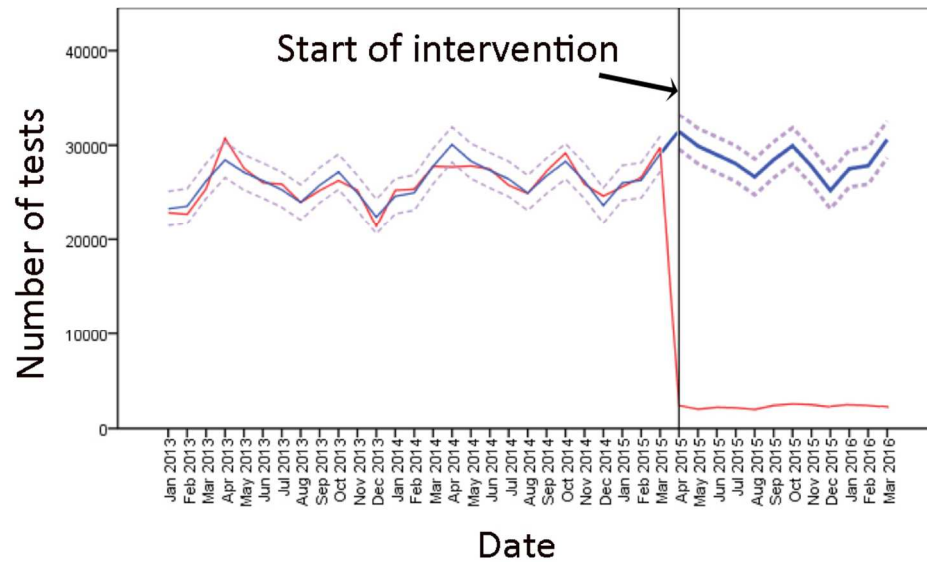


Figure 1. Time series analysis showing the effect of the Alberta vitamin D utilization management intervention. The red line is the observed monthly test volume and the blue line is the predicted volume. The dashed lines represent 95% confidence intervals for the predicted monthly volumes. There was a sustained 91.4% reduction in vitamin D requests over the first year of the intervention.

101x76mm (300 x 300 DPI)