

A low-cost initiative to reduce duplicate hepatitis B virus serological testing

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ABSTRACT

Background: Currently, multiple clinical laboratories provide serological testing for hepatitis B virus (HBV) in Alberta, Canada. Concerns were raised regarding single serology specimens having duplicate testing performed during the specimen referral process from one laboratory to another. In an attempt to reduce duplicate testing for anti-HBs and HBsAg markers, we implemented a stamp on paper requisitions to identify if testing had already been performed on referred specimens. We aimed to determine the number of duplicate tests and cost of duplicate testing pre- and post-stamp implementation.

Study design: The requisition stamp was implemented between May and August 2016. HBV serology testing results from two clinical laboratories between January 01, 2015 and December 31, 2017 (n = 803,637) were examined. The number of tests performed on the same individual within a 3-day window was identified and the associated costs were determined.

Results: After stamp implementation, duplicated HBsAg and anti-HBs tests decreased from 20.8% (n = 28,545) and 18.4% (n = 20,151) to 3.7% (n = 4,604) and 2.5% (n = 2,593), respectively. This represented an estimated annual savings of \$86,427 and \$82,522 CAD in supply costs for HBsAg and anti-HBs tests, respectively.

Conclusions: The requisition stamp initiative was effective in reducing the number of duplicate tests performed between two laboratory sites. This low-cost intervention could be applied to other testing situations, including other highly duplicated serological markers, which may have broad reaching cost-saving effects for laboratory testing.

1. Introduction

Hepatitis B virus (HBV) infection affects approximately 300 million people worldwide [1]. Hepatitis B (HB) clinically manifests in a spectrum, ranging from asymptomatic infection to liver cirrhosis and liver failure, and is associated with hepatocellular carcinoma development in 5–6% of HB surface antigen (HBsAg) positive infections [2]. Cases are identified as acute or chronic hepatitis B depending on symptomatology, epidemiological exposure and results of serological testing [3].

Alberta is a Canadian province of approximately 4 million people where laboratory testing is publicly funded. Provincially available serological markers include HBsAg, HB surface antibody (anti-HBs), HB e antigen (HBeAg), HB e antibody (anti-HBe), total antibody to HB

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core antigen (anti-HBc), and immunoglobulin M antibody to HB core antigen (anti-HBc IgM). Currently, multiple clinical laboratories (both public and private) provide HBV serological testing, however not all laboratories in the province perform testing for all available serological markers. Specimens with specific serological testing not available at the submitting laboratory site are reflexed to a second laboratory site with the capacity to test and report the remaining markers. Concerns were raised by provincial laboratory staff regarding single serology specimens having duplicate testing performed during the specimen referral process from one laboratory to another.

In response to this concern, we previously examined the number of duplicate HBV serology tests between 2004 and 2014 and confirmed that duplication was unintentionally occurring at a provincial level due to a lack of specimen testing protocols between private and public clinical laboratories. The most duplicated markers were HBsAg and anti-HBs, which are also the most commonly performed HBV serology tests. Duplicate testing of these two markers alone cost the provincial public healthcare system \$221,613.64 CAD in supply costs in 2014 based on 2019 cost estimates [4].

In response to this preliminary analysis, a pilot intervention was proposed in an attempt to reduce costs to the public healthcare system. This intervention involved stamping paper requisitions to indicate if specific serological marker testing had been completed on all serology requests between two laboratories. The aim of this quality improvement project was to determine the amount of duplicate testing and related costing pre- and post-stamp implementation.

2. Methods

HBV serological screening results from two laboratory sites for HBsAg, anti-HBs, anti-HBc, and anti-HBc IgM markers tested between January 1, 2015 and December 31, 2017 were extracted and analyzed. Both sites performed serological testing using the ARCHITECT® platform (Abbott, Ireland) as per manufacturer's instructions [5–8]. Personal healthcare numbers (PHN; unique codes given to each Albertan resident for health services billing) were extracted and used to identify if testing was performed at both laboratory sites. Duplicate testing was defined as any serological testing performed at both laboratory sites within a 3-day window (excluding any testing repeated at the same site).

The intervention was a stamp applied to paper requisition forms to indicate if anti-HBs or HBsAg serological testing had already been performed at Laboratory A. When Laboratory B received a specimen along with a requisition with this stamp applied to it, staff at Laboratory B would perform the remaining tests ordered, but not those listed on the requisition stamp. The requisition stamp was implemented in 2016 between May and August. During this implementation period, the process was formalized at both laboratory sites and staff were educated. Neither anti-HBc and anti-HBc IgM were included on the stamp but were included in this analysis to act as a control for specimen testing trends over this time period. The annual number and costing of duplicate tests were compared pre- and post-stamp implementation for 2015 and 2017, respectively. Supply costing estimates, excluding cost of labor, from 2019 were used to calculate current cost savings and are reported in Canadian dollars (CAD).

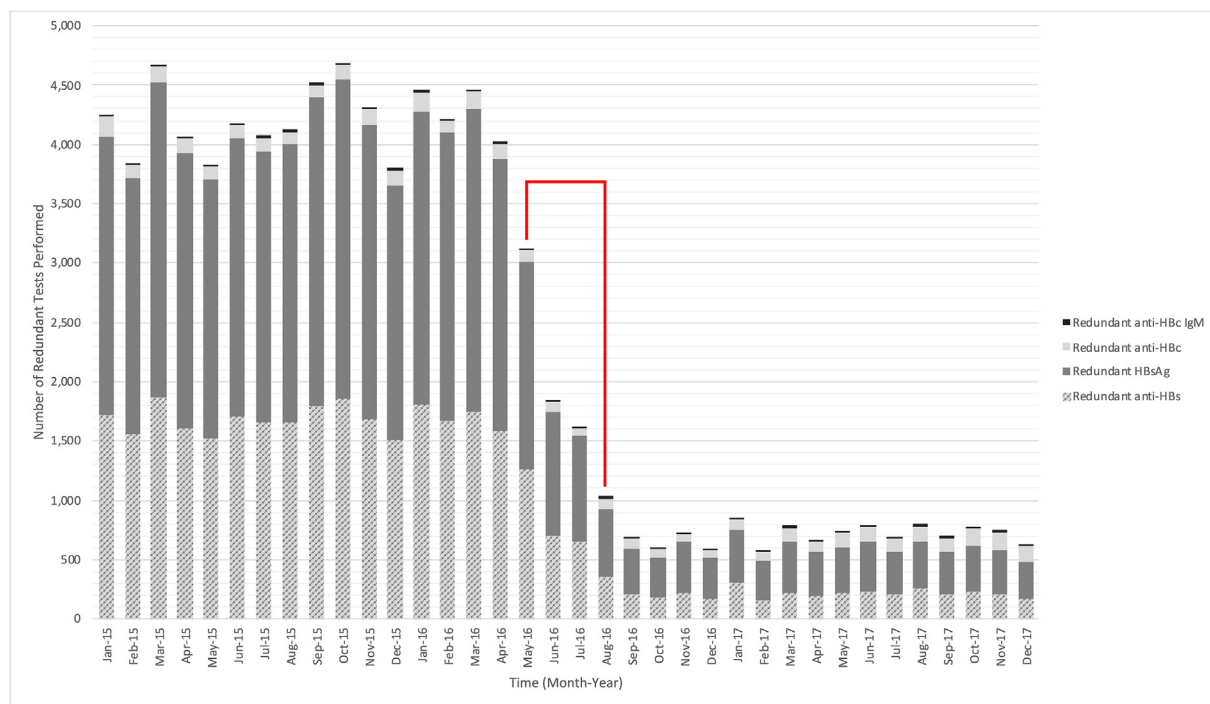


Fig. 1. Number of duplicate HBsAg ($n = 48,649$), anti-HBs ($n = 33,277$), anti-HBc ($n = 4,012$) and anti-HBc IgM ($n = 555$) serology performed between January 2015 and December 2017. The stamp implementation period between May 2016 and August 2016 is indicated by the red bracket.

Research ethics approval was obtained from the University of Alberta Health Research Ethics Board.

3. Results

A total of 803,637 serological screening results between January 1, 2015 and December 31, 2017, with valid PHN and result, were extracted and analyzed. Serological markers from both sites included HBsAg ($n = 395,222$), anti-HBs ($n = 323,163$), anti-HBc ($n = 74,839$) and anti-HBc IgM ($n = 10,413$).

The number of duplicate tests ($n = 86,493$) for each serological marker are shown in Fig. 1. In 2015, 20.8% (28,545 of 137,126 tests) of the HBsAg tests were redundant, and in 2017, 3.7% (4,604 of 124,123 tests) of the HBsAg tests were redundant. In 2015, 18.4% (20,151 of 109,294 tests) of the anti-HBs tests were redundant, and in 2017, 2.5% (2,593 of 103,893 tests) of the anti-HBs tests were redundant; a decrease of over 82% in the proportion of redundant testing for these two assays. These data represent an annual cost savings of \$86,427.01 and \$82,522.60 in supply costs for HBsAg and anti-HBs, respectively. In contrast, the amount of duplicate testing for serological markers not included on the stamp remained relatively constant. In 2015, 6.7% (1,454 of 21,848 tests) of the anti-HBc tests were redundant, and in 2017, 5.0% (1,361 of 27,027 tests) of the anti-HBc tests were redundant. In 2015, 5.8% (197 of 3,388 tests) of the anti-HBc IgM tests were redundant, and in 2017, 5.7% (202 of 3,548 tests) of the anti-HBc IgM tests were redundant.

4. Discussion

While the overutilization of laboratory services [9] and duplicate testing occurring upon patient transfer [10] has been documented in the literature, the internal processes within and between laboratory services can often be overlooked. Without the periodic review of test ordering and processing practices at the laboratory site level, duplicate testing can go undetected, ultimately creating unnecessary costs. In this case, it was not until our retrospective review in 2015 that the impact of duplicate testing between laboratory service providers was highlighted.

When laboratory testing is stratified across multiple laboratory information systems and identical testing is offered at multiple sites within the same healthcare system, as is in Alberta, the chance of unnecessary duplicate testing is increased. It becomes an inevitable consequence when there is a lack of communication between laboratory service providers. There is a significant cost to validate and test all serological markers at additional laboratory sites (particularly for low volume testing). Therefore, requirements for all laboratories to provide all hepatitis markers (in an effort to reduce duplicate testing), are often impractical. Panel testing could be routed only to laboratories that have the capability of running all requested testing, however, pre-existing service agreements for individual laboratories should be considered. Clinical decision support tools have been successfully used to reduce duplicate testing [11], but are also costly, and require an integrated electronic medical system that is not available in resource-limited jurisdictions.

Overall, the requisition stamp initiative was effective in reducing the number of duplicate tests performed between the two laboratory sites. Ongoing efforts are still being made to address the low, but persistent, level of duplicated testing. In the absence of an electronic test gating system, and without using significant amounts of staff time to check if testing had been previously been performed and reported, stamping requisitions provided a simple, low-cost yet effective means to improve communication. A similar approach could be easily applied to other testing situations where various laboratories, using paper-based requisitions, are dependent on others to complete testing panels.

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CRedit authorship contribution statement

Amrit Passi: Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Sabrina S. Plitt:** Formal analysis, Writing - review & editing. **Carmen L. Charlton:** Conceptualization, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.plabm.2021.e00205>.

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