# Random Selection for the Merit Performance Audit

# 2015/16

UPHOLDING FAIR HIRING IN THE
BC PUBLIC SERVICE

Prepared by the Office of the Merit Commissioner
with support from BC Stats

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# Background

The Office of the Merit Commissioner (the Office) was established by legislation as an independent office in 2006. The Merit Commissioner is responsible for performing annual audits of BC Public Service appointments to monitor the application of the merit principle under section 8 of the *Public Service Act* (the *Act*). The audits assess whether recruitment and selection practices have resulted in appointments based on merit, and whether individuals possessed the required qualifications for the position to which they were appointed. The results of the audits are reported to the Legislative Assembly, organization heads, and the Deputy Minister of the BC Public Service Agency.

In previous years, BC Stats conducted the sampling and resulting statistical analysis, as well as the preparation of this report. This year represents a change as BC Stats drew the first three samples, and provided direction and support to the Office for drawing the fourth sample, conducting the statistical analysis, and preparing this report.

Table 1 summarizes the in-scope population and sample totals of appointments across audit years since the establishment of the Office as an independent office in 2006. In the 2015/16 audit, the sampling rate was set at 6%, which meant 321 appointments were audited from an adjusted population of 5,343 appointments occurring during this period.[1] The Office has always and continues to strive for generalization of the audit results to the population of appointments.

| Table 1: Year-Over-Year Comparison of In-Scope Population and Sample Counts | | | |
|---|---|---|---|
| Year | Number of Appointments | Number of Audits | Sampling Rate |
| 2006 | 3,754 | 308 | 8.2% |
| 2007 | 5,508 | 531 | 9.6% |
| 2008[1] | n/a | n/a | n/a |
| 2009 | 2,429 | 302 | 12.4% |
| 2010[2] | 942 | 183 | 19.4% |
| 2011 | 3,942 | 222 | 5.6% |
| 2012 | 3,928 | 256 | 5.8% |
| Fiscal 2013/14[3] | 2,010 | 150 | 7.5% |
| Fiscal 2014/15 | 3,915 | 243 | 6.2% |
| Fiscal 2015/16 | 5,343 | 321 | 6.0% |

**Note 1:** An audit was not conducted in 2008.
**Note 2:** The 2010 audit was a partial year audit, covering appointments from September 1 to December 31, 2010.
**Note 3:** The 2013/14 audit was the first fiscal year audit, which covered seven months of appointments from September 1, 2013 to March 31, 2014.

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[1] See section titled "Sample Selection" for a full discussion of the number of appointments originally put forward for audit. A certain proportion, upon review, was deemed out of scope and this proportion was then estimated back into the original population.

## Appointment Population

The 2015/16 audit timeframe was April 1, 2015 to March 31, 2016. The types of appointments audited included permanent appointments and temporary appointments of more than seven months. The remaining appointments within the Merit Commissioner's jurisdiction of appointments made under Section 8 of the *Act*, such as auxiliary appointments and temporary appointments of seven months or less, were excluded from the audit population. Unlike previous years, direct appointments under section 10(b) of the *Act* were not included in the 2015/16 audit (see the report on the Merit Performance Audit 2015/16 for details). Based on these parameters, a total population of 5,474 appointments was identified.

## Sample Selection

### Objectives

The objective of the merit performance audit is to randomly sample all permanent appointments and temporary appointments greater than seven months in order to obtain an unbiased picture of the application of the merit principle under the *Act*. A simple random sample is considered a statistically representative sample of the population of appointments, from which results can be generalized to the total population of appointments[2].

Stratifying the population prior to sampling to achieve a proportionally representative sample for specific groups has been conducted in the past, but has resulted in complex sampling schemes. As well, stratification has the potential to reduce statistical efficiency if the strata do not represent homogeneous subpopulations. In an effort to manage these concerns, the degree of stratification has been reduced over the last several audits to the strata believed to be most meaningful. For the 2015/16 audit, organization size (over 1,000 employees and under 1,000 employees) was eliminated as a strata because there has been insufficient evidence of hiring practices varying by organization size. In 2015/16, one key characteristic of the population was used for stratification—appointment type (permanent appointment and temporary appointment of more than seven months).

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[2] See section titled "Estimates and Confidence Intervals" for more details about the precision of results from this audit.

## Random Selection of Cases

Eligible BC Public Service appointments took place across the entire fiscal year. In order to run an efficient audit and provide timely feedback, the Office divided the year into four sampling intervals. An appointment population list of eligible appointments was obtained from the BC Public Service Agency and the Liquor Distribution Branch (appointment details are stored independently for this organization) for each of the following sampling intervals:

➢ April 1 – June 30, 2015;

➢ July 1 – September 30, 2015;

➢ October 1 – December 31, 2015; and

➢ January 1 – March 31, 2016.

Prior to selecting the sample, the Office reviewed each appointment population list to identify employees appearing more than once in the population list. These entries were investigated by the Office to determine whether they represented unique and eligible appointments for the audit. Any appointments deemed ineligible or duplicate entries were removed from the population list. For each sampling interval, the lists from the BC Public Service Agency and the Liquor Distribution Branch were combined to form a single appointment population list from which the sample could be drawn.

For the 2015/16 audit which began in April 2015, the sampling rate was set at 6%. Sampling rates were adjusted slightly up or down for each sample drawn based on rounding and in an effort to ensure an adequate number of appointments represented the strata. Efforts were made to reach as close to a true sampling rate of 6% as possible, regardless of rounding error.

For each of the first three sampling intervals, a cumulative list of appointments made was provided to BC Stats. The Office drew the fourth sample, with the instruction, guidance and support of BC Stats. For each interval, the list was stratified by appointment type (permanent appointment and temporary appointment of more than seven months) and a 6% sampling rate was then applied to the strata to draw a random sample. The only variation in sampling technique was that the Office used a random number generator to randomize the appointments for selection of the sample, rather than the previously used software package for statistical analysis (SPSS) used by BC Stats.

Table 2 summarizes the four independent samples drawn during the 2015/16 fiscal year period for auditing. As none of the population sizes were evenly divisible by their respective systematic sample rate, the actual sampling rates slightly differed from the systematic rates.

| Table 2: 2015/16 Sample and Population Counts and Rates | | | | |
|---|---|---|---|---|
| Sampling Interval | Population | Sample Size | Systematic Sampling Rate | Actual Sampling Rate |
| Apr 1 – Jun 30, 2015 | 1414 | 85 | 6.0% | 6.01% |
| Jul 1 – Sep 30, 2015 | 1414 | 85 | 6.0% | 6.01% |
| Oct 1 – Dec 31, 2015 | 1160 | 70 | 6.0% | 6.03% |
| Jan 1 – Mar 31, 2016 | 1486 | 89 | 6.0% | 5.99% |
| **Total** | 5474 | 329 | 6.0% | 6.01% |

In 2015/16, as in previous audits, certain portions of the population were under-sampled so as to better optimize the distribution of the full sample. A post-stratification weighting adjustment ensured that any bias introduced by disproportionate sampling was minimized in the final population estimates. In total, a set of eight unique weights were created to adjust for bias in the overall sample.

Of the 329 randomly-sampled appointments, the Office, in conjunction with the BC Public Service Agency, identified eight cases as being out-of-scope, primarily due to coding errors in the source data. These eight cases were removed from the sample, leaving 321 in-scope appointments, which were all subsequently audited. The Office, with the support of the BC Stats, used the strata information to estimate back into the original population how many cases would likely be deemed out-of-scope if the entire population of cases had been audited. The statistics presented in the next section of the report are based on this reduced population—321 in-scope appointments out of an adjusted in-scope population of 5,343.

## Distribution of Audits

Table 3 shows how the audits are distributed according to the sample stratification of appointment type. Percentages were rounded to the first decimal place, and total to 100%.

The close correspondence between the sample percentages and percentages within all appointments on the strata indicates that the proportions mimic those of the total population. As discussed above, unique weights were created to adjust for bias in the overall sample. The adjusted numbers of appointments in Table 3 reflect the weight-adjusted in-scope number of appointments for each sample stratification type. Each stratum has unique in-scope weights attributed to the appointments dependent upon appointment type and sampling interval.

| Table 3: Audits by Appointment Type | | | | |
|---|---|---|---|---|
| **Appointment Type** | **Adjusted Number of Appointments** | **Per Cent of all Appointments** | **Number of Audits** | **Per cent of All Audits** |
| Permanent Hire | 5057 | 94.6% | 302 | 94.1% |
| Temporary > 7 Months | 286 | 5.4% | 19 | 5.9% |

## Estimates and Confidence Intervals

In order to apply confidence intervals to the estimates for the 2015/16 audit, the Office employed a methodology that was similar to what was used in audits from 2010 to 2014/15. As with those previous audits, the confidence intervals in 2015/16 were based on a Poisson distribution, whereas the confidence intervals from years prior to 2010 employed an F-distribution. While both methods provided accurate estimates, the Poisson offered a greater degree of flexibility, particularly for generating estimates for "rare events". For the purposes of the merit findings and the performance audit report, a "rare event" would include findings of "merit not applied" and "did not demonstrate".

In order to minimize sample bias and produce the best estimates, the micro data was weighted prior to generating the estimates. Due to year-over-year changes in sampling rates and adjustments to the audit program, caution should be used when interpreting the cumulative audit results.

The 95% confidence interval can be interpreted as: the true statistic would be found within the upper and lower bounds for that interval 95 times out of 100 with repeated sampling. In Table 4, the true population estimate for the "merit not applied" and "merit with exception" findings will lie within the lower and upper bounds of the respective confidence intervals 19 times out of 20. Given the extremely low occurrence of the "did not demonstrate" findings, the "did not demonstrate" results should not be generalized to the population of appointments.

| Table 4: Estimated Audit Findings and Confidence Intervals | | | | |
|---|---|---|---|---|
| **Audit** | **Audit Finding** | **Estimate (weighted)** | **95% Confidence Interval** | |
| | | | **Lower** | **Upper** |
| All Audits (2001 – 2015/16)[1] | Merit Not Applied | 4.7% | 3.9% | 5.6% |
| | Did Not Demonstrate[2] | 1.2% | 0.8% | 1.7% |
| Fiscal 2015/16 Audit | Merit Not Applied | 5.9% | 3.4% | 8.7% |
| | Did Not Demonstrate[2] | 0.3% | 0.0% | 1.1% |
| | Merit With Exception | 51.5% | 43.9% | 59.5% |

**Note 1:** As appointments for the 2010 audit were only drawn from a four month period, these results were not incorporated into the cumulative year-over-year results.
**Note 2:** Estimates for "did not demonstrate" findings are not reliable given the extremely low occurrence of this event.

In the 2015/16 audit, it is estimated that appointments with a "merit not applied" finding make up an estimated 5.9% of all appointments. The true proportion of appointments with a "merit not applied" finding may lie as low as 3.4% and as high as 8.7% in the total population. The true proportion of appointments with a "merit with exception" finding may lie as low as 43.9% and as high as 59.5%.

## Uses and Limitations of Audit Results

BC Stats has assisted the Office to draw representative sample populations to inform merit principle application trends for the whole population of appointments in a given time period. A certain degree of error and uncertainty is normally expected in sampling, as well as in the statistics of interest, and the ranges of their probabilities. This expectation of error is captured through the application of the confidence interval. The confidence interval level (here 95%) describes the level of precision associated with a sampling method given a range of possibilities both above and below the found statistic (± a percentage range).

As sample size increases, the likelihood of variance (or difference within the samples when compared to one another) decreases, and so does the error associated with the sampling. However, it is the sample size in relation to the population size that is of importance. Samples should always strive to achieve the lowest possible ranges on those statistics and as such, the confidence in being able to say that the samples represent the true population of appointments must be considered with the results of the confidence intervals in mind.

The appointments selected for audit are random samples of all appointments, representative of the strata used in the sampling process occurring between April 1, 2015 and March 31, 2016. In terms of

year-over-year comparisons, the number of audits conducted in fiscal 2015/16 (321) was more than in 2014/15 (243), and was the result of a larger population of appointments. One difference between the two populations of appointments is the exclusion of direct appointments in 2015/16. An analysis was conducted to recalculate the 2014/15 fiscal audit results for an equivalent population. The change to the final results was negligible, suggesting that the fiscal 2015/16 audit results can reliably be compared to the fiscal 2014/15 results (see Appendix A for details).

Considering the sample sizes used and the consistently applied sampling methodology, the results from the 2015/16 merit performance audit offer a reasonable degree of comparability to previous year's audit findings. Given the precision of the estimates, the samples and subsequent audit findings (excluding estimates for the "did not demonstrate" finding) can be stated to be of reasonable statistical strength.

## Appendix A

### Direct Appointments Removed for Comparison – Merit Performance Audit 2014/15

In order to compare results with confidence, analyses for 2014/15 were repeated with the removal of the direct appointments and associated stratum. The population of appointments dropped from 4,045 to 4,029, the number of in-scope appointments reduced from 243 to 238, and the adjusted in-scope population changed from 3,915 to 3,903. Table 5 demonstrates the results of the 2014/15 audit with an equivalent population to the 2015/16 audit. The estimate for "merit with exception" changed from 32.7% to 32.8%, and the associated upper bound increased from 40.1% to 40.2%. This small change in the results suggests that the 2015/16 audit results can reliably be compared to the 2014/15 results.

| Table 5: Estimated Audit Findings and Confidence Intervals (2014/15) with Direct Appointments Removed | | | | |
|---|---|---|---|---|
| **Audit** | **Audit Finding** | **Estimate (weighted)** | **95% Confidence Interval** | |
| | | | **Lower** | **Upper** |
| All Audits (2001 – 2014/15) | Merit Not Applied | 4.6% | 3.7% | 5.5% |
| Fiscal 2014/15 Audit | Merit Not Applied | 8.4% | 5.0% | 12.2% |
| | Merit With Exception | 32.8% *(32.7%)* | 25.7% | 40.2% *(40.1%)* |

**Note:** Values that changed once direct appointments are removed are printed twice; the 2014/15 values which include direct appointments in the population are in parentheses and are italicized. Values that are printed once were identical in both analyses.