**Supplementary Material**

**Some calculation formulas:**

1. Occurrence of Error as Percentages:
   * Formula: Occurrence of error as percentages = multiples of error \* input TEa (or input MAU)
   * Multiples of error: a list containing various multiples of the error ranging from -2.00 to +2.00
2. Occurrence of Error as Standard Deviations:
   * Formula: Occurrence of error as SDs = occurrence of error as percentages / imprecision input
3. Probability of false rejection (Pfr) (single rule scheme):
   * Pfr =1 - ((norm.cdf(1ks QC rule) - norm.cdf(-1ks QC rule)) ^ number of QC measurement)
4. Probability of Error Detection for QC Rules (Ped) (single rule scheme):
   * Formula: Ped = 1 - (norm.cdf(1ks QC rule - occurrence of error as SDs) - norm.cdf(-1ks QC rule - occurrence of error as SDs)) ^ number of QC measurement
5. Average Run Length to Error Detection (ARLed):
   * Formula: ARLed = 1/ Ped
6. The expected number of patient test results generated between the time an out-of-control condition occurs and the next QC event (E(N0)):
   * Formula: E(N0) = E(NB) / 2
   * E(NB): Expected Number of Patient Samples Between QC Events (from user input)
7. Average number of patient samples processed from the start of the out-of-control condition to QC detection E(NP):
   * Formula: E(NP) = E(N0) + E(NB) \* (1 / Ped - 1)
8. Probability of Exceeding TEa In-Control (P(TEa in-control)):
   * Formula: P(TEa in-control) = norm.cdf(-sigma value without bias - bias as multiples of CV) + (1 - norm.cdf(sigma value without bias - bias as multiples of CV))
   * Norm: normal distribution package of SciPy stats module
   * Cdf: cumulative distribution function
9. Probability of Exceeding TEa Out-of-Control (P(TEa out-of-control)):
   * Function Definition: P(TEa out-of-control) = norm.cdf(-(sigma value without bias + bias as multiples of CV + error as SD)) + (1 - norm.cdf(sigma value without bias - bias as multiples of CV - error as SD))
10. Incremental Probability of Exceeding TEa (ΔPE):
    * Formula: ΔPE = P(TEa in-control) - P(TEa out-of-control)
11. Expected Number of Unreliable Results (E(Nu)):
    * Formula: E(Nu) = E(NP) \* (ΔPE)
    * E(Np): Mean number of patient samples processed from the start of an out-of-control condition to QC detection
12. Percentage of Unreliable Results (UnR%):
    * Formula: UnR% = E(Nu) \* 100 / E(Np)
13. Expected Number of Unreliable Final Patient Results (E(Nuf)):
    * Formula: E(Nuf) = ΔPE \* [(ARLed-1) \* E(NB) - (1-Ped) \* (E(NB)-E(N0))]
    * ΔPE: the increase in the probability of producing unacceptable patient outcomes due to the presence of an out-of-control error condition
    * E(N0): Expected Number of Patient Test Results Before Next QC
    * E(NB): Expected Number of Patient Samples Between QC Events (from user input)
14. Expected Number of Correctable Unreliable Results (E(Nuc)):
    * Formula: E(Nuc) = ΔPE\*[Ped\*E(N0) + (1 - Ped)\*E(NB)]
    * ΔPE: the increase in the probability of producing unacceptable patient outcomes due to the presence of an out-of-control error condition
    * E(NB): expected number of patient samples between QC Events (from user input)
    * E(N0): Expected number of patient test results generated between the time an out-of-control condition occurs and the next QC event which is calculated as half of E(NB)
15. Maximum E(Nuf) (Max E(Nuf)):
    * Formula: Max E(Nuf): max(E(Nuf list))
16. Calculate Max Run Size:

* Formula: Max run size result = (E(NB) / Max E(Nuf)) \* patient risk factor input