

Table 1

The effect of increases or decreases in testing parameters on performance parameters (median percentage savings (MPS), probabilities of savings exceeding 75% ($Pr > S_{75\%}$) and minimum negative predictive values (MinNPV)) using the Modified Simple Pooling and Modified Halving Protocols

Testing Parameter Change		Effect on Performance Parameter		
		MPS	$Pr > S_{75\%}^b$	MinNPV
Prevalence	Increase	Decrease	Decrease ^c	Decrease
	(Decrease)	(Increase)	(Increase) ^c	(Increase)
Pool size	Increase	Protocol	Protocol	Increase
	(Decrease)	dependent	dependent	(Decrease)
Herd Size	Increase	No	Protocol	Increase ^d
	(Decrease)	change ^a	dependent	(Decrease) ^d
Sensitivity	Increase	Increase	Increase ^c	Increase
	(Decrease)	(Decrease)	(Decrease) ^c	(Decrease)

^aWidth of the distribution narrowed with increased herd size

^bProbabilities of savings exceeding 50% ($Pr > S_{50\%}$) varied in an identical manner

^cRemained invariant when probabilities were either 0 or 1

^dChanges were minimal

Table 2

Probability that the number of tests required to classify all individuals in a herd of 1000 animals after randomly allocating samples into pools of 5, 10, 20 and 50, respectively, will exceed the number of tests required when a pool size of 10 is used for various prevalences (P) and test sensitivities, given perfect test specificity

P	Pool Size	Sensitivity									
		Modified Simple Pooling					Modified Halving				
		0.5	0.6	0.7	0.8	0.9	0.5	0.6	0.7	0.8	0.9
0.01	5	1	1	1	1	1	1	1	1	1	1
	^a 10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	20	0.08	0.11	0.14	0.19	0.22	< 0.01	<0.01	<0.01	<0.01	<0.01
	50	0.65	0.81	0.91	0.96	0.98	0.01	0.02	0.07	0.17	0.36
0.05	5	0.99	0.98	0.96	0.93	0.87	1	1	1	1	1
	^a 10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	20	0.80	0.89	0.95	0.98	0.99	0.10	0.23	0.42	0.66	0.87
	50	0.94	0.98	1	1	1	0.38	0.67	0.89	0.98	1
0.10	5	0.82	0.63	0.43	0.24	0.10	1	1	1	0.99	1
	^a 10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	20	0.76	0.85	0.92	0.97	0.99	0.21	0.41	0.62	0.82	0.96
	50	0.75	0.85	0.93	0.98	1	0.35	0.61	0.83	0.97	1

^aComparisons with pool size of 10 represent a comparison with an identical distribution.

Table 3

Probability that savings attributable to Modified Simple Pooling and Modified Halving Protocols will exceed 75% of the cost of individual testing for various pool sizes, prevalences (P) and test sensitivities for a herd of 1000 animals given perfect test specificity

P	Pool Size	Sensitivity									
		Modified Simple Pooling					Modified Halving				
		0.5	0.6	0.7	0.8	0.9	0.5	0.6	0.7	0.8	0.9
0.01	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	10	0.17	0.05	0.01	<0.01	<0.01	0.99	0.95	0.82	0.55	0.16
	20	0.87	0.72	0.50	0.29	0.13	1	1	1	1	0.87
	50	0.37	0.19	0.08	0.02	0.01	1	0.99	0.96	0.86	0.37
0.05	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	20	<0.01	<0.01	<0.01	<0.01	<0.01	0.46	0.06	<0.01	<0.01	<0.01
	50	<0.01	<0.01	<0.01	<0.01	<0.01	0.30	0.04	<0.01	<0.01	<0.01
0.10	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	20	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
	50	<0.01	<0.01	<0.01	<0.01	<0.01	0.09	<0.01	<0.01	<0.01	<0.01

Table 4

Median, 2.5 and 97.5 percentiles for the distribution of savings as a percentage of the cost of individual testing for Modified Simple Pooling and Modified Halving Protocols at various prevalences (P), pool sizes and test sensitivities for a herd of 1000 animals given perfect test specificity

P	Pool Size	Sensitivity									
		Modified Simple Pooling					Modified Halving				
		0.5	0.6	0.7	0.8	0.9	0.5	0.6	0.7	0.8	0.9
0.01	5	56 (55, 58)	56 (55, 57)	56 (55, 57)	56 (55, 57)	55 (55, 56)	57 (56, 58)	57 (56, 58)	57 (56, 58)	56 (55, 57)	56 (55, 56)
	10	74 (71, 77)	73 (71, 76)	72 (70, 75)	73 (71, 76)	71 (70, 73)	77 (75, 79)	77 (75, 78)	76 (74, 78)	75 (74, 77)	74 (73, 76)
	20	78 (73, 84)	76 (72, 82)	76 (71, 80)	76 (72, 82)	73 (71, 78)	86 (83, 89)	85 (81, 88)	84 (80, 87)	82 (79, 85)	81 (79, 83)
	50	71 (56, 86)	66 (52, 81)	62 (52, 76)	66 (52, 81)	57 (47, 71)	88 (80, 95)	85 (77, 93)	83 (75, 90)	80 (72, 88)	75 (70, 83)
0.05	5	47 (44, 50)	45 (43, 48)	44 (41, 46)	43 (40, 45)	42 (40, 44)	51 (49, 54)	49 (47, 52)	45 (45, 50)	45 (43, 48)	43 (42, 45)
	10	56 (50, 63)	53 (47, 59)	50 (45, 56)	47 (42, 52)	45 (41, 50)	69 (65, 73)	66 (62, 70)	63 (59, 67)	59 (56, 63)	56 (53, 59)
	20	51 (39, 63)	46 (34, 57)	40 (29, 51)	36 (27, 46)	32 (23, 40)	74 (68, 81)	70 (62, 76)	64 (56, 71)	58 (51, 65)	52 (46, 58)
	50	37 (17, 61)	32 (12, 52)	22 (7, 42)	17 (2, 32)	8 (-2, 22)	72 (57, 85)	62 (47, 77)	54 (36, 69)	44 (29, 59)	31 (19, 46)
0.10	5	37 (34, 42)	34 (30, 38)	32 (28, 35)	29 (26, 33)	28 (25, 31)	45 (42, 48)	41 (38, 45)	37 (34, 41)	34 (31, 37)	30 (27, 33)
	10	42 (34, 50)	36 (29, 44)	31 (24, 39)	27 (21, 34)	23 (18, 30)	61 (56, 66)	56 (50, 61)	50 (44, 56)	44 (38, 49)	38 (33, 42)
	20	37 (24, 50)	29 (17, 42)	22 (11, 34)	15 (6, 26)	10 (2, 19)	66 (57, 74)	58 (48, 67)	49 (39, 58)	39 (30, 49)	29 (21, 38)
	50	32 (12, 56)	27 (7, 47)	17 (2, 37)	8 (-2, 27)	3 (-2, 17)	66 (49, 80)	54 (36, 72)	41 (24, 59)	29 (13, 44)	14 (1, 29)

Table 5

Minimum negative predictive values obtained from the distribution of test results for the Modified Simple Pooling and Modified Halving Protocols as a function of prevalence (P), pool size and test sensitivity for a herd of 1000 given perfect test specificity.

P	Pool Size	Sensitivity									
		Modified Simple Pooling					Modified Halving				
		0.5	0.6	0.7	0.8	0.9	0.5	0.6	0.7	0.8	0.9
0.01	5	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
	10	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
	20	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
	50	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
0.05	5	0.95	0.96	0.97	0.97	0.98	0.95	0.95	0.96	0.96	0.98
	10	0.95	0.96	0.96	0.97	0.98	0.95	0.95	0.96	0.96	0.97
	20	0.95	0.96	0.96	0.97	0.98	0.95	0.95	0.96	0.96	0.97
	50	0.95	0.95	0.96	0.97	0.98	0.95	0.95	0.95	0.96	0.97
0.10	5	0.91	0.92	0.93	0.95	0.97	0.90	0.91	0.92	0.94	0.96
	10	0.91	0.92	0.93	0.94	0.97	0.90	0.91	0.92	0.93	0.96
	20	0.91	0.92	0.93	0.95	0.97	0.90	0.91	0.92	0.93	0.95
	50	0.91	0.91	0.92	0.94	0.96	0.90	0.90	0.91	0.93	0.94

Table 6

Overall optimality rankings of different pool sizes for Modified Simple Pooling(MSP) and Modified Halving (MH) Protocols at prevalences of 0.01, 0.05 and 0.1 assuming
(i) invariant sensitivity and (ii) reduced sensitivity with increase in pool size

Ranking	Prevalence				
	0.01	0.05		0.1	
	(i)(ii)	(i)	(ii)	(i)	(ii)
1	MH ₂₀	^a MH ₂₀	MH ₅₀	MH ₁₀	MH ₅₀
2	MH ₅₀	^a MH ₁₀	MH ₂₀	MH ₂₀	MH ₂₀
3	MH ₁₀	MH ₅₀	MH ₁₀	MH ₅₀	MH ₁₀
4	MSP ₂₀	MSP ₁₀	MSP ₁₀	MH ₅	MH ₅
5	MSP ₁₀	MH ₅	MH ₅	MSP ₁₀	MSP ₅₀
6	MSP ₅₀	MSP ₂₀	MSP ₂₀	MSP ₅	MSP ₁₀
7	MH ₅	MSP ₅₀	MSP ₅₀	MSP ₂₀	MSP ₂₀
8	MSP ₅	MSP ₅	MSP ₅	MSP ₅₀	MSP ₅

^aParticularly for Se from 0.5 to 0.7

Table 7

Probability that savings attributable to Modified Simple Pooling and Modified Halving Protocols would exceed 50% of the cost of individual testing for various pool sizes, prevalences (P) and test sensitivities for a herd of 1000 animals given perfect test specificity

P	Pool Size	Sensitivity									
		Modified Simple Pooling					Modified Halving				
		0.5	0.6	0.7	0.8	0.9	0.5	0.6	0.7	0.8	0.9
0.01	5	1	1	1	1	1	1	1	1	1	1
	10	1	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	1	1	1	1	1	1
	50	1	1	0.99	0.98	0.96	1	1	1	1	1
0.05	5	0.02	<0.01	<0.01	<0.01	<0.01	0.88	0.33	0.02	<0.01	<0.01
	10	0.98	0.84	0.49	0.16	0.02	1	1	1	1	1
	20	0.55	0.18	0.03	<0.01	<0.01	1	1	1	0.99	0.73
	50	0.17	0.04	<0.01	<0.01	<0.01	1	0.94	0.64	0.17	0.01
0.10	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	10	0.02	<0.01	<0.01	<0.01	<0.01	1	0.98	0.48	0.01	<0.01
	20	0.02	<0.01	<0.01	<0.01	<0.01	1	0.94	0.39	0.01	<0.01
	50	0.09	0.01	<0.01	<0.01	<0.01	0.97	0.66	0.16	0.01	<0.01

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