

Supplemental Material: Consistent Comparison of Symptom-based Methods for COVID-19 Infection Detection

authors

ABSTRACT

A Results

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	53.11 (53.02 - 53.21)	52.53 (51.78 - 53.28)	56.02 (55.66 - 56.38)	39.15 (38.09 - 40.21)	50.47 (50.13 - 50.81)
Menni_2	63.94 (63.72 - 64.16)	58.46 (57.75 - 59.16)	57.84 (57.48 - 58.20)	58.57 (57.32 - 59.81)	65.12 (64.82 - 65.43)
Roland	59.21 (59.08 - 59.33)	62.28 (61.55 - 63.00)	65.78 (65.40 - 66.16)	57.59 (56.31 - 58.87)	64.96 (64.65 - 65.27)
Smith	72.10 (72.02 - 72.17)	56.26 (55.54 - 56.98)	57.46 (57.14 - 57.78)	50.75 (49.86 - 51.65)	63.97 (62.01 - 65.93)
Zoabi_55	90.43 (90.18 - 90.67)	35.24 (34.00 - 36.47)	49.00 (48.47 - 49.54)	37.36 (35.86 - 38.86)	65.39 (64.72 - 66.07)
Zoabi_65	90.68 (90.50 - 90.87)	35.28 (33.87 - 36.69)	48.55 (47.92 - 49.17)	37.82 (36.26 - 39.38)	65.04 (64.50 - 65.57)
CDC	88.09 (88.03 - 88.16)	88.44 (88.03 - 88.85)	89.16 (88.96 - 89.37)	86.99 (86.36 - 87.63)	88.57 (88.35 - 88.79)
Shoer	61.40 (61.30 - 61.50)	61.75 (61.05 - 62.46)	65.55 (65.15 - 65.94)	58.24 (57.27 - 59.20)	64.24 (63.93 - 64.56)
Bhattacharya	60.08 (60.00 - 60.16)	61.97 (61.24 - 62.70)	63.43 (63.10 - 63.77)	60.72 (59.92 - 61.53)	63.50 (63.18 - 63.82)
WHO	13.88 (13.82 - 13.94)	16.63 (16.15 - 17.11)	13.51 (13.25 - 13.78)	23.66 (22.98 - 24.35)	19.32 (19.04 - 19.59)
Perez	45.71 (45.62 - 45.80)	46.14 (45.40 - 46.87)	47.83 (47.47 - 48.18)	39.22 (38.37 - 40.07)	50.64 (50.31 - 50.98)
Mika	59.17 (59.09 - 59.25)	62.25 (61.52 - 62.98)	62.90 (62.57 - 63.22)	55.67 (54.80 - 56.54)	61.18 (60.85 - 61.51)
Akinbami_1	6.94 (6.89 - 6.99)	6.51 (6.15 - 6.87)	5.03 (4.86 - 5.19)	7.70 (7.22 - 8.18)	9.93 (9.71 - 10.16)
Akinbami_2	7.99 (7.94 - 8.05)	5.07 (4.78 - 5.35)	5.88 (5.72 - 6.04)	7.21 (6.74 - 7.68)	9.51 (9.31 - 9.72)
Akinbami_3	16.88 (16.81 - 16.95)	15.28 (14.80 - 15.76)	12.27 (12.00 - 12.54)	15.49 (14.83 - 16.14)	17.95 (17.70 - 18.20)
Salomon	18.98 (18.91 - 19.05)	18.70 (18.14 - 19.26)	15.94 (15.68 - 16.21)	31.32 (30.58 - 32.05)	27.36 (27.05 - 27.68)
Astley	69.34 (69.24 - 69.44)	38.82 (38.04 - 39.59)	52.43 (52.07 - 52.78)	34.51 (33.71 - 35.31)	60.34 (60.01 - 60.67)

Table 1. Sensitivity and its 95% confidence interval for the selected countries for 2020, in %

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	89.77 (89.71 - 89.84)	95.87 (95.79 - 95.96)	96.78 (96.74 - 96.83)	96.59 (96.48 - 96.70)	92.17 (91.99 - 92.34)
Menni_2	81.41 (81.23 - 81.58)	91.83 (91.71 - 91.94)	96.05 (95.92 - 96.17)	82.83 (82.32 - 83.34)	82.23 (82.00 - 82.45)
Roland	86.54 (86.44 - 86.64)	91.68 (91.56 - 91.81)	92.07 (91.93 - 92.20)	83.91 (83.16 - 84.66)	84.01 (83.81 - 84.21)
Smith	64.18 (64.09 - 64.27)	94.37 (94.28 - 94.47)	95.69 (95.64 - 95.74)	90.56 (90.39 - 90.72)	75.98 (73.43 - 78.53)
Zoabi_55	23.21 (22.64 - 23.79)	91.56 (90.65 - 92.48)	83.82 (83.53 - 84.11)	85.44 (84.14 - 86.73)	67.92 (66.89 - 68.95)
Zoabi_65	22.73 (22.31 - 23.15)	91.46 (90.45 - 92.47)	84.02 (83.70 - 84.34)	85.05 (83.71 - 86.38)	68.31 (67.53 - 69.08)
CDC	39.32 (39.21 - 39.42)	40.87 (40.68 - 41.06)	49.17 (49.04 - 49.31)	43.06 (42.75 - 43.37)	44.13 (43.84 - 44.41)
Shoer	84.86 (84.78 - 84.95)	91.60 (91.46 - 91.75)	91.50 (91.32 - 91.69)	86.83 (86.39 - 87.27)	83.90 (83.67 - 84.14)
Bhattacharya	85.81 (85.74 - 85.88)	92.01 (91.88 - 92.13)	94.11 (94.06 - 94.16)	81.11 (80.89 - 81.33)	84.95 (84.73 - 85.16)
WHO	97.51 (97.48 - 97.54)	97.79 (97.74 - 97.85)	98.41 (98.38 - 98.44)	93.69 (93.55 - 93.84)	96.96 (96.88 - 97.05)
Perez	90.64 (90.58 - 90.70)	93.98 (93.88 - 94.08)	95.81 (95.77 - 95.86)	87.46 (87.26 - 87.66)	91.13 (90.96 - 91.30)
Mika	86.75 (86.68 - 86.82)	91.69 (91.57 - 91.82)	94.34 (94.24 - 94.44)	88.55 (88.37 - 88.74)	86.83 (86.57 - 87.10)
Akinbami_1	98.80 (98.78 - 98.82)	99.18 (99.14 - 99.21)	99.46 (99.44 - 99.48)	99.17 (99.11 - 99.22)	98.76 (98.69 - 98.82)
Akinbami_2	99.02 (99.00 - 99.04)	99.78 (99.75 - 99.80)	99.69 (99.68 - 99.71)	99.80 (99.77 - 99.83)	99.24 (99.19 - 99.29)
Akinbami_3	94.85 (94.81 - 94.89)	96.30 (96.21 - 96.40)	98.12 (98.08 - 98.16)	94.02 (93.88 - 94.17)	96.50 (96.41 - 96.59)
Salomon	95.80 (95.76 - 95.84)	97.14 (97.08 - 97.20)	97.79 (97.76 - 97.82)	90.72 (90.56 - 90.88)	93.36 (93.20 - 93.51)
Astley	77.93 (77.81 - 78.05)	97.75 (97.68 - 97.82)	97.03 (96.99 - 97.08)	97.26 (97.15 - 97.38)	88.50 (88.29 - 88.72)

Table 2. Specificity and its 95% confidence interval for the selected countries for 2020, in %

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	85.64 (85.55 - 85.73)	56.41 (55.64 - 57.18)	66.16 (65.76 - 66.55)	57.27 (56.13 - 58.42)	78.42 (77.97 - 78.87)
Menni_2	80.17 (80.06 - 80.29)	42.76 (42.18 - 43.34)	63.71 (63.04 - 64.39)	30.51 (29.86 - 31.17)	67.69 (67.33 - 68.05)
Roland	83.80 (83.70 - 83.89)	43.89 (43.30 - 44.48)	49.74 (49.31 - 50.18)	32.00 (31.04 - 32.96)	69.90 (69.54 - 70.26)
Smith	70.17 (70.09 - 70.26)	50.99 (50.35 - 51.64)	61.26 (60.92 - 61.61)	40.75 (40.05 - 41.46)	63.42 (61.33 - 65.51)
Zoabi_55	58.07 (57.94 - 58.19)	32.48 (31.33 - 33.63)	26.58 (26.24 - 26.91)	26.07 (25.15 - 26.99)	54.01 (53.53 - 54.49)
Zoabi_65	57.98 (57.86 - 58.09)	32.55 (31.35 - 33.76)	26.66 (26.32 - 27.01)	25.84 (24.92 - 26.75)	54.09 (53.68 - 54.50)
CDC	62.94 (62.86 - 63.02)	13.51 (13.33 - 13.70)	17.18 (17.06 - 17.29)	16.26 (16.01 - 16.51)	47.87 (47.59 - 48.15)
Shoer	82.66 (82.58 - 82.75)	43.48 (42.84 - 44.11)	48.01 (47.52 - 48.50)	36.36 (35.54 - 37.17)	69.54 (69.17 - 69.91)
Bhattacharya	83.19 (83.11 - 83.27)	44.74 (44.13 - 45.36)	56.10 (55.79 - 56.41)	29.23 (28.73 - 29.74)	70.53 (70.15 - 70.91)
WHO	86.76 (86.60 - 86.92)	43.98 (43.01 - 44.95)	50.19 (49.44 - 50.95)	32.43 (31.45 - 33.41)	78.42 (77.85 - 79.00)
Perez	85.11 (85.01 - 85.20)	44.42 (43.73 - 45.12)	57.48 (57.10 - 57.86)	28.49 (27.80 - 29.17)	76.76 (76.36 - 77.16)
Mika	84.00 (83.92 - 84.08)	43.91 (43.32 - 44.50)	57.02 (56.51 - 57.52)	38.29 (37.65 - 38.94)	72.68 (72.25 - 73.11)
Akinbami_1	87.17 (86.95 - 87.39)	45.02 (43.20 - 46.84)	52.52 (51.22 - 53.83)	53.66 (51.23 - 56.09)	82.30 (81.48 - 83.13)
Akinbami_2	90.55 (90.37 - 90.73)	70.32 (68.01 - 72.64)	69.61 (68.35 - 70.86)	81.58 (79.19 - 83.97)	87.77 (87.04 - 88.50)
Akinbami_3	79.35 (79.20 - 79.51)	30.27 (29.42 - 31.13)	43.60 (42.84 - 44.36)	24.78 (23.78 - 25.77)	74.82 (74.21 - 75.43)
Salomon	84.15 (84.00 - 84.30)	40.49 (39.57 - 41.41)	46.16 (45.56 - 46.77)	30.12 (29.35 - 30.89)	70.22 (69.67 - 70.76)
Astley	78.69 (78.59 - 78.79)	64.33 (63.51 - 65.16)	67.79 (67.40 - 68.18)	61.82 (60.67 - 62.97)	75.02 (74.63 - 75.41)

Table 3. Precision and its 95% confidence interval for the selected countries for 2020, in %

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	45.56 (45.49 - 45.62)	41.96 (41.59 - 42.33)	50.12 (49.94 - 50.30)	38.87 (38.53 - 39.22)	45.44 (45.20 - 45.68)
Menni_2	61.38 (61.33 - 61.43)	70.30 (69.94 - 70.65)	80.67 (80.51 - 80.83)	67.74 (67.46 - 68.02)	67.11 (66.88 - 67.34)
Roland	59.02 (58.96 - 59.09)	56.82 (56.49 - 57.15)	65.60 (65.43 - 65.77)	66.10 (65.82 - 66.38)	60.86 (60.60 - 61.12)
Smith	69.00 (68.94 - 69.05)	48.06 (47.73 - 48.39)	52.86 (52.70 - 53.06)	50.07 (49.78 - 50.37)	74.04 (73.85 - 74.24)
Zoabi_55	66.13 (65.66 - 66.59)	38.77 (37.62 - 39.91)	26.94 (26.47 - 27.41)	37.39 (36.37 - 38.40)	69.70 (69.44 - 69.96)
Zoabi_65	66.66 (65.75 - 67.57)	39.34 (38.05 - 40.62)	26.60 (26.21 - 26.98)	40.18 (38.51 - 41.86)	69.61 (69.30 - 69.92)
CDC	42.56 (42.51 - 42.61)	88.39 (88.18 - 88.61)	88.39 (88.28 - 88.50)	85.90 (85.69 - 86.12)	88.09 (87.96 - 88.23)
Shoer	87.72 (87.68 - 87.76)	66.90 (66.53 - 67.27)	71.38 (71.20 - 71.55)	67.12 (66.67 - 67.57)	82.11 (81.92 - 82.31)
Bhattacharya	54.12 (54.06 - 54.18)	53.51 (53.17 - 53.85)	58.25 (58.07 - 58.42)	88.79 (88.73 - 88.85)	84.16 (84.03 - 84.29)
WHO	13.84 (13.80 - 13.88)	17.97 (17.71 - 18.24)	14.42 (14.30 - 14.54)	26.08 (25.81 - 26.36)	20.99 (20.84 - 21.15)
Perez	41.39 (41.33 - 41.44)	42.56 (42.24 - 42.89)	44.82 (44.64 - 45.01)	41.14 (40.82 - 41.46)	48.66 (48.45 - 48.87)
Mika	57.42 (57.36 - 57.48)	57.87 (57.35 - 58.40)	81.94 (81.81 - 82.10)	56.97 (56.54 - 57.41)	83.17 (83.05 - 83.28)
Akinbami_1	6.49 (6.46 - 6.52)	6.58 (6.42 - 6.75)	5.13 (5.05 - 5.22)	6.10 (5.93 - 6.27)	8.87 (8.75 - 8.99)
Akinbami_2	6.50 (6.47 - 6.53)	4.29 (4.16 - 4.43)	5.25 (5.17 - 5.34)	4.79 (4.66 - 4.93)	7.41 (7.31 - 7.51)
Akinbami_3	15.91 (15.87 - 15.95)	14.98 (14.74 - 15.23)	11.99 (11.87 - 12.11)	14.67 (14.46 - 14.89)	17.61 (17.44 - 17.77)
Salomon	18.76 (18.71 - 18.81)	20.50 (20.20 - 20.80)	16.45 (16.33 - 16.60)	32.02 (31.73 - 32.32)	26.68 (26.50 - 26.86)
Astley	56.60 (56.53 - 56.67)	34.44 (34.12 - 34.76)	31.92 (31.73 - 32.12)	38.99 (38.67 - 39.32)	89.09 (88.96 - 89.21)

Table 4. Sensitivity and its 95% confidence interval for the selected countries for 2021, in %

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	94.67 (94.65 - 94.70)	96.88 (96.84 - 96.91)	98.29 (98.28 - 98.30)	98.12 (98.09 - 98.15)	93.61 (93.52 - 93.70)
Menni_2	84.24 (84.21 - 84.28)	79.32 (79.11 - 79.53)	77.33 (77.29 - 77.36)	83.62 (83.48 - 83.77)	79.86 (79.70 - 80.02)
Roland	86.03 (85.99 - 86.06)	89.97 (89.90 - 90.04)	91.79 (91.78 - 91.81)	84.46 (84.39 - 84.53)	83.69 (83.53 - 83.85)
Smith	67.04 (67.00 - 67.09)	95.14 (95.08 - 95.19)	97.68 (97.67 - 97.69)	95.15 (95.11 - 95.20)	61.61 (61.44 - 61.79)
Zoabi_55	62.52 (61.75 - 63.29)	92.17 (91.54 - 92.81)	98.14 (98.05 - 98.24)	90.86 (90.30 - 91.41)	62.74 (62.40 - 63.09)
Zoabi_65	61.52 (60.02 - 63.03)	91.75 (91.04 - 92.46)	98.20 (98.12 - 98.27)	89.05 (88.07 - 90.02)	62.68 (62.24 - 63.11)
CDC	85.62 (85.58 - 85.66)	48.56 (48.44 - 48.68)	61.64 (61.61 - 61.68)	54.73 (54.63 - 54.83)	42.44 (42.26 - 42.63)
Shoer	57.88 (57.81 - 57.94)	82.04 (81.80 - 82.28)	87.72 (87.68 - 87.76)	85.96 (85.63 - 86.29)	62.96 (62.68 - 63.23)
Bhattacharya	90.14 (90.12 - 90.17)	92.79 (92.73 - 92.85)	96.49 (96.48 - 96.50)	60.31 (60.00 - 60.61)	59.11 (58.88 - 59.35)
WHO	97.73 (97.72 - 97.74)	97.72 (97.68 - 97.75)	99.19 (99.18 - 99.20)	97.05 (97.01 - 97.08)	95.88 (95.81 - 95.94)
Perez	93.57 (93.54 - 93.60)	94.60 (94.55 - 94.65)	97.53 (97.52 - 97.54)	92.82 (92.77 - 92.87)	90.86 (90.76 - 90.96)
Mika	87.47 (87.44 - 87.50)	89.78 (89.28 - 90.28)	76.27 (76.24 - 76.30)	93.26 (92.81 - 93.71)	60.61 (60.47 - 60.90)
Akinbami_1	98.97 (98.96 - 98.98)	99.04 (99.02 - 99.06)	99.70 (99.69 - 99.70)	99.60 (99.58 - 99.61)	98.24 (98.21 - 98.28)
Akinbami_2	99.38 (99.37 - 99.39)	99.70 (99.69 - 99.71)	99.89 (99.88 - 99.89)	99.90 (99.89 - 99.91)	99.16 (99.13 - 99.19)
Akinbami_3	95.80 (95.78 - 95.82)	96.84 (96.81 - 96.88)	98.84 (98.83 - 98.85)	96.43 (96.40 - 96.47)	95.50 (95.42 - 95.58)
Salomon	96.20 (96.18 - 96.22)	97.11 (97.07 - 97.15)	99.19 (99.18 - 99.20)	95.66 (95.62 - 95.70)	92.10 (92.01 - 92.20)
Astley	89.74 (89.70 - 89.78)	97.92 (97.88 - 97.96)	99.32 (99.31 - 99.32)	98.28 (98.25 - 98.31)	56.00 (55.76 - 56.24)

Table 5. Specificity and its 95% confidence interval for the selected countries for 2021, in %

Method	Brazil	Canada	Germany	Japan	South Africa
Menni_1	84.66 (84.66 - 84.74)	59.99 (59.68 - 60.29)	49.52 (49.4 - 49.64)	67.16 (67.89 - 68.31)	81.23 (81.15 - 81.32)
Menni_2	72.65 (72.6 - 72.7)	27.78 (27.61 - 27.95)	11.03 (10.99 - 11.07)	31.07 (30.88 - 31.27)	65.9 (65.79 - 66.03)
Roland	74.24 (74.21 - 74.28)	39.04 (38.84 - 39.24)	21.8 (21.72 - 21.87)	31.67 (31.51 - 31.83)	68.4 (68.32 - 68.48)
Smith	58.59 (58.55 - 58.64)	52.72 (52.47 - 52.96)	44.26 (44.14 - 44.37)	52.97 (52.77 - 53.19)	52.77 (52.62 - 52.93)
Zoabi_55	54.70 (54.50 - 54.90)	37.09 (36.22 - 37.96)	34.16 (33.61 - 34.70)	31.67 (30.82 - 32.52)	52.11 (51.90 - 52.32)
Zoabi_65	54.44 (54.05 - 54.84)	36.51 (35.55 - 37.46)	34.40 (33.93 - 34.86)	30.17 (29.16 - 31.18)	52.04 (51.80 - 52.29)
CDC	50.14 (50.10 - 50.18)	16.22 (16.14 - 16.31)	7.39 (7.36 - 7.41)	17.11 (17.02 - 17.20)	46.95 (46.81 - 47.07)
Shoer	52.66 (52.61 - 52.72)	29.66 (29.46 - 29.86)	17.47 (17.38 - 17.55)	34.32 (34.04 - 34.62)	53.75 (53.6 - 53.91)
Bhattacharya	78.77 (78.75 - 78.83)	45.57 (45.37 - 45.78)	50.54 (50.57 - 50.51)	30.88 (30.68 - 31.08)	50.86 (50.67 - 51.05)
WHO	80.52 (80.48 - 80.56)	47.07 (46.56 - 47.45)	38.42 (38.13 - 38.65)	49.04 (48.70 - 49.37)	74.79 (74.61 - 74.84)
Perez	81.28 (81.25 - 81.31)	47.07 (46.79 - 47.33)	38.67 (38.55 - 38.77)	38.39 (38.17 - 38.64)	75.47 (75.36 - 75.55)
Mika	75.77 (75.74 - 75.80)	39.23 (38.96 - 39.49)	30.95 (30.85 - 31.05)	48.53 (47.67 - 49.37)	51.99 (51.81 - 52.17)
Akinbami_1	80.80 (80.48 - 81.13)	43.47 (42.94 - 43.87)	37.32 (36.42 - 37.36)	62.18 (61.69 - 62.77)	74.83 (74.47 - 75.20)
Akinbami_2	87.91 (87.60 - 88.23)	61.62 (61.14 - 62.10)	62.53 (62.50 - 62.55)	83.71 (83.45 - 83.98)	83.73 (83.26 - 84.20)
Akinbami_3	71.91 (71.89 - 71.93)	34.89 (34.42 - 35.25)	26.45 (26.21 - 26.64)	30.93 (30.55 - 31.25)	69.26 (69.09 - 69.58)
Salomon	77.08 (77.07 - 77.08)	44.45 (44.06 - 44.9)	35.29 (35.05 - 35.39)	44.58 (44.28 - 44.86)	66.19 (66.08 - 66.29)
Astley	79.01 (78.99 - 79.04)	65.49 (64.96 - 66.02)	62.03 (61.93 - 62.10)	71.21 (71.04 - 71.35)	50.01 (49.83 - 50.19)

Table 6. Precision and its 95% confidence interval for the selected countries for 2021, in %

B List of Symptoms

In the UMD Global CTIS the following question is asked: “B1 In the last 24 hours, have you had any of the following?” [?]. The following is the list of possible answers (non exclusive):

- Fever (B1_1).
- Cough (B1_2).
- Difficulty breathing (B1_3).
- Fatigue (B1_4).
- Stuffy or runny nose (B1_5).
- Aches or muscle pain (B1_6).
- Sore throat (B1_7).
- Chest pain (B1_8).

- Nausea (B1_9).
- Loss of smell or taste (B1_10).
- Headache (B1_12).
- Chills (B1_13).