Antigen Test Positivity After COVID-19 Isolation — Yukon-Kuskokwim Delta Region, Alaska, January–February 2022

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Isolation is recommended during acute infection with SARS-CoV-2, the virus that causes COVID-19, but the duration of infectiousness varies among individual persons. Rapid antigen test results have been correlated with detection of viable virus (1–3) and might inform isolation guidance, but data are limited for the recently emerged SARS-CoV-2 B.1.1.529 (Omicron) variant. On January 5, 2022, the Yukon-Kuskokwim Health Corporation (YKHC) recommended that persons with SARS-CoV-2 infection isolate for 10 days after symptom onset (or, for asymptomatic persons, 10 days after a positive nucleic acid amplification or antigen test result). However, isolation could end after 5–9 days if symptoms were resolving or absent, fever was absent for ≥24 hours without fever-reducing medications, and an Abbott BinaxNOW COVID-19 Ag (BinaxNOW) rapid antigen test result was negative. Antigen test results and associated individual characteristics were analyzed among 3,502 infections reported to YKHC during January 1–February 9, 2022. After 5–9 days, 396 of 729 persons evaluated (54.3%) had a positive antigen test result, with a declining percentage positive over time. In a multivariable model, a positive antigen test result was more likely after 5 days compared with 9 days (adjusted odds ratio [aOR] = 6.39) or after symptomatic infection (aOR = 9.63), and less likely after previous infection (aOR = 0.30), receipt of a primary COVID-19 vaccination series (aOR = 0.60), or after both previous infection and receipt of a primary COVID-19 vaccination series (aOR = 0.17). Antigen tests might be a useful tool to guide recommendations for isolation after SARS-CoV-2 infection. During the 10 days after infection, persons might be infectious to others and are recommended to wear a well-fitting mask when around others, even if ending isolation after 5 days.

YKHC provides health care and public health services to approximately 27,000 persons in an area of southwest Alaska that includes 50 remote communities; high rates of COVID-19 have been reported in this region.* On January 5, 2022, after rapidly increasing incidence of SARS-CoV-2 infections associated with introduction of the Omicron variant,† YKHC recommended an isolation policy incorporating the use of SARS-CoV-2 antigen tests.§ All persons with a positive SARS-CoV-2 antigen or nucleic acid amplification test (NAAT) result were eligible to receive a follow-up BinaxNOW SARS-CoV-2 antigen test 5–9 days after symptom onset (or, in asymptomatic persons, after the first positive test result) if the person reported no symptoms or resolving symptoms, and no fever for ≥24 hours without fever-reducing medications. Persons were recommended to isolate for 10 days but could end isolation after 5–9 days if the follow-up antigen test was negative; all persons were advised to wear a well-fitting mask around others and to avoid close contact with persons at elevated risk for severe COVID-19, until the end of the 10-day period.

Persons with a positive SARS-CoV-2 NAAT or antigen test result were interviewed by a public health or clinic staff member after notification to YKHC, and at the time of a follow-up antigen test, if performed after the initial interview. Information collected included age, sex, whether the person was of the American Indian or Alaska Native race, and whether any symptoms were reported during follow-up. Persons were considered vaccinated if ≥14 days had elapsed since completion of a primary COVID-19 vaccination series and were considered to have received a booster dose if ≥7 days had elapsed after receipt of their booster dose. Previous infection was defined as a previous positive NAAT or antigen test result >90 days before the current infection episode; vaccination and previous infection status were assessed from electronic health records. Follow-up antigen testing was performed by YKHC staff members at a local health facility using the BinaxNOW antigen test¶; results of the first follow-up antigen test were recorded in the electronic health record.

Positive results of the first follow-up antigen test were evaluated by demographic characteristics, symptom status, previous infection, vaccination status, and number of days since symptom onset or a positive test result. Multivariable logistic regression models were used to identify factors independently associated with a positive follow-up antigen test result, adjusted for age group, previous infection, vaccination status, presence of symptoms, and number of days since symptom onset or the initial positive test result. Statistical analyses were conducted

* https://www.ykhc.org/covid-19/situation-reports (Accessed February 12, 2022).
† https://alvariants.github.io (Accessed February 7, 2022).
§ https://www.ykhc.org/wp-content/uploads/2022/01/010522-YKHC-Guidance-for-Vaccinated-and-Unvaccinated-Individuals1.pdf
¶ https://www.fda.gov/media/141570/download
During January 1–February 9, 2022, a total of 3,502 persons with SARS-CoV-2 infection were reported to YKHC, including 3,266 (93.3%) in whom symptom onset or the initial positive test result had occurred 5–9 days earlier. Among these persons, 729 (22.3%) received a follow-up BinaxNOW antigen test 5–9 days after symptom onset or, among asymptomatic persons, after the first positive test result (Supplementary Table, https://stacks.cdc.gov/view/cdc/114423). The median age was 30 years (IQR = 17–45 years), 380 (52.1%) were female, and 666 (91.4%) were of the American Indian or Alaska Native race. By the day of the initial positive test, 541 (74.2%) had completed a primary COVID-19 vaccination series ≥14 days earlier, including 215 (39.7%) who had also received a booster dose; 21 (2.9%) persons were partially vaccinated, and 167 (22.9%) were unvaccinated. Previous infection was documented in 145 (19.9%) persons, including 108 who had also completed a primary COVID-19 vaccination series; among persons with a previous infection, a median of 418 days (IQR = 343–439 days) had elapsed between the earlier infection and the current episode. Symptoms were reported by 564 (77.4%) persons. Compared with persons with SARS-CoV-2 infection without follow-up antigen testing, those with follow-up antigen testing were more likely to be older (median age = 30 years versus 22 years, p<0.001) and to have received a primary COVID-19 vaccine series (74.2% versus 59.9%; aOR = 0.60; 95% CI = 0.39–0.93) or after both previous infection (aOR = 9.63; 95% CI = 6.03–15.37), and less likely after symptomatic infection (aOR = 0.30; 95% CI = 0.19–0.46), receipt of a primary COVID-19 vaccination series (aOR = 0.60; 95% CI = 0.39–0.93) or after both previous infection and receipt of a primary COVID-19 vaccination series (aOR = 0.17; 95% CI = 0.09–0.33) (Table 2).

In this study conducted after SARS-CoV-2 infection during emergence of the Omicron variant, the majority of persons with follow-up testing had a positive antigen test result 5–9 days after symptom onset, or, among asymptomatic persons, after the initial positive diagnostic test. The proportion of positive test results declined with time since infection and was lower after asymptomatic than symptomatic infections. The proportion of positive follow-up antigen test results was also lower after previous SARS-CoV-2 infection or vaccination and was lowest among vaccinated persons with a previous infection. However, the percentage of positive test results after SARS-CoV-2 infection among those who had received a booster dose was similar to that among unvaccinated persons; the reasons for this finding are unclear and might reflect differences in testing practices or other individual characteristics. Overall, these findings are consistent with other analyses of positive test results by time since infection, including a recent study in which 43% percent of health care workers with SARS-CoV-2 infection were found to have received a positive antigen test result after 5–10 days.**

Among 167 unvaccinated persons, 98 (58.7%) had a positive antigen test result. In multivariable models, a positive antigen test result was more likely after 5 days than after 9 days (aOR = 6.39; 95% CI = 3.39–12.03), symptomatic infection (aOR = 9.63; 95% CI = 6.03–15.37), and less likely after previous infection (aOR = 0.30; 95% CI = 0.19–0.46), receipt of a primary COVID-19 vaccination series (aOR = 0.60; 95% CI = 0.39–0.93) or after both previous infection and receipt of a primary COVID-19 vaccination series (aOR = 0.17; 95% CI = 0.09–0.33) (Table 2).

** Discussion **

In this study conducted after SARS-CoV-2 infection during emergence of the Omicron variant, the majority of persons with follow-up testing had a positive antigen test result 5–9 days after symptom onset, or, among asymptomatic persons, after the initial positive diagnostic test. The proportion of positive test results declined with time since infection and was lower after asymptomatic than symptomatic infections. The proportion of positive follow-up antigen test results was also lower after previous SARS-CoV-2 infection or vaccination and was lowest among vaccinated persons with a previous infection. However, the percentage of positive test results after SARS-CoV-2 infection among those who had received a booster dose was similar to that among unvaccinated persons; the reasons for this finding are unclear and might reflect differences in testing practices or other individual characteristics. Overall, these findings are consistent with other analyses of positive test results by time since infection, including a recent study in which 43% percent of health care workers with SARS-CoV-2 infection were found to have received a positive antigen test result after 5–10 days.**

Persons are estimated to be most infectious approximately 4 days after SARS-CoV-2 infection (4), and SARS-CoV-2 virus generally can be cultured up to 10 days after symptom onset (3). Rapid antigen test results have previously been shown to correlate with real-time reverse transcription–polymerase chain reaction cycle threshold values (5), and with detection of viable virus, for several days after infection (1,3,6). Among persons in this study with symptomatic infection, 64% received a positive antigen test result during the 5–9 days after symptom onset. However, a positive antigen test result does not necessarily mean that a person is infectious; similarly, a negative test result does not necessarily mean that a person is not infectious. Nonetheless, a positive or negative antigen test might be a useful proxy for the risk for being infectious. Therefore, lower prevalence of positive test results over time and after asymptomatic infections might reflect lower infectiousness. However,
### TABLE 1. Characteristics associated with a positive SARS-CoV-2 antigen test result 5–9 days after symptom onset or after a positive initial test result for SARS-CoV-2 — Yukon-Kuskokwim Delta region, Alaska, January–February 2022

| Characteristic                        | All infections†  | Symptomatic infections‡  | Asymptomatic infections‡  |
|--------------------------------------|------------------|--------------------------|--------------------------|
|                                      | (N = 729)        | (n = 564)                | (n = 165)                |
| **Symptomatic**                      |                  |                          |                          |
| No                                   | 35/165 (21.2)    | —                        | 35/165 (21.2)            |
| Yes                                  | 361/564 (64.0)   | 361/564 (64.0)           | —                        |
| **Age group, yrs**                   |                  |                          |                          |
| 0–17                                 | 93/186 (50.0)    | 83/131 (63.4)            | 10/55 (18.2)             |
| 18–49                                | 216/400 (54.0)   | 196/315 (62.2)           | 20/85 (23.5)             |
| ≥50                                  | 87/143 (60.8)    | 82/118 (69.5)            | 5/25 (20.0)              |
| **Sex**                              |                  |                          |                          |
| Male                                 | 180/349 (51.6)   | 159/253 (62.8)           | 21/96 (21.9)             |
| Female                               | 216/380 (56.8)   | 202/311 (65.0)           | 14/69 (20.3)             |
| **Race and ethnicity**               |                  |                          |                          |
| American Indian or Alaska Native     | 361/666 (54.2)   | 329/513 (64.1)           | 32/153 (20.9)            |
| Other                                | 35/63 (55.6)     | 32/51 (62.7)             | 3/12 (25.0)              |
| **Previous infection§**              |                  |                          |                          |
| No                                   | 346/584 (59.2)   | 315/459 (68.6)           | 31/125 (24.8)            |
| Yes                                  | 50/145 (34.5)    | 46/105 (43.8)            | 4/40 (10.0)              |
| **Primary COVID-19 vaccination¶**    |                  |                          |                          |
| No                                   | 98/167 (58.7)    | 88/123 (71.5)            | 10/44 (22.7)             |
| Yes                                  | 285/541 (52.7)   | 264/427 (61.8)           | 21/114 (18.4)            |
| **Primary COVID-19 vaccination or previous infection¶§** |          |                          |                          |
| Unvaccinated, no previous infection  | 82/131 (62.6)    | 72/96 (75.0)             | 10/35 (28.6)             |
| Vaccinated, previous infection       | 16/36 (44.4)     | 16/27 (59.3)             | 0/9 (—)                  |
| Vaccinated, no previous infection    | 251/433 (58.0)   | 234/349 (67.0)           | 17/84 (20.2)             |
| Vaccinated, previous infection       | 34/108 (31.5)    | 30/78 (38.5)             | 4/30 (13.3)              |
| **Days since onset or test****       |                  |                          |                          |
| 5–9                                  |                  |                          |                          |
| 5                                    | 160/237 (67.5)   | 142/179 (79.3)           | 18/58 (31.0)             |
| 6                                    | 91/166 (54.8)    | 80/121 (66.1)            | 11/45 (24.4)             |
| 7                                    | 75/144 (52.1)    | 74/111 (66.7)            | 1/33 (3.0)               |
| 8                                    | 43/112 (38.4)    | 39/93 (41.9)             | 4/19 (21.1)              |
| 9                                    | 27/70 (38.6)     | 26/60 (43.3)             | 1/10 (10.0)              |
| 5–9                                  | 396/729 (54.3)   | 361/564 (64.0)           | 35/165 (21.2)            |

Abbreviation: NAAT = nucleic acid amplification test.

*Abbott BinaxNOW COVID-19 Ag (BinaxNOW) rapid antigen test.
†SARS-CoV-2 infection diagnosed by NAAT or antigen test. persons were classified as symptomatic if symptoms were reported during routine case interview or isolation follow-up call.
§Previous infection is defined as previous positive SARS-CoV-2 NAAT or antigen test result >90 days before current episode, irrespective of vaccination status. Among those who were vaccinated and with previous infection, 96 had an infection before completion of the vaccination series.
¶Vaccinated was defined as being ≥14 days after 2 doses of an mRNA COVID-19 vaccine (Pfizer-BioNTech or Moderna) or 1 dose of the Janssen (Johnson & Johnson) COVID-19 vaccine. Compared with no vaccination; 21 persons with partial vaccination were excluded. Among vaccinated persons, 518 had completed a 2-dose COVID-19 mRNA vaccination series, and 23 had received 1 dose of the Janssen vaccine. Two hundred fifteen persons were ≥7 days after a booster dose, among whom 127 of 215 (59.1%) had a positive antigen test result (126 of 212 [59.4%] among those aged ≥18 years); 158 of 326 (48.5%) other vaccinated persons had a positive test result (119 of 232 [51.3%] among those aged ≥18 years).
**Defined as days since symptom onset if symptomatic, or days since the initial NAAT or antigen test if asymptomatic.

reinforces the importance of correct and consistent mask use during this period.

The findings in this report are subject to at least six limitations. First, only one follow-up antigen test was included in the analysis for each person; data were cross-sectional rather than longitudinal. However, the multivariable model accounted for changes in reported characteristics over time. Second, the timing of acquisition of asymptomatic infections was unknown, limiting interpretation of changes in positivity over time in this group. Third, information is still accruing on the correlation between antigen tests and virus culture over time. Correlation

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https://www.cdc.gov/coronavirus/2019-ncov/your-health/quarantine-isolation.html (Accessed February 12, 2022).
大约 50% 的抗原检测结果在感染后 5-9 天是阳性，但阳性结果的比例在这段时间内下降。阴性后续的抗原检测结果与无症状感染、先前感染和完成主要 COVID-19 疫苗系列有关。在感染后的 10 天内，人们可能会传染他人，并建议在他人周围时戴好口罩，并避免与高风险人群接触。

### Summary

**What is already known about this topic?**

阳性快速抗原检测结果在 SARS-CoV-2 感染后与存在活病毒有关，但抗原检测在 SARS-CoV-2 感染者的隔离指导中的作用尚不清楚。

**What is added by this report?**

在感染后 5-9 天，大约 54% 的人有阳性 SARS-CoV-2 抗原检测结果。阳性结果的比例随时间下降。阴性后续抗原检测结果与无症状感染、先前感染和完成主要 COVID-19 疫苗系列有关。阳性结果的比例随时间下降。阴性后续抗原检测结果与无症状感染、先前感染和完成主要 COVID-19 疫苗系列有关。

**What are the implications for public health practice?**

抗原检测可能是一个有用的工具来指导 SARS-CoV-2 感染后隔离的建议。
TABLE 2. Associations between individual characteristics and a positive SARS-CoV-2 antigen test result 5–9 days after symptom onset or after a positive initial SARS-CoV-2 test result — Yukon-Kuskokwim Delta region, Alaska, January–February 2022

| Characteristic | All infections* (N = 729) | Symptomatic infections* (n = 564) | Asymptomatic infections* (n = 165) |
|----------------|---------------------------|------------------------------------|-----------------------------------|
|                | Unadjusted                | Adjusted†                          | Unadjusted                        | Adjusted†                        | Unadjusted                        | Adjusted†                        |
| Symptomatic infection‡ | 6.61 (4.38–9.96)          | 9.63 (6.03–15.37)                  | —                                 | —                                | —                                 | —                                |
| Age group, yrs |                           |                                    |                                    |                                    |                                    |                                    |
| <18 (Ref)      |                           |                                    |                                    |                                    |                                    |                                    |
| 18–49§         | 1.17 (0.83–1.66)          | 1.2 (0.78–1.85)                    | 0.95 (0.63–1.45)                  | 1.05 (0.65–1.71)                  | 1.39 (0.59–3.24)                  | 1.93 (0.69–5.45)                  |
| ≥50‡           | 1.55 (1.00–2.42)          | 1.62 (0.95–2.76)                   | 1.32 (0.78–2.24)                  | 1.58 (0.87–2.86)                  | 1.13 (0.34–3.72)                  | 1.36 (0.33–5.61)                  |
| Vaccination and previous infection status |                      |                                    |                                    |                                    |                                    |                                    |
| Previous infection** | 0.36 (0.25–0.53)          | 0.3 (0.19–0.46)                    | 0.36 (0.23–0.55)                  | 0.29 (0.18–0.46)                  | 0.34 (0.11–1.0)                   | 0.37 (0.11–1.19)                  |
| Primary COVID-19 vaccination†† | 0.78 (0.55–1.11)          | 0.6 (0.39–0.93)                    | 0.64 (0.42–1)                     | 0.6 (0.36–0.99)                   | 0.77 (0.33–1.8)                   | 0.67 (0.26–1.76)                  |
| Unvaccinated, no previous infection (Ref) |                      |                                    |                                    |                                    |                                    |                                    |
| Primary COVID-19 vaccination, no previous infection§§ | 0.28 (0.16–0.47)          | 0.17 (0.09–0.33)                   | 0.21 (0.11–0.4)                   | 0.16 (0.08–0.34)                  | 0.39 (0.11–1.39)                  | 0.30 (0.07–1.29)                  |
| No. of days after symptom onset until positive SARS-CoV-2 antigen test result |                      |                                    |                                    |                                    |                                    |                                    |
| 5¶¶ | 3.31 (1.9–7.55) | 6.39 (3.39–12.03) | 5.02 (2.68–9.38) | 6.84 (3.49–13.43) | 4.05 (0.48–34.41) | 4.11 (0.45–37.37) |
| 6¶¶ | 1.93 (1.09–3.42) | 3.39 (1.78–6.46) | 2.55 (1.35–4.81) | 3.16 (1.61–6.23) | 2.91 (0.33–25.63) | 3.18 (0.34–29.67) |
| 7¶¶ | 1.73 (0.97–3.1) | 2.85 (1.48–5.47) | 2.62 (1.37–4.99) | 3.47 (1.74–6.93) | 0.28 (0.02–4.95) | 0.34 (0.02–6.29) |
| 8¶¶ | 0.99 (0.54–1.83) | 1.24 (0.63–2.42) | 0.94 (0.49–1.82) | 1.18 (0.59–2.35) | 2.4 (0.23–24.96) | 2.25 (0.19–26.76) |
| 9 (Ref) |                          |                                    |                                    |                                    |                                    |                                    |

Abbreviations: NAAT = nucleic acid amplification test; Ref = referent group.
* SARS-CoV-2 infection diagnosed by NAAT or antigen test. Persons were classified as symptomatic if symptoms were reported during routine case interview or isolation follow-up call.
† Adjusted for age group, days since symptom onset or positive test result, previous infection status, previous vaccination status, and whether symptoms were reported.
‡ Compared with symptomatic infection. Adjusted analyses excluded 21 persons (14 symptomatic and seven asymptomatic).
§ Compared with children and adolescents (aged <18 years). Adjusted analyses excluded 21 persons (14 symptomatic and seven asymptomatic).
** Defined as previous positive SARS-CoV-2 NAAT or antigen test result ≥90 days before current episode, irrespective of vaccination status.
†† Vaccinated was defined as being ≥14 days after 2 doses of an mRNA COVID-19 vaccine (Pfizer-BioNTech or Moderna) or 1 dose of the Janssen (Johnson & Johnson) COVID-19 vaccine. Compared with no COVID-19 vaccination. Excluded 21 persons with partial vaccination (14 symptomatic infections and seven asymptomatic infections). Among 541 vaccinated persons, the adjusted odds ratio for a positive test result after being ≥7 days after a booster dose compared with no booster was 1.69 (95% CI = 1.13–2.52), after adjusting for age group, days since symptom onset or positive test result, previous infection status, and whether symptoms were reported.
§§ Compared with unvaccinated without previous infection. Excluded 21 persons with partial vaccination, and 36 unvaccinated persons with previous infection (overall 57 excluded, 41 symptomatic infections and 16 asymptomatic infections).
¶¶ Compared with day 9, where the day is defined as symptom onset (if symptomatic) or initial positive NAAT or antigen test result (if asymptomatic). Adjusted analyses excluded 21 persons (14 symptomatic and seven asymptomatic).

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