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Lessons Learned From a Prospective Observational Study of U.S. Marine Recruits During a Supervised Quarantine, Spring–Fall 2020



Andrew G. Letizia, MD,¹ Carl W. Goforth, PhD,¹ Yongchao Ge, PhD,² Michael S. Termini, MD,³ Megan A. Schilling, PhD,¹ Victor A. Sugiharto, PhD,^{1,4} Hua Wei Chen, PhD,^{1,4} Irene Ramos, PhD,² Stuart C. Sealfon, MD²

Introduction: Quarantining is commonly used to mitigate the spread of SARS-CoV-2. However, questions remain regarding what specific interventions are most effective.

Methods: After a 2-week home quarantine, U.S. Marine Corps recruits underwent a supervised 2-week quarantine at a hotel from August 11 to September 21, 2020. All recruits were assessed for symptoms through oral questioning and had their temperatures checked daily. Study participants answered a written clinical questionnaire and were tested for SARS-CoV-2 by polymerase chain reaction shortly after arrival in quarantine and on Days 7 and 14. The results were compared with those of a previously reported Marine-supervised quarantine at a college campus from May until July 2020 utilizing the same study, laboratory, and statistical procedures.

Results: A total of 1,401 of 1,514 eligible recruits (92.5%) enrolled in the study, 93.1% of whom were male. At the time of enrollment, 12 of 1,401 (0.9%) participants were polymerase chain reaction positive for SARS-CoV-2, 9 of 1,376 (0.7%) were positive on Day 7, and 1 of 1,358 (0.1%) was positive on Day 14. Only 12 of 22 (54.5%) participants endorsed any symptoms on a study questionnaire, and none of the participants had an elevated temperature or endorsed symptoms during daily screening for SARS-CoV-2. Participation rate (92%) was much greater than the approximately 58.8% (1,848 of 3,143) rate observed in the previous Marine-supervised college campus quarantine, suggesting the changing attitudes of recruits during the pandemic ($p < 0.001$). Approximately 1% of participants were quantitative polymerase chain reaction positive after self-quarantine in both studies.

Conclusions: Key findings include the shifting attitudes of young adults during the pandemic, the limitations of self-quarantine, and the ineffectiveness of daily temperature and symptom screening to identify SARS-CoV-2-positive recruits.

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From the ¹Naval Medical Research Center, Navy Medicine, Silver Spring, Maryland; ²Department of Neurology, Icahn School of Medicine at Mount Sinai, New York, New York; ³Navy Medicine Readiness and Training Command Beaufort, Navy Medicine, Beaufort, South Carolina; and ⁴Henry M Jackson Foundation for the Advancement of Military Medicine, Bethesda, Maryland

Address correspondence to: Andrew G. Letizia, Naval Medical Research Center-Asia, 503 Robert Grant Avenue, Silver Spring MD 20910. E-mail: Andrew.g.letizia@mail.mil.
2773-0654/\$36.00
<https://doi.org/10.1016/j.focus.2022.100003>

INTRODUCTION

Quarantining has been used as a mitigation strategy to prevent the spread of infection since the beginning of the coronavirus disease 2019 (COVID-19) pandemic.¹ Examples of when quarantining would be used include before military training, travel, entering correctional facilities, and most commonly, after exposure.^{2–5} However, adherence to self-quarantining, optimal duration of supervised quarantine, and when to augment with testing remain unknown.^{6–8}

As of April 2020, the U.S. Marine Corps (USMC) required all new recruits to observe 2 quarantine periods before beginning recruit training: an unsupervised home quarantine for 2 weeks followed by a second Marine-supervised quarantine for an additional 2 weeks. We previously described the experience at the first quarantine location that utilized a college campus in South Carolina as part of the COVID-19 Health Action Response for Marines study from May 11, 2020 to July 29, 2020.⁹ From August 11, 2020 through the conclusion of enrollment for this study on September 21, 2020, the USMC-supervised quarantine occurred at a hotel in Georgia. Comparing 2 different quarantine settings using the same laboratory methodology among a homogenous cohort in which primarily asymptomatic spread occurred provides real-world data that can inform quarantine design and refine model development even for newer variants of concern.^{10,11}

METHODS

The hotel-supervised quarantine utilized severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) public health mitigation measures such as those previously described at the college campus quarantine.⁹ However, some distinctions were present (Appendix Table 1). Recruits in the hotel quarantine left their rooms only 3 times during the 14 days. Recruits in groups of 60–100 gathered for 3–5 hours on the first day of quarantine for orientation, at which point they were offered enrollment in this study, and on the fourteenth day when all recruits underwent SARS-CoV-2 quantitative polymerase chain reaction (qPCR) testing. Recruits opened their room doors to retrieve meals placed outside their doors, leave trash for collection, and perform daily temperature checks and oral symptom screening. Otherwise, the recruits remained in double- or triple-occupancy rooms. In addition, instructors who ensured enforcement of quarantine regulations were restricted to the hotel and required to wear masks. The public was prevented from entering the hotel.

Study procedures and laboratory methodology previously described included qPCR testing for SARS-CoV-2 on Day 0, Day 7, and Day 14 of quarantine; administration of a questionnaire at each encounter; and immediate isolation of any positive cases.¹¹ All recruits, regardless of enrollment in the study, were tested for SARS-CoV-2 by qPCR on the last day of quarantine. The qPCR testing procedures, data, and statistical analysis were unchanged from the previous study's description.⁹ The study protocol was approved by the Naval Medical Research Center IRB, and all participants provided written informed consent.

RESULTS

Among the 1,819 recruits who entered the hotel quarantine, a total of 1,401 eligible recruits (92.5%) enrolled in the study. Similar to those of the previous quarantine location at the college campus, 93.1% of participants were male, with a mean age of 18.9 years (Appendix Table 2). A total of 305 recruits were ineligible for the study because they were aged <18 years and an additional 113 recruits chose not to participate (Figure 1). During the study, 21 participants exited the quarantine and did not return owing to a variety of reasons, including separating from the USMC, personal emergency, or needing in-patient medical care, and were subsequently lost to follow-up. At the time of enrollment, 12 of 1,401 (0.9%) were positive for SARS-CoV-2 by qPCR (Table 1). A total of 10 additional incident infections were identified among study participants, including 9 of 1,376 (0.7%) on Day 7 and 1 of 1,358 (0.1%) on Day 14. Only 12 of 22 (54.5%) participants endorsed any symptoms on study questionnaires, all of which were minor and had not been reported to Marine instructors as part of daily screening.

DISCUSSION

Although the timing during the pandemic, location, and select aspects of the quarantine methodology varied between the hotel- and college campus-supervised quarantines, the similar demographics among recruits and unchanged enrollment and laboratory methodology allowed for a comparison between the 2 locations. Additionally, the procedural and epidemiologic similarities allow for the combining of some results between the 2 quarantines to increase statistical power.

A total of 110 recruits (including study participants and nonparticipants) were positive for SARS-CoV-2 during the 2 supervised quarantines: 77 at the college (previously reported) and 33 at the hotel. Notably, none of the cases were originally identified using temperature checks or symptom reporting as part of the daily procedure. In addition, no SARS-CoV-2 cases were identified among recruits who presented to sick call for formal evaluation by a provider or through any other means during the quarantine. Although a little more than half of the participants endorsed symptoms at the time of infection on the written study questionnaires, either the symptoms did not rise to a level of severity that warranted reporting to an instructor or recruits chose to deny their presence when questioned daily. Temperature checks and inquiring about the presence of select symptoms were insensitive methods to identify infections

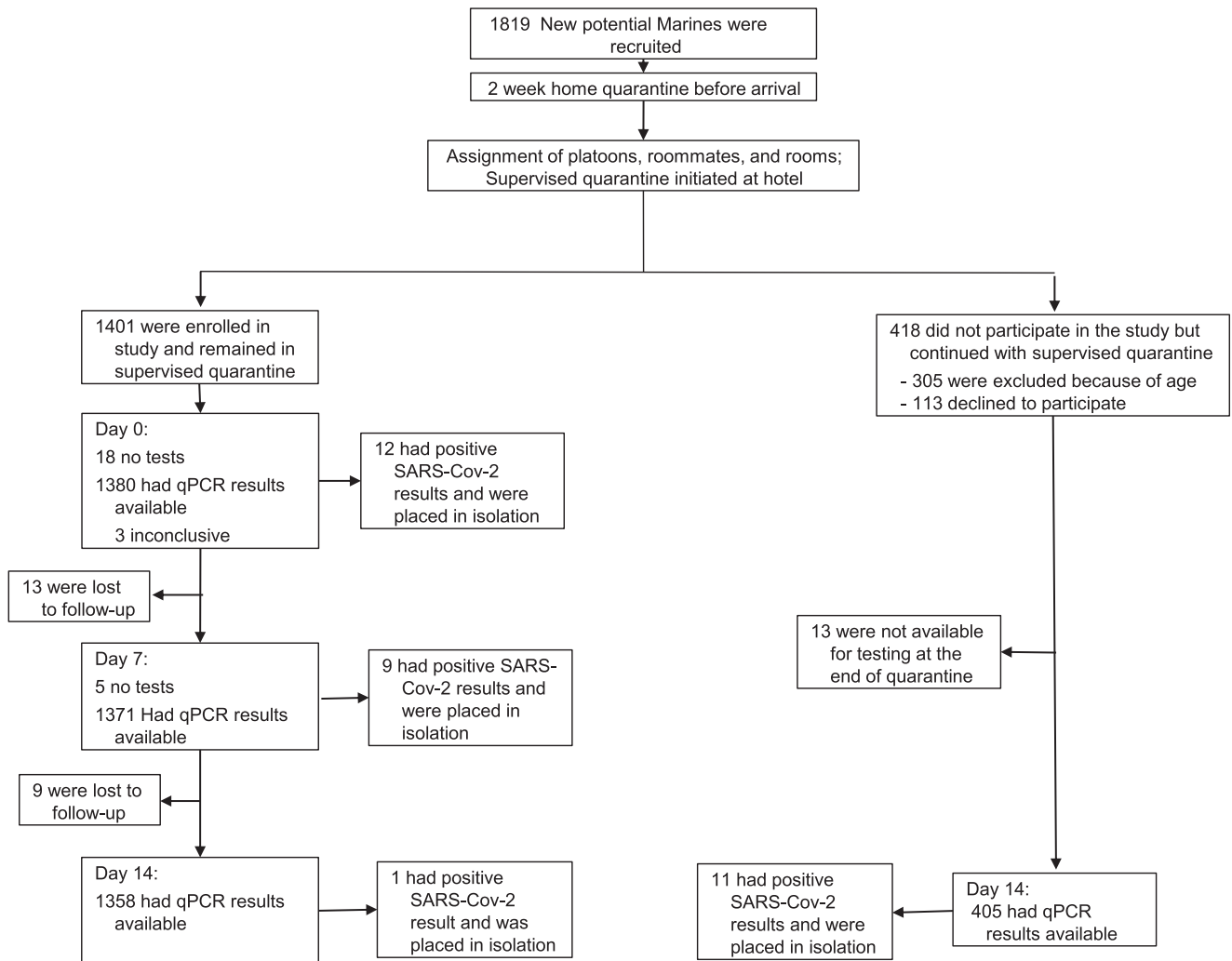


Figure 1. Study design for SARS-CoV-2 testing during hotel quarantine. Marine Corps recruits entering a strict, supervised 2-week quarantine from August 11, 2020 through September 21, 2020 at a hotel in Georgia were asked to volunteer for CHARM longitudinal study for monitoring the transmission of SARS-CoV-2 infection. Recruits who were not enrolled in the study were tested by means of qPCR assay, as required by the Marine Corps, after 14 days of quarantine. CHARM, COVID-19 Health Action Response for Marines; qPCR, quantitative polymerase chain reaction.

among a young and healthy population, identifying none of the 110 cases in the 2 quarantine locations.

The participation rate among eligible recruits at the college campus during the spring/summer was 58.8%, whereas it was 92.5% at the hotel during the late summer/autumn ($p < 0.001$). The difference could be related to the timing of the quarantines against the background of a shifting pandemic in the U.S., personally knowing someone who was infected, and greater awareness regarding the effects of the virus. The increased proportion of recruits volunteering suggests a change in the recruits' attitudes regarding the pandemic over just a few months.

Both quarantine locations had an almost identical percentage of recruits with a positive qPCR test for SARS-CoV-2 on arrival after self-quarantining: 0.86%

(12 of 1,401) and 0.87% (16 of 1,847), respectively ($p = 1.0$). This suggests that even as the pandemic progressed and attitudes toward study participation changed, self-quarantining practices did not. A small but consistent proportion of participants who endorsed not leaving home for 2 weeks or being around a known infected individual had a positive qPCR test on arriving at the supervised quarantine and could have spread the infection to other recruits. Recruit self-quarantine alone, which has been utilized, is unlikely to prevent introductory events in the training environment.¹²

The USMC test-assisted quarantine strategy that evaluated all recruits on Day 14 gives us an idea of the proportion of cases that would have been missed using a test-free quarantine strategy. Using data from both

Table 1. SARS-CoV-2 Positivity, Presence of Symptoms, and Infected Roommates for the Hotel Quarantine Location

| Variables | Number/total number (%) | | |
|---|-------------------------|-----------------|-----------------|
| | Day 0 | Day 7 | Day 14 |
| Study participants | | | |
| First positive qPCR result | 12/1,401 (0.86) | 9/1,376 (0.65) | 1/1,358 (0.07) |
| Cumulative number of recruits with positive qPCR results ^a | 12/1,401 (0.86) | 21/1,401 (1.50) | 22/1,401 (1.57) |
| Cumulative number of symptomatic recruits ^b | 3/12 (25.0) | 10/21 (47.6) | 12/22 (54.5) |
| Nonparticipants ^c | | | |
| Positive qPCR result | Not tested | Not tested | 11/405 (2.72) |
| All recruits, including study participants and nonparticipants | | | |
| Cumulative number of recruits with positive qPCR results | 12/1,401 (0.86) | 21/1,401 (1.50) | 33/1,806 (1.82) |
| Cumulative number of recruits with a roommate ^d | 0/12 (0.00) | 5/21 (23.8) | 7/33 (21.2) |

^aThe cumulative total number includes all recruits who underwent testing up to and including the relevant test day.

^bSymptomatic recruits had a fever or any symptoms within the 7 days before the positive test result. The total number is the cumulative number of study participants with positive qPCR results.

^cInformation regarding the symptoms of nonparticipants is not available. Recruits who did not participate in the study underwent testing only on Day 14, as mandated by the Marine Corps.

^dThe number of recruits indicates the number of positive recruits with a roommate who had a first positive test on or before the given test day, and the total number is the cumulative qPCR positivity for all recruits in this category.

qPCR, quantitative polymerase chain reaction.

quarantine locations, 49 of 110 (44.5%) cases were not identified until the last day of quarantine. Therefore, a test-assisted quarantine strategy was needed to identify almost half the total cases that otherwise would not have been detected using a test-free quarantine.

Some limitations of this study include that the enrollment took place at different times in the year and that the recruits' attitudes about the pandemic, behavior before quarantine, and behavior even after arrival may not be the same. Because not only the location but aspects of quarantine operations changed between locations, including the amount of outdoor group activity compared with being primarily confined to one's room, it is difficult to determine which specific aspects had the greatest effect on mitigating the spread of the infection. However, these concerns are tempered by using the same study staff, enrollment brief, field and laboratory methodologies, and testing strategy. The generalizability of these data is limited because the population was primarily young, healthy males.

The USMC quarantine experience from May until September 2020 showed that oral symptom and temperature screenings did not identify SARS-CoV-2-positive cases in this population. This experience also revealed the limitations of self-quarantine, and potential benefits of regular testing during quarantine to decrease the cumulative case numbers.

ACKNOWLEDGMENTS

The authors acknowledge Captain Adam Armstrong for strategic guidance and administrative support throughout this study, the

many U.S. Navy Corpsmen who assisted in the logistic and sample acquisition, and the Marine Corps recruits who volunteered for this study.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government. The study sponsor did not have any role in study design; collection, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication.

This work was supported by a grant (9700130) from the Defense Health Agency through the Naval Medical Research Center and by the Defense Advanced Research Projects Agency (contract number N6600119C4022). AGL, CWG, and MST are military service members or employees of the U.S. Government. This work was prepared as part of the author's official duties. Title 17, U.S.C., §105 provides that copyright protection under this title is not available for any work of the U.S. Government. Title 17, U.S.C., §101 defines a U.S. Government work as a work prepared by a military service member or employee of the U.S. Government as part of that person's official duties. The study protocol was approved by the Naval Medical Research Center IRB (Protocol Number NMRC.2020.0006) in compliance with all applicable federal regulations governing the protection of human subjects. All participants provided written informed consent for participation.

No financial disclosures were reported by the authors of this paper.

CREDIT AUTHOR STATEMENT

AGL and SCS conceptualization. YG data curation. AGL, CWG, YG, and SCS formal analysis. AGL and SCS funding acquisition. MAS, VAS, and HWC investigation. MST project administration. MAS, VAS, and HWC resources. MAS and IR validation. AGL and YG visualization. AGL, CWG, YG, and SCS writing-original draft.

AGL, CWG, YG, MST, MAS, VAS, HWC, IR, and SCS writing - review and editing.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.focus.2022.100003](https://doi.org/10.1016/j.focus.2022.100003).

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