

## Comparison of Flocked and Rayon Swabs for Detection of Nasal Carriage of *Staphylococcus aureus* among Pathology Staff Members<sup>∇</sup>

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**Comparison of flocked swabs (E-swabs; Copan) to the standard rayon swabs (Copan) was undertaken for detection of *Staphylococcus aureus* nasal carriage among staff at Dorevitch Pathology in Heidelberg, Melbourne, Australia. Among 100 volunteers, 36 were found to be colonized with *S. aureus* by one or both swab results. The prevalence detected by E-swabs was 35%, and the prevalence through rayon swabs was 34% (95% confidence interval [CI] for the difference in proportions, –12 to 14). Thirty-three volunteers tested positive with both types of swabs, while 2 were detected on E-swabs alone and another on rayon swab testing alone. There was no evidence of a significant difference in carriage detected by E-swabs or rayon swabs.**

*Staphylococcus aureus* is a common cause of infections in the community and a major cause of hospital-associated morbidity (18). Colonization is well described, with up to 30% of the population thought to be carriers (7, 16, 18), and is associated with a higher risk of infection in the hospital setting (2, 4, 9, 11, 12, 15, 17, 18). The anterior nares have been shown to be the most frequent site of carriage and therefore a single site for detection (9, 10, 18). Nasal carriage is defined as “persistent” or “intermittent or noncarriage,” with persistent carriers showing an increased risk of infection, compared with intermittent carriers who share the same low risk as noncarriers (13). Given the clinical relevance, it is imperative to use the best swab system which would provide the highest yield in detecting nasal carriage. Flocked swabs have been described as improving uptake of epithelial cells and, therefore, microorganisms and viruses (1, 5, 6, 14), but are more expensive than standard rayon swabs, so it is therefore worth investigating whether there is evidence that E-swabs perform better in detecting nasal carriage.

**Aims.** This study was designed to determine if there is a difference in the performance of E-swabs over standard rayon swabs in detecting nasal carriage of *S. aureus* among healthy adult staff volunteers at a pathology service in Melbourne, Australia.

Ethics approval was gained from The University of Melbourne Human Research Ethics Committee (identification no. 0826852). Volunteers were recruited from staff based at Dorevitch Pathology in Melbourne.

All volunteers were sequentially allocated a study identification number, and individual results remained anonymous. Each volunteer had sampling from each naris with both swabs

(E-swab and Rayon swab; Copan). To ensure that equal numbers of participants were swabbed with each swab type, participants with odd study numbers were sampled with an E-swab first (right then left naris) followed by the rayon swab and those with even study numbers were swabbed in the reverse order. The swab sequence was therefore captured in the study identification number, allowing us to investigate whether swab sequence was important and to control for potential bias associated with swab sequence. Laboratory staff involved in isolating *S. aureus* were blinded to the swabbing sequence.

To maximize sensitivity in detecting any *S. aureus* strains in the presence of other organisms collected by each of the swab types, the swabs were placed in an enrichment broth (tryptic soy broth [TSB] with 6.5% NaCl) overnight (3). The broth culture was then streaked onto horse blood agar (HBA) and chromogenic agar (CHROMID *Staphylococcus aureus* bioMérieux) using an inoculum of 10  $\mu$ l (8). The plates were reviewed between 18 and 24 h, and any colony morphologically consistent with *S. aureus* had a Gram stain, followed by a coagulase test (Staphytec Oxoid) and confirmation using DNase (with ACM 5190 for *S. aureus* and ATCC 12225 for *Staphylococcus epidermidis* used as controls). Any discordant results were evaluated using a tube coagulase test (at 4 and 24 h).

A sample size of 100 was chosen to provide 80% power to detect a difference as small as 4.5% at a 0.05 probability level, assuming an *S. aureus* carriage prevalence of about 30% detected by rayon swabs. Descriptive statistical analyses and 95% confidence intervals (CI) were computed using Stata (version 10). As there is no “gold standard” test, we used a positive result on at least one swab type as the denominator for computing sensitivity.

A total of 100 volunteers were successfully recruited from the 677 staff employed at Dorevitch Pathology, Melbourne, representing approximately 15% of the total staff.

Thirty-six of the 100 volunteers had *S. aureus* detected from either or both swabs, with an overall carriage prevalence based

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TABLE 1. Overall results from flocked and rayon swabs

Rayon swab result	No. of E-swab results:		
	Positive	Negative	Total
Positive	33	1	34
Negative	2	64	66
Total	35	65	100

on both swab results of 36%. Thirty-three carriers were detected by both the E-swabs and rayon swabs (Table 1).

Table 2 represents the swab results for the three individuals who had discordant results between the two swabs; all three were swabbed with the rayon swab first.

The prevalence detected by E-swabs was 35%, while that through rayon swabs was 34% (95% CI for the difference in proportions, -12 to 14). Presuming the volunteers with any positive result represent the true-positive population (36%), the sensitivities for carriage are 97.2% for the E-swabs (95% CI, 85.5 to 99.9) and 94.4% for the rayon swabs (95% CI, 81.3 to 99.3). The swab results were concordant for 92% of the 36 volunteers who had at least one positive result. It should be noted that the only positive rayon swab result among the discordant results occurred when the rayon swab was applied first. The two discordant results positive by the E-swab only, on the other hand, occurred when the E-swab was the second swab used and so cannot be explained by the swabbing sequence.

Our findings do not argue for the use of E-swabs in large-scale screening programs for nasal carriage, particularly given the swab cost differential (E-swab, \$1.60 Australian; rayon swab, \$0.38 Australian).

There are several limitations to this study, including the lack of a gold standard to compare the E-swabs with for determination of sensitivity and specificity. Only one anatomical site for screening was used, and it been well described in the literature that sampling more than one site increases the yield of detection (18). The main reason for choosing the anterior nares alone was that the nares were deemed the least invasive site, had previously been described as the best single site for detection of colonization (9, 18), and are being used in large-scale community-based studies: for instance, the Community Onset *Staphylococcus aureus* Household (COSAHC) study under way in Melbourne. Finally, we only tested these swabs under more optimal volunteer conditions; we cannot rule out that one swab type may be more effective than the other in clinical settings where other patient and context factors may have an impact on the swabbing procedure.

Flocked swabs are becoming more commonly used in pathology specimen collection. The increased surface area and ease of use have been major positive aspects of their use. This small study illustrates that the standard rayon swabs can be as effective in detection of *S. aureus* nasal carriage as the more expensive E-swabs. The use of E-swabs in sampling other colonization and wound sites may be worth investigating further.

TABLE 2. Discordant results between the two swabs<sup>a</sup>

Study volunteer no.	Result from:	
	Rayon swab	E-swab
6	+	-
16	-	+
36	-	+

<sup>a</sup> In each case, the rayon swab was the first swab.

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