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Infection Prevention in a Long-Term Acute Care Hospital With Universal Prophylactic Use of a Surgically Based Alcohol Nasal Hygiene/ Decolonization Method

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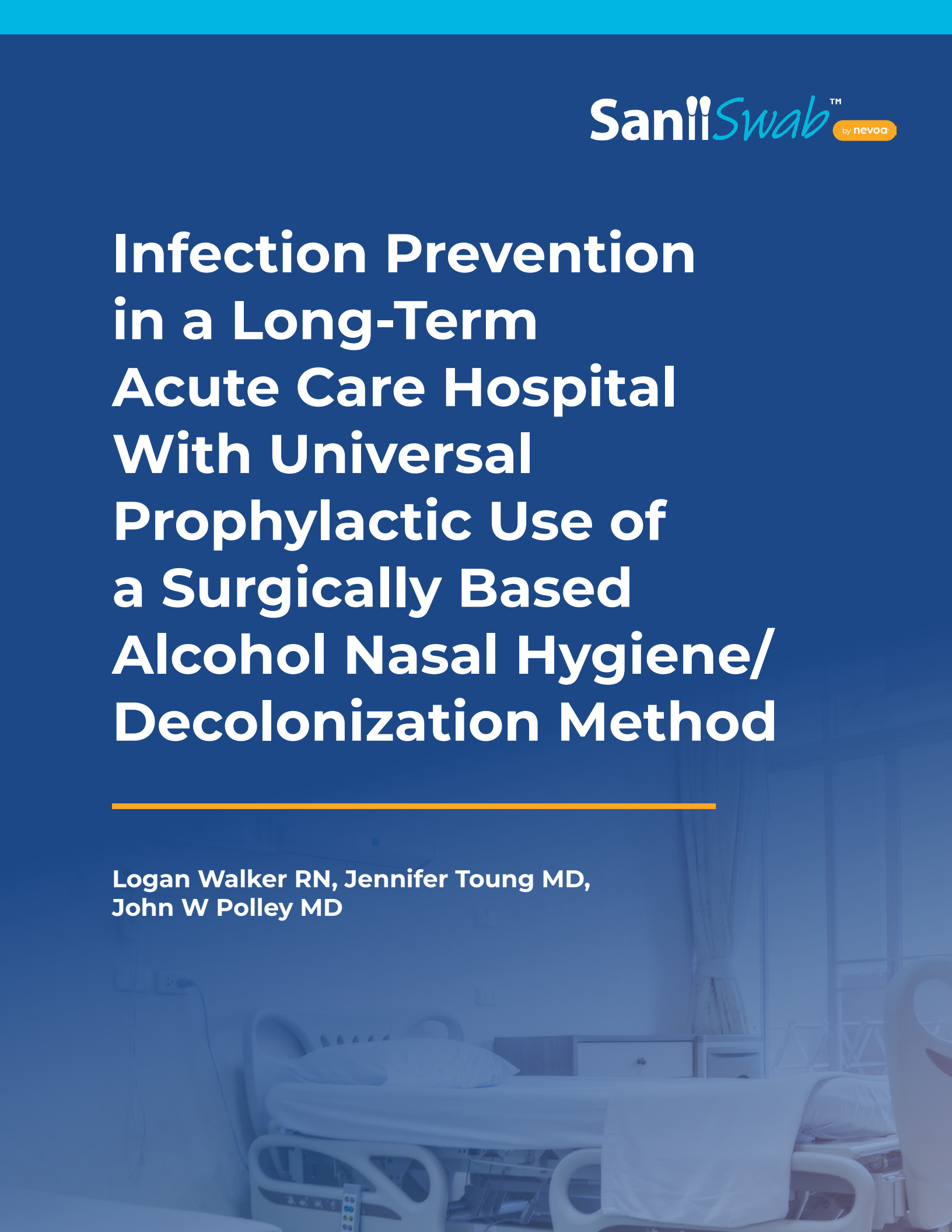


INTRODUCTION:

Nasal decolonization is now recognized as an important adjunct in infection control for hospitalized patients[1,2,3]. This paper evaluated the outcomes of a 90-day trial of nasal decolonization in a long-term, acute care 40-bed hospital setting. All inpatients were offered a surgically proven, two-step nasal decolonization method once per day. The number of blood and sputum cultures sent for microbiologic evaluation, and the number of positive cultures from those sent, during the 90-day period were recorded.

Cultures were drawn on patients who had clinical or physical findings of an infectious process. The data from the nasal decolonization period was then compared to both immediate and past historical data over similar time periods. Data review was performed by both the lead authors as well as an outside independent contractor. The findings strongly support nasal decolonization as an important factor in the reduction of suspected inpatient infectious processes.

METHODS:

A nasal decolonization trial was performed at a 40-bed, long-term acute care hospital. The trial ran for 90 days from October 15, 2023, through January 15, 2024. During this period all hospitalized inpatients were offered a daily nasal decolonization method. The nasal decolonization method is a surgically based, two-step dual prep methodology known as SaniiSwab. SaniiSwab is an antibiotic free, two-step cleaning methodology and includes both mechanical cleaning of the nasal vestibular skin along with two separate sanitizing agents, of which the lead agent is alcohol-based.

During the trial period average inpatient census was 85% or 34 of 40 bed occupancy. Patient compliance for using the nasal decolonization method throughout the trial period was consistently 80%. After an initial demonstration for each patient on how to use the double prong SaniiSwab two-step technique, patients then performed their own daily nasal decolonization. Compliance was recorded by the patient's nurse.

Blood (peripheral or central line samples) and sputum (oral or tracheostomy samples) cultures were obtained on patients who had clinical evidence of an infectious process based upon their evaluation by the treating physician. Blood cultures were routinely sent for a fever of 101.2 Fahrenheit or greater. Sputum cultures were sent based on the treating physician's patient history and pulmonary physical exam. Blood cultures were drawn either peripherally or from an indwelling central line if present.

The number of cultures sent, both blood and sputum, as well as the number of positive cultures for bacterial growth were recorded throughout the period of the trial. The results of the number of total cultures obtained and number of positive cultures during the period of the nasal decolonization trial were then compared to historical data. Total cultures obtained and number of positive cultures for bacterial growth were reviewed over the same chronologic period of October 15 through January 15 for the prior 6 years beginning in 2017 through 2023. In addition, total cultures obtained and number of positive cultures for bacterial growth were reviewed for the 6-month period prior to initiation of the decolonization trial in 2023 beginning April 15, 2023.

Census reports were also reviewed for all historical time periods evaluated prior to initiation of the nasal decolonization trial. Statistically the *p*-value for the total number of positive cultures obtained was calculated using *z*-score analytical statistics. (Table 2).

TABLE 2

$$Z = \frac{x - \mu}{\sigma}$$

RESULTS:

Numerical and graphic results of total cultures sent and positive bacterial cultures for each of the historical time periods as well as the nasal decolonization trial period are illustrated in Figures 1 through 11 and Table 1. The 6-year average of the same chronologic period (Figure 1), October 15 through January 15, revealed an average number of total cultures sent at 97 with an average of 28% of those cultures being positive for bacterial growth. This same chronologic time period, October 15, 2023, through January 15, 2024 during the nasal decolonization trial saw a total of 64 cultures sent with 16% of those being positive for bacterial growth.

The reduction in total cultures and positive cultures for each of the prior six years are illustrated in Figures 4 thru 9. Looking at the immediate 3 months prior to initiation of the nasal decolonization trial, the number of cultures obtained during the nasal decolonization period was 68% less than that of the preceding 3 months and 38% less for positive bacterial cultures from the preceding 3 months (Figure 2).

FIGURE 1

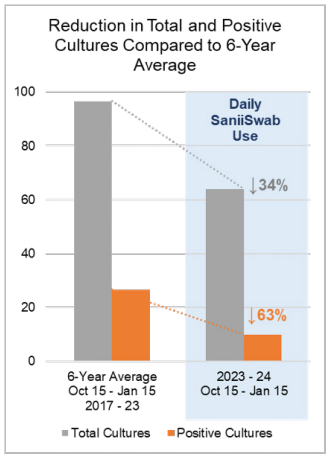
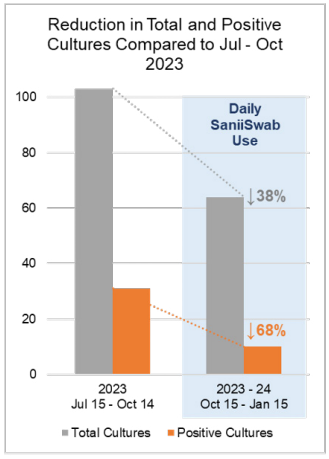


FIGURE 2



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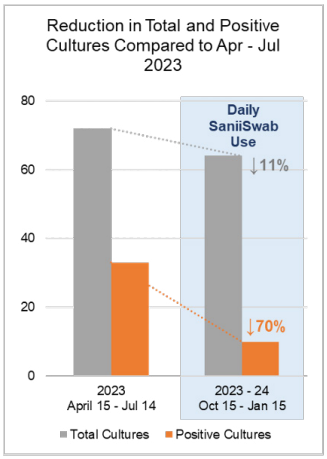

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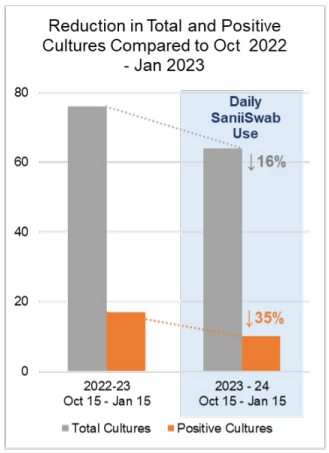

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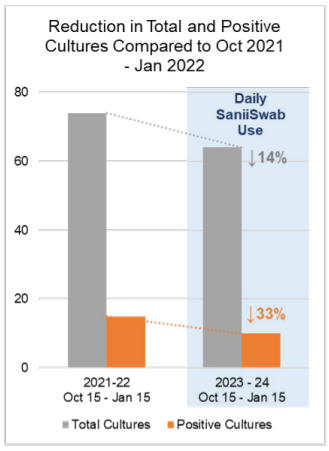

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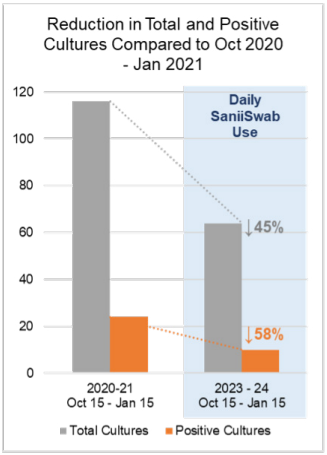

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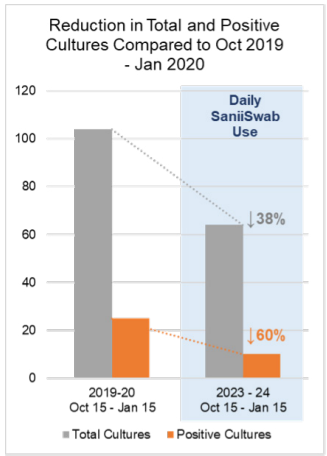

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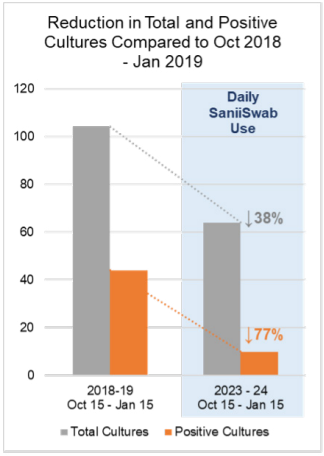
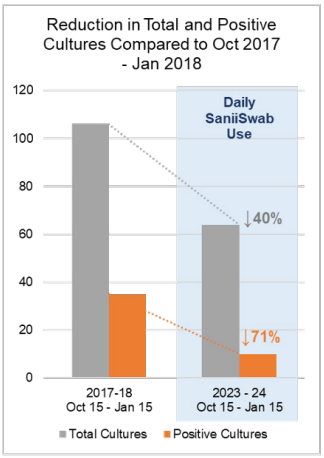


FIGURE 9



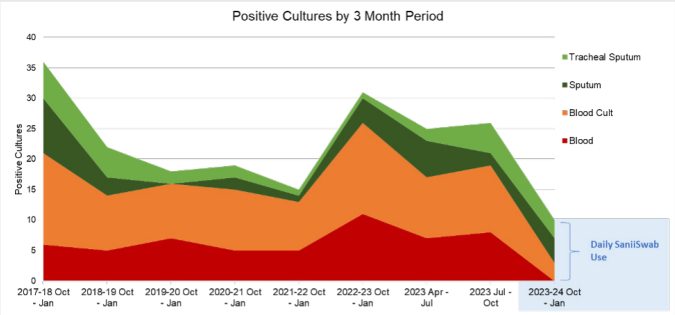
There was an average reduction during the nasal decolonization trial of **63%** in positive cultures and an average reduction of **34%** in total cultures obtained.

Compared to the 3-month time period April 15, 2023 through July 15, 2023 there was a reduction of 11% of total cultures and 70% positive cultures compared to the trial period of October 15, 2023 through January 15, 2024 (Figure 3). These data sets are further illustrated in Figures 10 and 11 and Table 1 below.

TABLE 1

Cultures Over Three-Month Periods 2017 - 2024			
Period	**Positive** (Count)	**Total** (Count)	**Positive** (%)
Oct 15, 2017 - Jan 15, 2018	41	108	38%
Oct 15, 2018 - Jan 15, 2019	31	102	30%
Oct 15, 2019 - Jan 15, 2020	22	108	20%
Oct 15, 2020 - Jan 15, 2021	23	111	21%
Oct 15, 2021 - Jan 15, 2022	17	77	22%
Oct 15, 2022 - Jan 15, 2023	35	79	44%
Apr 15, 2023 - July 14, 2023	33	72	46%
Jul 15, 2023 - Oct 14, 2023	31	103	30%
Oct 15, 2023 - Jan 15, 2024 *Daily SaniiSwab Use Instructed*	10	64	16%
Average	**27**	**92**	**30%**

FIGURE 10



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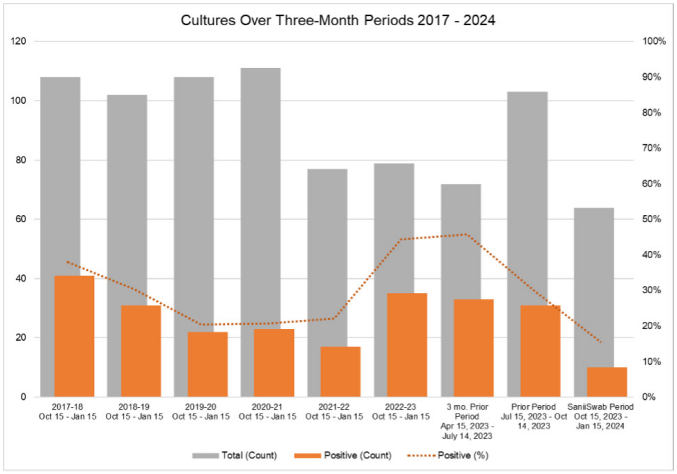

We found a significant relationship between the daily use of SaniiSwab and the reduction in positive cultures (p=.04) and a near-significant relationship in the reduction of total cultures (p=.06). The significance threshold was set at .05 (Table 2).

DISCUSSION:

A Hospital Acquired Infection (HAI) is the dreaded result of a patient who did not have an infection upon admission to a hospital but developed an infection during their hospital stay. HAIs are linked with potential high morbidity and mortality. It is estimated that 1 in 31 hospital patients develop a HAI, affecting 2 million patients yearly and accounting for over 100,000 deaths in the United States alone[4].

The financial burden for treating HAI's is estimated at over $40 billion annually[4]. Hospitals in particular feel this financial burden as the expenses for treating HAIs are often not reimbursable through the patient's insurance and in fact the Center for Medicare Services (CMS) penalizes those hospitals with the highest HAI rates[5]. Based in part on the financial incentive to reduce HAIs, hospitals over the past two decades have changed from the concept of most HAIs being an unpreventable "cost of business " to the understanding that the majority of HAIs are preventable. The focus for hospital programs has now shifted from infection control to infection prevention.

HAI data is now followed closely by the Center for Disease Control (CDC) through national and state HAI progress reports from individual hospitals[5,6]. HAIs are broken down into categories including post-operative surgical site infections (SSI), respiratory/pulmonary infections, access line infections including peripheral and central lines, and catheter related infections most commonly of the genitourinary tract.

It is well understood that with postoperative surgical site infections the source of the infectious agent or bacteria most always arises from an endogenous source from the patient themselves. Gram-positive cocci including Staphylococcus aureus are the most common organisms initially involved in postop surgical site infections[4]. Gram-positive cocci like all bacteria thrive in and an environment that is warm, has moisture or water, and somewhere that avoids light exposure. In addition, like all living organisms, bacteria need nutrition for sustainability and propagation.

The ideal locations in the human body that supply all these requirements are the hair bearing skin areas of the groin, axillae, and nasal vestibules. These three areas are protected from the outside environment, are warm, moist, dark, and are abundant in apocrine glands and eccrine glands that can supply the basic nutrient requirements for bacteria along with lipids and proteins from the desquamating epithelium of the skin. Preoperative body washes focus on thorough cleaning of the axilla and groin as does an appropriate preoperative surgical prep technique. Cross-contamination from these areas of the body to other sites of HAIs likely plays a very important role in the initiation of these infections as well.

We are finally beginning to understand that nasal hygiene is as, or perhaps more, important than hand hygiene for good health and for the prevention of respiratory and other HAIs.

In 1846 Ignaz Semmelweis linked the importance of hand hygiene to infection prevention. Recently most evaluations on strategies to prevent HAIs have focused on handwashing and its critical importance for the prevention and spread of infectious diseases in the hospital and public setting[4]. It is important to realize that infectious organisms on the hand, in and of themselves, do not cause infections. It is only when they are physically transferred from the hand to an open body source such as a fresh incision or open wound, a skin piercing line, a catheter conduit, or access to enter the pulmonary respiratory system.

The other major hair bearing area of the body that houses infectious viruses and bacteria is the nose. 90% of the air we breathe in is through the nose. This air first enters the anterior nose or nasal vestibule which are lined with skin containing apocrine glands, eccrine glands, hair and hair follicles. These hairs and sticky secretions in the nasal vestibules form our bodies natural air filter, trapping contagious viruses, bacteria, and allergens that we breath in.

It has been shown that the nasal vestibules, when clean, are very efficient at trapping particles 0.5 µm or greater[7,8,9]. This includes all allergy danders and bacteria. A lone virus itself has a diameter less than 0.5 µm but typically viruses are transported by an aerosol with particles that range from 0.5 µm or greater[10]. It is well-documented that the anterior nose is much more heavily colonized by bacteria than any other site in the upper respiratory tract. The CDC now recommends the anterior nasal swab as the diagnostic site for respiratory viruses including COVID versus the posterior pharyngeal airway[11,12].

Germs can incubate in the nasal vestibules typically in 2-6 days and then can become infectious, spreading to the host or transmitted to others[13]. As with hand washing, daily nasal hygiene for suppression of these germs early in the incubation process prior to becoming infectious is the goal. What is needed is an effective, safe, and easily performed technique for cleaning the nose that doesn't require constant medical supervision.

This trial utilized SaniiSwab, the clinically proven method and device for safely and efficiently performing nasal hygiene/decolonization. SaniiSwab was designed following the surgically documented effectiveness of a two-step, dual prep technique for sanitizing the nasal vestibules. The two steps include:

Step 1:

a mechanical cleaning procedure of both nasal vestibules utilizing safe and readily available surfactants.

Step 2:

sanitizing the now clean nasal vestibules with readily available sanitizing agents.

** The entire procedure is quickly and safely performed and is self-administered, sparing valuable time of other care providers.*

Positive cultures from the total cultures sent during the SaniiSwab period were 63% less than the prior 6-year average.

In the long-term acute care 40-bed facility where this trial took place blood and or sputum samples were cultured on patients who were suspected of having an infection based on a fever protocol and the judgment of the treating physician. Blood cultures were routinely sent on patients having a fever of 101.2 F or greater, and sputum cultures were sent based on respiratory/pulmonary physical findings.

Even with a patient SaniiSwab noncompliance rate of 20%, the total number of cultures sent during the SaniiSwab time period was 34% less than the prior 6-year average.

Compared to the preceding 3-month period prior to initiation of SaniiSwab total cultures sent were 38% less and total positive cultures were 68% less during the SaniiSwab trial.

These findings are not surprising. The importance of handwashing for the reduction of HAIs is understood. We now clearly understand the importance of nasal hygiene/decolonization in the prevention of HAIs as well. This study mirrors closely the findings of the larger study by Gussin[1] who found similar rates in the reduction of infections following nasal decolonization and body hygiene techniques in nursing homes and long-term acute care hospitals.

The real question now becomes how often should the nasal hygiene/decolonization technique be used by the patient? In this trial nasal hygiene was performed once a day. We ask ourselves how many times a day do healthcare professionals in the hospital setting wash their hands? These questions and the time effectiveness of the hygiene techniques will need further evaluation.

It has been clearly demonstrated that even once a day appropriate nasal hygiene/decolonization can have a very real impact on the reduction of HAIs.

The important financial questions must also be evaluated. It is estimated that the cost for a successful treatment of an HAI averages more than $40,000 USD in the US. But there is also the question of what is the cost of an unsuccessful treatment of an HAI that results in one patient mortality[1,14]?

CONCLUSION:

Nasal decolonization is recognized as an important protocol in infection control for hospitalized patients[1,2,3]. The results of this study strongly support the universal use of the SaniiSwab, surgically based, two-step dual prep decolonization method on hospitalized patients for pathogen reduction and the prevention of HAIs.

REFERENCES:

[1]Gussin, GM, et. al. Reducing hospitalizations and multi-drug resistant organisms via reginal decolonization in hospitals and nursing homes. JAMA Online publication. E 1-14. April 1, 2024

[2]Septimus, EJ, Schweizer, ML. Decolonization in prevention of health care-associated infections. Clinical Microbiology Reviews. April 2016, Vol 29 #2 pp201-221.

[3]Septimus, EJ. Nasal decolonization: What antimicrobials are most effective prior to surgery? Am J. of Infection Control 47 (2019) A53-A57

[4]Center for Disease Control: Current HAI Progress Report. 2021 www.cdc.gov

[5]Stone PW et.al. CMS changes in reimbursement for HAI's. Med Care, 2010 May:48(5);433-439

[6]Cohen, CC, et.al. Financial incentives to reduce hospital-acquired infections under alternative payment arrangements. Infect Control Hosp Epidemiol, 2018 May;39(5):509-515

[7]Oneal RM et.al. Surgical anatomy of the nose. Otolaryngol Clin North Am. 1999 Feb; 32(1):145-181.

[8]Patel RG. Nasal anatomy and function. Facial Plast Surg. 2017 Feb; 33(1):3-8.

[9]Jones N. The nose and paranasal sinuses physiology and anatomy. Adv Drug Deliv Rev 2001 51:5-19

[10]Hatch TF, Gross P. Pulmonary deposition and retention of inhaled aerosols. Academic Press 1964 NY London

[11]Heikkinen T, et.al. Nasal swab versus nasopharyngeal aspirate for isolation of respiratory viruses. J Clin Microbio, 2002 Nov; 40(11),4337-4339

[12]Bhatta DR, et.al. Nasal and pharyngeal colonization by bacterial pathogens: A comparison study between preclinical and clinical sciences medical students. Canadian J Infec Dis V 2018, Art ID 7258672 6 pages

[13]Lessler J, et.al. Incubation periods of acute respiratory viral infections: A systemic review. Lancet Vol 9: May 2009pp 291-300.

[14]Benenson S, et.al. Is it financially beneficial for hospitals to prevent nosocomial infections? BMC Health Services Research 20, Article number: 653 (2020)