



Nasal microflora of adult waste pickers of Iligan City, Philippines

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Abstract

The indigenous nasal microbiome plays an important role in human health and disease. To have a baseline data on the bacterial microflora of individuals who are persistently exposed to unsegregated wastes, 33 waste pickers of Iligan City was recruited to be part of the study. Increased nasal bacterial colonization rates were seen from dry to wet season (~10⁶ CFU/swab to >300 CFU/swab). Eight different genera of bacteria were then presumptively identified with *Staphylococcus aureus* (37 isolates) and *Corynebacterium* (15) as the predominant bacterial strains. *Lactobacillus* (14 isolates), *Bacillus* (11), *Micrococcus* (5) and *Mycobacterium* (4) were not typical nasal microbiota that was detected.

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Introduction

Urbanization has led to the increased production and economic diversification but also deprivation, poverty and marginalization. The latter conditions have spurred urban migrants to seek out lodging in slums and garbage dumps. The waste generation of the Philippines has been observed to have steadily risen the past few years (Galarpe, 2017). Economic opportunities associated with waste dumps has led to the establishment of communities adjacent to disposal sites. Majority of garbage dump dwellers as well as proximal residents, earn their living by waste picking.

These waste pickers usually constitute about one percent of the urban population and they belong to vulnerable groups: recent migrants, the unemployed, the disabled, women, children, the elderly (Medina, 2008). Generally, recovery of recyclable material waste materials is considered one of the easiest informal labour markets that the populace can enter and is commonly the only means of livelihood. However, they work on the streets and in open dumps, where daily contact with all kinds of waste—including hazardous and medical waste—poses risks to their health (Cointreau, 2006).

Previous studies have indicated that solid waste handling and scavenging is a significant health risk. Waste pickers of Vietnam have been reported to have back pains due to constant bending motion required to search for recyclables. Other health problems include cough, headache, stomach and muscle aches, itchy skin and rashes. In Bangalore, Manohar and New Delhi, India tuberculosis, bronchitis, pneumonia, dysentery, and malnutrition are the most common illnesses of rag pickers (Nguyen *et al.*, 2001).

However, scavenging for wastes in various dumps and piles where there are mixed wastes, it is not clear which specific exposure may induce health problems. In the Philippines, there is a definite gap of information as to the etiological effect of garbage and waste that can be cited through an individual's nasal colonization pattern.

Thus, it is the objective of this study to determine the colonization rate of microorganisms as well as to identify potentially pathogenic bacteria from nasal swab specimens of adult waste pickers of Iligan City, Philippines.

Methodology

Study Population

Adult waste pickers of Iligan City were recruited to be part of this study. A questionnaire guided interview was done prior to nasal swab collection. Demographic data collected are the following: age, sex, civil status, medical history, common illnesses previously experienced, medications and supplements taken, history of antibiotic use, smoking habits, pregnancy status and presence of skin lesions.

Nasal Swab Collection

After a verbal consent was obtained from each subject, a nasal specimen was collected from their nares with a dry, unmoistened swab. The tip of the collection swab was inserted approximately one inch (2.56 centimetres) into the nares and rolled five times in each nostril (Warren *et al.*, 2004). Collected specimens were transported and stored at ambient room temperature. Specimens were immediately processed in the laboratory within an hour after collection. Nasal specimens were requested from the subjects for 6 sampling periods with an interval of two weeks.

Determination of Nasal Colonization Rates

Each collection swab was initially inoculated into nutrient agar plates. After 24 and 48 hours of incubation at ambient room temperature, the well-isolated colonies are counted and CFU (colony forming units) per swab was determined (Practical II, 2010).

Presumptive Identification of Nasal Bacterial Microflora

Since this study was intended for the recovery, isolation and identification of different bacterial species colonizing the nares, the following traditional microbiological methods were employed (General

Microbiology Lab Manual, 2017): morphological (growth patterns on NA plates, slants and nutrient broth tubes), cellular characterization (various stains: Gram, sporulation and acid-fast) and a number of biochemical reactions (catalase test, coagulase, blood agar haemolysis, glucose and mannitol salt fermentation test).

Results and discussion

Representative Waste Picker Population of Iligan City

The members of the study population were mostly underprivileged who earned their living by foraging for recyclables. Some wastes that can be recycled like cartons, plastic bottles, metals, unused electronic parts were sold to various junk shops.

These people can often sell recyclables as much as 10 USD (US Dollar) per day. However, majority of these individuals do not use the necessary protective gear that would shield them from infectious wastes that they might come in contact with. Instead they only have improvised gloves and old cloth that covered their eyes. For protection from the intense heat of the sun, they wore long, thin long-sleeved shirts.

An ordinary workday of a scavenger consists of waste picking beginning early in the morning until the rest of the day. Sometimes, some individuals would remain until dusk to continue foraging in the hopes of gaining additional money. The different categorical variables of 33 identified scavengers (20 females and 13 males) are shown in Table 1.

Table 1. Demographic profiles of the study population.

Variable	Number of Individuals (Percentage)		
	Male	Female	Total
Smoker	4 (31)	2 (10)	6 (18)
Experienced common illnesses	4 (31)	10 (50)	14 (42)
Experienced serious illnesses	2 (15)	3 (15)	5 (15)
Antibiotic user	2 (15)	2 (10)	4 (12)

Antibiotic users and smokers were the minority in the population (6 and 4 individuals, respectively). Incidence of infection and diseases according to the subjects, vary from time to time depending on how much stress they were experiencing or on the abrupt

weather changes. Three females and two male waste pickers suffered from ulcer, kidney infections, asthma attacks and migraines and were categorically considered to have serious health problems.

Table 2. Average colonization rates of waste pickers during dry and wet seasons.

Demographic Factor	Colonization Rate (CFU/swab)	
	Dry Season	Wet Season
Smoker	88	>300
Experienced common illnesses	125	>300
Experienced serious illnesses	105	>300
With history of antibiotic use	108	>300

Bacterial Colonization Rates

In Table 2, the average nasal colonization rates of different subpopulations of waste pickers during wet and dry season are shown. Increased colonization rates were seen in all subgroups from dry to wet season. This is because of residues, most commonly

faecal matter, were left behind wherein there is a rain-wash. Waste pickers who at the same time are smokers exhibited the largest increase of CFU/swab (88 vs >30). No statistical significance was seen in the increase of colonization rates with the identified subgroup.

The high amount of bacterial colonization is but typical as the human respiratory tract is exposed to potential pathogens via the smoke, soot and dust that are inhaled in the air. It has been calculated that the average individual ingests about 8 microorganisms per minute or 10,000 per day (WHO, 2003).

Nasal Bacterial Species among Waste Pickers

Table 3 shows the different bacterial species presumptively identified from the nasal swab specimens of adult waste pickers. The human nose

contains different species of bacteria and these microbes colonize the human body during birth or shortly thereafter and are referred to as normal flora (Davis, 2001). Microorganisms that are commonly found in the nose are *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Corynebacterium diphtheriae*, *Streptococcus pneumoniae*, *Nisseris meningitidis* and *Haemophilus influenzae*, making up the basal bacterial flora (Frank *et al.*, 2010; Bassis *et al.*, 2014).

Table 3. Colonization rate of nasal microorganisms amongst adult waste pickers.

Bacterial Strain	Number of Isolates
<i>Staphylococcus aureus</i>	37
<i>Corynebacterium sp.</i>	15
<i>Lactobacillus sp.</i>	14
<i>Bacillus sp.</i>	11
CoNS	7
<i>Streptococcus sp.</i>	7
<i>Micrococcus sp.</i>	5
<i>Mycobacterium sp.</i>	3
TOTAL	99

The abundant bacterial species isolated is *Staphylococcus*: *S. aureus* with 37 isolates and the isolation of *S. aureus* as the predominant bacterial species is typical as *S. aureus* colonizes the human anterior nares in 20-80% of all individuals in the normal population (Brown *et al.*, 2013). However, colonization of *S. aureus* in the nares is a potent and increasingly prevalent risk factor for subsequent *S. aureus* infection (Gorwitz *et al.*, 2008; Wertheim *et al.*, 2004; Davis *et al.*, 2004; Perl *et al.*, 2002;) *Corynebacterium* was the second most predominant nasal isolate (15). The results of this study is similar to that of Frank *et al.* (2010) where healthy adults harbored nares communities dominated by Actinobacteria (mainly *Propionibacterium* and *Corynebacterium spp.*). The predominance of *Staphylococcus* and *Corynebacterium* in the microbial ecological studies of the anterior nares (Frank *et al.*, 2010; Grice *et al.*, 2009; Human

Microbiome Project Consortium, 2012; Zhou *et al.*, 2013) is very similar to the result obtained in this study. Humidity and moisture have also been suggested to be favorable environmental factors for *Corynebacterium* and *Staphylococcus* species and may explain the abundance of *Corynebacterium* and *Staphylococcus* species at mucosal sites (Yan *et al.*, 2013).

Despite staphylococcal strains being common inhabitants of the skin and mucus membranes (Talaro and Talaro, 1993), there were only 7 coagulase-negative staphylococci (CONs) isolated from the subjects. This may be due to the fact that CONs are mostly skin inhabitants (Todar, 2005).

There were 7 Streptococcal isolates recovered from the 33 subjects. Colonization with the pathobionts *Streptococcus pneumoniae*, *Haemophilus influenzae*

and *S. aureus* is associated with lower levels of bacterial microbiota diversity and decreased levels of commensals, indicating a potentially disturbed microbiota (Chonmaitree *et al.*, 2017; Bessesen *et al.*, 2015).

Lactobacillus (14 isolates), *Bacillus* (11), *Micrococcus* (5) and *Mycobacterium* (4) are non-microfloral nasal strains and its isolation can only be attributed to the constant exposure of the subjects to scavenging through unregulated wastes.

References

- Bassis CM, Tang AL, Young VB, Pynnonen MA.** 2014. The nasal cavity microbiota of healthy adults. *Microbiome* **2**, 27.
<http://dx.doi.org/10.1186/2049-2618-2-27>.
- Bessesen MT, Kotter CV, Wagner BD, Adams JC, Kingery S, Benoit JB, Robertson CE, Janoff EN, Frank DN.** 2015. MRSA colonization and the nasal microbiome in adults at high risk of colonization and infection. *Journal of Infection* **71(6)**, 649-657.
<http://dx.doi.org/10.1016/j.jinf.2015.08.008>.
- Brown AF, Leech JM, Rogers TR, McLoughlin RM.** 2013. *Staphylococcus aureus* Colonization: Modulation of Host Immune Response and Impact on Human Vaccine Design. *Frontiers in Immunology* **4**, 507.
<http://dx.doi.org/10.3389/fimmu.2013.00507>
- Chonmaitree T, Jennings K, Golovko G, Khanipov K, Pimenova M, Patel JA, McCormick DP, Loeffelholz MJ, Fofanov Y.** 2017. Nasopharyngeal microbiota in infants and changes during viral upper respiratory tract infection and acute otitis media. *PLoS One* **12**, e0180630.
<http://dx.doi.org/10.1371/journal.pone.0180630>
- Cointreau S.** 2006. Occupational and Environmental Health Issues of Solid Waste Management: Special Emphasis on Middle and Lower-Income Countries. *Urban Papers 2*, World Bank.
- Davis KA, Stewart JJ, Crouch HK, Florez CE, Hospenthal DR.** 2004. Methicillin-resistant *Staphylococcus aureus* (MRSA) nares colonization at hospital admission and its effect on subsequent MRSA infection. *Clinical Infectious Disease* **39**, 776–782.
- Davis CP.** 1996. Normal Flora. *Medical Microbiology*. 4th edition. Galveston (TX): University of Texas Medical Branch at Galveston, USA.
- Frank DN, Feazel LM, Bessesen MT, Price CS, Janoff EN, Pace NR.** 2010. The human nasal microbiota and *Staphylococcus aureus* carriage. *PLoS ONE* **5**, e10598.
- Galarpe VRKR.** 2017. Review on the Impacts of Waste Disposal Sites in the Philippines. *Science International* **29(1)**, 379-385.
- General Microbiology Lab Manual.** 2017.
- Grice EA, Kong HH, Conlan S, Deming CB, Davis J, Young AC, Bouffard GG, Blakesley RW, Murray PR, Green ED.** 2009. NISC Comparative Sequencing Program . Topographical and temporal diversity of the human skin microbiome. *Science* **324**, 1190–1192.
- Gorwitz RJ, Kruszon-Moran D, McAllister SK, McQuillan G, McDougal LK.** 2008. Changes in the Prevalence of Nasal Colonization with *Staphylococcus aureus* in the United States, 2001-2004. *Journal of Infectious Disease* **197**, 1226–1234.
- Human Microbiome Project Consortium.** 2012. Structure, function and diversity of the healthy human microbiome. *Nature* **486**, 207–214.
- Medina M.** 2008. The informal recycling sector in developing countries. *Gridlines* 44.

- Nguyen DM, Mascola L, Bacroft E.** 2001. Recurring Methicillin-resistant *Staphylococcus aureus* in Infections in a Football Team. *Emerging Infectious Diseases* **11(4)**.
- Perl TM, Cullen JJ, Wenzel RP, Zimmerman MB, Pfaller MA.** 2002. Intranasal mupirocin to prevent postoperative *Staphylococcus aureus* infections. *New England Journal of Medicine* **346**, 1871–1877.
- Practical II.** 2010. Microbiology Practical Guide (A). pages 10-11.
- Talaro A, Talaro K.** 1993. *Foundation in Microbiology*. Brown Publishers, USA.
- Todar K.** 2005. *Staphylococcus*. University of Wisconsin-Madison Department of Bacteriology. <http://www.textbookofbacteriology.net/staph/html>.
- Warren DK, Liao RS, Merz LR, Evelend M, Dunne WM Jr.** 2004. Detection of methicillin-resistant *Staphylococcus aureus* directly from nasal swab specimens by a real-time PCR assay. *Journal of Clinical Microbiology* **42(12)**, 5578-81.
- Wertheim HF, Vos MC, Ott A, van Belkum A, Voss A.** 2004. Risk and outcome of nosocomial *Staphylococcus aureus* bacteraemia in nasal carriers versus non-carriers. *Lancet* **364**, 703–705.
- World Health Organization (WHO).** 2003. Report 2003, shaping the future, Geneva, Switzerland.
- Yan M, Pamp SJ, Fukuyama J, Hwang PH, Cho DY, Holmes S, Relman DA.** 2013. Nasal Microenvironments and Interspecific Interactions Influence Nasal Microbiota Complexity and *S. aureus* Carriage. *Cell Host & Microbe* **14**, 631–640. <http://dx.doi.org/10.1016/j.chom.2013.11.005>
- Zhou Y, Gao H, Mihindukulasuriya KA, La Rosa PS, Wylie KM, Vishnivetskaya T, Podar M, Warner B, Tarr PI, Nelson DE.** 2013. Biogeography of the ecosystems of the healthy human body. *Genome Biology* **14**, R1.