

# Acceptance and effects of nasal lavage in volunteer woodworkers

S. J. Rabone\* and S. B. Saraswati†

\*5 Johnston Crescent, Lane Cove 2066, Australia; †Nunyarra. PO Wisemans Ferry 2775, Australia

Wood dust is an irritant and is carcinogenic to the nasal mucosa. It inhibits its own clearance from the nose. It therefore makes sense to lavage retained wood dust from the nose following exposure. To our knowledge this is the second study conducted to determine whether the procedure of nasal lavage reduces nasal symptoms in woodworkers. Forty-six woodworkers from 150 approached volunteered to trial nasal lavage using gravity fed, home-made unbuffered isotonic saline for 2 months in a crossover trial and then be followed-up a year later. The group reported significantly decreased nasal symptoms and over half continued to use nasal lavage voluntarily after 1 year. Results support the findings of the previous study that nasal lavage improves nasal symptoms and supplements those findings with data indicating patterns of voluntary usage following the study's conclusion. It is concluded that nasal lavage is an acceptable, effective and inexpensive option with minimal side effects for woodworkers who experience nasal symptoms and who wish to try the procedure.

**Key words:** Nasal cancer; nasal irrigation; nasal lavage; nasal symptoms; prevention; saline; wood-dust.

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## INTRODUCTION

Exposure to wood dust is associated with nasal problems such as blocked nose, dry nose, runny nose, nosebleeds and sinusitis.<sup>1,2</sup> Wood dust is a mucous membrane irritant<sup>3</sup> and nasal symptoms are common amongst woodworkers.<sup>4,5</sup> Wood dust is also a Group 1 IARC carcinogen,<sup>6</sup> causing nasal adenocarcinoma. A proposed mechanism for carcinogenesis is that wood dust in high concentrations inhibits normal mucociliary clearance<sup>7,8</sup> and secondly that the dust contains many chemicals which have been demonstrated to be irritant, genotoxic and/or mutagenic.<sup>9,10,11</sup> It is postulated that inhaled wood dust remains in the nose leading to carcinogenesis.<sup>12,13</sup>

It is logically accepted that zero exposure to wood dust is the best way to prevent nasal symptoms and cancer. There is, however, little information about how to proceed following exposure. Because the nose may not be capable of self-cleansing, it is sensible to wash out wood dust retained in the nose following exposure. The process is directly comparable to handwashing following chemical exposure. Such lavage could reduce nasal irritant symptoms and possibly reduce the risk of adenocarcinoma.

The effect of nasal lavage on nasal symptoms in wood

industry workers was investigated by Hölmstrom *et al.*<sup>5</sup> They studied 45 wood industry workers over a period of six weeks. Over the first three weeks the workers used nasal lavage with 'Rhinomer' (de-ionised sterilised isotonic seawater) four times a day and then nothing for the remaining three weeks. Hölmstrom demonstrated a significant improvement in nasal symptoms, peak nasal expiratory flow and mucociliary clearance following 'Rhinomer' usage, and then a return to pre-intervention levels 3 weeks after cessation of nasal lavage. The study indicated that 80% of participants were enthusiastic about continuing to use 'Rhinomer' after the study was completed.

This was the second study of which we were aware of on the effects of nasal lavage on nasal symptoms in woodworkers. The objectives of the study were to determine whether saline nasal lavage (SNL) reduced nasal symptoms, and whether it was acceptable and useful to woodworkers. The SNL technique used was Jala Neti, a yoga practice. Effects of SNL on nasal cancer could not be assessed by this study.

## MATERIALS AND METHODS

### Study design

Initially a crossover trial<sup>14</sup> was performed. Fifty woodworkers were randomly allocated to two groups. The first

Correspondence to: S. J. Rabone, 5 Johnston Crescent, Lane Cove 2066, Australia.

group used SNL twice daily for 2 months whilst the second group did not. Then the second group used SNL for 2 months while the first group did not. At the end of this crossover trial, subjects were given the option of purchasing a 'pot' used to perform the procedure, instructed to use SNL if they wanted to, and then reassessed 1 year later. Response data were obtained on four occasions: prior to commencement of the study (control data), at two months, at four months and at the 1 year follow-up. Responses were obtained from self-administered questionnaires.

### Selection of participants

**Crossover study.** The study population included woodworkers in Sydney, Australia. From three meetings of woodworking groups, a population of 150 attendees produced 50 volunteers for the study. Prior to commencement of the crossover study, four volunteers withdrew. Two had trialed SNL.

### Saline nasal lavage (Jala Neti)

Jala Neti is an old yoga method. A purpose built pot, not unlike a small teapot with a volume of 400 ml, is filled with warm tap water and a teaspoon of salt is added to produce an approximately isotonic solution. The pot has a smooth conical nozzle for insertion into one nostril. The smooth nozzle prevents trauma and forms a seal with the nostril to prevent leakage. The person performing the procedure then bends forwards until the nasal passages are at a lower level than the larynx. The head is then turned 25 degrees, for example, to the right, and the nozzle inserted into the right nostril. Warm saline

then fills the right nasal cavity, passes behind the nasal septum and flows out of the left nostril. Mouth breathing is possible during the procedure. The other side is then lavaged, and the nose dried by 'panting' through the nose (Figure 1).

### Questionnaires

Basic demographic data were obtained by questionnaire, as well as records of SNL usage, measures of the perceived usefulness of the procedure and general comments. Questions about the presence of nasal symptoms, other symptoms, general health and sleep patterns recorded responses on 0–100 mm visual analogue scales with prompts written below the scales (see legend, Table 1).

Repeatability<sup>15</sup> of the questionnaire was estimated by subtracting the results from the first response (prior to commencing the study) from the response after 2 months of not using SNL. The standard deviation of the measurement error ('s') was calculated as

$$s = \sqrt{(1/2n) \sum (x_i - y_i)^2}.$$

For nasal problems,  $s = 16.0$ , mean = 9.0. For eye problems  $s = 15.1$ , mean = 5.7. Results for all other variables in Table 1 were generally comparable with these.

### Statistical analysis

Analysis of the 0–100 mm visual analogue scale crossover trial data was performed according to Armitage and Berry.<sup>14</sup> The crossover trial used data taken at 0 months (control), 2 months and 4 months. Analyses used two-

Figure 1. Procedure of Jala Neti.



**Table 1.** Perceptions of participants on a scale of 0–100

	Crossover trial			1 year follow-up		
	Before SNL	After SNL	<i>p</i> value	Control	1 year	<i>p</i> value
Nose problems	51	37	<0.0001	59	39	<0.0001
Dryness	18	14	0.0560	15	9	0.0183
Blocked/congested	39	31	0.0078	40	32	0.1065
Sinus problems	30	19	0.0010	30	21	0.1101
Runny nose	24	21	0.3129	27	15	0.0053
Nosebleeds	8	9	0.8830	12	7	0.0821
Post-nasal drip	14	12	0.4536	15	12	0.1230
Itchy/sneezing	25	21	0.0915	35	17	<0.0001
Poor sense of smell	22	20	0.2106	26	17	0.0275
Eye problems	27	28	0.6271	33	23	0.0240
Burning/itching	15	12	0.1502	21	10	0.0085
Dryness	16	13	0.1458	20	18	0.6832
Watering	12	11	0.8878	12	6	0.0322
Redness	17	16	0.4055	17	14	0.2407
Grittiness	21	20	0.7185	24	19	0.0960
General problems						
No energy	18	14	0.0518	28	19	0.0245
Headaches	18	14	0.1221	17	12	0.0582
Snoring	25	22	0.1135	27	17	0.0126
Sore throat	19	13	0.0898	17	11	0.0088
Frequent colds	16	12	0.0671	16	9	0.0263
General health	34	30	0.2238	28	25	0.2393
Getting to sleep	19	21	0.3283	19	21	0.4358
Waking up	51	47	0.2397	49	44	0.2275
Waking at night	48	40	0.0193	42	47	0.2756

**Legend:**

Nose, eye, & general problems	no problem = 0	some problems = 50	lots of problems = 100
Getting to sleep	easy = 0		difficult = 100
Waking at night	never = 0	sometimes = 33	often = 67
Waking up	refreshed = 0		always = 100
Specific symptoms	no problem = 0	minor problem = 25	quite annoying = 50
			v. annoying = 75
			require treatment = 100

sample *t*-tests to test SNL effect, period effects and period  $\times$  SNL interaction. SNL  $\times$  period interaction was assessed using control readings. (These *t*-tests for period effects and period  $\times$  SNL interaction were uniformly insignificant indicating no detectable period effect or interaction). To assess one year follow-up changes, follow-up results were subtracted from control (0 month) results and the differences analysed using one-sample *t*-tests.

## RESULTS

### Characteristics of participants

The participants were four women and 42 men. Ages ranged from 24–71 years (mean = 43 years). There were five smokers, 23 ex-smokers and 18 never-smokers. Thirty-four subjects worked more than 10 hours per week, 10 worked 4–10 hours per week and the remaining two worked 1–4 hours per week. Mean time potentially exposed to wood dust was 2.8 years. Twenty-three people used no dust controls at work except personal protection. Wetting was used by 14, fans by three and extraction ventilation by seven. Sixteen used personal respiratory protection most of the time at work, 27 sometimes and three never. Five reported 'no nasal problems', 24 'some problems' and 17 'lots of nose problems'.

Forty-six subjects completed the crossover trial. Thirty-nine purchased 'pots' and provided information at 1 year follow-up.

### Effect on nasal symptoms

The procedure of nasal lavage was shown to be significantly ( $p = 0.0001$ ) associated with the perception of decreased nasal problems both during the crossover study and at 1 year follow-up. Table 1 shows the mean perceptions for the four measurement periods as well as the statistical significance of changes. Of the 39 subjects who completed the study, 14 had reported 'lots of nose problems' and 21 'some problems' prior to the study. After 1 year only two reported 'lots of nose problems' while 18 reported 'some problems'.

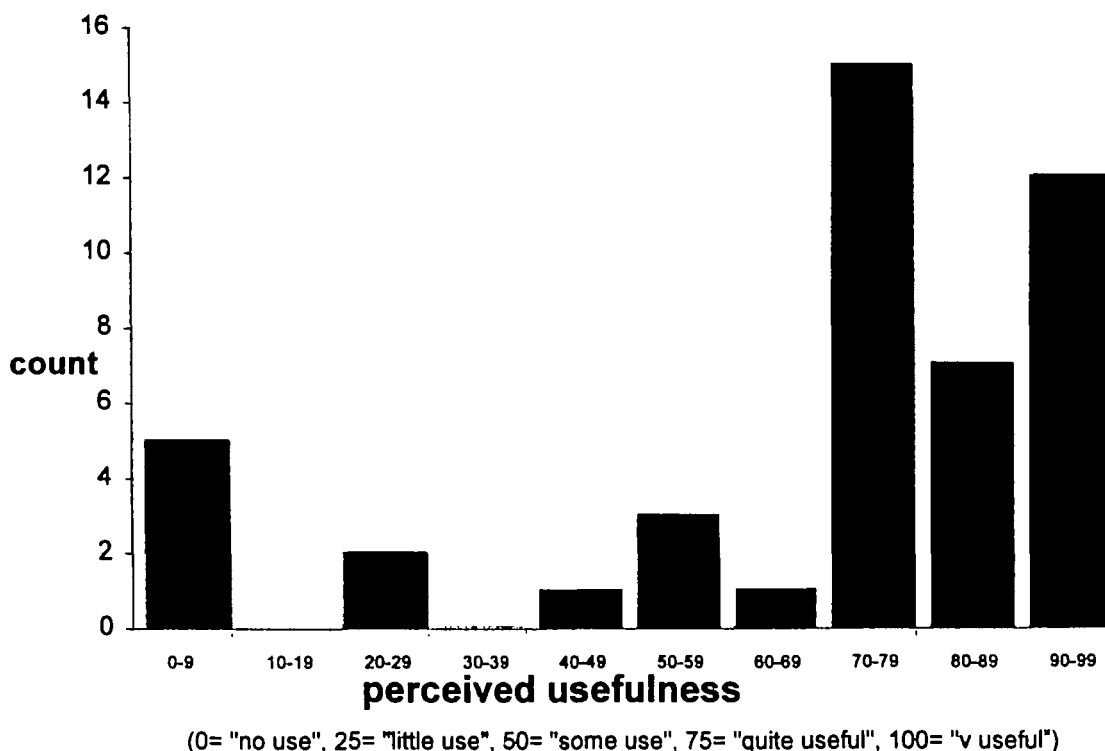
### Acceptability and usefulness

Twenty-two subjects reported regular SNL usage at 1-year follow-up (Table 2). More than 34 found SNL useful (Figure 2).

Difficulties encountered were more frequent initially and included water running into the mouth, slow flow through a blocked nostril, finding the correct head angle, stinging due to an incorrect salt/water mix and nosebleeds. These problems did not occur after the initial crossover trial. Twenty-one subjects had no difficulties at

**Table 2.** SNL usage of 46 subjects after 1 year

Never	Rarely	After dust exposures occasionally	After dust exposures regularly	For other reasons occasionally	For other reasons regularly	Every day
9	4	9	12	3	2	7

**Figure 2.** Perceived usefulness of SNL at 1-year follow-up ( $n = 46$ ).

the first attempt at SNL, and this had increased to 32 after the first week.

Only two subjects used SNL at the workplace. Most used it in their bathrooms at home. The time reported to perform the procedure averaged 4 min 20 sec. At 1-year follow-up, eight of 39 participant comments about SNL spontaneously mentioned that SNL removes wood dust from the nose.

### Other symptoms

Changes in other aspects of health and well-being were not demonstrated convincingly (Table 1).

## DISCUSSION

The study supports the previous findings of Hölmström *et al.*<sup>5</sup> that SNL improves nasal symptoms in woodworkers (Table 1). It provides supplementary information by following subjects over 1 year. The study shows that many volunteer woodworkers who wish to try SNL will benefit from using it, continue to use it (Table 2) and regard it as a useful long-term aid (Figure 2). Indications are that people will use SNL according to their own needs, and particularly after wood dust exposure (Table 2).

This study recruited volunteers who may not be representative of woodworkers in general. Despite this sampling shortcoming, the study suggests that the procedure could be of use to a proportion of woodworkers. The proportion is probably significant, because one third of woodworkers approached volunteered to participate in the study, and 74% of these found SNL 'quite' or 'very' useful. Study results must apply only to volunteers and are not generalizable.

This study did not have a control group using a placebo, so subjects were aware that they were using SNL, and placebo effects may have occurred. This shortcoming was addressed by using a 1-year follow up, after which time placebo response would be diminished. The 1-year follow-up indicated that subjects continued to use SNL and reported fewer nasal symptoms. This continued voluntary use is a very strong indicator that the procedure is worthwhile, and also indicates that the wishes of 80% of Hölmström's group to continue voluntary lavage may be a genuine response.

Questionnaires were not standardised. The repeatability of responses is indicated above under 'Materials and methods'. This poor repeatability casts doubts upon the results shown in Table 1. Nevertheless, the strongly significant ( $p < 0.0001$ ) and consistent (during the cross-over trial and at 1-year follow-up) reported decrease in

nasal symptoms coupled with a rate of continued regular voluntary usage of approximately 50% (Table 2) suggest nasal problems are probably reduced by SNL.

The most acceptable method of nasal lavage is not determined by this study. Both studies used different methods of SNL, with good reports of ease of teaching, subsequent acceptance and benefits. Hölmstrom *et al.* used 'Rhinomer' which is described as isotonic sea-water 'packed under high pressure, in a plastic bottle for repeated use . . . the pressure in the water stream is adequate for lavage of the nasal cavity . . . three ml of the water is ejected per second'. Jala Neti offers advantages in terms of cost and availability because the cost of the 'pot' is \$A40, the cost of commercial salt and water is minimal and ingredients (salt and water) are freely available.

If tolerated, SNL using the Jala Neti method is cheap, convenient and has minimal side effects. Therapeutic options for woodworkers with nasal symptoms include nasal vasoconstrictors (which produce tolerance and rebound phenomena) and nasal steroids. Both are expensive. Therapeutic options for those with nasal cancer are quite limited; prevention is better.

There is logical reason to believe that regular SNL could reduce nasal cancer risk, although proof of this would require a longitudinal study with a large number of subjects over several decades.

It is possible that the SNL procedure could be of use in reducing nasal symptoms in other dusty occupations.

The study concludes that the procedure of SNL deserves more attention from industry and training groups. The usefulness of SNL, using different methods, has now been demonstrated in two studies. SNL could be introduced to wood workers during apprenticeships or training as an option to try if nasal symptoms become a problem, if compliance with wearing of personal protection is difficult or if development of nasal cancer is a concern.

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## REFERENCES

1. Andersen HC, Andersen I, Solgard J. Nasal cancers, symptoms and upper airway function in woodworkers. *Br J Ind Med* 1977; 34: 201–207.
2. Pisaniello DL, Connell KE, Muriale L. Wood dust exposure during furniture manufacture — results from an Australian Survey and considerations for Threshold Limit Value Development. *Am Ind Hyg Assoc J* 1991; 52: 485–492.
3. Enarson D, Chan-Yeung M. Characterization of health effects of wood dust exposures. *Am J Ind Med* 1990; 17: 33–38.
4. Wilhelmson B, Drettner B. Nasal problems in wood furniture workers. A study of symptoms and physiological variables. *Acta Oto-laryngol* 1984; 98: 548–555.
5. Hölmstrom M, Rosen G, Wahlander L. Effect of nasal lavage on nasal symptoms and physiology in wood industry workers. *Rhinology* 1997; 35: 108–112.
6. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, Vol. 62, Wood Dust and Formaldehyde*. Lyon, France: IARC, 1995: 191–194.
7. Black A, Evans JC, Hadfield EH, MacBeth RG, Morgan A, Walsh M. Impairment of nasal mucociliary clearance in woodworkers in the furniture industry. *Br J Ind Med* 1974; 31: 10–17.
8. Andersen HC, Solgard, Andersen I. Nasal cancer and mucus transport rates in woodworkers. *Acta Oto-laryngol* 1976; 82: 263–265.
9. Mohtashimipur E, Norpoth K, Hallerberg B. A fraction of beech wood mutagenic in the Salmonella/mammalian microsome assay. *Int Arch Occup Environ Health* 1986; 58: 277–234.
10. Singer JT, Jackson JA, Rice RW. Investigation of potential toxicity and mutagenicity of distillates from the drying of five species of wood. *Forest Prod J* 1995; 45: 45–50.
11. Mark HFL, Naram R, Singer J, Rice R, Bastan B, Beauregard L, LaMarche PH. Cytotoxicity and genotoxicity of wood drying condensate from Southern Yellow Pine: an in vitro study. *Mutation Research* 1995; 342: 191–196.
12. Wilhelmsson B, Hellquist H, Olafsson J, Klintenberg C. Nasal cuboidal metaplasia with dysplasia: Precursor to adenocarcinoma in wood-dust exposed workers. *Acta Oto-laryngol* 1985; 99: 641–648.
13. Wilhelmsson B, Lundh B. Nasal epithelium in woodworkers in the furniture industry: A histological and cytological study. *Acta Oto-laryngol* 1984; 98: 321–334.
14. Armitage P, Berry G. *Statistical Methods in Medical Research, Third Edition*. Oxford, UK: Blackwell Scientific Publications, 1994: 245–249.
15. Bland M. *An Introduction to Medical Statistics*. Oxford, UK: Oxford Medical Publications, 1987; 276–277.

