

# Qualitative Aspects of Nasal Irrigation Use by Patients With Chronic Sinus Disease in a Multimethod Study

David Rabago, MD

Bruce Barrett, MD, PhD

Lucille Marchand, MD

Rob Maberry, BA

Marlon Mundt, MS

University of Wisconsin Madison,  
Madison, Wisc



Conflicts of interest: none reported

## CORRESPONDING AUTHOR

David Rabago, MD  
Department of Family Medicine  
UW-Madison  
777 South Mills St  
Madison, WI 53715  
rabago@fammed.wisc.edu

## ABSTRACT

**PURPOSE** We qualitatively assessed attitudes regarding use of hypertonic saline nasal irrigation (HSNI) for frequent rhinosinusitis and chronic sinonasal symptoms in a 3-part, multimethod study.

**METHODS** We conducted semistructured, in-depth interviews with 28 participants who recently used nasal irrigation in studies assessing HSNI.

**RESULTS** Four themes emerged: (1) HSNI improved self-management of sinus symptoms, creating a sense of empowerment; (2) HSNI produced rapid and long-term improvement in quality of life; (3) participants identified discomfort, time, and mild side effects as barriers to HSNI use; and (4) participants identified aspects of training and at-home use that overcame these barriers.

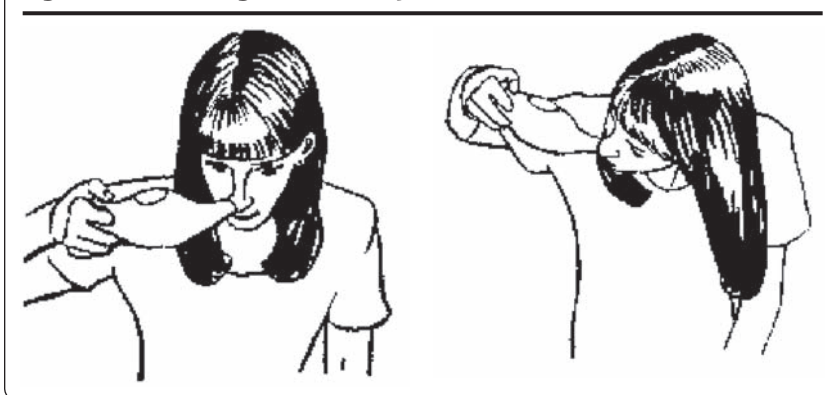
**CONCLUSION** HSNI is a safe, well-tolerated, inexpensive, effective, long-term therapy that patients with chronic sinonasal symptoms can and will use at home with minimal training and follow-up. Success with HSNI will likely be improved by patient education.

*Ann Fam Med* 2006;4:295-301. DOI:10.1370/afm.552.

## INTRODUCTION

Rhinosinusitis<sup>1</sup> is a common clinical problem with considerable morbidity and often-refractory symptoms, accounting for approximately 26.7 million office and emergency department visits and resulting in \$5.8 billion in direct costs for 1996.<sup>2</sup> Rhinosinusitis was the fifth most common diagnosis for which antibiotics were prescribed from 1985 to 1992.<sup>3</sup> The Centers for Disease Control and Prevention has estimated the 1994 number of cases of chronic rhinosinusitis in the United States to be 35 million, a prevalence of 134/1,000.<sup>4</sup> The impact on patients' quality of life is significant.<sup>5</sup>

Originally part of the Yogic and Ayurvedic traditions, hypertonic saline nasal irrigation (HSNI) is an adjunctive therapy for rhinosinusitis and sinus symptoms<sup>6-8</sup> that flushes the nasal cavity, facilitating the evacuation of potentially allergen- and irritant-containing mucus<sup>9</sup> (Figure 1). Several randomized controlled trials examining HSNI suggest that it is a safe, effective, and tolerable therapy for rhinosinusitis and sinus symptoms.<sup>10-17</sup> Previous randomized controlled trials have reported improvement of quality-of-life scores,<sup>10-12,17</sup> and improvement of several surrogate measures.<sup>12-14,17</sup> In a closely monitored 6-month randomized controlled trial (phase 1, Figure 2),<sup>17</sup> our group found that daily HSNI using 2% saline is associated with high patient satisfaction, improved quality of life, decreased antibiotic and nasal spray use, and improved sinus symptoms in adult participants with a history of frequent rhinosinusitis and chronic sinus complaints. In a 12-month follow-up study (phase 2),<sup>18</sup> we found that patient education

**Figure 1. Nasal irrigation technique.**

without close monitoring enabled phase 1 control participants to initiate and maintain identical HSNI use patterns, and that control participants had the same significant and clinically meaningful improvements in quality of life. HSNI has received attention in the lay press<sup>19</sup> and was recently identified as “an important component in the management of most sinonasal conditions” that is “effective and underutilized.”<sup>20</sup>

Successful use of even proven therapy is often difficult for patients, however.<sup>21</sup> Clinicians may be hesitant to prescribe unfamiliar therapy, and misunderstandings between clinician and patient often occur.<sup>22</sup> HSNI is associated with difficult adherence issues because rinsing the nasal cavity is not intuitive. Clinicians and patients would be well served by descriptive information of successful HSNI use, but no study has assessed the natural history of long-term use of HSNI and its incorporation into daily life. We therefore undertook a qualitative study (phase 3) to assess perceptions, experiences, and strategies regarding successful HSNI use at the conclusion of phases 1 and 2.

## METHODS

The study protocol was approved by the University of Wisconsin Health Sciences Human Subjects Committee. The inclusion criterion was being an HSNI-user in either the phase 1 randomized controlled trial or the phase 2 follow-up study (Figure 2). The primary inclusion criteria of phase 1 was having either 2 episodes of acute sinusitis or 1 episode of chronic sinusitis per year for 2 consecutive years, and a moderate-to-severe overall daily quality-of-life burden of sinus disease. Participants randomized to HSNI in phase 1 received an educational intervention that included a brief discussion of rhinosinusitis, a demonstration of HSNI, and coaching to facilitate each participant’s proficiency. All participants in phase 1 were monitored frequently with validated questionnaires.<sup>23</sup> In phase 2, phase 1

control participants were given the same patient-education and pooled into 1 HSNI use group. All phase 2 participants were thereafter assessed less frequently. The mean HSNI use frequency at the time of the interviews was 2.4 irrigations per week after at least 12 months of assessment.<sup>18</sup> For the current study, we contacted phase 1 and phase 2 HSNI users sequentially from a randomized list of all 66 possible participants (Figure 2). Study personnel tape-recorded interviews of 21

participants in person and 7 participants by telephone at our institution from April to July 2002. We followed a standard qualitative research method of transcribed, in-depth, long interviews.<sup>24</sup> The semistructured 30-minute interview consisted of open-ended questions with several prompts that the interviewer could use to encourage salient discussion (Table 1). Transcripts were stripped of all identifiers except a code number. All interviews were completed and transcribed before being analyzed. Each transcript was reviewed individually by each of the first 4 authors and was then discussed by all of the first 4 authors in 6 meetings over 2 months using a consensus approach to identify major themes.

## RESULTS

Consent from 28 participants was obtained from the first 35 HSNI users queried; 7 participants declined to participate, stating they did not have time, resulting in a 28-member sample similar to the 66 HSNI users in phases 1 and 2 in sex, age, and quality-of-life scores at the beginning and end of the studies. One participant had completed phase 1 only, 27 had completed both phases 1 and 2 (Table 2). The 28 transcribed interviews were analyzed in 6 meetings. Four major themes emerged (Table 3).

### Major Themes

#### Empowerment

Among the major themes, participants reported several ways in which use of HSNI improved their ability to control sinus symptoms and their treatment, a major aspect of their health and health care. We have termed this *empowerment*. Participants expressed a strong sense of satisfaction with the ability to use, monitor, and adjust several aspects of HSNI themselves (eg, water temperature, salinity, timing, frequency) as opposed to making multiple office visits with a clinician. This attitude was commonly reflected in such comments as,

"I've learned that I can take care of a lot of this [sinus symptoms] by myself, so I do," and "... [HSNI] makes me feel more in control of my own health and my own sinus condition." Participants also expressed satisfaction in their perception that at-home use of HSNI greatly reduced the number of trips to their physician and the number of antibiotic prescriptions.

**Improvement in Quality of Life**

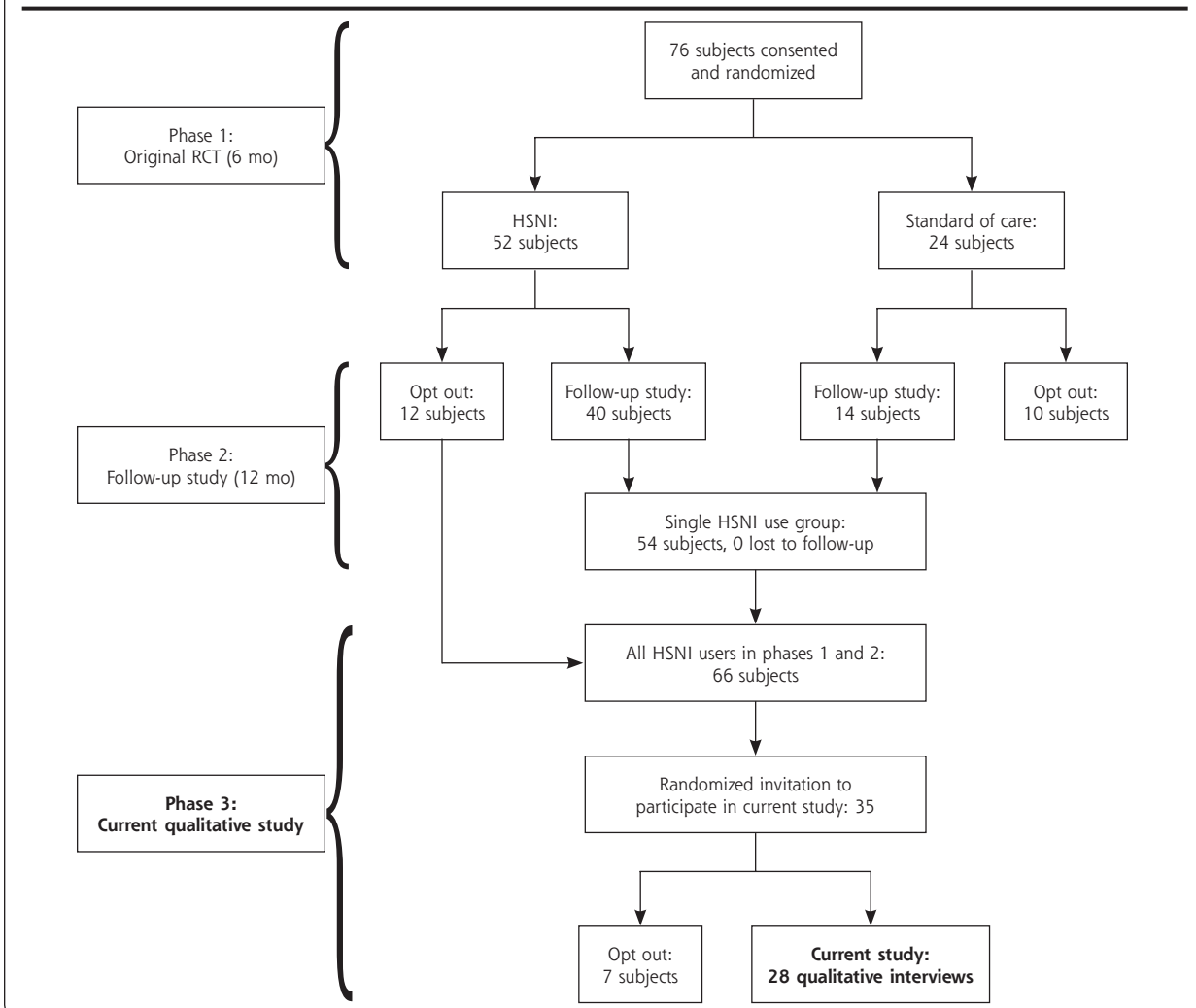
Participants confirmed the results of phases 1 and 2; use of HSNI improved short- and long-term sinus symptoms and sinus-related quality of life. Many participants were enthusiastic, reporting improvements with the first or second use: "... my results were immediate," and "... almost instant relief of the congestion." Most participants also confirmed positive long-term effects of HSNI on sinus-related quality of life, and noted a deep sense of satisfaction associated with the diminution of their

sinus symptoms, often reflected in moving comments, such as, "It just made a world of difference in my life," and "... when you suffer from a chronic illness for so long and then you don't, ... it's such a big relief ... (to) enjoy things that people take for granted." Participants

**Table 1. Open-Ended Questions for Participant Discussion**

1. What were your sinus problems like before using nasal irrigation, and how did nasal irrigation affect you?
2. Did you experience any problems from using nasal irrigation?
3. How did you fit nasal irrigation into your life?
4. Did you get any reactions about using nasal irrigation from those around you?
5. How do you feel about nasal irrigation now?
6. What was the informational meeting like for you?
7. Is there anything else you'd like to tell us about your experience with nasal irrigation or this study?

**Figure 2. Subject participation in phase 1, randomized controlled trial; phase 2, follow-up study; and phase 3, current study.**



**Table 2. Baseline Demographic, Medical Characteristics, and Quality-of-Life Scores of All HSNI Users and Current Study Participants**

Characteristic	Phase 1 and 2 HSNI Users (n = 66)	Current Study/ Phase 3 Participants (n = 28)
Age, $\bar{y} \pm \text{SEM}$	42.4 $\pm$ 1.3	44.8 $\pm$ 1.8
Female, No. (%)	48 (73)	19 (68)
Baseline RSDI,* No. $\pm$ SEM	58.8 $\pm$ 1.8	57.2 $\pm$ 2.9
Baseline SIA,† No. $\pm$ SEM	3.95 $\pm$ 0.12	4.02 $\pm$ 0.20
Seasonal allergies, No. (%)	44 (67)	21 (75)
Asthma, No. (%)	16 (24)	7 (25)
Nasal surgery, No. (%)	25 (38)	12 (43)
Nasal polyps, No. (%)	11 (17)	3 (11)
Deviated septum, No. (%)	16 (24)	8 (29)
<b>Quality-of-life scores at end of phase 2</b>		
End of phase 2 RSDI, No. $\pm$ SEM	77.9 $\pm$ 1.8	80.1 $\pm$ 2.9
End of phase 2 SIA, No. $\pm$ SEM	2.36 $\pm$ 0.13	2.29 $\pm$ 0.18

HSNI = hypertonic saline nasal irrigation; RSDI = Rhino Sinusitis Disability Index; SIA = single-item assessment.

\* Using a 30-item validated multidimensional disease-specific assessment instrument, participants scored their sinus symptoms: 0 = maximal impact of sinus symptoms on quality of life, 100 = no impact.

† Using a 1-7 Likert scale, where 1 = no impact, and 7 = maximal impact, participants responded to the statement: "Please evaluate the overall severity of your sinus symptoms since enrolled in the study."

also expressed satisfaction with a perceived association with decreased allergy symptoms and with the naturalness and economy of HSNI.

### Barriers to HSNI Use

While HSNI was effective for many participants, many also reported substantial barriers to initial and consistent use of HSNI. These barriers included fear of having water in the nasal cavity, initial unpleasant sensation of water in the nasal cavity, having to learn how to perform HSNI effectively, taking time at home to do HSNI, and experiencing occasional mild side effects. Consistent with phases 1 and 2, such side effects as saline drainage, nasal burning, or irritation were noted but not identified as important enough to stop HSNI.

### Strategies to Overcome Barriers to HSNI Use

Participants identified how they overcame barriers to using HSNI. Participants identified each element of the teaching strategy used in the introductory meeting as important in their use of HSNI. These 30-minute meetings were made up of 2 to 6 participants per meeting; they involved a sequence of activities starting with a group discussion of participants' sinus disease histories, a 5-minute film and discussion of nasal irrigation, and a demonstration and coached practice of HSNI. Participants identified coached practice as the single most important element of the enrollment meeting. Each participant was able to perform the pro-

cedure before leaving the enrollment meeting.

Participants also noted several at-home strategies that facilitated regular use, which included incorporating HSNI into an already-existing daily hygiene routine, placing HSNI materials in convenient and accessible locations, adjusting the HSNI use schedule and salinity to decrease or eliminate discomfort, and using warm water. Social concerns were also addressed by our interviewers. Because HSNI therapy is novel for most patients and could engender stigma or embarrassment, we wondered whether social issues played a part in the tendency to regular use. Participants reported reactions from family and friends that included encouragement, surprise, or amusement; none reported that negative reactions from family or friends limited their use of HSNI.

The themes and quotations illustrate participants' range of experience. The overall story of using HSNI, however, may be better told using an extended quotation. An abbreviated transcript of a representative participant whose narrative provides a more personal view of the major themes can be found in Table 3. Her reporting was neither especially negative about the initial aspects of nasal irrigation nor overly effusive about her success. It is consistent with the data from this group of participants who had a debilitating condition (chronic sinus symptoms), who were introduced to a nonintuitive therapy, the mastery of which required work and insight (performing HSNI), and who achieved therapeutic success (improved quality of life). Her transcript identified the core themes in a matter-of-fact manner. Bracketed words are the authors' interpretation of the participant's original intent; they are used to link ideas or abbreviate wordiness.

## DISCUSSION

This study is the third of a 3-phase study assessing HSNI for frequent rhinosinusitis and chronic sinus complaints. Phases 1 and 2 found that participants in both a fastidious<sup>25</sup> randomized controlled trial<sup>17</sup> and pragmatic follow-up setting<sup>18</sup> experienced improved quality of life, reduced sinus symptoms, and decreased use of sinus medications, including antibiotics. The current study is the first to assess the perceptions, experiences, and strategies surrounding use of HSNI and thereby bridge

**Table 3. Major Themes and Representative Narrative Emerging From the Qualitative Survey**

Theme	Descriptive Comments
Empowerment	<p>"It's really truly a wonderful opportunity for me to get what I needed health-wise that makes me feel more in control of my own health and my own sinus condition."</p> <p>"What's different is that I don't anymore feel like there's no relief."</p> <p>"It's so simple, whenever you want, you can do it."</p> <p>"I've learned that I can take care of a lot of this by myself, so I do."</p> <p>"You don't have to run to the doctor every few months to get on antibiotics again."</p> <p>"The best thing is not having to go to the doctor. Not having to use antibiotics."</p>
Quality of life	<p>"... almost instant relief of the congestion..."</p> <p>"... my results were immediate. I went from being congested to breathing, and I would stay clear all day."</p> <p>"I could actually feel ... the pressure—kind of a dam held, and then it whooshed out the other side."</p> <p>"It just made a world of difference in my life."</p> <p>"For me this is the magic cure for my sinuses."</p> <p>"Best thing I've ever had. Better than any medication. It's amazing. I would recommend it to anybody."</p> <p>"When you suffer from a chronic illness for so long and then you don't have problems with it anymore: I think it's such a big relief and I can't explain it, it's such a big change where you can enjoy things that people take for granted."</p> <p>"I was so desperate to get some relief from my sinuses and not have to go back and have surgery again. Planting my flower beds was just terrible, I would just have hay fever and then I'd be plugged up and then I'd have to go to the doctor. (Now) I can go outdoors ... and not worry about my sinus' plugging up on me and causing the great facial pain. I really couldn't believe that that one simple thing could have changed my life, but it has."</p>
Barriers to use of HSNi	<p>"It was [initially] uncomfortable and it kind of burned."</p> <p>"... the first time that you use it, it's a strange sensation—that feeling of water..."</p> <p>"... it was kind of strange—kind of like you're drowning, almost ..."</p> <p>"Pure and simple: it was gross. It took a while to get used to it. It felt really funky."</p> <p>"The hardest part was creating a habit of doing it and doing it all the time."</p> <p>"I thought it was not a very graceful thing. Not a very easy thing to do."</p>
<b>Strategies for overcoming barriers</b>	
Teaching strategies	<p>"It helped to hear that there were other people going through those reactions and stuff, and I didn't realize that I was feeling isolated until I met some of the other people."</p> <p>"(The part of the first meeting I liked most ... was) being around other people that are having trouble with their sinuses."</p> <p>"It needs to be not just prescribed: It needs to be taught with a video or some type of informational packet with it."</p> <p>"I think the demonstration that the doctor had with us was the most helpful part."</p> <p>"The hands-on was critical."</p> <p>"The actual instruction when we went to the [sink] and you showing us directly how to use it made all the difference in the world."</p>
At-home strategies	<p>"I just established a habit."</p> <p>"I learned to adjust the temperature and salt content to what felt best."</p> <p>"I guess when I was in the shower it was a lot easier."</p> <p>"I don't know if I was more relaxed and the steam or whatever..., but it seemed to be a lot more effective in the shower."</p> <p>"After you do it a few times, it's nothing anymore"</p>
<b>Representative narrative</b>	<p>"I spent a lot of time in the doctor's office for sinus infections or being frustrated with sinus symptoms ... and [had] frequent sinus headaches—as many as 3-4 per week. [The first time I used HSNi] it felt like warm water running down my nose and some of it into my throat ... I did it wrong. My initial thought was 'Oh my God, this is not going to work.' But I did it ... when we were coached ... and I ... worked at it ... about 20 minutes in the bathroom that night. When I got it to work, it felt wonderful. I'd say it took a week before I got it down to a fine art. The first evening, I could already tell I was cleaning something out... I was blowing all this junk out of my head. By the third evening, it was clear that there was definitely a point to this, less sinus drainage, and that it was going to help me. I also notice that I've been able to smell things [better]. I haven't had a sinus infection in I can't remember how long. I use it about 3 days out of 7, when my nose puffs up ... or my sinuses start swelling. I don't wait until I get severe [sinus symptoms] to go back to use [HSNi] every day. [The worst thing about nasal irrigation] is having to occasionally clean my face, not a big deal. For me warm water is more comfortable and seems slightly more effective. I use [HSNi] in the shower [or by the sink], clean the face, brush the teeth. I store the materials tucked in a closet in the bathroom and [leave] the water bottle and nasal pot sitting on the counter. I leave it out [as a reminder]. In the winter I'll do it twice per day ... in the summer [once]. [I use] gentle variations of the positions they taught us. [The mixing of the solution] is the easiest part; I generally do that [with each use]. My partner has been supportive. My family says [HSNi] is 'bohemian' and roll their eyes a little, but they never bothered me."</p> <p>"[I will continue to use nasal irrigation] and have several friends who have sinus and allergy troubles to whom I've introduced [HSNi], and recommend it to others. Small-group demonstration is the best way to teach [it]. You get a demonstration from someone who knows [it]. They tell you 'you will feel the water here and there.' That alleviates the [concern of drowning, or the water getting in the wrong place]. One person [should train] 2 to 3 people, [and] actually do [HSNi]."</p> <p>"I'm amazed and a bit humbled. There ought to be a way to [find] ... people with [sinus problems] and send them information about this treatment. More ... people are beginning to say, 'OK, what alternatives are there to antibiotics?'"</p>

the gap between clinical effectiveness of HSNI in formal studies and success with at-home use. We found that participants receiving clear and focused instruction can overcome initial barriers to HSNI use and can create at-home strategies to facilitate long-term HSNI use.

Effective teaching combined with a positive clinical outcome led to improved quality of life and sense of empowerment for these participants. The introductory meeting set the stage for participants' use of a therapy by establishing a relationship with research staff and trust in the overall research plan. Group discussion of clinical histories promoted an esprit de corps regarding use of HSNI and participation in the study. Group interaction and discussion have been used to facilitate understanding and acceptance of one's condition, and the notion that active involvement in therapy can facilitate improved clinical outcomes. Group discussion also served to decrease the alienation and stress that participants may have felt in isolation. Hearing others' clinical stories likely increased bonds with fellow participants and may have helped participants feel that their own story was heard and valued. Positive effects of group behavior programs have resulted in improved outcomes in other treatment settings.<sup>26-28</sup>

Early demonstration and coached practice of HSNI ensured proficiency before the participants' first at-home use. Patient education and coached practice have been identified as important aspects of successful care of chronic illness<sup>29</sup> and have been linked to successful treatment of chronic conditions such as asthma and COPD.<sup>30</sup>

Given that the immediate effect of HSNI under supervision was generally positive, and side effects were limited, participants were able to adapt the scheduling, location, and materials handling to best suit their personal and social context in the long term. This ability to manage their own treatment likely contributed to the reported sense of empowerment and personal control of their chronic symptoms, further enabling continued use. A sense of empowerment among users of complementary medical therapy is consistent with recent findings that characterize patients' views about complementary medical therapy compared with conventional therapy.<sup>31</sup>

Because 3 of us (DR, BB, RM) were co-researchers on phases 1 and 2, we anticipated that the comments would be positive, but several aspects of the results surprised us. First was the passion and drama of many reports. Sinus disease, HSNI, and clinical improvement are clearly important to these participants and deeply affect the quality of their lives. Also surprising was the uniform reporting about 2 issues. First, most participants expressed the need to overcome the oddness of pouring water through the nasal cavity. Second, it

was worth the effort of doing so, because HSNI truly improved quality of life for this group of participants, most of whom had had less success with multiple previous therapies.

Our study has several limitations. These results may not generalize well to patients who have uncomplicated acute bacterial rhinosinusitis, less-frequent rhinosinusitis, sinus symptoms that are less chronic, or have undergone less HSNI coaching. Recollection of initial experiences and feelings toward HSNI may have been inaccurate, because participants were interviewed 12 to 18 months after starting phase 1. We did not use an iterative process to guide the formulation of interview questions and may have missed issues important to participants. The researchers may have been biased in favor of HSNI because 3 coauthors were familiar with the positive quantitative HSNI results of phases 1 and 2.

### Implications for Clinicians

This study has important implications for clinicians. HSNI can be confidently and safely prescribed to patients with chronic sinonasal symptoms. Adherence to HSNI will likely be improved by a patient-education encounter that includes coached practice of HSNI. Consideration should be given to grouping several patients into a single class for patient education. In our clinical practice, we describe the rationale for HSNI as part of the treatment plan for patients with chronic sinonasal complaints; if the patient is interested, we explain the technique with an illustrated patient hand-out, as shown in Supplemental Appendix, which can be found online at <http://www.annfammed.org/cgi/content/full/4/4/295/DC1>, and at <http://www.fammed.wisc.edu/research/projects/nasalirrigation-instructions.pdf>, before we proceed with guided practice. We recommend using nasal irrigation once daily at the onset of sinus symptoms until resolution, and thereafter for maintenance as needed. The materials are inexpensive, and nasal irrigation cups are increasingly available at local pharmacies nationwide.

### Implications for Researchers

This study has implications for future HSNI research. Questions remain about the basic science of HSNI, clinical protocol (eg, irrigation schedule, irrigant concentration, buffering, and irrigant delivery system), specific indications, and optimal training techniques and context. These issues require study in a larger patient population with more identified subgroups, including acute bacterial rhinosinusitis, vasomotor rhinitis, and asthma.

In addition, the current study also has implications for primary care research. Integrated, multi-

method research techniques in primary care have been described and advocated.<sup>32,33</sup> Taken together with phases 1 and 2, the current study is an example of such an approach. By using both qualitative and quantitative methods, a broader and deeper picture of HSNI use emerges than if either were used alone. Phases 1 and 2 used a conventional, quantitative hypothesis-testing approach that produced internally consistent conclusions; HSNI is an effective therapy for patients with recurrent rhinosinusitis and chronic sinonasal complaints. In phase 3, we asked participants to describe and interpret the experience of HSNI. Such qualitative data brings the use of HSNI closer to real clinical life by making the quantitative findings easier to act upon for physicians and patients.

Participants confirmed positive results from 2 previous studies. HSNI is an effective, safe, well-tolerated, inexpensive therapy that patients with frequent rhinosinusitis and chronic sinus symptoms can learn in the office and use at home over the long term with minimal training and follow-up. Clinical success with HSNI will likely be improved by brief patient education, HSNI demonstration, in-person coaching, and the ability to tailor HSNI use to individual needs.

**To read or post commentaries in response to this article, see it online at <http://www.annfamned.org/cgi/content/full/4/4/295>.**

**Key words:** Nasal irrigation; sinusitis/therapy; rhinosinusitis; chronic sinus symptoms; quality of life; qualitative study

Submitted August 1, 2005; submitted, revised, November 23, 2005; accepted November 29, 2005.

## References

- Lanza DC, Kennedy DW. Adult rhinosinusitis defined. *Otolaryngol Head Neck Surg.* 1997;117:S1-S7.
- Ray NF, Baraniuk JN, Thamer M, et al. Healthcare expenditures for sinusitis in 1996: contributions of asthma, rhinitis, and other airway disorders. *J Allergy Clin Immunol.* 1999;103:408-414.
- McCaig LF, Hughes JM. Trends in antimicrobial drug prescribing among office-based physicians in the United States. *JAMA.* 1995;273:214-219.
- Current estimates from the National Health Interview Survey, 1994. *Vital Health Stat 10.* 1995:261-520.
- Gliklich RE, Metson R. The health impact of chronic sinusitis in patients seeking otolaryngologic care. *Otolaryngol Head Neck Surg.* 1995;113:104-109.
- Kaliner MA, Osguthorpe JD, Fireman P, et al. Sinusitis: bench to bedside. Current findings, future directions. *J Allergy Clin Immunol.* 1997;99:S829-848.
- Druce HM. Adjuncts to medical management of sinusitis. *Otolaryngol Head Neck Surg.* 1990;103:880-883.
- Zeiger RS. Prospects for ancillary treatment of sinusitis in the 1990s. *J Allergy Clin Immunol.* 1992;90:478-495.
- Ponikau JU, Sherris DA, Kephart GM, et al. Striking deposition of toxic eosinophil major basic protein in mucus: implications for chronic rhinosinusitis. *J Allergy Clin Immunol.* 2005;116:362-369.
- Heatley DG, McConnell KE, Kille TL, Levenson GE. Nasal irrigation for the alleviation of sinonasal symptoms. *Otolaryngol Head Neck Surg.* 2001;125:44-48.
- Tomooka LT, Murphy C, Davidson TM. Clinical study and literature review of nasal irrigation. *Laryngoscope.* 2000;110:1189-1193.
- Taccariello M, Parikh A, Darby Y, Scadding G. Nasal douching as a valuable adjunct in the management of chronic rhinosinusitis. *Rhinology.* 1999;37:29-32.
- Bachmann G, Hommel G, Michel O. Effect of irrigation of the nose with isotonic salt solution on adult patients with chronic paranasal sinus disease. *Eur Arch Otorhinolaryngol.* 2000;257:537-541.
- Shoseyov D, Bibi H, Shai P, et al. Treatment with hypertonic saline versus normal saline nasal wash of pediatric chronic sinusitis. *J Allergy Clin Immunol.* 1998;101:602-605.
- Rabone SJ, Saraswati SB. Acceptance and effects of nasal lavage in volunteer woodworkers. *Occup Med (Lond).* 1999;49:365-369.
- Holmstrom M, Rosen G, Wahlander L. Effect of nasal lavage on nasal symptoms and physiology in wood industry workers. *Rhinology.* 1997;35:108-112.
- Rabago D, Zgierska A, Mundt M, et al. Efficacy of daily hypertonic saline nasal irrigation among patients with sinusitis: a randomized controlled trial. *J Fam Pract.* 2002;51:1049-1055.
- Rabago D, Pasic T, Zgierska A, et al. The efficacy of hypertonic saline nasal irrigation for chronic sinonasal symptoms. *Otolaryngol Head Neck Surg.* 2005;133:3-8.
- Ivker R. *Sinus Survival.* New York, NY: G.P. Putnam's Sons; 1995; 71-73.
- Brown CL, Graham SM. Nasal irrigations: good or bad? *Curr Opin Otolaryngol Head Neck Surg.* 2004;12:9-13.
- Beardon PH, McGilchrist MM, McKendrick AD, McDevitt DG, MacDonald TM. Primary non-compliance with prescribed medication in primary care. *BMJ.* 1993;307:846-848.
- Britten N, Stevenson FA, Barry CA, Barber N, Bradley CP. Misunderstandings in prescribing decisions in general practice: qualitative study. *BMJ.* 2000;320:484-488.
- Benninger MS, Senior BA. The development of the Rhinosinusitis Disability Index. *Arch Otolaryngol Head Neck Surg.* 1997;123:1175-1179.
- Crabtree BF, Miller WF. *Doing Qualitative Research.* Thousand Oaks, Calif: Sage Publications; 1992.
- Ernst E, Pittler MH, Stevinson C, White A. Randomised clinical trials: pragmatic or fastidious? Focus on Alternative and Complementary Therapies *FACT.* 2001;6:179-180.
- Kleinman A. *The Illness Narratives: Suffering Healing and the Human Condition.* New York, NY: Basic Books; 1988.
- Charmaz K. Stories of suffering: subjective tales and research narratives. *Qual Health Res.* 1999;9:362-382.
- Stead LF, Lancaster T. Group behaviour therapy programmes for smoking cessation. *Cochrane Database Syst Rev.* 2005:CD001007.
- Hilton S. Does patient education work? *Br J Hosp Med.* 1992;47:438-441.
- Gallefoss F, Bakke PS. How does patient education and self-management among asthmatics and patients with chronic obstructive pulmonary disease affect medication? *Am J Respir Crit Care Med.* 1999;160:2000-2005.
- Barrett B, Marchand L, Scheder J, et al. Themes of holism, empowerment, access, and legitimacy define complementary, alternative, and integrative medicine in relation to conventional biomedicine. *J Altern Complement Med.* 2003;9:937-947.
- Stange KC, Miller WL, Crabtree BF, O'Connor PJ, Zyzanski SJ. Multi-method research: approaches for integrating qualitative and quantitative methods. *J Gen Intern Med.* 1994;9:278-282.
- Stange KC, Miller WL, McWhinney I. Developing the knowledge base of family practice. *Fam Med.* 2001;33:286-297.