THE IHS PRIMARY CARE PROVIDER

A journal for health professionals working with American Indians and Alaska Natives

June 1998 **Published by the IHS Clinical Support Center** **Volume 23, Number 6**

Sweat Lodges: A Medical View

Lawrence R. Berger, MD, MPH; and J. Eric Rounds, BS, MA, The Lovelace Clinic Foundation, Albuquerque, New Mexico

Introduction

Sweat lodges are becoming increasingly popular both within Native American communities and among non-Indians.[1-3] In addition to their traditional use for purification of mind, body, and spirit, sweats are now frequently used as a component of substance abuse treatment and rehabilitation programs for incarcerated Native Americans. A resurgent interest in and respect for Native American culture and traditions among the general public, and the growing popularity of New Age spirituality, have also prompted a dramatic rise in the number of people participating in Native American sweat lodges.

There is great variation in how sweats are conducted.[2,4] Some are led by recognized Native American spiritual leaders, take place over several hours with intense heat, and are restricted to persons with a profound commitment to tradition and ceremony. At the other extreme are sweats that are open to anyone, have no leaders, and are primarily social gatherings. While the spiritual and philosophical issues raised by the proliferation of sweat lodges are important, we focus in this article on the medical aspects. What are the potential health benefits of sweat lodges? What risk factors might prompt individuals to approach sweats with caution? What medical issues deserve further research? To help answer these questions, we conducted an extensive literature review. Relevant articles were identified via searches of Medline (1966-1997), Toxline (1966-1997), Science Citation Index (1966-1997), Sociological Abstracts (1963-1997), Biological Abstracts (1969-1997), Psychological Abstracts (1967-1997), and Carl (Un)Cover (1990-1997). We also searched the World Wide Web using the browsers "Infoseek" and "Excite."

This article reviews the health risks and therapeutic benefits of sweating. Our goals are to stimulate research interest in the therapeutic value of sweat lodges, promote the health and safety of individuals considering participation in regular sweats, and highlight another aspect of traditional, Native American wisdom. We especially hope this information will be of value to health practitioners whose patients may ask for guidance regarding participation in sweats; and to sweat lodge leaders, who should consider the physical and medical condition of individuals, in addition to their emotional and spiritual preparedness, before inviting them to a sweat lodge.

This article is consistent with the IHS policy of encouraging "a climate of respect and acceptance in which an individual's private, traditional beliefs become a part of the healing and harmonizing forces within his or her life." By discussing the potentially beneficial medical and physical aspects of the sweat lodge, as well as the conditions that might warrant caution in its intensive use, we hope to increase the visibility of, and appreciation for, this powerful activity. In no way is our emphasis on physical health meant to diminish the profound spiritual and ceremonial importance of sweat lodges.

Potential Health Benefits

Natural health practitioners have recommended sweat therapy for persons with a variety of ailments, from infectious diseases to insomnia.[3,5,6] There is growing scientific support for

In This Issue...

69 Sweat Lodges: A Medical View
75 Buckle Up for Life: An Incentive Program
80 Position Vacancies
81 Meetings of Interest
81 NCME Videotapes Available
82 Native American Medical Literature

their enthusiasm based on laboratory work, clinical studies, and research involving heat chambers and saunas. Clinical studies of Scandinavian sauna-bathing are particularly relevant to sweat lodges. Both are often practiced weekly and involve high temperatures and high humidity generated by throwing water on hot stones, although saunas in the United States often use dry heat, as do some Native American sweat lodges.

Anti-infectious. The heat of a sweat lodge is capable of raising core body temperature, creating what might be called a "temporary fever." In a sauna at 80 degrees Centigrade (C), adults raise their rectal temperature about 1 degree C after 30 minutes.[7] There is increasing evidence that mild to moderate elevations of temperature can enhance specific and nonspecific immunity.[8-14] Febrile temperatures have been shown to promote the migration of neutrophils, the production of antibacterial substances by leukocytes, and the antiviral activity of interferon.[14] An experiment with mice infected with herpes virus provides a dramatic example of improved host defenses: increasing their core temperature by 2 degrees Centigrade improved their survival rate from 0% to 100%.[8] Studies in humans have shown that children with chickenpox have a longer time to total crusting of lesions when treated with temperature-lowering doses of acetaminophen, and adults with rhinovirus have more nasal viral shedding when they receive aspirin rather than placebo.[9]

Human sweat contains immunoglobulin-A (IgA) and specific antibodies to such antigens as hepatitis B and tetanus.[15,16] There are also many agents in sweat associated with the inflammatory response.[17-21] These proteolytic enzymes, histamine, kinin, and interleukins very likely enhance resistance to viral, bacterial, and parasitic infections.[10,17,22] They may provide local protection of the skin and prevent the invasion of harmful agents through the skin and into the bloodstream.

Certain infections, however, may actually be facilitated by increased body temperature. The best example is recurrent herpes simplex infections.[13] So-called "fever blisters" are lesions caused by the recrudescence of latent herpesvirus infections. They occur during natural fevers or artificial elevations of body temperature.

Anti-cancer. Hyperthermia appears to be a promising modality for cancer treatment when combined with radiotherapy or chemotherapy, although the experimental body temperatures (41-45 degrees C) are well above those experienced in a sweat lodge.[23-24] Yet there may also be anti-cancer benefits to raising body temperature to the febrile range. Elevated temperatures have been shown to retard the proliferation of certain tumor cells, increase the antitumor activity of interferon and interleukins, and enhance the killing efficiency of specific cytotoxic t-lymphocytes.[14, 23]

As in the case of infections, there is reason for caution in concluding that raised body temperature is uniformly helpful in cancer prevention and treatment. Laboratory studies indicate that hyperthermia can cause dysfunction of gene repair mechanisms and reduced natural killer activity of human mononuclear cells.[25,26] Also, some animal studies have shown an increase in metastases following whole body heating.[27]

Detoxification. The idea that deleterious "toxins" can be eliminated from the body by sweating is a popular one, as evidenced by these quotes from publications intended for the general public: "Sweating is one of our most important mechanisms of natural healing, since it allows the body to rid itself of unwanted materials"[3]; "Impurities in many body organs are flushed out as the capillaries dilate and the heart increases its pace"[2]; "'Heat stress'...is very effective in releasing fat-stored toxins from the cells."[28] While there is no question that sweat glands are excretory organs, the clinical significance of human sweat as an excretory pathway for specific substances has received little scientific scrutiny.

Human sweat is a dilute solution that contains mainly sodium, potassium, chloride, and bicarbonate.[29] Urea, amino acids, glucose, magnesium, calcium, lactate, proteins, and enzymes also appear in sweat. The concentration of ammonia in sweat is 20 to 50 times higher than in plasma.[30] Sweat appears to be an important excretory pathway for zinc and copper, and possibly other trace metals such as cadmium, manganese, aluminum, lead, iron, and nickel.[31,32] Workers occupationally exposed to lead have extremely high levels of lead in sweat even when their blood lead levels are only moderately elevated.[33]

Water-soluble bile pigments are excreted by the sweat glands of patients with severe liver disease.[34] Patients with renal failure have elevated sweat potassium concentrations and increased sweating "may play a role in removal of sweat electrolytes from the body."[29] The concentration of urea in sweat is approximately the same as the plasma concentration. This accounts for the occurrence of "urea frost" on the skin of patients with uremia.[30]

Street drugs (such as amphetamines, heroin, cocaine) and their metabolites are excreted in sweat, but usually in nanogram amounts.[35-37] Medications, such as antineoplastic drugs, benzodiazepines, iodine, and antibiotics, are detectable in sweat.[35,38-41] Ethyl alcohol is secreted in sweat in concentrations that approximate its concentration in blood.[20]

Healthy skin and treatment of skin disorders. Repeated sweat baths may promote healthier skin by several mechanisms including a direct therapeutic effect of heat, increased blood flow to the skin, and the delivery of substances within sweat itself. In a sweat lodge or sauna, the temperature of the skin can rise from 32 degrees C at room temperature to 40 degrees C or higher.[42] Heat stress leads to an increase in cardiac output and vasodilation over the entire body surface.[43] Blood circulation to the skin can reach up to 8 liters per minute in an adult (from less than one liter per minute at room temperature). As much as 50-70% of the cardiac output may be directed to the blood vessels of the skin (versus 5-10% at room temperature).[42,44] This dramatic increase in blood flow means increased perfusion and the delivery of oxygen, immune agents, and other substances to

the skin. Wound healing may be accelerated by interleukins, chemokines, and nitrates in sweat that result in the generation of nitric oxide on the skin surface.[17,18,45-47]

Local hyperthermia and/or sauna bathing have been used to treat psoriasis, atopic eczema, warts, scleroderma, pemphigus, pityriasis versicolor, tinea, leg ulcers, fungal and atypical mycobacterial skin infections, and scabies.[42,48-50] Sweat urea may function as a natural skin moisturizer.[30] The excretion of medications via sweat can improve the treatment of resistant cutaneous fungal infections:

> For example, orally administered griseofulvin and ketoconazole are secreted into sweat, thereby quickly reaching the stratum corneum where dermatophytes are present, bypassing the slow diffusive pathway across the epidermal cell layer… The best way to improve the antifungal effect of these agents is to obtain maximal perspiration while the patient is taking the drugs.[30]

Other Conditions. A double-blind study of patients with perennial rhinitis found that raising intranasal temperature by inhalation of saturated hot air (42-44 degrees C) resulted in reduced rhinitis symptoms and increased nasal patency.[51] Hot baths 1.5 hours before bedtime resulted in deeper and more restful sleep among a group of women aged 60-72 years with insomnia.[52]

Pain relief and muscle relaxation from sweat baths may be of particular benefit in persons with musculoskeletal injuries, overuse ailments, arthritis and other rheumatic diseases, premenstrual syndrome, and insomnia.[53-56] Heat may alleviate pain by releasing endogenous opioids and reducing anxiety.[53,57] Heat may promote muscle relaxation by increasing the extensibility of collagen-rich tissues (such as tendons, fasciae, and articular capsules), increasing oxygen delivery to stressed muscles, speeding immune cellular repair, and reducing pain.[47,53] The plasma concentration of prolactin increases during heat exposure.[58] This physiologic effect, along with the relaxation induced by a sweat bath, might facilitate breast feeding.

Potential Health Risks

Injuries. Based on conversations with sweat lodge leaders, probably the most common hazards of sweat lodges are falls, lacerations, and abrasions from participants tripping or stepping on objects while walking barefoot to and from the lodge.

Acute musculoskeletal disorders. Laboratory studies suggest that higher temperatures can increase the breakdown of articular cartilage and tissues that contain collagen.[55,59] In experimental animals, hyperthermia can exacerbate acute inflammation.[53] These *in vitro* studies may explain why some patients with joint and musculoskeletal symptoms complain of increased pain after heat exposure. Several authors recommend that patients with acute inflammatory processes in muscles, joints, or back should not undergo heat stress in the first few days after injury, or while there is ache, swelling, redness, or tenderness at rest.[53,54,60]

Pregnancy and women's health. A prospective study of over 23,000 women found an increased risk of neural tube defects (spina bifida, anencephaly, or encephalocele) among infants born to women who were exposed to heat during the first trimester of pregnancy. The exposures were in the form of hot tubs, saunas, or fevers.[61] This research supports animal studies concluding that heat is teratogenic.[51,62] A review of pregnancy and the sauna in Finland concludes that "healthy pregnant women may safely have sauna baths throughout their pregnancy."[63] However, the review notes that the fetal heart rate rises during maternal hyperthermia and thermal stress may induce uterine contractions and lower uterine blood flow.[63] Sweat iron loss coupled with a low dietary iron intake may result in a negative iron balance and anemia for women.[64] At least one study found a lower sweat volume among females than males.[65]

Dehydration. A person who is dehydrated upon entering a sweat lodge is at risk of heat exhaustion, hypotension, and syncope. Dehydration lowers the sweating rate for a given core temperature, increases heart rate, and decreases cardiac output.[20,43,66] In very hot environments, water losses from sweating can approach two liters per hour.[67]

Male infertility. In otherwise healthy men, increased scrotal temperatures are associated with decreases in sperm count and in the percentage of motile spermatozoa. These abnormalities are reversible when temperatures return to normal. Infertile men are advised to avoid hot environments.[68,69] The contraceptive efficacy of a daily mild increase (1-2 degrees C) in testicular temperature during waking hours is under investigation.[70]

Cardiovascular conditions. Individuals with cardiovascular problems (such as hypotension or hypertension, congestive heart failure, or impaired coronary circulation), or who are taking medications which might affect blood pressure, need to exercise caution in exposing themselves to prolonged heat.[71,72] During heat waves, chronic cardiovascular diseases are the most common underlying disorders among patients with heat stroke.[73] Heat stress causes fluid shifts in the body as a result of both cutaneous vasodilation and fluid loss from sweating. Also, cardiac output increases in order to transfer internal heat to the outside environment via the skin and respiratory system.[71,72] The rise in cardiac output (2.8 l/min for every one degree Centigrade increase in body temperature) is primarily due to changes in heart rate (which increases by about 30 beats per minute for each degree increase in internal temperature).[43,44]

Blood pressure usually falls during heat stress as a result of the redistribution of blood volume to skin and away from the splanchnic (gastrointestinal, splenic, and pancreatic), renal, and skeletal muscle circulations.[43,44] Decreased coronary perfusion pressure, combined with increased blood viscosity (due to decreased intravascular fluid volume) and increased myocardial oxygen demand from tachycardia, all increase the risk of myocardial ischemia. Conversely, blood pressure may

rise dramatically on exposure to cold, such as when a person leaves a sweat lodge on a winter's day. Sudden cold exposure increases the work of the heart because of the very rapid transitory volume and pressure loads, accelerated heart rate, and increased sympathetic activity. These changes increase the risk of myocardial ischemia and arrhythmias.[44,54,72] Changes in circulating blood volume, blood viscosity, and blood pressure also pose a risk for cerebrovascular events (syncope, stroke).

Children. When exposed to hot environments, children experience a much more rapid rise in core temperature than adults do. This is reflected in the excess death rate due to heat illness among infants and children during heat waves.[74] Higher metabolic rates per unit mass, greater body surface area/mass ratio, and limited circulatory adaptation to increased cardiac demands play a role.[7,66,74-76] Maturation of the ability to regulate body temperature by sweating is said to occur only at puberty.[66,76] Children's thinner skin layers (epidermis and dermis) also increase their susceptibility to burns,[76a] both from the hot steam and heated stones of a sweat lodge.

Medications. Sympathomimetic drugs may provoke tachycardia and arrhythmias with heat stress. Atropine, glutethimide, tricyclic antidepressants, phenothiazines, and antihistamines have anticholinergic action that can predispose to syncope and heat stroke.[66,73] Diuretics can produce hypovolemia, hyperosmolality, and reduced evaporative water losses through a reduction in sweat rate.[67] Barbiturates and beta-blockers can also impair heat loss mechanisms.[77,78]

The Elderly. The ability to maintain core temperature during heat stress decreases with increasing age because of decreased sweat gland function, cutaneous blood flow, and innervation to sweat glands.[79,80] Also, elderly individuals may be prone to orthostatic hypotension and need to be cautious to avoid syncope when standing up after a sweat bath.[72]

Diabetes. The impact of sweat bathing on insulin levels is not easily predicted. Subcutaneously injected insulin is absorbed faster than usual in hot environments, probably because of increased cutaneous circulation. At the same time, heat exposure increases the secretion of catecholamines (such as noradrenaline) and possibly other insulin antagonists.[54,58] Individuals with neuropathy can experience burns from lack of sensation and an impaired sweating ability.[20,81]

Alcohol abuse. Acute alcohol intoxication poses many hazards in the sweat lodge. Decreased judgement, balance, and coordination can lead to burns and falls. Both alcohol and heat stress dilate peripheral vasculature, increasing the risk of orthostatic hypotension and syncope; and both increase adrenergic activity, predisposing to cardiac arrhythmias.[82] Chronic liver disease can lead to abnormal sweating because of autonomic dysfunction.[83]

Asthma. Smoke from cedar, sweetgrass, tobacco, or other plants used in sweat lodges may serve as pulmonary irritants. Humid air has a variable effect on patients with asthma, decreasing forced expiratory volume and airway conductance in some studies and increasing it in others.[84-86] Bronchodilators in combination with heat stress may provoke tachycardia and arrhythmias.[87]

Skin disorders. The onset or exacerbation of certain skin disorders (eczema, cholinergic urticaria, acantholytic dermatosis, miliaria) have been linked to heat and sweating.[42,88,89] "Heat rash" is caused by the plugging and rupture of sweat glands following sweating-induced skin maceration.[77] Some skin disorders (e.g., psoriasis, miliaria rubra) can occlude sweat ducts, substantially reducing sweating.[20] Sunburn decreases the responsiveness of the sweat gland and its capacity to deliver sweat to the skin surface.[66]

Kidney disease. Patients with chronic renal failure often complain of dry skin and pruritus, which may be due to the atrophy of sweat glands, elevated antidiuretic hormone, and a decreased sweating response.[29,90] Excessive sweating may affect electrolyte balance, since patients with advanced renal failure have higher sweat concentrations of potassium.[29]

Neurologic disorders. Although some patients with multiple sclerosis (MS) show improvement after warming, about 80% suffer neurological deterioration (such as muscular weakness and ocular abnormalities) when subjected to heat. Until the early 1980s, the "hot bath test" was used in diagnosing the disease. The test was largely abandoned "because it sometimes resulted in permanent neurologic deficits in MS patients."[91] Patients with Parkinson's disease can exhibit a range of sweating disorders.[92]

Patients with peripheral neuropathies (e.g., from diabetes, alcoholism, Guillain-Barre syndrome, leprosy) that impair sensation are obviously at risk for serious burns in the sweat lodge, both from hot steam and contact with the heated stones.

Other Conditions. Reduced ability to sweat can place a person at risk of heat stroke during a sweat lodge. Conditions associated with impaired sweating include extensive scarring from burns, total body electron beam irradiation, diabetes with neuropathy, Parkinsonism, multiple sclerosis, cervical spine lesions, central nervous system tumors, hypothyroidism, amyloidosis, injuries, or hemorrhages.[29,92] Untreated hyperthyroidism can increase core heat production by up to 400%, greatly increasing the risks of heat exposure.[73,78]

Conclusions and Recommendations

The potential health benefits of regular participation in Native American sweat lodges are numerous. This is not at all surprising, given that sweat bathing has been practiced for thousands of years in many cultures throughout the world. What is very surprising is the scarcity of research about the practice, especially in light of the growing worldwide interest in complementary healing. Promising areas for research are the value of sweat bathing for preventing and treating infectious diseases (especially with the rise in antibiotic-resistant infections); treating arthritis (where heat can have paradoxical effects on inflammation); treating skin disorders (where remarkable increases in skin blood flow enhance both natural immunity and the delivery of medications); treating and reha-

bilitating individuals with alcohol and other substance abuse disorders (for example, there are no studies estimating the amounts of drug metabolites excreted during profuse and prolonged sweating); and preventing cancers, their metastases, and post-treatment relapses. Research is especially urgent where current evidence is conflicting, such as the impact of elevated temperatures on tumor behavior, the immune system, and joint disorders.

The sacred and ceremonial nature of traditional sweat lodges does not mean their physical effects cannot be evaluated. For example, the value of sweat lodges as an adjunct to alcohol treatment programs could be assessed by comparisons among treatment sites, perhaps with a crossover design. Furthermore, disregarding spiritual aspects, the sweat lodge and the sauna are remarkably similar physically, and possibly have an identical origin.[93] Conditions of heat and humidity in the sweat lodge can be duplicated in the sauna, making possible randomized trials of individuals with specific medical conditions. Any research involving sweat lodges per se (as opposed to studies of sweating in clinical or laboratory settings) must necessarily involve a collaboration among participants, traditional healers, and investigators. What factors, if any, do traditional healers or Tribes think are important to study? How might studies be undertaken with full respect for traditional values and practices? How would results be shared? The ethical and cultural implications of such research are as important to consider as the cultural issues.

The potential health hazards of sweat lodges need not exclude individuals with mild or moderate risk factors from participation. The social, spiritual, and psychological benefits of a sweat lodge may greatly outweigh a person's potential medical risks. Again, a collaboration among participants, traditional healers, and health providers (physicians, nurses, substance abuse counsellors) is necessary. Participants with asthma, diabetes, and arthritis must be made aware that their responses to the conditions of the sweat lodge are not predictable. After consultation with Native healers and Native or non-Native medical providers, individuals might decide to participate on a trial basis. Persons with blood pressure problems or cardiac conditions might attend only one round of the lodge, avoid standing up suddenly, and protect themselves from cold exposure when leaving the lodge. Anyone experiencing dizziness, nausea, chest pain, or palpitations should be encouraged to leave the lodge. They can sit near the entrance to the lodge so they can leave without disturbing the proceedings or risking injury from stepping over the hot stones.

In general, clearing rocks, broken glass, and other hazards in a path from the lodge before dark, and having a flashlight available, can prevent injuries and falls. Participants should avoid eating a heavy meal before a sweat and should drink adequate fluids before and after the lodge.

Authors' note

Readers who wish to obtain a complete list of references may contact Dr. Berger at the Lovelace Clinic Foundation. Also, the authors welcome any comments on or additions to this paper, since even a comprehensive literature review of such a broad topic is likely to omit important studies.

References

1. Brady M. Culture in treatment, culture as treatment. A critical appraisal of developments in addictions programs for indigenous North Americans and Australians. *Social Science & Medicine.* 1995;41(11):1487-1498.
2. Bruchac J. *The Native American Sweat Lodge: History and Legends.* Freedom, CA: The Crossing Press; 1993.
3. Weil A. *Eight Weeks to Optimum Health.* New York: Alfred A. Knopf; 1997:114-116.
4. Weil A. The Indian Sweat: Traditional purification ritual brings benefit to mind and body. *American West.* 1982;19:42-49.
5. Herriott E. Steam and sauna therapy. *Massage Magazine.* 1997;67 (May/June):32-35.
6. Weil A. Natural help for hepatitis. *Self Healing.* 1998;April;1,6-7.
7. Leppaluoto J. Human thermoregulation in sauna. *Annals of Clinical Research.* 1988;20(4):240-43.
8. Hasday J. The influence of fever on host defenses. Chapter 11 in Mackowiak P. *Fever: Basic Mechanisms and Management.* Second Edition. Philadelphia: Lippincott-Raven;1997:177-196.
9. Mackowiak P. Benefits versus risks of the febrile response. Chapter 19 in, Mackowiak P. *Fever: Basic Mechanisms and Management.* Second Edition. Philadelphia: Lippincott-Raven;1997:279-85.
10. Mackowiak P. Fever: blessing or curse? A unifying hypothesis. *Ann Intern Med.* 1994;120:1037-40.
11. Nesse RM, Williams GC. *The New Science of Darwinian Medicine: Why We Get Sick.* New York: Random House;1994.
12. Shen RN, Lu L, Young P, et al. Influence of elevated temperature on natural killer cell activity, lymphokine-activated killer cell activity and lectin-dependent cytotoxicity of human umbilical cord blood and adult blood cells. *Int J Radiation Oncology Biol Phys* 1994;29(4):821-6.
13. Roberts NJ. Temperature and host defense. *Microbiological Reviews.* 1979;43 (2):241-259.
14. Kluger M, Kozak W, Conn C, et al. The adaptive value of fever. Chapter 17 in Mackowiak P. *Fever: Basic Mechanisms and Management.* Second Edition. Philadelphia: Lippincott-Raven;1997:255-266.
15. Metze D, Jurecka W, Gebhart W, et al. Immunohistochemical demonstration of Immunoglobulin A in human sebaceous and sweat glands. *J Invest Dermatol* 1989;92(1):13-17.
16. Imayama S, Shimozono Y, Urabe A, Hori Y. A simple method for measuring the amount of immunoglobulin A secreted onto the skin surface. *Acta Dermato-Venereologica.* 1995;75(3):212-7.
17. Jones AP, Webb LM, Anderson AO, et al. Normal human sweat contains interleukin-8. *J Leukocyte Biology* 1995;57: 434-437.
18. Sato K, Sato F. Interleukin-1 alpha in human sweat is functionally active and derived from the eccrine sweat gland. *Amer J of Physiol* 1994;266(3 Pt 2):R950-959.
19. Hibino T, Takemura T, Sato K. Human eccrine sweat contains tissue kallikrein and kininase II. *J of Invest Derm.* 1994;102(2):214-20.
20. Quinton PM. Sweating and its disorders. *Ann Rev Med.* 1983;34:429-452.
21. Boehm KD, Jun JK, Garner C, et al. In situ detection of cytokine messenger RNAs in the eccrine sweat gland of normal human skin. *Lymphokine and Cytokine Research* 1994;13(1):9-13.
22. Howard OM, Ben-Baruch A, Oppenheim JJ. Chemokines: progress toward identifying molecular targets for therapeutic agents. *Trends in Biotechnology* 1996;14(2):46-51.
23. Streffer C. Biological basis of thermotherapy (with special reference to oncology). Chapter 1 in, Gautherie M (Editor). *Biological Basis of Oncologic Thermotherapy*. New York: Springer-Verlag;1996.
24. Kakehi M, Ueda K, Mukojima T, et al. Multi-institutional clinical studies on hyperthermia combined with radiotherapy or chemotherapy in advanced cancer of deep-seated organs. *International Journal of Hyperthermia* 1990;6(4):719-40.
25. Dinarello CA, Dempsey RA, Allegretta M, et al. Inhibitory effects of elevated temperature on human cytokine production and natural killer activity. *Cancer Research* 1986;46:6236-6241.
26. Sakkers RJ, Filon AR, Brunsting J, et al. Selective inhibition of repair of

active genes by hyperthermia is due to inhibition of global and transcription coupled repair pathways. *Carcinogenesis*. 1995;16(4):743-748.
27. Kapp DS. Thermal dose response, systemic hyperthermia, and metastases: old friends revisited. *Int J Radiation Oncology Biol Phys.* 1996;35(1): 189-194.
28. Krohn J, Taylor F, Prosser J. *Natural Detoxification: The complete guide to clearing your body of toxins*. Point Roberts, WA: Hartley and Marks;1996.
29. Yosipovitch G, Reis J, Tur E, et al. Sweat electrolytes in patients with advanced renal failure. *J Lab Clin Med* 1994;124(6):808-12.
30. Sato K, Kang WH, Saga K, Sato KT. Biology of sweat glands and their disorders: normal sweat gland function. *J of the Amer Acad of Derm.* 1989;20(4):537-563.
31. Omakhodian FO, Howard JM. Trace elements in the sweat of acclimatized persons. *Clinica Chimica Acta.* 1994;231:23-28.
32. Cohn JR, Emmett EA. The excretion of trace metals in human sweat. Annals of Clin and Lab Science. 1978;8(4):270-275.
33. Lilley SG, Florence TM, Stauber JL. The use of sweat to monitor lead absorption through the skin. *Science of the Total Environment* 1988;76:2-3:267-78.
34. Kanzaki T, Tsuda J. Bile pigment deposition at sweat pores of patients with liver disease. *J Amer Acad of Derm.* 1992;26(4): 655-656.
35. Cone EJ, Hillsgrove MJ, Jenkins AJ, et al. Sweat testing for heroin, cocaine, and metabolites. *J Analytical Toxicology*. 994;18:298-305.
36. Fay J, Fogerson D, Schoendorfer RS, et al. Detection of methamphetamine in sweat by EIA and GC-MS. *J of Analytical Toxicology.* 1996;20(6):398-403.
37. Spiehler V, Fay J, Fogerson R, et al. Enzyme immunoassay validation for qualitative detection of cocaine in sweat. *Clinical Chemistry.* 1996;42(1):34-8.
38. Madsen ES, Larsen H. Excretion of mutagens in sweat from humans treated with anti-neoplastic drugs. *Cancer Letters.* 1988;40:199-202.
39. Kintz PA, Tracqui A, Mangin P. Sweat testing for benzodiazepines. *J Forenseic Sciences* 1996;41:851-54.
40. Hoiby N, Johansen HK. Ciprofloxacin in sweat and antibiotic resistance. *Lancet* 1995;346 (8984):1235.
41. Joyce WT, Cowan RJ. A potential false-positive posttherapy radioiodine scan secondary to I-131 excretion in perspiration. *Clinical Nuclear Medicine* 1995;20(4):368-9.
42. Hannuksela M, Vaananen A. The sauna, skin and skin diseases. *Annals of Clinical Research.* 1988;20(4):276-278.
43. Johnson JM and Proppe DW. Cardiovascular adjustments to heat stress. Chapter 11 in Fregly MJ, Blatteis CM. Handbook of Physiology, Section 4: Environmental Physiology, Volume 1. New York: Oxford University Press;215-238.
44. Vuori I. Sauna bather's circulation. *Annals of Clinical Research.* 1988;20(4):249-256.
45. Weller R, Pattullo S, Smith L, et al. Nitric oxide is generated on the skin surface by reduction of sweat nitrate. *J Invest Dermatol* 1996;107(3):327-31.
46. Heck DE, Laskin DL, Gardner CR, Laskin JD. Epidermal growth factor suppresses nitric oxide and hydrogen peroxide production by keratinocytes: potential role for nitric oxide in the regulation of wound healing. *J Biological Chemistry.* 1992;267(30):21277-21280.
47. Kloth LC. Physical modalities in wound management: UVC, therapeutic heating and electrical stimulation. *Ostomy Wound Management*. 1995;41(5):18-20,22-4,26-7.
48. Urabe H, Nishitani K, Kohda H. Hyperthermia in the treatment of psoriasis. *Arch of Derm.* 1981;117:770-774.
49. Dover JS, Phillips TJ, Arndt KA. Cutaneous effects and therapeutic uses of heat with emphasis on infrared radiation. *J Am Acad Dermatology* 1989;20(2 Pt 1):278-86.
50. Goutzamanis JJ, Gilbert GL. Mycobacterium ulcerans infection in Australian children: report of eight cases and review. *Clinical Infectious Diseases.* 1995;21(5):1186-92.
51. Ophir D, Elad Y, Fink A, et al. Effects of elevated intranasal temperature on subjective and objective findings in perennial rhinitis. *Annals of Otology, Rhinology & Laryngology.* 1988;97(3 Pt 1): 259-63.
52. Dorsey CM, Lukas SE, Teicher MH, et al. Effects of passive body heating on the sleep of older female insomniacs. *J Geriatric Psychiatry & Neurology.* 1996;9(2):83-90.
53. Isomaki H. The sauna and rheumatic diseases. Annals of Clinical Research 1988;20(4):271-75.
54. Vuori I. Healthy and unhealthy sauna bathing. *Annals of Clinical Research* 1988;20(4):217-219.
55. Scull SA, Dow MB, Arthreya BH. Physical and occupational therapy for children with rheumatic diseases. *Pediatric Clinics of North America.* 1986;33(5):1053-77.
56. Castleman M. Nature's Cures. New York: Bantam Books;1996;230-239.
57. Sorri P. The sauna and sauna bathing habits — a psychoanalytic point of view. *Annals of Clinical Research.* 1988;20(4):236-239.
58. Kukkonen-Harjula K, Kauppinen K. How the sauna affects the endocrine system. *Annals of Clinical Research.* 1988;20(4):262-266.
59. Oosterveld PG, Rasker JJ. Treating arthritis with locally applied heat or cold. *Seminars in Arthritis & Rheumatism.* 1994;24(2):82-90.
60. Hartigan C, Miller L, Liewehr SC. Rehabilitation of acute and subacute low back and neck pain in the work-injured patient. *Orthopedic Clinics of North America.* 1996;27:841-60.
61. Milunsky A, Ulcickas M, Rothman KJ, et al. Maternal heat exposure and neural tube defects. *JAMA* 1992;268:882-85.
62. Warkany J. Teratogen update: hyperthermia. Teratology. 1986;33:365-371.
63. Vaha-Eskeli, Erkkola R. The sauna and pregnancy. *Annals of Clinical Research.* 1988;20(4): 279-82.
64. Waller MF, Haymes EM. The effects of heat and exercise on sweat iron loss. *Medicine & Science in Sports and Exercise.* 1996;28(2):197-203.
65. Aladjem M, Fine BP, Lasker N, et al. Effects of essential hypertension and antihypertensive medications on sweat formation. *Journal of Hypertension.* 1992;10:69-76.
66. Sawka MN, Wenger CB, Pandolf KB. Thermoregulatory responses to acute exercise-heat stress and heat acclimation. Chapter 9 in Fregly MJ, Blatteis CM. *Handbook of Physiology,* Section 4: Environmental Physiology, Volume 1. New York: Oxford University Press;157-186.
67. Mack GW, Nadel ER. Body fluid balance during heat stress in humans. Chapter 10 in Fregly. 187-214.
68. Lipshultz LI, Howards SS, eds. *Infertility in the Male.* St. Louis: Mosby;1997:324.
69. Mieusset R, Bujan L, Mondinat C, et al. Association of scrotal hyperthermia with impaired spermatogenesis in infertile men. *Fertility and Sterility.* 1987;48(6):1006-1011.
70. Mieusset R, Bujan L. The potential of mild testicular heating as a safe, effective and reversible contraceptive method for men. I*nternational J Andrology.* 1994;17(4):186-91.
71. Ahonen E, Nousiainen U. The sauna and body fluid balance. *Annals of Clinical Research.* 1988;20(4):257-61.
72. Eisalo A, Luurila OJ. The Finnish sauna and cardiovascular diseases. Annals of Clinical Research. 1988;20(4):267-270.
73. Knochel JP, Goodman EL. Heat stroke and other forms of hypothermia. Chapter 34 in, Mackowiak P. *Fever: Basic Mechanisms and Management.* Second Edition. Philadelphia: Lippincott-Raven;1997, pages 437-458.
74. Tsuzuki-Hayakawa K, Tochihara Y, Ohnaka T. Thermoregulation during heat exposure of young children compared to their mothers. *European J of Applied Physioogy & Occupational Physiology* 1995;72(1-2):12-7.
75. Gates DM. *Man and His Environment: Climate*. New York: Harper and Row; 1972.
76. Jokinen E, Gregory EL, Valimaki I. The sauna and children. *Annals of Clinical Research.* 1988;20(4):283-286.
76a. Berger LR and Mohan D. *Injury Control: A Global View*. New Delhi: Oxford University Press; 1996, p138.
77. Schmidt EW, Nichols CG. Heat and sun-related illnesses. In, Harwood-Nuss AL, ed. *The Clinical Practice of Emergency Medicine.* Second Edition. Philadephia: Lippincott-Raven Publishers; 1996:1473-1476.
78. Lee-Chiong TL, Stitt JT. Disorders of temperature regulation. *Comprehensive Therapy*. 1995;21(12):697-704.
79. Inoue Y. Longitudinal effects of age on heat-activated sweat gland density and output in healthy active older men. *Euro J of Appl Phys & Occu Physi.* 1996;74(1-2):72-77.
80. Abdel-Rahman TA, Cowen T. Neurodegeneration in sweat glands and skin of aged rats. *J Autonomic Nervous System.* 1994;46(1-2):55-63.
81. Ejaz AA, Zabaneh RI, Popli S, et al. Gustatory sweating in a diabetic end-stage renal disease patient maintained on hemodialysis. *Nephron.* 1995;69:337.

82. Ylikahri R, Heikkonen E, Suokas A. The sauna and alcohol. *Annals of Clinical Research.* 1988;20(4):287-291.
83. Oliver MI, Miralles R, Rubies-Prat J, et al. Autonomic dysfunction in patients with non-alcoholic chronic liver disease. *J Hepatology.* 1997;26(6):1242-8.
84. Aitken Ml, Marini JJ, and Culver BH. Humid air increases airway resistance in asthmatic subjects. *Western J Medicine.* 1988;149(3):289-93.
85. Gravelyn TR, Capper M, Eschenbacher WL. Effectiveness of a heat and moisture exchanger in preventing hyperpnoea induced bronchoconstriction in subjects with asthma. *Thorax.* 1987;42(11): 877-80.
86. Linn WS, Shamoo DA, Anderson KR, et al. Effects of heat and humidity on the responses of exercising asthmatics to sulfur dioxide exposure. *Am Rev Respiratory Disease.* 1985;131(2):221-5.
87. Laitinen LA, Lindqvist A, Heino M. Lungs and ventilation in sauna. *Annals of Clinical Research.* 1988;20(4):244-248.
88. Hu CH, Michel B, Farber EM. Transient acantholytic dermatosis (Grover's disease). A skin disorder related to heat and sweating. *Arch of Derm.* 1985;121(11):1439-41.
89. Morren MA, Przybilla B, Bamelis M, et al. Atopic-dermatitis: triggering factors. *J Amer Acad Dermatology.* 1994;31(3):467-473.
90. Park TH, Park CH, Ha SK, et al. Dry skin (xerosis) in patients undergoing maintenance haemodialysis: the role of decreased sweating of the eccrine sweat gland. *Nephrology Dialysis Transplantation.* 1995;10:2269-2273.
91. Guthrie TC, Nelson DA. Influence of temperature changes on multiple sclerosis: critical review of mechanisms and research potential. *J of Neuro Sciences.* 1995;129:1-8.
92. Mano. Sweat function in Parkinson's disease. *Journal of Neurology.* 1994;241(10):573-6.
93. Lopatin IA. Origin of the Native American steam bath. *American Anthropologist.* 1960;62:977-993.

Acknowledgments

The authors are grateful to Drs. Richard Goldman, Matt Kluger, Ed Rose, and Timothy Taylor for their insights and advice, and to Sandy Spurlock for her expert library assistance. This work was supported in part by the Robert Wood Johnson Foundation and the Indian Health Service. □

Buckle Up for Life
An Incentive Program

Don Williams, Injury Prevention Specialist, Tucson, Arizona

Introduction

The incentive campaign described in this article was conducted as a project for the Indian Health Service Injury Prevention Fellowship. At the outset, it was decided that the project would be in the area of vehicle occupant restraint. The author was in the process of finishing a road hazard study that examined three years of crashes on two primary reservation highways. There were four fatal crashes during that period in which none of the nine deceased were wearing seat belts. Three of the crashes involved ejections, which would have certainly been prevented with seat belts. Another crash with five fatalities was a head-on collision with no seat belt use.

One of the primary recommendations that emerged from that study was the need for a campaign to increase car seat/seat belt use. This was particularly important on the Indian reservation where the author was stationed; years of research and data from the Indian Health Service have shown that Native Americans are killed by motor vehicle crashes at a rate twice that of non-Indians. For Indian children the rate is three times higher than non-Indians, and for infants and toddlers it is four times higher. Based on both statistical analysis and direct observation, as well as anecdotal evidence, it was apparent that increasing restraint use was the most effective method to decrease injuries. The decision was made to attempt this with a car seat/seat belt incentive campaign. This was primarily a behavior modification study.

According to the Utah traffic code, children under age eight will be secured in car seats or by a seat belt. All front seat passengers are to be restrained by seat belts. The Bureau of Indian Affairs Police on the subject reservation have adopted the Utah Code. Citations for seat belt violations, however, have not been a high priority of the local police department. It has naturally followed that there has been very little fear of repercussions for ignoring this facet of the traffic laws.

Methods

Approval to conduct an incentive campaign was obtained from the Injury Prevention Specialists of the Phoenix Area Indian Health Service. The BIA superintendent was then approached for support, which was readily given. He had been involved in efforts in other locations to increase restraint use and was enthusiastic about doing so at Ft. Duchesne. The Captain of the Police Department pledged any assistance he or his department could offer.

The final approval was sought from the Ute Tribe Business Committee, the governing body of the tribe. After it was explained that the goal was the reduction of injuries to tribal members, the Committee gave their support. This was the most critical step up to this point since the governing body of the tribe must approve any project that takes place on the Reservation.

The project consisted of several phases. The first was baseline data collection to document the problem. Contacting merchants for donation of incentives followed. Designing and implementing the publicity portion was the next phase, along

with awarding coupons to drivers of vehicles in which everyone in the vehicle was properly restrained. Distributing the incentives was the final portion of the behavior modification. This was followed by further data collection on several occasions to gauge the impact of the campaign.

Observational studies were conducted in a variety of locations throughout the area to obtain a representative sample; these took place at the U. S. Post Office and the Indian Health Service Clinic during both Obstetrics/Gynecology Clinic and Pediatric Clinics. Vehicles at a Head Start Center during a medical screening activity were also observed.

The author conducted all of the observations. The standard Indian Health Service observational form was utilized as the collection instrument. The form divides vehicles into five categories: Sedan, Station wagon, Pickup Truck, Utility (4-Wheel Drive, Van), or GSA/Government vehicle, which included tribal and police vehicles. Occupant descriptors on the form are driver gender, driver seat belt use, passenger seat belt use, and infant seat use. Only when there was no doubt as to the accuracy of the observation was the vehicle counted. If there was a question about whether a vehicle was equipped with seat belts or if a car seat was properly installed, that vehicle was not counted. A total of 389 vehicles were observed during the baseline data collection period.

The author then began contacting merchants in the area to seek donors for the incentives. A total of 26 merchants in the three nearby towns were asked to make a donation in exchange for mention in radio advertising and inclusion on a poster to publicize the campaign. With two exceptions where merchandise was donated, all of the incentives were in the form of gift certificates. The certificates ranged from a low of ten dollars to a high of one hundred dollars with an average of thirty dollars. There were three fifty dollar donations that were referred to as the "jackpot" prizes. All of the merchants contacted were able to donate something; there were no refusals.

For the poster portion of the publicity, a local printing company was contacted. One of the focal points of the poster was a beaded seat belt design that was created by one of the graphic artists employed by the Ute Tribal Public Information Office. Using the seat belt design and a logo borrowed in part from the Indian Health Service Occupant Protection Manual, the printer and author designed the poster that was used to advertise the campaign. The coupons that were awarded to drivers were also developed and printed at this time. As his contribution to the campaign, the printer agreed to lower his customary charges for services. The final cost was approximately one half of what it would otherwise have been.

The two local radio broadcast companies, each of which operate both an AM and FM station, offered advertising on a four-for-one basis. This worked out to over sixteen hundred dollars worth of advertising at a cost of four hundred dollars. The money was provided by the Office of Environmental Health Injury Prevention funds. One of the salespersons for the radio stations is a former health educator and provided assistance with writing some of the script for the advertising. The scripts were performed by both health professionals and tribal members occupying positions of influence. Each one had a tagline mentioning three of the merchants whose support was making the project possible. In addition to financial support, the radio stations were also very generous with their technical support for the actual recording of the advertising. In some cases there were three or four attempts before we were satisfied with the results, and the technicians were unfailingly patient and supportive.

The first three ads to air were recorded by the Clinical Director and the Nurse Practitioner at the Uintah and Ouray (U & O) Health Center, and the Director of the Ute Tribe Ambulance Service, who is a tribal member. A second set of ads were recorded by the Health Center's pediatrician, the Chair of the Ute Tribe Health Board, and the author. The reason for selecting these individuals was to have the message concerning the importance of restraint use come from persons in positions of responsibility, who are respected members of the community or the health care team. The ad done by the Clinical Director (who also serves as an emergency room physician at a local hospital) stressed that he had never had to pronounce dead a crash victim who was wearing a seat belt. He also emphasized that no matter how skilled a driver you are it is the other driver who you cannot control and have to be aware of. The nurse practitioner stressed that crashes tend to occur within twenty-five miles of home and that the excuse that "I'm just going a brief distance and therefore don't need a seat belt" is a fallacy. The message from the Ambulance Service Emergency Medical Technician explored the myth that you are less likely to be injured if you are thrown from the wreckage of a crash. She explained that you are twenty-five times more likely to be injured if you are ejected from the vehicle and go skidding along the pavement. She further stated that by being properly restrained inside the vehicle, you're much more likely to be conscious and able to help yourself.

The ad done by the pediatrician from the health center emphasized that her prescription for the health of one's children is to always have them in car seats, starting with the first ride home from the hospital. The fact that car seats should always be in the center of the back seat was another primary point. She also stressed that children should never ride in the front seat of cars equipped with air bags. The ad recorded by the author served a twofold purpose. The first was to introduce the basic concept of injury prevention: that injuries are predictable and preventable. It was explained that injuries are predictable in a house fire; they are preventable with the use of smoke alarms. Injuries are predictable in a motor vehicle crash and are preventable with the use of car seats and seat belts. The second purpose of the ad was to announce the extension of the incentive program for another two weeks because restraint use had noticeably increased.

There was very positive community feedback regarding the ads. News stories were aired by the radio stations, including an interview with the author, and news stories were printed in two of the three newspapers serving this area. The tribal newspaper also provided support by printing the poster in every issue

throughout the publicity campaign. The "News From Indian Country" radio show, produced by the Ute Tribe Public Relations Department, also publicized the project. This is a weekly, thirty minute radio show solely devoted to tribal news and announcements that has a faithful following among the Native American community. Thus, three newspapers and four radio stations in the area were publicizing the campaign in either a news or public service announcement format.

After two weeks of publicity, the coupon phase of the campaign began. This was done by stationing an observer at the same locations where the baseline studies were conducted. This was conducted by the BIA Police, the Office of Environmental Health secretary, and the author. Occupants of vehicles entering these areas were observed for restraint use. When all of the occupants were properly restrained, a coupon was given to the driver along with an explanation of what we were hoping to accomplish. They were also told that they were now eligible for the drawing for prizes donated by local merchants. Further positive reinforcement was also provided by talking about how important it is to have all occupants protected and how they were to be commended for having done so.

Word of this effort spread rapidly, and the Office of Environmental Health soon started getting calls asking where the observers would be set up. All persons in the office were instructed to tell callers that they might be anywhere on the reservation, and if they were buckled up they would certainly try to find them. At no time were any locations given to callers.

As the coupons were being given to persons who were buckled up, as time permitted an explanation of what we were doing was given to other drivers who were not so protected. Encouragement and reasons for restraint use were given along with the hope that the next time we saw them they would be eligible for coupons and prizes. All of the encouragement and explanations were given in a positive and friendly manner. This approach seemed to be fruitful, as during subsequent observations we saw persons who had never worn seat belts become users.

The coupon phase of the campaign was originally scheduled to be conducted from mid October through early December. As the target date approached, it was decided to extend the program for two more weeks to simply continue the reinforcement. That still left time for the winners of the incentives to use them for Christmas if they desired. The radio stations were once again generous and agreed to continue running the ads as public service announcements through December 15.

The incentives were announced and awarded on December 18 on the "News From Indian Country" radio show. All of the stubs from coupons that had been given to people were put in a container and were drawn one at a time. We began with the three incentives that had been referred to throughout the campaign as jackpot prizes. This had been done in adherence to the behavior modification maxim that the term "jackpot" carries stronger connotations and is therefore more effective as a modification tool than comparable terms. Those three prizes were all fifty dollar gift certificates. Two were from nationally recognized area discount department stores and the third from a popular local trading post that features Native American jewelry and beadwork supplies.

The remaining 26 prizes were awarded in the same manner. An incentive would be announced, and a name drawn for that incentive. This presented one final opportunity to reinforce what we were trying to accomplish. It was also another opportunity to thank all of the individuals, businesses, and radio stations who had been so generous in their support.

As soon as the incentives were awarded the post-campaign observations commenced. These were conducted in the same locations at the same time of day and day of the week as the baseline studies. The only observation location used in the baseline period that was not duplicated was the Head Start facility.

Discussion

The results of the post-incentive observations showed at least a doubling of usage rates in all categories. Driver seat belt use and infant car seat use showed the greatest gains. Driver seat belt use in sedans went from 17% to 36% and in pickup trucks from 11% to 35% (Table 1). Four-wheel drive vehicle and van driver use had been the best category in the baseline studies at 29%; this category increased by 5%, to 34%. Government (GSA) and Tribal vehicle restraint use increased from 29% to 75%. The category that was the poorest in the baseline studies was passenger use, but there were still incremental gains in this group. For passengers in sedans and station wagons the rate increased from 14% to 22%, and in pickup trucks from 4% to 13% (Table 2) . In four-wheel drive vehicles and vans the rate actually decreased from 17% to 12%. Infant car seat use showed the biggest gains of all, rising as much as 389% in sedans or station wagons (Table 3).

One of the interesting trends that the observational data show is that seat belt and car seat usage is continuing to increase rather than regress to the mean as might be expected to happen once an incentive program ceases. As each observation in the series of follow-up observations is completed it has shown gains in use rates. A possible explanation for this is publicity about increased enforcement. The author sent local media a news story stating that the incentive campaign was a success. The story emphasized that enforcement would increase and that tickets would be given to violators. Each story included a quote from the BIA Police Chief that people had been given the opportunity in a friendly manner to get into the restraint habit, and if they had not, then tickets would indeed be issued. He also emphasized that there had been far too much needless death and injury, and that if it took tickets to reduce these, then that is what would happen. An article was sent to the Head Start newsletter emphasizing that police would be patrolling looking for violators, and would specifically be targeting vehicles with children. The goal was to firmly fix in

people's minds the idea that there will be a penalty to pay if they choose to ignore this law. Even though it has not yet been seen, there will probably be some regression as we move away from the incentive campaign. This is where enforcement will become more valuable than ever. It is well established that behavior is influenced not by the severity of punishment but the certainty. It is vital that people have that certainty, and enforcement is the only way to achieve it. Enforcement is certainly the reason the North Carolina "Click it or Ticket" campaign has been so successful, raising usage rates there to over 80%. The success of the programs on the Navajo and Cherokee Reservation is further proof of the effectiveness of this approach. A location such as a reservation lends itself to publicizing a program like this because word of mouth is so effective within what is a close-knit, compact community.

Enforcement is now increasing on the Uintah and Ouray Reservation, and further observations are planned to gauge the impact of enforcement as compared to the incentive campaign.

There were a few difficulties that were encountered in conducting the study that should be mentioned. It is hard to gauge the age of children and decide whether they should be classified as passengers or in the infant seat use category. An attempt was made to account for this by counting those who were obviously infants and toddlers as those who should be in infant or car seats, while any older children were counted as passengers. This may have skewed the data regarding these categories to some extent. Another confounding factor is that 95 of the children observed were coming to a Head Start child screening program that was conducted during the baseline observation period. There was no similar event during the post-incentive observations so it was not possible to recreate it. The number of children observed during the baseline (98) was greater than during the post-incentive observations (25), which might have indicated a greater increase than was actually experienced. The fact that mothers bringing their children to a program designed to give their children a boost as they start their formal education process do not follow the most basic automotive safety rules is a source of continual amazement. The author will not attempt to explain this phenomenon. During the course of this study, whenever a parent was asked about a child who was unrestrained the questioner was usually told that most of the time a car seat was used but that it was forgotten that day, it was in the other car, or they were in a hurry. Sometimes parents reasoned that their child did not like to use a seat. In the author's experience a child who rides in a car seat from birth does not question using it as they grow older.

All expectant mothers who are eligible for services from the Indian Health Service receive a car seat and instruction on its proper use during the eighth month of their pregnancy. This program has been in existence since 1990. It is funded by the Indian Health Service; the seats are distributed and education on their use is provided by the Women, Infants and Children (WIC) program. Therefore, seats have been available since present day elementary school-age children were infants. As for the non-Indian children who were observed, there are loaner programs that make seats available to those at all income levels. Lack of availability or economic circumstances should not be a factor influencing the decision to use a car seat.

Recommendations

The groundwork has now been established for an ongoing occupant protection program at the Uintah and Ouray Service Unit. There is a strong commitment from the Indian Health Service to continue the car seat program, and the seats are now ordered on a quarterly basis by the health center supply technician. The WIC program must continue to emphasize car seat use, particularly during the prenatal period when the car seat and education are provided. The health center staff and contract obstetrics physicians must increase efforts to emphasize car seat use as a form of immunization to prevent injuries. The Head Start staff can and should play a vital role in continuing this education both with children and their parents or care providers. Establishing the habit from the beginning is a proven method to make it lifelong.

The most important recommendation is to work with the Tribal government to pass a resolution for the BIA Police mandating enforcement. The BIA Superintendent and Police Chief can both support enforcement but the officers working in the community are the ones who must translate support into action. Finally, it should be a responsibility of the service unit sanitarian to work to achieve these recommendations and to perform surveillance. Education for parents and children should be provided; both Head Start and schools play an important role. The real payoff will be in the reduction of injuries and the accompanying trauma.

Conclusions

Incentive campaigns will work. They are a positive, friendly method of behavior modification. Although there remains much work to be done on the Uintah and Ouray Reservation to increase restraint use to national averages, this program did have successes. There were substantial increases in usage in every category except passengers in utility vehicles. There were large increases in usage in pickup trucks and government/tribal vehicles. It was especially significant to be able to document the increases in car seat use for children, the most vulnerable members of society. Two of the most important changes as a result of this campaign were the increased awareness of the need for restraint use in vehicles, and police concentrating on the effort to protect motor vehicle occupants. Police efforts are mandatory for future success, as without enforcement a decreasing effect from the incentive campaign can be reliably predicted. The author has now worked with the police department long enough to be asked to come to their staff meetings to reiterate the importance of restraint use enforcement. Certainly having a positive relationship with the police is fundamental to gaining their assistance to conduct a program such as this.

There will be further observations to see how increased enforcement will affect the rates, and whether or not the

increases are more substantial than using incentives without enforcement.

A campaign of this type can be conducted in any community. This writer believes it is especially well suited to Native American communities where word of mouth plays an important role in spreading news and information. It is relatively low cost; total expenditures were less than 600 dollars. It was the willingness of the merchants and business people to offer the incentives and advertising that kept the costs as low as they were. The savings from the prevention of or a reduction in the severity of injuries in one motor vehicle crash will have made this effort worthwhile.

Table 1. Driver seat belt use.

Vehicle Type	Before	After	Change
Sedan or Station Wagon	17%	36%	+111%
Pickup Truck	11%	35%	+218%
4-Wheel Drive or Van	29%	34%	+17%
Government or Tribal	29%	75%	+159%

Table 2. Passenger seat belt use.

Vehicle Type	Before	After	Change
Sedan or Station Wagon	14%	22%	+ 57%
Pickup Truck	4%	13%	+225%
4-Wheel Drive or Van	17%	12%	-29%

Table 3. Infant car seat use.

Vehicle Type	Before	After	Change
Sedan or Station Wagon	9%	44%	+389%
4-Wheel Drive or Van	23%	71%	+209%

Post Study

Further observations were conducted one year later to see if the gains that were made during the incentive campaign had been maintained or regressed. The same data collection format as the original was used in the same locations. The results show that not only has regression not occurred, except in the government or tribal category, but there have actually been increases in some categories. Tables 4 and 5 illustrate the original percentages, those after the incentive campaign, and after one year. □

Table 4. Driver seat belt use.

Vehicle Type	Original	After	1 Year
Sedan or Station Wagon	17%	36%	41%
Pickup Truck	11%	35%	38%
4-Wheel Drive or Van	29%	34%	38%
Governent or Tribal	29%	75%	38%

Table 5. Passenger seat belt use.

Vehicle Type	Original	After	1 Year
Sedan or Station Wagon	14%	22%	23%
Pickup Truck	4%	13%	50%
4-Wheel Drive or Van	17%	12%	43%

Change of Address or Request for New Subscription Form

Name _____ **Job Title** _____

Address _____

City/State/Zip _____

Worksite: ☐ **IHS** ☐ **Tribal** ☐ **Urban Indian** ☐ **Other**

Service Unit (if applicable) _____ **Social Security Number** _____

Check one: ☐ **New Subscription** ☐ **Change of address**

If change of address, please include old address, below, or attach address label.

Old Address _____

THE IHS PRIMARY CARE PROVIDER

The Provider is published monthly by the Indian Health Service Clinical Support Center (CSC). Telephone: (602) 640-2140; Fax: (602) 640-2138; e-mail: provider@smtp.ihs.gov. Previous issues of *The Provider* (beginning with the December 1994 issue) can be found on the CSC Internet home page (http://www.csc.ihs.gov).

Circulation: The Provider (ISSN 1063-4398) is distributed to more than 6,000 health care providers working for the IHS and tribal health programs, to medical and nursing schools throughout the country, and to health professionals working with or interested in American Indian and Alaska Native health care. If you would like to receive a copy, send your name, address, professional title, and place of employment to the address listed below.

Publication of articles: Manuscripts, comments, and letters to the editor are welcome. Items submitted for publication should be no longer than 3000 words in length, typed, double-spaced, and conform to manuscript standards. PC-compatible word processor files are preferred. Manuscripts may be received via the IHS Banyan electronic mail system.

Authors should submit at least one hard copy with each electronic copy. References should be included. All manuscripts are subject to editorial and peer review. Responsibility for obtaining permission from appropriate tribal authorities and Area Publications Committees to publish manuscripts rests with the author. For those who would like more information, a packet entitled "Information for Authors" is available by contacting the CSC at the address below or through our fax retrieval service. Call 602-640-2140, ask for the fax retrieval service, and request document #3005. After business hours, press 8, and follow the instructions.

Dept. of Health and Human Services
Indian Health Service
Clinical Support Center
1616 East Indian School Road, Suite 375
Phoenix, Arizona 85016

BULK RATE
Postage and Fees Paid
U.S. Dept. of Health & Human Services
Permit No. G-290

ADDRESS CORRECTION REQUESTED

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300