many intervening variables could influence the relationship between labor and delivery. Women admitted in preterm labor have intravenous therapy instituted, which might suffice to interrupt labor in individuals whose contractions are linked to dehydration. Also, medications are used to inhibit labor. Finally, a time series analysis with appropriate corrections for long-term trends such as seasonality and autocorrelation and for temperature alone would be necessary before one could definitively establish an independent effect for heat–humidity index by either day or week.

In summary, in a pilot study of prenatal patients in one geographic area, we found an association between high heat–humidity indexes and preterm labor. Given the preliminary, yet important, nature of the data, further prospective evaluation is warranted. □

References

1. Dreiling CE, Carman FS, Brown DE. Maternal endocrine and fetal responses to heat stress. *J Dairy Sci.* 1991;74:312–327.
2. Vaha-Eskeli K, Erkkola R. The effect of short-term heat stress on uterine contractility, fetal heart rate and fetal movements at late pregnancy. *Eur J Obstet Gynecol Reprod Biol.* 1991;38:9–14.
3. Steadman RG. The assessment of sultrines. *J Appl Meteorology.* 1979;18:861–884.
4. Oliver JE. Climate and man. In: Oliver JE. *Climate and Man's Environment: An Introduction to Applied Climatology.* New York, NY: John Wiley & Sons Inc; 1973;7:195–205.
5. Mehta CR, Patel NR, Tsiatis A. Exact significance testing to establish treatment equivalence for ordered categorical data. *Biometrics.* 1984;40:819–825.

Vaginal Douching and Adverse Health Effects: A Meta-Analysis

Jun Zhang, MB, PhD, A. George Thomas, MD, and Etel Leybovich

ABSTRACT

Objectives. The meta-analysis described here reviewed the current literature on adverse health effects of vaginal douching.

Methods. Papers published in English from 1965 through 1995 were potentially eligible.

Results. One third of White women and two thirds of Black women of reproductive age reported douching regularly. Analyses indicated that vaginal douching increases the overall risk of pelvic inflammatory disease by 73% and the risk of ectopic pregnancy by 76%. Frequent douching was shown to be highly associated with pelvic inflammatory disease and modestly associated with cervical cancer.

Conclusions. Current literature suggests that frequent douching increases the risk of pelvic inflammatory disease, ectopic pregnancy, and, possibly, cervical cancer. (*Am J Public Health.* 1997;87:1207–1211)

Introduction

Vaginal douching is an ancient practice. It is widely performed in the United States, yet the benefits, risks, and relevant biological mechanisms have been inadequately studied. Scientific data are not only limited but also inconsistent; thus, some physicians are unaware of reported potential risks related to douching, and others remain unconvinced. The public is often confused by inconsistent results from different studies. On the other hand, commercial douche products are actively marketed and readily available. Since the population that douches regularly is so large, even a small risk will bear an important public health implication. This review focuses on the epidemiology of vaginal douching; describes a meta-analysis of the associations of douching with pelvic inflammatory disease, ectopic pregnancy, and cervical cancer; and discusses unresolved issues for future research.

Methods

We started with a MEDLINE literature search using "douching" as the key word. All of the papers published in English from 1965 through July 1995 were eligible for this review. We also searched the potentially eligible studies by cross-checking all of the references included. We then restricted our topics to epidemiology of vaginal douching and associations with pelvic inflammatory disease, ectopic pregnancy, and carcinoma of the cervix. Other topics related to vaginal douching, such as vulvovaginitis, have an insufficient number of studies for the purpose of meta-analysis. Only papers that provided actual measurement of prevalence or an estimate of association were included. We extracted information of interest from each study and summarized the information in a table (available from the senior author). All of the researchers adjusted for potential confounders that were available and important to their studies, and all presented adjusted relative risks (RRs) and 95% confidence intervals (CIs). Our meta-

Jun Zhang is with the Department of Community Medicine, Mount Sinai School of Medicine, New York City. A. George Thomas is with the Department of Obstetrics, Gynecology, and Reproductive Science, Mount Sinai School of Medicine. Etel Leybovich is with the College of Art and Science, New York University, New York City.

Requests for reprints should be sent to Jun Zhang, MB, PhD, Department of Community Medicine, Box 1043, Mount Sinai School of Medicine, One Gustave L. Levy Pl, New York, NY 10029-4571.

This paper was accepted September 6, 1996.

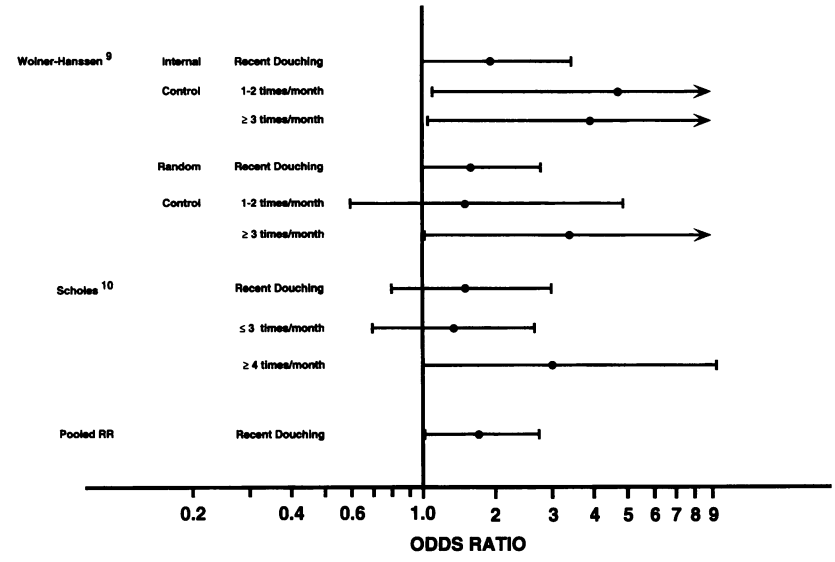

FIGURE 1—Meta-analysis of studies on vaginal douching and risk of pelvic inflammatory disease.

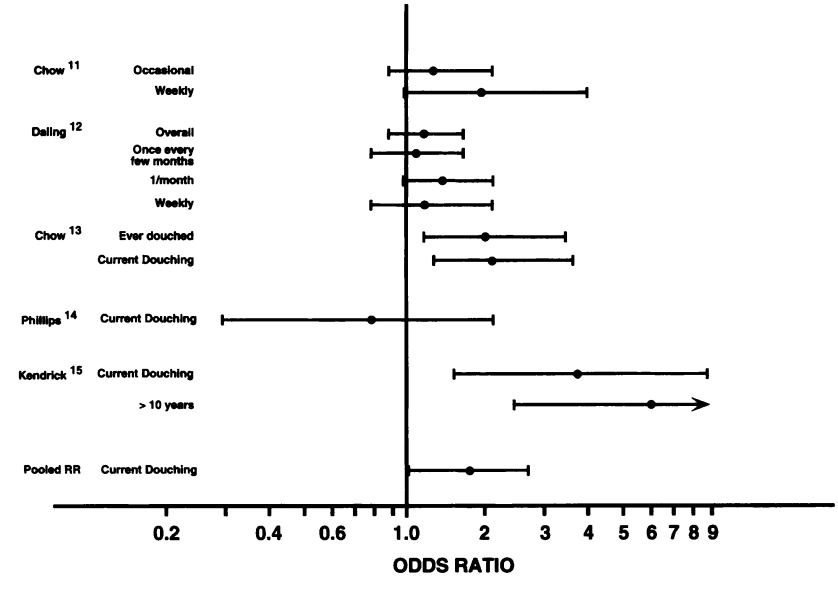

FIGURE 2—Meta-analysis of studies on vaginal douching and risk of ectopic pregnancy.

analysis was based on adjusted relative risks.

As for data synthesis, we combined individual relative risks from each study with an appropriate weight. We used a random effects model to calculate the pooled relative risk, and we computed the 95% confidence interval on the basis of the logarithm of the pooled relative risk and the sum of weights from individual studies.[1] To examine a dose–response pattern between frequency of douching (per month) and risks of pelvic inflammatory disease and cervical cancer, we used a weighted linear dose–response model with a zero intercept to obtain the slope and its standard error for each individual study. Then we used a random effects model to obtain the weighted pooled slope across studies and the 95% confidence interval. In this case, the slope refers to how much the log relative risk increases (or decreases) when the frequency of douching per month increases (or decreases) one unit. Statistical methods have been detailed elsewhere.[2]

Results

Epidemiology of Vaginal Douching

In the last 30 years, there have been five published studies that included information on prevalence of vaginal douching.[3–7] The 1988 National Survey of Family Growth[3] showed that 37% of US women of reproductive age (15 to 44 years) reported douching regularly, and half of them douched at least once a week. However, there was a striking racial difference in prevalence: two thirds of Black women douched regularly, while one third of White women did so. Blacks also tended to douche more frequently than Whites. Women of lower socioeconomic status (measured by years of schooling and poverty level) were more likely to douche, and this tendency was much more prominent in Whites than in Blacks. However, the prevalence varied little by age, place of residence, or marital status in either racial group. These results were generally consistent with those from other studies.[4–7]

Two other studies[6,7] further indicated that approximately two thirds of douching women douche for hygiene (e.g., "to feel clean after sex and/or after a period"). About 25% of women who douche do so to prevent or self-treat infection, and less than 5% douche to prevent pregnancy. About 50% of douching women use commercial preparations, 30% use a home mixture of vinegar and water, 10% use water alone, and 10% use other preparations.[4,6,7]

Vaginal Douching and Pelvic Inflammatory Disease

Pelvic inflammatory disease is the most frequent serious infection encountered by US women, and it has reached an epidemic level. It is responsible for more than a quarter of a million hospital admissions and 2.5 million outpatient visits each year.[8] Although it has been suspected that vaginal douching may be a detrimental factor for acute pelvic inflammatory disease, only two case–control studies specifically examined this issue (Figure 1).[9,10] The pooled overall relative risk from these studies was 1.73 (95% CI = 1.07, 2.79), suggesting that women who douche have a 73% increase in risk

of pelvic inflammatory disease in comparison with those who do not douche. Both studies further examined the frequency of douching and risk of pelvic inflammatory disease, and identified a clear dose–response pattern; that is, the more frequently a woman douches, the higher her risk of having pelvic inflammatory disease. The pooled slope was 0.34 (95% CI = 0.29, 0.38), indicating that if a woman douches once a week or more, she will have an approximately fourfold increased risk relative to women who never douche (RR = 3.9, 95% CI = 3.2, 4.6).

Vaginal Douching and Ectopic Pregnancy

Five hospital-based case–control studies examined whether douching is a risk factor for ectopic pregnancy (Figure 2).[11–15] Case patients were women with surgically confirmed ectopic pregnancies. In four of the studies,[11,13–15] control patients were women with normal intrauterine pregnancies; in the other study,[12] control patients were nonpregnant women. One study[15] examined this association only in Blacks, while in another study[12] approximately 85% of the subjects were White. After having controlled for several potential confounders, three studies[11–13] showed a modestly increased risk of ectopic pregnancy among women who douched. The study focusing on Black women[15] found a fourfold higher risk overall and a sixfold higher risk if a woman had douched for longer than 10 years. However, a small study[14] failed to show any association between vaginal douching and ectopic pregnancy. We combined these results and found that the case patients were 1.8 times more likely to douche than the control patients (pooled RR = 1.76, 95% CI = 1.10, 2.82); that is, if a woman who douches gets pregnant, she will have a 76% higher risk of having an ectopic pregnancy than a woman who does not douche. Two studies further examined the frequency of douching in relation to the risk of ectopic pregnancy. A clear dose–response pattern was indicated in one study[11] but not in the other.[12] One study[11] found that women using commercial preparations had 4.4 times the risk of ectopic pregnancy (95% CI = 1.6, 12.7) of women who never douched, but women using water only or water and vinegar had no elevated risk.

Vaginal Douching and Cervical Cancer

In the last 2 decades, douching has been suggested as a risk factor for cervical cancer in some studies. However, the evidence has been inconsistent. Six population-based case–control studies have been published[16–21]; two of these studies included both carcinoma in situ and invasive cancer in the case group.[16,20] The combined results indicate a weak overall association between douching and cervical cancer (pooled RR = 1.25, 95% CI = 0.99, 1.59) (Figure 3). The dose–response pattern between frequency of douching and risk of cervical cancer was marginal (pooled slope = 0.13, 95% CI = 0.04, 0.21). However, among women who douched at least once a week, the pooled adjusted relative risk was 1.86 (95% CI = 1.29, 2.68), indicating that women who douche frequently may have an 86% higher risk of cervical cancer than women who do not douche. With regard to the relationship between duration of regular douching and risk of cervical cancer, one study showed a positive dose–response pattern,[17] while another large study failed to confirm this pattern.[21] In terms of those who had douched more than 20 years, the pooled relative risk from three studies[16,17,21] was 1.47 (95% CI = 0.83, 2.61). One study[17] showed that women using commercial preparations had 2.4 times the risk of cancer (95% CI = 1.4, 4.0) of women who never douched, but women using water and vinegar had no elevated risk.

A small case–control study on carcinoma of the vagina is also noteworthy. In 41 patients with carcinoma in situ or invasive cancer of the vagina and 97 community control patients, Brinton et al.[22] found that, overall, the age-adjusted relative risk for douching was 1.8 (95% CI = 0.8, 3.8). For women who used

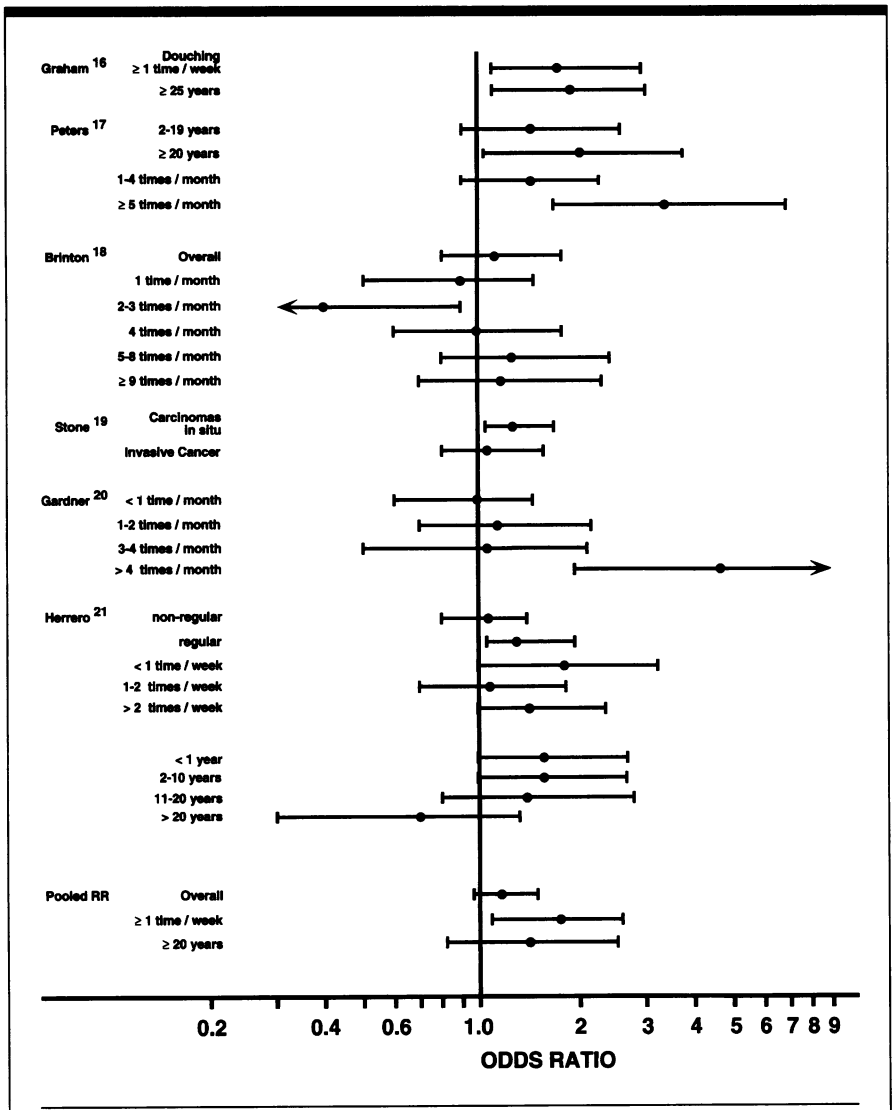

FIGURE 3—Meta-analysis of studies on vaginal douching and risk of cervical cancer.

preparations other than water or vinegar, the relative risk was 2.7 (95% CI = 0.8, 9.1). However, there was no distinct relationship of risk with either years of douching or weekly frequency of douching.

Discussion

Our meta-analysis suggests that frequent douching (once a week or more) is associated with a significantly increased risk of pelvic inflammatory disease and a moderate risk of ectopic pregnancy. A possibility is that douching may provide a fluid vehicle for pathogen transport.[23] Ectopic pregnancy may be subsequent to the sequelae of pelvic inflammatory disease. These hypotheses are consistent with anecdotal reports that pressure douching causes pelvic inflammatory disease.[24] Although regular douching might not have the same risk as pressure douching because of the protective effect of the cervical mucus plug, occasional, unintentional high pressure may occur during douching. Moreover, timing of douching during the menstrual cycle may be an important factor. Immediately after menstruation, the cervical os is small and contains a plug of thick, turbid, tenacious mucus.[25] The microstructure of the mucus prevents the uterus from invasion of most exogenous pathogens. With the approach of ovulation and an increase in circulating estrogen, the os opens gradually and cervical mucus becomes more profuse, clearer, and easier to wash away. At ovulation, the cervical os gapes. Within a day or two after ovulation, the cervical os closes and mucus returns to a postmenstrual appearance. Thus, the risk of ascending infection might depend on the timing of douching, the risk being the highest around ovulation. The more frequently and longer a woman douches, the higher the cumulative risk of ascending infection. However, no previous studies have examined the pressure of douching and timing of douching in relation to pelvic inflammatory disease and ectopic pregnancy.

The modest association between frequent douching and cervical cancer appears to be less straightforward, especially when findings were inconsistent. Some sexually transmitted vaginal and cervical infections, such as human papillomavirus infection, herpes simplex virus 2 infection, chlamydia, and trichomoniasis, were associated with cervical cancer.[19] Vaginitis has also been linked to cervical cancer in some studies.[26] Thus, it is speculated that frequent douching might increase the risk of vaginitis and cervicitis by disturbing vaginal microflora.[27] As a result, the risk of cervical cancer might be increased. On the other hand, it is of concern whether douching is just a surrogate for other unfavorable characteristics such as low socioeconomic status and more sexual partners, which are risk factors for cervical cancer. Gardner et al.[20] conducted a population-based case–control study in a low-risk population in Utah to address this issue, and they found that the association between frequent douching and cervical cancer could not be explained by confounding effects. Nevertheless, the biological mechanism of this association is yet to be elucidated.

Several studies tend to suggest that use of commercial douches results in a higher risk of cervical cancer, ascending infection, and vulvovaginitis than use of water and vinegar or water alone.[11,17,28] Whether this is because of certain gradients of commercial douche products or because using commercial douches simply reflects more aggressive and frequent douching needs further research. It should be noted that all of the studies on health effects analyzed here were case–control studies. More studies, especially prospective cohort studies, are warranted. Meanwhile, women should be informed that vaginal douching is unnecessary in routine feminine hygiene. When performed infrequently and correctly at an appropriate time in the menstrual cycle, it may not be harmful, but frequent douching appears to be highly associated with pelvic inflammatory disease and modestly associated with ectopic pregnancy and cervical cancer. □

Acknowledgments

We are grateful to Dr Maureen Hatch and Dr Henry Sacks for their critical review of the manuscript.

References

1. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Controlled Clin Trials.* 1986; 7:177–188.
2. Smith SJ, Caudill SP, Steinberg KK, Thacker SB. On combining dose-response data from epidemiological studies by meta-analysis. *Stat Med.* 1995;14:531–544.
3. Aral SO, Mosher WD, Cates W Jr. Vaginal douching among women of reproductive age in the United States: 1988. *Am J Public Health.* 1992;82:210–214.
4. Stock RJ, Stock ME, Hutto JM. Vaginal douching: current concepts and practices. *Obstet Gynecol.* 1973;42:141–146.
5. Rosenberg MJ, Phillips RS, Holmes MD. Vaginal douching: who and why? *J Reprod Med.* 1991;36:753–758.
6. Chacko MR, McGill L, Johnson TC, Smith PB, Nenney SW. Vaginal douching in teenagers attending a family planning clinic. *J Adolesc Health Care.* 1989;10:217–219.
7. Forrest KA, Washington AE, Daling JR, Sweet RL. Vaginal douching as a possible risk factor for pelvic inflammatory disease. *J Natl Med Assoc.* 1989;81:159–165.
8. Washington AE, Katz P. Cost of and payment source for pelvic inflammatory disease. Trends and projections, 1983 through 2000. *JAMA.* 1991;266:2565–2569.
9. Wolner-Hanssen P, Eschenbach DA, Paavonen J, et al. Association between vaginal douching and acute pelvic inflammatory disease. *JAMA.* 1990;263:1936–1941.
10. Scholes D, Daling JR, Stergachis A, Weiss NS, Wang SP, Grayston JT. Vaginal douching as a risk factor for acute pelvic inflammatory disease. *Obstet Gynecol.* 1993;81:601–606.
11. Chow WH, Daling JR, Weiss NS, Moore DE, Soderstrom R. Vaginal douching as a potential risk factor for tubal ectopic pregnancy. *Am J Obstet Gynecol.* 1985;153: 727–729.
12. Daling JR, Weiss NS, Schwartz SM, et al. Vaginal douching and the risk of tubal pregnancy. *Epidemiology.* 1991;2:40–48.
13. Chow JM, Yonekura ML, Richwald GA, Greenland S, Sweet RL, Schachter J. The association between *Chlamydia trachomatis* and ectopic pregnancy. *JAMA.* 1990;263: 3164–3167.
14. Phillips RS, Tuomala RE, Feldblum PJ, Schachter J, Rosenberg MJ, Aronson MD. The effect of cigarette smoking, *Chlamydia trachomatis* infection, and vaginal douching on ectopic pregnancy. *Obstet Gynecol.* 1992;79:85–90.
15. Kendrick JS, Atrash HK, Strauss PM, Gargiullo PM. Vaginal douching and risk of ectopic pregnancy among Black women. *Am J Epidemiol.* 1995;141:S25. Abstract.
16. Graham S, Schotz W. Epidemiology of cancer of the cervix in Buffalo, New York. *J Natl Cancer Inst.* 1979;63:23–27.
17. Peters RK, Thomas D, Hagan DG, Mack TM, Henderson BE. Risk factors for invasive cervical cancer among Latinos and non-Latinos in Los Angeles County. *J Natl Cancer Inst.* 1986;77:1063–1077.
18. Brinton LA, Hamman RF, Huggins GR, et al. Sexual and reproductive risk factors for invasive squamous cell cervical cancer. *J Natl Cancer Inst.* 1987;79:23–30.
19. Stone KM, Zaidi A, Rosero-Bixby L, et al. Sexual behavior, sexually transmitted diseases, and risk of cervical cancer. *Epidemiology.* 1995;6:409–414.
20. Gardner JW, Schuman KL, Slattery ML, Sanborn JS, Abbot TM, Overall JC Jr. Is vaginal douching related to cervical carcinoma? *Am J Epidemiol.* 1991;133:368–375.
21. Herrero R, Brinton LA, Reeves WC, et al. Sexual behavior, venereal diseases, hygiene practices, and invasive cervical cancer in a high-risk population. *Cancer.* 1990;65:380–386.

22. Brinton LA, Nasca PC, Mallin K, et al. Case-control study of in situ and invasive carcinoma of the vagina. *Gynecol Oncol.* 1990;38:49–54.
23. Rosenberg MJ, Phillips RS. Does douching promote ascending infection? *J Reprod Med.* 1992;37:930–938.
24. Hirst DV, Bluffs C. Dangers of improper vaginal douching. *Am J Obstet Gynecol.* 1952;64:179–183.
25. Perloff WH, Steinberger E. In vivo survival of spermatozoa in cervical mucus. *Am J Obstet Gynecol.* 1964;88:439–442.
26. Benrubi GI. Vaginitis and female cancer. In: Horowitz BJ, Mardh P, eds. *Vaginitis and Vaginosis.* New York, NY: Wiley-Liss Inc; 1991:145–148.
27. Cohen MS. Vaginal mucosal defenses. In: Horowitz BJ, Mardh P, eds. *Vaginitis and* Vaginosis. New York, NY: Wiley-Liss Inc; 1991:33–37.
28. Spinillo A, Pizzoli G, Colonna L, Nicola S, de Seta F, Guaschino S. Epidemiologic characteristics of women with idiopathic recurrent vulvovaginal candidiasis. *Obstet Gynecol.* 1993;81:721–727.

State-Imposed Limits on Medicaid Reimbursement for Nursing Facility Care

James H. Swan, PhD, Charlene Harrington, PhD, Susan K. de Wit, MA, and Ming Zhong, MS

ABSTRACT

Objectives. Nursing cost-center limits were examined, along with their effects on Medicaid.

Methods. A national survey of Medicaid nursing facility reimbursement provided data on cost centers for nursing, administration, and capital, whether in specific, larger, or multiple cost centers.

Results. Most states impose nursing and administration limits. Far fewer states impose capital limits, but only capital limits may be related to constraint of reimbursement rates.

Conclusions. Shifting toward limiting capital costs, or simply eliminating cost-center limits, might accommodate cost control while removing negative constraints on direct resident care. (*Am J Public Health.* 1997;87:1211–1213)

Introduction

Medicaid payment methodology is a major policy issue as Medicaid consumes larger portions of state budgets, primarily as a result of payments to nursing facilities.[1] Medicaid contributed more than half of nursing facility payments in 1993,[2] covering 60% to 65% of residents.[3,4] Although likely to shrink, Medicaid's share of payments should exceed 40% for the next decade.[5] States have great Medicaid policy discretion, allowing them not only to address costs[6,7] but also to enhance access and quality.[6]

Use of cost centers and cost-center limits allows control over input of costs into rate setting. Cost centers are cost groupings that allow common analysis, limits, and other treatment in rate setting. They vary in specificity, as well as in terms of limits on how they will be covered in payment. A cost type (e.g., nursing) may be its own cost center, may be included in a larger center (e.g., patient care), or may be subdivided into multiple centers (e.g., direct and indirect nursing). Some states use no cost centers; others lack centers for some costs. Such costs need not go unreimbursed, but they are not considered as specific components.

A limit on nursing costs caps inputs into care but may also negatively affect quality.[8,9] Limits on larger cost centers may allow substitution among services but may create overall disincentives to care provision. Limits on multiple centers allow greater program control but restrict facility discretion in care provision. This leads some observers to oppose cost limits on care,[8,10] in contrast to limits on capital that may allow cost constraint without detracting from resident care. Likewise, dividing capital into multiple cost centers may allow detailed control of its components.

This paper examines cost limits and their apparent effects on Medicaid rates. It also considers implications for other goals, particularly the delivery of needed high-quality care.

Methods

Data were derived from three national telephone surveys of state Medicaid reimbursement conducted by the authors in 1993 through 1995, following surveys in 1983, 1986, and 1989.[7] All 50 states and the District of Columbia responded to structured survey instruments collecting data on seven service types from state Medicaid personnel best acquainted with each service. Data included average Medicaid nursing facility rates (not payments), methods, cost centers, and limits.

At the time of the study, James H. Swan, Susan K. de Wit, and Ming Zhong were with the Department of Public Health Sciences, Wichita State University, Wichita, Kan. Charlene Harrington is with the Department of Social and Behavioral Sciences, School of Nursing, University of California, San Francisco.

Requests for reprints should be sent to James H. Swan, PhD, Department of Public Health Sciences, Wichita State University, Wichita, KS 67260-0043.

This paper was accepted September 16, 1996.

Note. The conclusions are those of the authors and should not be attributed to the funding agencies.