

## Self-management versus parental involvement to increase children's compliance with home fluoride mouthrinsing

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### Abstract

*This study tested the effectiveness of behavioral interventions in maximizing second grade children's home usage of a daily fluoride mouthrinse. It was thought that parents might play a critical role in compliance because of the question of autonomy in this age group. The 116 participants in this study were assigned to 1 of the following 4 conditions: a self-management group, parental involvement group, self-management/parental involvement group, and a control group. Participants were expected to use the mouthrinse daily at home for 10 weeks and to return mouthrinse bottles at 2-week intervals at school. Compliance was measured by the number of doses used over the 10-week period as read from dispensing bottles which released only a single dose a day. The results revealed that the 3 experimental groups used significantly more doses of mouthrinse than the control group ( $p < .01$ ). Possibly because of the complexity of parent-child interactions there were no significant differences among the experimental groups. However, self-monitoring, an element common to the 3 experimental groups, promises practical application in preventive dentistry.*

A vast literature exists which examines the various factors related to adult's compliance with medical and dental treatment and preventive health regimens.<sup>1-3</sup> Yet relatively little research examines children's compliance. Exceptions to this generalization have been a series of studies by Kegeles et al.<sup>4-6</sup> investigating adolescents' acceptance of topical fluoride applications and home fluoride mouthrinse usage, and a few studies using behavior modification to improve oral hygiene.<sup>7-11</sup>

This paper addresses the issue of children's compliance and presents the results of the first of 2 experiments designed to increase children's compliance

with home fluoride mouthrinse usage. The primary purpose of this experiment was to compare the effectiveness of 2 methods of increasing children's compliance with a simple preventive recommendation.

The first method was self-management, a behavioral technique consisting of self-monitoring, self-evaluation, and self-reinforcement. Self-management strategies such as monitoring have been shown to be effective in increasing compliance with many health recommendations for adults.<sup>12-15</sup> The second method was parental involvement, chosen because of the frequent assertion that children's compliance is influenced, if not determined, by parental actions.<sup>16-19</sup>

A secondary purpose of the experiment was to examine both parents' and children's beliefs, attitudes, and prior dental experiences for interrelationships and for their ability to predict children's compliance. The experiment was intended to serve as a model for increasing children's compliance with other simple preventive or therapeutic regimens in other health contexts.

### Methods

#### Procedures

This experiment took place in 4 suburban elementary schools.<sup>a</sup> Before the program began, a questionnaire was mailed to all parents of second grade children and a parallel, structured questionnaire was verbally administered to the children in school. These questionnaires assessed both parents' and children's prior

<sup>a</sup> Four of the 5 elementary schools in suburban Simsbury, Connecticut participated in the study. Simsbury is a suburb of Hartford with a population of 21,161 and a mean family income of \$37,383.

experiences, practices, dental health beliefs, and health locus of control.

All children were shown an educational cartoon slide show on the benefits of fluoride prior to volunteering for the program. Children who volunteered and received parental permission to participate were asked to use an acidulated fluoride mouthrinse daily at home for 10 weeks and to return at 2-week intervals to pick up a fresh supply of mouthrinse. All participants were mailed reminders of these appointments and all participants were rewarded with inexpensive toys for keeping their appointments.

Fourteen doses of mouthrinse were dispensed in bottles designed with a pump which only allows release of a single dose (5 ml) every 8-14 hr. These bottles, described in a previous report,<sup>5</sup> contain a number of characteristics which allow easy detection of misuse (Fig 1).

### Experimental Design

The 116 subject pairs of parents and children who participated in this experiment randomly were divided by school into 4 groups: 1 control and 3 experimental, with 1 experimental condition per school. The reason for choosing this method of assignment was that the experimental materials in each condition differed markedly in appearance and it would have been impossible to avoid comparisons among students assigned to each group. Since the program was offered to all of the second graders in each school, the number of subjects assigned to each condition varied from 19 to 47 according to the second grade

population of the school. The basic experimental design is illustrated in Table 1. A brief description of the groups follows.

1. *Control Group (Group 1)*. Children in this group received only the following: preprogram questionnaire, introductory slide show, mail reminders of appointments, and rewards for returning bottles.
2. *Self-Management Group (Group 2)*. In addition to the procedures common to all 4 groups described above, children in the self-management group received a colorful, attractive calendar chart on which to record their daily mouthrinsing with stickers which were provided. The calendar provided the opportunity for self-management and the children in this group were encouraged to use the calendars as a means of self-reinforcement.

Each time the children came in to return a bottle and pick up a fresh supply of mouthrinse, they received evaluative feedback as to how they were doing in the program with respect to number of doses used. Those children who were having difficulties remembering to use the mouthrinse were given specific suggestions on finding a convenient time to use the mouthrinse and were encouraged to use their calendars as a reminder. Appointment reminder stickers were mailed directly to the children in this group.

3. *Parental Reinforcement Group (Group 3)*. At the start of the program, parents in this group were sent a letter asking them to reinforce their child's behavior by praising their use of the mouthrinse. The children in this group also received a calendar chart to be used by their parents. Parents were encouraged to participate in recording the daily mouthrinsing on the chart and to use this time to reinforce the child's activity. Parents in this group also were asked to remind their children to use the mouthrinse if needed and to remind their child on the day of the appointment to pick up a new bottle of mouthrinse. As a counterpart of the "evaluative feedback" given directly to the child in Group 2, parents of children in this group received letters at the end of each bottle period with a report indicating how well their child was doing in the program, the number of doses used (and, for parents of children who had used fewer than 11 doses, suggestions on how to encourage their children). Appointment stickers were addressed to the parent in this group and mailed 4 days prior to the appointment.

4. *Child and Parental Reinforcement Group (Group 4)*. This group combined elements from Groups 2 and 3. The children were given the same calendar chart as that used in the "self" and "parental" conditions and parent and child were encouraged to



FIG 1. The principal dependent measure of compliance, number of doses of mouthrinse used, was measured from this dispensing bottle consisting of an outer bottle with an inner reservoir used to measure each dose. The pump releases only a single dose from the inner chamber every 8 - 14 hr. The number of doses used was measured from the label. The bottle could not be opened without breaking the DO NOT OPEN TAP AND TEARING THE LABEL.

**TABLE 1.** Elements of Experimental Groups

	Monitoring		Evaluative Feedback		Reinforcement	
	Calendar To Child	Instructions To Parents	To Child	To Parent	Self	Parent
Group 1 (control)						
Group 2 (self-man- agement)	X		X		X	
Group 3 (parental involvement)	X	X		X		X
Group 4 (parental involvement and self- management)	X	X	X	X	X	X

participate together in recording the daily mouth-rinsing on the chart.

Children in this group received all of the same instructions, as well as evaluative feedback, as the children in the self-management group. In addition, parents of children in this group received all of the same instructions, suggestions, and communications as those of the children in the parental reinforcement group. Appointment stickers were addressed to both parent and child and mailed 4 days prior to the appointment.

As a manipulation check to assess the degree to which the 4 experimental groups differed in practice and to assess the actual parental role in the program, a postprogram questionnaire was sent to all parents. Questions asked whether or not the parents reminded their children to use the mouthrinse or to return bottles, and whether they participated in recording the children's usage as requested in Groups 3 and 4.

### Compliance

Compliance with the program was measured 3 ways: the percentage of doses of mouthrinse used as measured from the bottle and summed over the 5-bottle (10-week) period; the percentage of doses of mouthrinse used based on the self-reports of the child; and the number of bottles of mouthrinse picked up and returned.

### Questionnaire Measures<sup>b</sup>

<sup>b</sup> Questionnaires were pretested for readability and clarity using 10 subjects who did not participate in the research. Internal consistency of the scales and subscales was checked using alpha reliabilities.

The questionnaire administered to parents prior to the onset of the program contained 58 questions. The children's questionnaire contained 21. A summary of the types of questions follows.

1. *Health Beliefs.* Items were based on the Health Belief Model which has been hypothesized to influence health behavior and used extensively to explain compliance.<sup>20-22</sup> According to the Health Belief Model, in order to take a particular health action, one must believe the problem or disease to be serious, feel susceptible, and believe that the benefits of treatment outweigh any barriers to action. Parents' own health beliefs, their beliefs about their children's health, and children's health beliefs were measured.
2. *Health Locus of Control.* Other attitude scales that might be thought to influence compliance are the Health Locus of Control Scales.<sup>23</sup> The Health Locus of Control is a concept that attempts to measure the degree to which respondents attribute responsibility for health outcomes to themselves or to the environment, and within the latter, to health professionals or to chance factors beyond anyone's control. Thus, the Internal Health Locus of Control Scale measures perception of personal responsibility, the Powerful Others Health Locus of Control measures perception of health professionals' responsibility, and the Chance Health Locus of Control Scale measures responsibility attributed to fate, luck, or chance. Both parents' and children's Health Locus of Control were measured.
3. *Parents' Dental Experiences.* Parents' prior dental experiences and practices and those of their children were probed in a series of questions which

covered such topics as frequency of toothbrushing, flossing, and periodic checkups; where they received their dental treatment and their degree of satisfaction; if their child ever had been to the dentist and why; and the types of dental treatment the child had received.

## Results

A total of 116 of 151 eligible students agreed to participate. The analysis of experimental effects on compliance is based on these 116 students. However, complete questionnaire data from both parent and child were available for only 72 of the subject pairs. Thus, analyses of beliefs and experiences are based on these 72 subject pairs.

### Compliance.

Table 2 presents the means and standard deviations of all of the compliance measures by experimental group. As can be seen, overall compliance with the program was very high. Most important, the children used a large percentage of mouthrinse doses ( $\bar{x}$  = 81%) as measured from their bottles. Not surprisingly, self-reported compliance was even higher ( $\bar{x}$  = 91%). Of the 5 bottles handed out, the mean number of bottles picked up was more than 4 ( $\bar{x}$  = 4.7), while the mean number returned also was greater than 4 ( $\bar{x}$  = 4.4). The majority of these bottles was or most were returned on time ( $\bar{x}$  = 3.8).

Planned comparisons revealed that the 3 experimental groups used significantly more doses of

mouthrinse than the control group [ $t(112) = .28, p < .01$ ]. There were no significant differences among the experimental groups in dose usage. As can be seen, there were no other significant differences among groups for any of the other compliance measures, despite the fact that there were substantial correlations among the dependent measures.

### Correlations Between Parent and Child Beliefs

Tables 3 and 4 present the questionnaire items and the Pearson correlation coefficients for the parents' own health beliefs, the parents' health beliefs about their children, and the children's health beliefs. Oddly, there is not only very little correlation between parents' and children's beliefs, but there is little correlation between parents' beliefs about themselves and their beliefs about their child.

An exception is the moderate correlation between parents' beliefs in the seriousness of dental disease for themselves and their belief in its seriousness for their children. Additionally, parents' beliefs about the seriousness of dental disease for themselves are slightly correlated to their children's beliefs in the efficacy of toothbrushing.

Pearson correlation coefficients for the parents' and children's Health Locus of Control Scales showed very little correspondence. The only significant correlation was between parents' and children's beliefs in the "chance" dimension.

### Effects of Beliefs and Experience on Compliance

The influence of background factors (beliefs, ex-

TABLE 2. Means and Standard Deviations of all Dependent Measures by Experimental Group

	Measured - % Doses Mouthrinse Used		Self-Reported % Doses Mouth- rinse Used		Bottles Picked Up		Bottles Returned		Number Bottles Returned On Time	
	X	Sd	X	Sd	X	Sd	X	Sd	X	Sd
Control Group 1 N = 23	.71	.23	.88	.17	4.70	.70	4.30	1.36	3.96	1.30
Self-Management Group 2 N = 27	.84	.18	.92	.11	4.59	.84	4.37	1.18	3.85	1.46
Parental Reinforcement Group 3 N = 47	.83	.17	.91	.13	4.87	.40	4.55	.77	3.96	1.10
Self & Parental Reinforcement Group 4 N = 19	.82	.17	.93	.09	4.53	1.26	4.32	1.25	3.63	1.42
Total N = 116	.81	.19	.91	.13	4.72	.77	4.42	1.09	3.88	1.27

**TABLE 3.** Questionnaire Measures of Parents' and Children's Health Beliefs

A. Health Belief Items from Parental Questionnaire	
Item Grouping	Item Content
<i>Seriousness</i>	
Seriousness of dental problems for self	How serious do you think tooth decay is?
	How serious do you think gum disease is?
Seriousness of dental problems for child	How serious would it be if you had to wear full dentures?
	How serious would it be if your child had more than one cavity at his/her next checkup?
	How serious would it be if your child broke a front tooth?
<i>Susceptibility</i>	
Personal susceptibility to dental problems	How likely is it that you will have a cavity at your next dental checkup?
	How likely is it that you will develop gum disease at some time in your life?
	How likely is it that you will have all of your own teeth when you are 65?
Child's susceptibility to dental problems	How likely is it your child will have a cavity at his/her next dental checkup?
	How likely is it that your child will have all of his/her own teeth when he/she is 65?
<i>Efficacy (benefits-barriers)</i>	
Benefits of preventive dentistry	How effective is toothbrushing in preventing tooth decay?
	How effective is dental floss in preventing gum disease?
	How important is it to visit a dentist every 6 months?
Barriers to preventive care	How affordable is dental care?
	How convenient are your dentist's office hours?
	How unpleasant is it to go to the dentist?
Efficacy for child	How effective is fluoride in reducing your child's chance of having a cavity?
B. Health Belief Items from Children's Questionnaire	
<i>Seriousness</i>	How would you feel to have a cavity?
	How would you feel if you had to wear false teeth?
<i>Susceptibility</i>	What chance is there that you will have a cavity during this next year?
	What chance is there you will have to wear false teeth when you are old?
<i>Efficacy</i>	If you brush your teeth will you get a cavity?

periences, and practices of the parents and children) on compliance was tested using simple multiple regressions. Table 5 presents a summary of the findings from this series of regression analyses. It appears that depending on experimental condition, attitudes, experiences, and beliefs had a differential effect on compliance. When the study population was taken as a whole, (N = 72 pairs), the only attitudinal variables that were found to be predictive of compliance were parental health beliefs. In this regression, the only significant variable was a parental belief in susceptibility to dental problems.

Only in the control condition, in the absence of systematic behavioral interventions designed to influence mouthrinse usage, were children's own health beliefs found to have a significant relationship to compliance. In this case it was only children's belief in the seriousness of tooth decay that had a significant impact on their mouthrinse usage.

In the experimental groups, on the other hand, children's experiences and health locus of control were found to be predictive of compliance. Children who had an internal locus of control in combination with the report that their teeth were very healthy, were most compliant.

The effects of interactions between parents' and children's health beliefs and health locus of control were tested using a hierarchical multiple regression, with interactions entered as a second step after accounting for the main effects.

Examining parents' and children's health beliefs simultaneously increased the ability to predict compliance in the subject population as a whole. While parental health beliefs alone accounted for 8% of the variance, and children's health beliefs alone accounted for only 1% of the variance, combining parents' and children's beliefs in a single regression equation increased to 11% the explained variance in compliance. In this case, it was again a parental belief in susceptibility and children's belief in the seriousness of dental problems that contributed most significantly to this result. The fact that considering these beliefs simultaneously improved the prediction of compliance suggests that a synergistic effect between parental and children's beliefs may be responsible for optimal compliance. That there is no simple relationship between parents' and children's beliefs and compliance further is supported by the lack of correlation between the 2 variables which contributed most significantly to the effect.

## Discussion

The results of this experiment provide an important insight into the compliance of children with preventive regimens. The age group studied appears

**TABLE 4.** Pearson Correlation Coefficients, Health Beliefs

	2	3	4	5	6	7	8	9	10
1. Parental health belief model	.49***	-.02	.65***	.23*	-.23*	.14	-.08	.20*	.09
2. Parental seriousness	—	-1.02	-.03	.41***	-.07	.03	-.02	.12	.29**
3. Parental susceptibility		—	.18	.08	-.04	.04	.06	.12	-.03
4. Parental efficacy			—	.18*	-.17	.08	-.02	-.06	.02
5. Parental seriousness for child				—	-.06	.10	.16	.08	.09
6. Parental susceptibility for child					—	-.14	-.12	.06	-.10
7. Parental efficacy for child						—	-.04	.18	-.01
8. Child's seriousness							—	-.26**	.18
9. Child's susceptibility								—	-.09
10. Child's efficacy									—

N = 72; \* p < .05; \*\* p < .01; \*\*\* p < .001.

**TABLE 5.** Multiple Regression Analyses-Effects of Attitudes, Beliefs and Experiences on Children's Compliance

	Total Subject Population	Control Group	Experimental Groups
Parental experience	F (15,56) = .82 adjusted r <sup>2</sup> = .039	—	F (15,43) = .57 adjusted r <sup>2</sup> = .125
Child's experience	F (4,67) = 2.41 adjusted r <sup>2</sup> = .074	F (4,8) = .15 adjusted r <sup>2</sup> = .395	F (4,54) = 3.06* adjusted r <sup>2</sup> = .125
Parent health beliefs	F (3,68) = 3.13* adjusted r <sup>2</sup> = .083	F (3,9) = 1.85 adjusted r <sup>2</sup> = .176	F (3,55) = 2.25 adjusted r <sup>2</sup> = .061
Parent health beliefs regarding child	F (4,67) = 1.43 adjusted r <sup>2</sup> = .024	F (4,8) = 2.26 adjusted r <sup>2</sup> = .295	F (4,54) = .49 adjusted r <sup>2</sup> = .061
Child's health beliefs	F (3,68) = 2.48 adjusted r <sup>2</sup> = .059	F (2,10) = 7.55* adjusted r <sup>2</sup> = .52	F (3,55) = .45 adjusted r <sup>2</sup> = .029
Parent health locus of control	F (3,68) = .07 adjusted r <sup>2</sup> = .04	F (3,9) = .12 adjusted r <sup>2</sup> = .283	F (3,55) = .15 adjusted r <sup>2</sup> = .046
Child health locus of control	F (3,6) = 1.86 adjusted r <sup>2</sup> = .05	F (4,8) = .22 adjusted r <sup>2</sup> = .354	F (4,54) = 3.64* adjusted r <sup>2</sup> = .154
Parental health beliefs, children's health beliefs interaction	F (6,65) = 3.43** adjusted r <sup>2</sup> = .170	—	—
Parental health locus of control children's health locus of control interactions	F (4,67) = .07 adjusted r <sup>2</sup> = .055	—	—

\*p = .05; \*\*p < .01.

It was impossible to combine the independent variables to run a single summary regression because the number of variables cannot exceed the number of subjects. The author will share the results of the individual regressions with interested persons.

capable of high compliance which can be significantly enhanced by the systematic application of behavioral principles. In fact, children's ability to comply was much greater than had been anticipated. Even more interesting, mouthrinse usage was increased from 71% in the control group to 83% in the experimental groups

by supplying the children with reinforcement and calendars on which to monitor their mouthrinsing. No significant differences were found among experimental groups. However, the high compliance found suggests that the failure to distinguish between experimental groups may have been due to a ceiling

effect; that is, children already were complying at such a high level that it was impossible to increase their compliance still further.

A second explanation of the results is that second graders are more independent than expected and that monitoring, the common element in the 3 experimental groups with the highest compliance, provided a useful tool for these newly independent school-age children. If this was the case, it is difficult to determine whether it was daily monitoring which increased usage or the intrinsic "reward" of placing stickers on the calendars (which the children seemed to enjoy very much).

An alternative explanation is that the experimental intervention had not been successful in increasing parental participation over its normal occurrence. There are 2 possible reasons for this: 1 is that the written communications did not reach the parents effectively; and the other is that parents and children are so interdependent that a separate effect is impossible to achieve.

A final explanation of the failure to distinguish among experimental groups, is that the program was not long enough to detect differences among experimental groups.

Regardless of a failure to distinguish among experimental groups, this experiment demonstrated two important points: first, is the capacity of second grade children to comply with a novel preventive activity at very high levels, higher than ever have been reported; and second, is that even this high level of compliance could be increased still further by the use of behavioral strategies.

The results of the preprogram attitude questionnaires were also interesting because, contrary to what might be expected, there was surprisingly little correlation between parents' and children's beliefs and attitudes concerning dental health. Two exceptions were noted: one was that parents who expressed beliefs that good health was determined by fate, luck, or chance, tended to have children who believed similarly; and the second was that parents who felt dental disease was serious had children who believed in the efficacy of toothbrushing. Thus, the findings do not support the notion that parent's health beliefs and attitudes have a direct relationship to those of their children as might be expected.

The preprogram parental questionnaire also showed that there was very little correspondence between the degree of parents' concern about their own dental health and their concern for their children's dental health. Two exceptions to this generalization were noted, namely those parents who felt dental caries was a serious problem for themselves and those who felt preventive activities to be efficacious also felt dental caries to be a serious problem for their children.

The lack of correspondence between parents' belief in personal susceptibility and a belief in their children's susceptibility is probably quite reasonable since different age groups are susceptible to different dental problems.

Attempts to predict compliance from parents' and children's attitudes, experiences, and beliefs using a multiple regression approach demonstrated complex relationships which, while intriguing, still must be considered exploratory. Further analyses may define more clearly how attitudes, experiences, and beliefs interacted with the experimental variables to influence compliance.

### Implications of the Findings

This study has practical implications for providers and practitioners interested in increasing children's compliance with preventive regimens. It demonstrates very high compliance among second grade children. It shows that the systematic application of behavioral principles can increase children's compliance significantly over even the high level found in this study.

This study questions common assumptions concerning the expected correspondence between parents' and children's attitudes and beliefs and raises issues for those interested in predicting or taking advantage of existing attitudes or beliefs to enhance compliance.

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### **Quotable quote: drinking water and birth defects**

Experimental studies in pregnant rats failed to demonstrate the presence of a teratogenic agent in water from the Mount Gambier Blue Lake or from several local bores, even when the water from each of those two sources was concentrated tenfold and fivefold respectively, by freeze drying. The experimental data thus failed to corroborate the previously reported epidemiological evidence of an increased risk of human teratogenesis in pregnant women who were drinking water from these sources. The growth of rat embryos in culture in serum taken from pregnant women in the Mount Gambier region was identical, regardless of the source of drinking water consumed by the individual donors. The findings do not suggest the presence of a teratogen in Mount Gambier water supplies; however, they should be regarded by the caution which is usually associated with teratogenic studies conducted across the boundaries of species.

Dreosti IE, McMichael AJ, Bridle TM:  
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