Using Automated Emergency Notification Systems to Inform the Public: A Field Experiment

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Research and experience have shown that it can be difficult to get citizens to pay attention to risk messages and preparedness information in the absence of an actual emergency. As the use of computerized systems that alert the public to hazards by automatically ringing their home phones increases, we thought it important to ask if tests of these "call down" systems can also be used to convey preemergency information. We worked with a local government to add instructions on how to shelter-in-place to the message on a routine test of a call down system. We then surveyed a test group and a control group before and after the test call and a second control group only after the call. The results indicate that the test call raised awareness of the emergency notification system without generating undue concern about the possibility of a chemical accident. Those who received the test call demonstrated significant improvements in their knowledge of how to shelter-in-place while no such improvement was observed in those who did not get the call. While the nature of the sample used in this study limits generalizability, we feel this outcome is positive enough to warrant further exploration of this method of disseminating risk information and preparedness instructions.

KEY WORDS: Risk communication; emergency preparedness; emergency notification; risk perception; shelter-in-place or in-place protection.

1. INTRODUCTION

Both academic research and practitioners' experience indicate that, in the absence of an actual emergency, citizens are often reluctant to pay attention to risk information and preparedness messages.[1–4] Sources of this problem range from a reluctance to accept one's own vulnerability to a rational effort to cope with the large number of stimuli to which we are all exposed.[5,6] At the same time, strong public reactions to specific hazards have generated concern that citizens will exaggerate risks once they become aware of them.[7–9] As a result, agencies seeking to inform the public about environmental hazards face the difficult task of capturing people's attention without provoking undue alarm. Computerized systems that alert the public to hazards by automatically ringing their home phones may offer one mechanism for addressing this problem. These "call down" or "ring down" systems are tested periodically by actually calling citizens' homes. Such a call should alert citizens to the fact that they might be affected by a chemical emergency. If this captures their attention, test calls may present an excellent opportunity to effectively convey emergency preparedness or risk information which is often ignored when distributed in other forms (public service announcements, brochures, etc.).[10]

To evaluate the potential of call down tests as vehicles for communicating pre-emergency information, the authors worked with the Health Services Department in Contra Costa County CA to add information on how to shelter-in-place[2] to the standard message used in a

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[2] The terms "shelter-in-place" and "in-place protection" are both commonly used to designate the process of having people stay in their homes and sealing them against hazardous fumes. Since the term "shelter-in-place" was used in the surveys conducted for this study, we will use that term throughout this report.

routine test of the County's call down system known as the Community Alert Network or C.A.N. (the Appendix contains the text of this message). We mailed questionnaires to randomly selected residents before and after the test call in order to evaluate its impact.

The project had three objectives. We wanted to learn (1) how the test call was handled when it reached citizens' homes, (2) how receiving it affected citizens' awareness of and attitudes toward chemical hazards and emergency preparedness, and (3) if the shelter-in-place message that accompanied the test call improved citizens' understanding of this self-protective technique. This article describes the methods we used to gather the data, summarizes the findings, and assesses the implications of these results for risk communication efforts.

2. RESEARCH METHODS

Contra Costa County government provided us with address labels corresponding to all the telephones numbers the C.A.N. had for the areas scheduled to receive the test call and for selected streets adjoining the test areas. Since the C.A.N. was legally prohibited from identifying citizens, the labels had neither residents' names nor apartment numbers on them. This affected the study in two ways. First, it forced us to use an impersonal mailing which probably reduced the response rate. Second, it meant that we could not be sure of mail delivery to apartments. Accordingly, we removed all multiple labels at the same address in an effort to eliminate apartments from the sample. This restricted our sample to single-family residences with listed (or voluntarily reported) telephone numbers.

While these areas were primarily residential, any businesses in the C.A.N. database for the area were also included in the set of labels provided by the county. Since they could not be identified as businesses from the labels, they were unavoidably included in the mailing. As a result, we do not know the exact number of valid potential respondents and can not report response rates or calculate sampling errors with complete accuracy. In what follows, we make the conservative assumption that all the addresses to which we mailed questionnaires were residences. To the extent that some of the addresses were commercial (and therefore not valid respondents), this assumption has the effect of *under*stating the response rates and *over*stating the sampling errors.

Next we used the address labels to draw a systematic random sample of each of three groups:

The Test Group consisted of addresses that were scheduled to receive a phone call as part of the C.A.N. test. This group was sent a questionnaire both before and after the test call. Of the 668 addresses in this group, 209 responded to the pretest mailing (for a 31% pretest response rate). Of this 209, 130 responded to the posttest mailing (for a post-test response rate of 62%).

Control Group 1 was drawn from a list of addresses on streets that were adjacent to those scheduled to receive the test call but that were *not* to receive the call. This group was sent a questionnaire both before and after the date of the test call. Inclusion of this group allows us to isolate the effect of the test call from other factors that might have changed citizens' responses (like news reports of a chemical accident). Of the 181 addresses in this group, 74 responded to the first mailing (for a 41% pretest response rate). Thirty-nine of the 74 responded to the second mailing (to give a posttest response rate of 53%).

Control Group 2 was drawn from addresses that were in the areas scheduled to receive the C.A.N. test call but had *not* been selected for the test group. This group received *only* a posttest mailing and was included in the study to allow us to gauge any "test effect" created by sending the first questionnaire. Seventy four of the 222 addresses in this group returned the posttest questionnaire (for a response rate of 33%).

Table I provides a demographic profile of the three groups. There are no statistically significant differences between the test group and either control group in gender or educational level, and the test group and control group 1 do not differ statistically in age.[3] However, the test group is significantly younger than control group 2. Since age did not prove to be a strong predictor of responses to any of the questions on which we compared the test group and control group 2, we do not feel that this small demographic difference renders control group 2 unacceptable as a comparison group for purposes of identifying any test effect.[4]

The nature of the sampling frame from which we worked imposed several limitations on the study. First, the fact that the sample included *only* residents of single-family dwellings excludes most renters and introduces

[3] Throughout this report, the statistical significance of differences among groups was determined using tests of statistical significance available through the cross-tabulation procedure of the Statistical Package for the Social Sciences. Specific tests were determined by the level of measurement of the variables involved in each analysis. In all cases reported here a probability of .05 or less was required to designate a difference as statistically significant.

[4] It is important to note that the samples were *not* drawn from the entire county and may not be representative of Contra Costa County as a whole. Since the areas selected for the C.A.N. test call did not correspond to census tracts, we were unable to obtain census data against which to compare our demographic results in order to verify the representativeness of our sample. However, the high level of similarity in the demographic profiles of the three samples strongly suggests that our sampling procedures produced reliable samples that should be representative of the areas from which they were drawn.

Table I. Demographic Profile of Experimental Groups

Variable	Percent of group in category		
	Test group (N = 209)	Control 1 (N = 74)	Control 2 (N = 69)
Gender			
Male	46%	47%	50%
Female	54%	53%	50%
Age[a]			
Under 40 yr	32%	26%	16%
40-to-60 yr	44%	40%	40%
Over 60 yr	24%	34%	44%
Education			
12 yr or less	21%	22%	28%
Some college	34%	30%	34%
College degree	21%	25%	18%
Graduate education	24%	22%	20%

[a] Age and education were measured at the interval level and collapsed into ordinal categories for presentation.

some biases into the sample. Respondents are likely to be a little older, more affluent, and more educated than a cross section of the public. (The demographic profiles presented in Table I are consistent with this expectation.) As a result, responses from this sample will probably *over*state the level of citizens' information about hazardous materials and emergency preparedness issues.

Second, while the sample is large enough to represent residents of single-family dwellings in or near the test calling areas, it is small in absolute size and restricted to a single county. As a result, we must be somewhat cautious about generalizing from the results of this study to other populations.

3. RESULTS

The pretest responses from the test group and control group 1 indicate that respondents had very little awareness of emergency procedures. For example, only 18% said they had seen or heard a description of the emergency notification system. Only 9% claim to have seen instructions on evacuation procedures. When asked if they would know what to do if asked to evacuate, only 28% said they would know what to take with them, 18% said they would know what routes to use, and 9% said they would know where to go for shelter. Only 13% reported having seen or heard instructions on how to shelter-in-place. When asked in an *open-ended* format what steps to take to shelter in a chemical emergency, only a minority of respondents were able to identify appropriate actions (see Section 3.2 below for details). In addition, 61% (including many who had guessed at appropriate actions) volunteered that they did not know what steps to take.

3.1. Handling of the Test Call

We can describe the handling of the test call from the responses of the 130 persons who were scheduled to receive calls and also returned the posttest questionnaire. The first question is one of how effectively the call reached the intended audience.

Forty two percent (55 individuals) reported having received the call. This relatively low contact rate is probably explained by the fact that the test call involved only one attempt to reach each phone number. In an actual emergency, multiple attempts would be made and the contact rate is likely to be much higher. Of those respondents who reported receiving the C.A.N. call, 70% said that they were the ones who actually took the call. Twenty-two percent reported that the call went to an answering machine. Forty-eight percent of these said that the machine got the full message, 38% said it got only part of the message, and 14% did not know how much of the message was captured.[5]

An impressive 86% of those who received the call said they listened to the entire message, 4% listened to only part of it, and 7% reported hanging up as soon as they heard that it was a C.A.N. test call. The rest indicated that they did not know how much of the message was received or gave some other response.

The test call message gave citizens the option of pressing a button to receive additional information on how to shelter-in-place. Twenty-two percent of those receiving the call said that they took advantage of this option at the end of the call. Forty-seven percent indicated that their family discussed the test call after it came. Of these, 33% said they talked about sheltering-in-place, 3% discussed the emergency notification system, 3% discussed chemical hazards and 58% gave an answer that was too general to classify (e.g., "how important it was" or "the call").

In all, apart from the low contact rate caused by the single attempt at each number, these data indicate that the test call was fairly successful in reaching its

[5] The emergency notification test message began playing as soon as a connection was made. However, most answering machines present a message of their own before beginning to record. Thus it is possible that the *first* portion of the test call message was "cut off" when it came to an answering machine. None of the respondents mentioned this situation in open-ended comments so we do not know if it created a problem for any of them.

intended audience. Answering machines did not prove to be a major problem and most people listened to the full message.

3.2. Impact of the Test Call

We want to know both what difference the emergency notification aspect of the test call made in citizens' perceptions and if the preparedness message that accompanied the test call increased citizens' information about what to do in an emergency. To address the first question, we can compare the pretest and posttest responses of the 55 members of the test group who reported receiving the C.A.N. call with the responses of the 39 members of control group 1 who responded to both mailings.

First, it is worth noting that, when asked how they expected to be notified in the event of an emergency, 71% of those *who got the call* identified the C.A.N. while only 11% of those who did *not* get the call mentioned the C.A.N. Since less than 10% of both the test and control groups expected to be notified by the C.A.N. in the pretest, it seems safe to assume that the test call alerted people to the existence and purpose of the notification system.

Second, in light of the common view that efforts to educate the public about chemical hazards might create undue concern, we wanted to know if the test call increased citizens' estimates of the possibility of a chemical accident. In both the pretest and posttest questionnaire we asked: "What do you think is the chance that your neighborhood will be affected within the next year or so by an accident involving hazardous chemicals?" Respondents were given the response options of "Almost no chance," "Very little chance," and "A substantial chance." Table II compares the responses of those who got the C.A.N. call with the responses of a control group that did not get the call.

Members of the control group were coincidentally more likely to feel that there was "a substantial chance" of a chemical accident from the beginning. There was, however, no statistically significant overall increase or decrease in their estimates from pretest to posttest. Similarly, while those who got the test call were less likely to say that there was "no chance" after the call than before, there was no dramatic increase in their overall likelihood estimate from pretest to posttest.

While our use of a single-item indicator of the concept of "perceived risk" calls for caution in drawing conclusions, these results indicate that the test call alerted most who received it to the possibility of a chemical emergency but did *not* cause any undue alarm. While 64% of those who had said "no chance" in the pretest switched to the objectively more realistic "very little chance" response after receiving the test call, *none* of them switched to the "substantial chance" category. Only 12% of the test group members who had said "very little chance" in the pretest switched to "a substantial chance" in the posttest.

Table II. Perceived Chance of a Chemical Accident

	Test group (N=55[a])		Control group 1 (N=39[b])	
Response	Pretest	Posttest	Pretest	Posttest
Almost no chance	20%	13%	26%	23%
Very little chance	50%	52%	28%	36%
Substantial chance	30%	33%	43%	41%
Don't know	0%	2%	3%	0%

[a] Includes only those who returned both the first and second questionnaires *and* received the test call.

[b] Includes only those who returned both the first and second questionnaires but did not receive the test call.

To examine the impact of the emergency preparedness message we compared the pretest and posttest responses of the 55 citizens who both got the C.A.N. call *and* returned the second questionnaire, and then contrasted those responses with the reactions of the two control groups.

To judge the success with which call down tests can be used to educate the public we must ask if citizens learned anything about sheltering-in-place from the call. First, it is important to note that only 20% of the 55 citizens who got the test call said they had seen or heard instructions on how to shelter-in-place *prior* to the call. After the call, 64% said that they had seen or heard such instructions and 77% of those who said they had received such instructions cited the C.A.N. test call as the source. By comparison, in the *posttest* only 10% of control group 1 who did not get the test call indicated that they had seen or heard instructions on how to shelter.

Did the shelter-in-place information "register" with citizens? Table III compares the three experimental groups with respect to their responses to an *open-ended* question about what steps to take to shelter-in-place.

For those in the test group who received the call, there were statistically significant improvements in the percent of respondents who named every step in effective sheltering. For those in control group 1 who did not receive the call, there was a significant improvement in only one category--"go or stay indoors." Our prior experience with questions on sheltering suggests that this

Table III. Respondents' Knowledge of Sheltering-in-Place

Sheltering Step Named	Test group (N=55)		Control group 1 (N=39)		Control group 2[a] (N=68)
	Pretest	Posttest	Pretest	Posttest	Posttest
Go/stay indoors	27%	65%	18%	33%	62%
Close doors/windows	47%	85%	46%	46%	74%
Seal doors/windows	9%	50%	13%	18%	53%
Shut off ventilation	22%	40%	5%	5%	41%
Listen to TV/radio	18%	29%	3%	10%	29%
Close fireplace	6%	27%	8%	5%	35%
Don't use phone	0%	4%	0%	0%	3%
Don't know what to do	46%	20%	54%	49%	20%

[a] No pretest was administered to Control Group 2 in order to avoid any "test effect." One respondent in this group failed to answer the question about how to shelter-in-place.

one difference may be a matter of chance since some respondents *assume* that people will go indoors and do not bother to mention it.[11] In addition, there was a dramatic reduction in the proportion of the test group who said that they did not know what to do to shelter (from 46% to 20%), but *no* statistically significant change in the proportion of control group 1 who indicated that they did not know what to do.

To be sure that this improvement in knowledge of sheltering procedures resulted from the test call and not from our first questionnaire spurring people to learn about sheltering, we compared the test group to control group 2 whose members got the test call, but did *not* get a pretest questionnaire. The right-hand column of Table III shows that members of control group 2 exhibited posttest knowledge of sheltering that was statistically indistinguishable from that of the test group, indicating that there was no "test effect." This is consistent with the fact that the overwhelming majority of respondents in both groups who said they had been exposed to information on how to shelter cited the test call as the source of that information.

4. CONCLUSIONS

These results suggest that the test call served to educate citizens about emergency notification procedures and was effective in communicating information about sheltering for those who got and listened to the call. While recognizing the limitations imposed by the nature of this sample, we would argue that the outcome is positive enough to warrant further exploration of this method of disseminating preparedness information.

The main challenges seem to be as follows. (1) Finding ways to ensure that the contact rate on test calls is high enough to inform most citizens. This is largely a matter of using multiple attempts to reach each number even in the test calls. This would increase the costs of the tests but is necessary for full coverage. (2) Verifying the results of this study with a larger and more diverse sample than was available for this study. (3) Testing to see how long the information is retained by reinterviewing citizens after the posttest. (4) Evaluating the effectiveness of this technique with other message content (like evacuation procedures or risk information). (5) Assessing the impact of test calls on risk perceptions more thoroughly than our single-item measure of risk perception allowed. If all of these efforts have positive results localities with call-down systems may want to seriously consider using tests of their systems as means of disseminating vital emergency preparedness instructions and risk information. This practice obviously has its limits since extensive use of test calls for this purpose could undermine their effectiveness by making them seem routine, and since no one technique is going to reach all citizens. However, our results suggest that judicious use of call down tests to communicate key information to those most at risk could play an important role in a larger public information effort.

APPENDIX. TEXT OF THE C.A.N. TEST CALL MESSAGE

This is a test of Contra Costa County's Community Alert Network. Again, this is only a test. If this had been a real emergency involving hazardous chemicals, you might have been asked to "shelter-in-place." It is usually safer to remain inside a building while a cloud of chemicals passes overhead, instead of trying to evacuate immediately. If this were an actual emergency and you were asked to shelter-in-place you should stay inside, lock all doors and windows, turn off heating and cooling

systems, put out fireplace fires and close the fireplace dampers. Any openings around doors, windows, and vents should be sealed with tape or any available materials. Stay off your phone unless you have a life threatening emergency. In a real emergency you should tune your radio to KISS AM 990 or FM 92 for further information and instructions. Again this has been a test. If you would like more information on shelter-in-place listen carefully to the following instructions. If you would like more information, please press the number 5 on your touch tone phone now. If you have a rotary phone please call 646-2286 during normal business hours and request this information. Again that number is 646-2286. Thank you.

Response to those requesting more information: You have indicated that you would like more information on shelter-in-place. Please allow three weeks for delivery. If you do not receive the information, please call 646-2286. Again that number is 646-2286. Thank you!

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