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Communicating Information in an Emergency Preparedness Pill Distribution Campaign

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Objectives: Public health agencies are often tasked with the development and execution of interventions, but the communication strategy and its impact on the effectiveness of an intervention is often not evaluated or incorporated by local and state health agencies. The primary objective of this study was to determine the impact of information from various sources on knowledge about an emergency preparedness public health intervention involving the mass distribution of medicine. *Methods*: The study used validated written mail surveys containing 12 simple knowledge-based questions. One-way ANOVA, the Studentized Newman-Keuls (SNK) test, logistic regression, and multiple regression were used to evaluate the data. *Results*: Reading an educational fact sheet or receiving job training were the highest predictive variables for correct responses on the survey among all groups. Commercial media were found to potentially diminish comprehension among survey respondents. There was significant variability in knowledge among different groups surveyed, ranging from an average of 15% to 74% correct responses on the survey. *Conclusions*: This study found that job training and fact sheets that are delivered directly to the intended recipients are very effective at enhancing knowledge among the general public and emergency responders. Conversely, we found that commercial media, such as television, may be detrimental to educating the public about important public health interventions. The internet was not widely used by the survey respondents to obtain information; this raises questions regarding the usefulness of websites for emergency preparedness education.

The attacks in September 2001 and the subsequent contamination of post offices and mail with anthrax in October 2001 resulted in significant government activity in response to terrorist and other criminal attacks on critical infrastructure. There has long been a realization that nuclear power plants are ideal targets for terrorists and other criminal activity, because these plants play a crucial role in providing energy for almost every aspect of our modern society and because damage and potential releases of radioactive materials would cause widespread hysteria.

In New Jersey, about half of the electric power used in the state is generated by four nuclear reactors located on two distinct sites. These two nuclear sites are also appealing to those with criminal intent because they are close to large and densely populated communities, with one site having more than 450,000 people living within 10 miles of the plant. Fortunately, these two nuclear sites have intense security programs with heavily armed guards and other preventive measures. Also, the state has detailed radiological emergency response plans, which include the use and consideration of medicines that can help provide some protection to people who might be exposed to radioactive materi-

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als (i.e., chemoprotective agents). Potassium iodide (KI) is one of the principal chemoprotective agents that can be administered to people who have been exposed to radioactive materials released from a nuclear power reactor, and the administration and distribution of KI are part of the state's radiological emergency response plans. The state and local health departments are responsible for maintaining supplies of KI and distributing KI to the public and emergency responders within the emergency planning zones of the nuclear reactors.

Mass distribution of pharmaceuticals to the general public for the purpose of emergency preparedness has been debated for many years, particularly with regard to nuclear emergencies. Distributing pharmaceuticals such as potassium iodide pills has been the subject of debate and regulatory review in the United States since 1972.[1] KI pills were distributed and used in Poland immediately after the Chernobyl accident.[2] Le Guen and colleagues described the French government's experience,[3] and Millership[4] and Astbury and colleagues[5] have described the British government's experiences with mass pill distribution campaigns.

In response to the U.S. Nuclear Regulatory Commission's (NRC) final rule regarding KI pill distribution,[6] the New Jersey Department of Health and Senior Services (NJDHSS) organized KI distribution clinics in the summer of 2002. The goal of these distribution clinics was to "predistribute" KI to vulnerable populations living or working in close proximity to the nuclear power plants so that, should an event occur, people would already have a supply of KI immediately available. These voluntary clinics offered KI pills to people who lived or worked within 10 miles of one of the state's two nuclear power–generating stations. NJDHSS provided carefully designed educational materials about KI prophylaxis, which were written at a Flesch Kincaid Grade level of 6.5 and pilot tested before use, for those individuals attending the distribution clinics.

The objectives of this research study were to describe the knowledge about the use of KI pills of various groups who live or work within close proximity to the nuclear power plants, to determine which sources of information are used by these groups to understand mass prophylaxis and the KI pill distribution campaign, and to assess the impact of these sources of information on understanding among these groups. This was important because previous studies have suggested that both members of the general public and public officials correctly recall only about 50% of the medical or technical information provided to them.[7–11]

We hypothesized that there would be highly variable levels of understanding among the general public and emergency responders and that carefully designed outreach materials could significantly improve comprehension. An assessment of the general public's participation in the New Jersey pill distribution campaign can be found in Blando et al.,[12] and a discussion of general nuclear emergency preparedness and potential behaviors and beliefs about KI pill use is in Blando et al.[13] In addition, a detailed state report with recommendations for mass pill distribution can be found on the New Jersey Health Department's website at http://nj.gov/health/eoh/survweb/documents/ki_finalrpt.pdf.[14]

METHODS

A written survey was developed to determine the knowledge and understanding of KI pill use among three major groups and seven minor groups (Table 1) of individuals who were eligible to participate in the mass pill distribution campaign conducted by the state health department. This survey was then sent through the U.S. mail with a postage paid return envelope. Survey respondents were offered a $10 gift card for completing and returning the mailed survey. The survey questions were validated and pilot tested

Table 1. Major and Minor Groups of Survey Respondents and Response Rates

Major group	*Emergency responders*		*General public*		*Healthcare providers*
Minor groups	1. Firefighters 2. Police 3. HazMat responders 4. Government officials		5. KI recipients 6. Non–KI recipients		7. Healthcare, including physicians, nurses, pharmacists
Number of surveys sent	91 POCs contacted		KI recipients Non–KI recipients Total	741 825 1,566	Total = 116
Number of surveys returned	Firefighters Police HazMat Gov't officials Unidentified Total	65 65 12 8 18 168	KI recipients Non–KI recipients Unidentified Total	421 286 22 729	Total = 36 Note: 20 were school nurses

before use. Face validity was evaluated through the use of focus groups, and content validity was assured through review of the surveys by an expert panel.

Twelve knowledge-based questions about KI prophylaxis (Figure 1) were used to assess understanding of KI pill use among these groups, and comparisons were made between the different groups of survey respondents. In addition, the survey instrument collected demographic information and inquired about the sources of information that each survey respondent had used to obtain information about KI pills. The surveys were mailed during February 2005, approximately 2 1/2 years after the state-sponsored KI distribution clinics were held.

The three major groups surveyed were the general public, emergency responders, and healthcare providers. Within the general public major group, there were "KI recipients" and "non–KI recipients." KI recipients were people who had attended a KI distribution clinic and had obtained a KI pill. They were identified from informed consent forms filled out at the distribution clinic. Non–KI recipients were those members of the general public who had not attended a KI distribution clinic and had not obtained a KI pill. They were identified through local phone and address books.

The emergency responder major group included firefighters, police officers, government officials involved with emergency response, and hazardous materials response team personnel (HazMat). The healthcare provider major group included physicians, nurses, and pharmacists. Several sources of information and databases were used to identify these emergency response agencies and healthcare providers, including mailing lists from the Public Employees Occupational Safety and Health program and the NJ State Police emergency management program, the internet, local phone books, and the Dun and Bradstreet iMarket database (D&B Corporation, Waltham, MA). Individual healthcare providers could be easily identified and were mailed one survey each. However, individual emergency responders could be identified only through a point of contact (POC), often a fire or police chief. Each point of contact was asked to complete a survey and distribute additional surveys to five of their staff.

Analysis

Description of Knowledge among Groups

A knowledge score (i.e., the percentage of KI knowledge–based questions answered correctly) was calculated for each respondent, and the mean knowledge score was calculated for each of the seven minor subgroups. A one-way ANOVA and Student-Newman-Keuls (SNK) tests were performed using SASv8 (Cary, NC) to determine if the knowledge scores of the different subgroups were different and specifically which subgroups differed.

Description of Sources of Information Used by Different Groups

This data description related the self-reported sources of information from which individuals obtained information about the use of KI pills. The percentage of survey respondents who reported using a particular source of information was calculated and plotted in a histogram. This was evaluated for each of the seven minor subgroups and the three major groups of survey respondents.

Assessment of Impact

First, the information sources used by each survey respondent were noted and coded with dummy variables as either using (coded as 1) or not using (coded as 0) an information source. The information sources evaluated were newspapers, television, job training, state health department fact

Figure 1. Knowledge-based Questions Asked on Survey

Questions 1–6 are true/false, and questions 7–12 are multiple choice.

1. Radioactive iodine is present during all radiation emergencies, including "dirty bombs." (correct answer: FALSE)
2. KI pills provide protection from all types of radiation. (correct answer: FALSE)
3. In general, pregnant women may safely take a KI pill. (correct answer: TRUE)
4. Persons who have had or currently have thyroid disease should ask their doctor before taking a KI pill. (correct answer: TRUE)
5. Persons allergic to iodine can safely take a KI pill. (correct answer: FALSE)
6. In general, persons above the age of 40 should take KI if they are exposed to a very small amount of radioactive iodine. (correct answer: FALSE)
7. KI pills or tablets protect "_____." (correct answer: Thyroid only)
8. When should someone take their first dose of a KI pill or tablet? (correct answer: within hours of exposure)
9. What is the recommended KI dose for adults? (correct answer: 1 full tablet)
10. What is the recommended KI dose for children over 3 years old? (correct answer: 1/2 tablet)
11. How long does effective protection last for a single dose of KI? (correct answer: 24 hours)
12. Would taking several doses of KI at one time provide more immediate protection than just one dose? (correct answer: no)

sheet, or "other." Logistic regression in SASv8 was used to calculate the univariate odds ratio for each information source. This odds ratio represented the chance for someone who uses a particular information source to correctly answer an individual knowledge-based question compared with someone who did not use that information source. Potential confounders were considered to be the survey respondent's age, education level, whether the survey respondent had had college-level science classes, and income. Statistically significant univariate odds ratios were noted and used to further determine which variables might be important for additional analysis.

Next, a variable called Ksum was calculated and used to assess each individual's level of understanding across all 12 KI pill knowledge–based questions. Ksum was the total number of correct answers given by a survey respondent, with a Ksum of 12 meaning the survey respondent had answered all 12 knowledge-based questions correctly and a Ksum of zero meaning that the respondent had not answered any of the knowledge-based questions correctly. The distribution of Ksum was assessed for normality using Proc Univariate Normal Plot in SASv8, and trends in crude residuals also were evaluated. This analysis demonstrated that parametric statistical testing was appropriate. This allowed us to use simple multiple regression techniques to further evaluate the contribution of the information sources and the potential confounders to understanding among survey respondents. Proc Reg was used in SASv8 to conduct this multiple regression, and Bonferroni corrections were used to adjust for multiple comparisons. In addition, covariance among the independent variables and potential multicollinearity was considered, but after evaluation adjustments to the model were not required.

RESULTS

There was good participation from all three of the major groups surveyed: the general public, emergency responders, and healthcare providers (Table 1). The overall response rate for the voluntary general public survey was 49%. Twenty-two general public survey respondents could not be accurately identified as KI recipients or nonrecipients and therefore were excluded from analysis. Healthcare providers had a response rate of 34%, while overall 67% of emergency response points of contact had at least one person from the unit return a survey. A total of 14 responders identified themselves as having no role, and the roles of 4 emergency responders could not be clearly determined; therefore, these 18 emergency responders were excluded from analysis.

The demographic characteristics of the KI recipients who attended a clinic and responded to the survey were fairly similar to the non–KI recipients who did not attend a clinic. Overall, both groups were demographically similar to the population described in the 2000 Census for this geographic area in New Jersey, which included communities located within 10 miles of the nuclear power plants (i.e., the emergency planning zones, also referred to as the EPZ). The demographic characteristics of our general public survey respondents indicated that 85% were over 40 years of age, 54% were female, 93% were white non-Hispanic in race/ethnicity, and 99% spoke English as a primary language in their homes.

The demographic data also indicated that there were some similarities and differences among the emergency response and health professional groups surveyed in this study. For all emergency responder groups, the most prevalent age range was 40–64 years of age. Fire and HazMat units had a number of survey respondents above 65 years of age—14% and 17%, respectively. This was probably because of the voluntary nature of some fire companies and HazMat units, which allow retired people to be part of their unit. Nearly all survey respondents were non-Hispanic white English-speaking people, with emergency responders (police, fire, HazMat) almost exclusively male (>89%) and health professionals a more mixed gender group (57% female and 43% male).

Education also varied among the different respondent groups, with only about 30% of emergency responders compared with more than 90% of health professional respondents having had some formal scientific training and the health professional group being more highly educated overall. The HazMat, police, and health professional groups all had household incomes roughly above the NJ state median of $50K per year, while the firefighters had only 54% of their respondents with household incomes above the state median.

Description of Knowledge among Survey Groups

The statistical analysis (i.e., one-way ANOVA) demonstrated that KI-knowledge scores differed among the seven subgroups analyzed ($p < 0.001$). Table 2 shows the average percent of KI knowledge–based questions that were answered correctly by each of the seven subgroups surveyed and their SNK grouping. Scores within the same SNK grouping are not considered significantly different. For example, in Table 2 police, firefighter, KI recipient, and HazMat groups had roughly the same percentage of survey questions answered correctly (i.e., SNK group B) but significantly more than the non–KI recipients (i.e., SNK group C).

Sources of Information Used by Various Subgroups

Many sources of information were used by the general public, emergency responders, and healthcare providers. Figure 2 shows that, overwhelmingly, KI pill recipients obtained

Table 2. KI Knowledge Scores and Ranking of Seven Survey Subgroups Analyzed

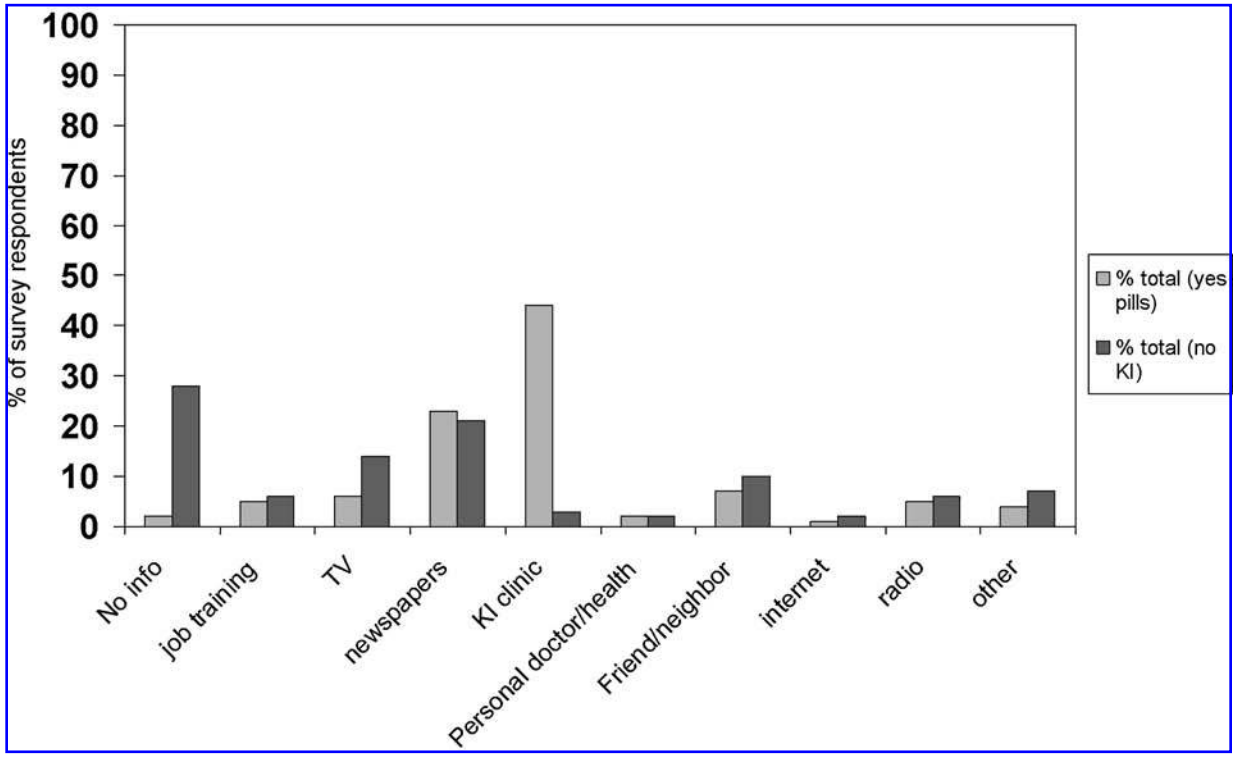
Respondent subgroup	*Average % questions answered correctly*	*Number of survey respondents*	*% of Survey respondents who graduated college*	*SNK grouping*
Gov't officials	74	8	75	A
Healthcare providers	63	36	98	A
Police	48	65	38	B
Firefighters	46	65	31	B
KI recipients	46	421	33	B
HazMat tech	44	12	42	B
Non–KI recipients	15	286	29	C

Note: Respondent subgroups with the same letter in the SNK grouping column are not statistically different from each other; only groups with different letters are statistically different.

their information at the pill distribution clinic and that the non–KI recipients often did not receive any information about KI pills. In addition, of those who did not receive KI pills and who obtained some information about the pills without attending the clinic, the information was more often obtained from sources that may lack quality control or accurate information, such as a friend or TV. Approximately the same percentage of KI pill recipients and non–KI pill recipients obtained information from newspapers, and fewer than 2% of members of the general public used the internet to obtain information.

Emergency responders and healthcare providers had a slightly different profile of information sources. Job training was a source of information for 31% of the emergency responders compared with 18% of the healthcare providers. Newspapers were a source of information for approximately 15% of emergency responders and 21% of healthcare providers, whereas other miscellaneous sources of information were used by 9% of emergency responders and 17% of healthcare providers. Other miscellaneous information sources were often reported to be the pharmaceutical insert that comes in the pill package, medical training, and discussion with other professionals. The internet was not a frequent source of information for emergency responders (3%) or healthcare providers (7%), despite the information about KI pills that is available online.

Figure 2. Sources of information used by general public survey respondents



Assessment of Impact

Individual Sources of Information

An initial review of the data for the general public using univariate logistic regression found that there were many factors that had statistically significant associations for at least some of the 12 knowledge-based questions. For all 12 of the knowledge-based questions, people who read the state health department fact sheet were significantly more likely to give correct answers. Respondents who read the fact sheet were between 2.1 and 4.3 times more likely to correctly answer a survey question not directly addressed by the fact sheet—such as "Is radioactive iodine present during all radiation emergencies?"—than were those who did not read the fact sheet. Higher odds ratios were found for questions that were directly answered by the fact sheet. For example, those who read the fact sheet were 14.9 times more likely (95% confidence interval 8.0–27) than those who did not read the fact sheet to correctly answer questions directly addressed by the fact sheet, such as "Can KI be taken during pregnancy?" Increased age among survey respondents (i.e., those over 65 years of age) and obtaining information from television was found to be significantly and negatively associated with answering a question correctly—that is, giving the wrong answer or responding "don't know"—on eight and two survey questions, respectively (Table 3).

For emergency responders and healthcare providers, this univariate analysis showed fewer factors that were significantly associated with answering the questions correctly. Emergency responders who had job training were more likely to give correct answers on 11 of the 12 survey questions for those respondents that had job training regarding KI pill use and 6 of 12 questions for those survey respondents who had been to a distribution clinic. For example, emergency responders who had job training were 4.1 times more likely (odds ratio confidence interval 2.1–8.0) to correctly answer the question, "Can someone who is allergic to iodine safely take a KI pill?" than were those emergency responders who had not received any job training. Healthcare providers essentially did not have any statistically significant odds ratios for any factor, even for job training. This could have been in part because the low number of healthcare provider survey respondents resulted in insufficient power to detect a significant difference.

Personal Traits and Sources of Information

For the general public, only two factors were statistically significant in the multiple regression model using Ksum as the outcome variable (Table 4). The two significant predictors of the Ksum scores were (1) reading the KI fact sheet and (2) age. Reading the KI fact sheet was the only information source that was significantly associated with having a higher Ksum score, and age was a significant confounder. Increasing age was associated with lower Ksum scores in the multiple regression model, as evidenced by the negative regression coefficient. Approximately 40% of the variability in the Ksum scores within the general public model was accounted for by the fact sheet, which was the strongest predictor of higher Ksum scores (Table 3).

For emergency responders, the only two variables that were statistically significant and associated with higher Ksum scores were (1) job training and (2) attendance at a KI distribution clinic (Table 3). Approximately 17% of the variability in Ksum scores in the emergency responder survey was accounted for by job training, which was the strongest predictor of having higher Ksum scores among emergency responders. Multiple regression models were not used for healthcare providers because the univariate analysis did not indicate any significant explanatory variables for correctly answering questions on the survey.

Discussion

The results of this study demonstrate that there was variability in knowledge regarding the use of the KI pill among the different groups surveyed. The reasons for this can be difficult to untangle because of the many interrelated factors that affect comprehension, including personal characteristics such as education, socioeconomic status, previous scientific training, motivation to learn, and age.

Although many factors may affect comprehension, groups that received high-quality outreach materials, such as a fact sheet and job training, had a better understanding of KI pill use. In addition, education, family income, previous scientific training, and relevance of the KI pill to their work in each group alone did not fully explain the differences in knowledge between the groups, because the education levels, family income, and previous scientific training were fairly similar across all groups, with the exception of healthcare providers and government officials. Healthcare providers had much higher levels of previous scientific training and education, but the relevance of KI to their daily work duties was similar to many other groups with the exception of government officials. Therefore, although many of these personal factors likely played a role in comprehension, they also did not fully explain the differences in the knowledge among the groups. For example, the education level among the KI recipients and the non–KI recipients was similar, yet the difference in their comprehension was significant (46% vs. 15%, respectively). Therefore, it is likely that the fact sheets and job training were significant contributors to the knowledge levels in these groups.

Many forms of outreach and education exist today, especially with the expansion of communication technologies such as the internet, digital video discs (DVDs), email, and

Table 3. General Public Univariate Odds Ratios (with Wald Confidence Interval in parentheses; bold numbers are statistically significant at $\alpha = 0.05$)

	Q1: radioactive iodine always present	*Q2: KI protects from all radiation*	*Q3: KI use during pregnancy*	*Q4: KI use with thyroid disease*	*Q5: KI use with iodine allergy*	*Q6: KI use when over 40 years of age*	*Q7: KI protects thyroid*	*Q8: when first dose*	*Q9: adult dose*	*Q10: child dose*	*Q11: how long protection lasts*	*Q12: taking several doses is better*
Age	**0.6**	**0.6**	1.1	0.9	0.8	**0.7**	**0.6**	**0.8**	**0.8**	**0.6**	**0.7**	**0.6**
	(0.4–0.9)	**(0.5–0.7)**	(0.8–1.5)	(0.7–1.1)	(0.6–1.0)	**(0.5–0.9)**	**(0.5–0.8)**	**(0.6–0.9)**	**(0.6–0.9)**	**(0.5–0.8)**	**(0.5–0.9)**	**(0.5–0.7)**
TV	1.0	1.0	**0.4**	0.9	0.7	0.9	1.1	0.9	**0.5**	0.6	0.7	0.8
	(0.5–2.1)	(0.7–1.5)	**(0.2–0.9)**	(0.6–1.4)	(0.4–1.1)	(0.5–1.8)	(0.8–1.7)	(0.6–1.3)	**(0.3–0.8)**	(0.3–1.1)	(0.4–1.2)	(0.5–1.1)

Note. Odds ratios are calculated for each of the 12 survey questions, with the outcome calculated as the odds of a survey respondent correctly answering the survey question. Age was categorized into four categories (<25, 25–39, 40–64, >65), and the odds ratio represents the odds of an older age group versus the odds of a younger age group answering the question correctly. The odds ratio for TV represents the odds of someone who obtained information from TV versus the odds of someone who did not obtain information from TV getting the correct answer on a survey question. Odds ratios below 1 indicate that older age or TV was associated with decreased probability of getting the correct answer.

podcasts. Thus, it is crucial to understand the potential benefits and limitations of all the sources of information used today in a public health and emergency preparedness campaign.

This study found that many sources of information were used by the general public, emergency responders, and healthcare providers. The quality of information provided by these various sources can be highly variable, and, in some cases, as with obtaining information from the television, comprehension was actually reduced. The fact that a significant number of KI pill recipients obtained their information from the KI pill fact sheet given out at the clinic is important, because the fact sheet, unlike most other sources of information that were used, was carefully reviewed by multiple experts and designed with careful attention to providing accurate information. Job training provided by the Bureau of Nuclear Engineering and Safety was frequently a source of information reported by emergency responders, which was useful because this training is carefully designed and given by knowledgeable experts in the field. Interestingly, some emergency responders and healthcare providers also used "other" information sources, including the pharmaceutical pill package inserts and discussions with other professionals.

Newspapers were frequently cited as a source of information for all three major groups of survey respondents. This is a concern because newspapers are widely read but can have highly variable quality. The prevalence of newspapers as a source for the general public, emergency responders, and healthcare providers implies that it is important for government agencies to ensure that accurate information is published in local newspapers and to correct any inaccuracies that may have been previously published.

Interestingly, the internet was not a widely used source of information for any of the groups surveyed; this may imply that significant investments in internet-based information must be carefully considered, especially for groups that may not have access to or interest in using the internet (e.g., older people). In addition, the motivation for using the internet to find emergency preparedness information may not be high for individuals during a time when there is no emergency, especially if the potential emergency is not obvious, understood, and recently publicized to the general public.

The assessment of the impact of various information sources using logistic regression and multiple regression techniques allowed for potential confounders and multiple factors to be taken into account. The univariate logistic regression demonstrated that several demographic characteristics for the general public (e.g., college-level science course work, age, etc.) could be important to consider when evaluating knowledge about pill use, but the multiple regression analysis found that none of these factors was significant when assessed together except for age. The multiple regression analysis showed that for the general public, the only factor that enhanced knowledge about pill use was the KI fact sheet. In fact, some sources of information that are of lower quality either were not statistically significant predictors of enhanced knowledge in the multiple regression model (e.g., newspaper, $p = 0.22$) or were shown to be detrimental to knowledge, as was the case with television in the univariate analysis that showed the odds of getting a correct answer was often lower if information was obtained from television. For example, the general public survey respondents who obtained their information from television were only about 20% as likely to correctly answer the question, "Can someone take potassium iodide if they are pregnant?" when compared to general pub-

Table 4. Multiple Regression Model Details for Emergency Responders and the General Public[a]

Model variable	*Number of observations*	*Regression coefficients*	*Variable R-squared*	P *value*
Emergency responder model				
Job training	168	2.41	0.17	<0.001
Attended KI clinic	168	2.33	0.08	<0.001
Role during emergency	168	0.17	0.003	0.42
General public model[b]				
Fact sheet	515	4.3	0.40	<0.001
Age	515	−0.51	0.01	0.001
Newspaper	515	0.29	0.004	0.23
Scientific background	515	0.64	0.002	0.07
Education level	515	−0.08	0.001	0.35

[a]Univariate logistic regression was used to detrmine which variables to include in regression model, as described in the Methods section.
[b]Income level of survey respondent was also added to the model; however, this variable did not reach a 0.5 significance level and therefore was not included in the model by the forward selection procedure.

lic survey respondents who obtained information from other sources. The same type of finding was true for emergency responders, where both the univariate and multiple regression models showed that the education provided by job training and the KI distribution clinic were the only information sources that were significantly predictive of enhanced knowledge of proper pill use.

One factor that could not be measured in this study for the general public was the influence of personal motivation among clinic attendees and their resulting motivation to be educated on proper pill use. It is likely that the voluntary nature of the pill distribution clinics resulted in self-selection among clinic attendees, with KI pill recipients being more highly motivated and interested in obtaining information when compared to non–KI pill recipients. This may have enhanced the knowledge differences between these two groups.

In addition, educational differences among emergency responders likely played some role that could not be completely controlled for in our analysis, especially with regard to government officials and healthcare providers. These factors for the emergency responders and general public are difficult to untangle in an observation study of this type conducted in the "real world." However, evidence was found that the fact sheet and training were important and played a role in the improvement of comprehension.

Another limitation, as in any study where many statistical tests are conducted, is that the large number of tests could result in spurious statistical associations. Attempts to control for multiple comparisons were used when applicable, and when looking at the overall trends in multiple data points, it is unlikely that spurious artifacts could completely explain the overall results.

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REFERENCES

1. Becker DV, Zanzonico P. Potassium iodide for thyroid blockade in a reactor accident: administrative policies that govern its use. *Thyroid* 1997;7(2):193-197.
2. Nauman J, Wolff J. Iodide prophylaxis in Poland after the Chernobyl reactor accident: benefits and risks. *Am J Med* 1993;94(5):524-532.
3. Le Guen B, Hemidy PY, Garcier Y. French approach for the distribution of iodine tablets in the vicinity of nuclear power plants. *Health Phys* 2002;83(2):293-300.
4. Millership S. Distribution of stable iodine in a nuclear emergency—are we prepared? *J Public Health Med* 1998;20(2): 191-195.
5. Astbury J, Horsley S, Gent N. Evaluation of a scheme for the pre-distribution of stable iodine (potassium iodate) to the civilian population residing within the immediate countermeasures zone of a nuclear submarine construction facility. *J Public Health Med* 1999;21(4):412-414.
6. Consideration of potassium iodide in emergency plans final rule, 10 CFR 50. Nuclear Regulatory Commission. *Fed Regist* Jan 19, 2001;66(13):5427-5440.
7. Ceccato MG, Acurcio FA, Bonolo Pde F, Rocha GM, Guimaraes MD. HIV patients' understanding of information on antiretroviral therapy. *Cad Saude Publica* 2004;20(5): 1388-1397.
8. Mortensen MG, Kiyak HA, Omnell L. Patient and parent understanding of informed consent in orthodontics. *Am J Orthod Dentofacial Orthop* 2003;124(5):541-550.
9. Chapman K, Abraham C, Jenkins V, Fallowfield L. Lay understanding of terms used in cancer consultations. *Psychooncology* 2003;12(6):557-566.
10. Schillinger D, Piette J, Grumbach K, et al. Closing the loop: physician communication with diabetic patients who have low health literacy. *Arch Intern Med* 2003;163(1):83-90.
11. Winder A, Hossain Z, Reddy S. The health effects of ionizing radiation: a survey of local health officials in New England and New York. *Public Health Rep* 1994;109(2):219-227.
12. Blando J, Robertson C, Pearl K, Dixon C, Valcin M, Bresnitz E. Assessment of potassium iodide (KI) distribution program among communities within the emergency planning zones (EPZ) of two nuclear power plants. *Health Phys* 2007;92(2 Suppl 1):S18-S26.
13. Blando J, Robertson C, Pearl K, Dixon C, Valcin M, Bresnitz E. Evaluation of KI prophylaxis knowledge and nuclear emergency preparedness—New Jersey, 2005. *Am J Public Health* 97(Suppl 1):S100-S102.
14. Blando J, Robertson C, Bresnitz E. *Final Report: Assessment of Potassium Iodide (KI) Distribution Campaign and Emergency Response Around New Jersey's Nuclear Power Facilities*. Trenton, NJ: New Jersey Department of Health and Senior Services; 2007. http://nj.gov/health/eoh/survweb/documents/ki_finalrpt.pdf. Accessed January 14, 2008.

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