

Improving communication on *Cryptosporidium* and 'Boil Water' notices: Lessons from Pitsford

Final report to the Drinking Water Inspectorate

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1. Grant details

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2. Researchers

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3. Background

Pitsford

On the evening of Tuesday 24th June 2008, Anglian Water's laboratory discovered that low levels of *cryptosporidium* oocysts were present in a filter cartridge that had been in use at the Pitsford water treatment works. The Drinking Water Inspectorate was informed and a 'Boil Water' notice was implemented to 108,000 households at 06:00 on Wednesday 25th June. Anglian Water commenced delivery of 'Boil Water' cards on Wednesday 25th June and this was completed by Royal Mail on Thursday 26th June. Loud hailers from vans were also used to spread the advice. The water notice remained in place for ten days. On Monday 14th July, Anglian Water was able to confirm that the source of the *cryptosporidium* in the water was a rabbit that had gained entry into the treatment works.

Mythe

This study was run in parallel with a project investigating a natural disaster incident entitled *The impact of language and cognition on compliance during a natural disaster*, funded by The Leverhulme Trust. In July 2007, Gloucestershire experienced heavy rainfall and its worst ever floods in the UK. The Mythe water treatment works was inundated and was forced to be shut down, resulting in complete loss of water to 340,000 residents. When tap water was restored, consumers were issued a 'Do Not Drink' notice for seven days, which was then replaced with a 'Boil Water' notice for a further four days. In the aftermath of the Mythe incident in 2007, Severn Trent Water shared its experiences with other UK water companies, including Anglian Water, allowing them to better prepare for future events.

4. Objectives

This study aimed to investigate the level of public compliance with and understanding of the Pitsford 'Boil Water' notice and highlight the factors behind non-compliance. This included effects of demographics, previous experience, use of information sources and general folk beliefs about water safety. In addition, we also aimed to compare compliance with and understanding of the 'Boil Water' notices in the routine Pitsford incident with that of the natural disaster incident at Mythe. As the Pitsford incident only affected the drinking water, that is, other resources such as traffic, communications and electricity were unaffected, we hypothesised better compliance with advice.

5. Research Design

In order to allow comparison between Pitsford and Mythe, the same research design was utilised for both incidents. Ethical approval for both studies was obtained from the King's College London Social Sciences, Humanities and Law Research Ethics Sub Committee.

We obtained postcodes for the two affected areas from the Drinking Water Inspectorate. The Royal Mail Postcode Address File provided full addresses, from which addresses were selected using a random number generator. These addresses were examined and any businesses or schools were substituted for a further randomised selection of residential addresses. A postal questionnaire was sent to 1000 randomly selected households affected per incident. The questionnaire queried basic demographics, what information consumers remembered receiving, information sources used, degree of satisfaction with information and activities performed with mains water during the notice period. Non-responders were sent a reminder after four weeks.

Data was entered into Microsoft Access 2007 and then validated against the original questionnaires. For statistical comparison, data was transferred into SPSS version 16 and validated a second time. Some questions were not (fully) answered by all respondents, thus sample size often varied between questions. Quantitative analysis was mainly descriptive. Inferential analysis was carried out using Chi-Square, Mann-Whitney, ANOVA, MANOVA, and Linear Regression, as appropriate. For all analyses with multiple predictor variables, only those variables that were significant at the $p < 0.2$ level in single predictor models were included in the multiple predictor models. The least significant variable was then removed from the model until all predictor variables were significant at the $p < 0.2$ level. The value of the model in predicting each dependent variable was then derived from the tests of between subjects effects in the corrected model. Throughout, the level of significance was set at 5% and only options with at least 10 responses were included as variables.

6. Results

A response rate of just below 20% (common for postal surveys) was achieved for both incidents. We compared the two samples, Pitsford and Mythe, using Chi-Square, confirming that there were no statistical differences between the demographic backgrounds of the participants.

Information sources

Use of individual sources was consistently higher for Pitsford, with the exception of local radio (see Table 1). Pitsford consumers primarily consulted the water company (76.5%), followed by television (54.9%) and local radio (48.1%). Use of local newspapers was associated with consumers in paid employment; no other background factors predicted information source use. During the 'Boil Water' stage of the Mythe incident, on the other hand, residents used the local radio (55.7%) in almost equal proportion to the water company (57.4%).

Table 1: Use of information sources by Pitsford and Mythe respondents

Information source	Pitsford N=162		Mythe N=115		P ^a
	n	%	n	%	
family/friend/neighbour	59	36.4	12	10.4	1.1×10^{-6}
local newspaper	67	41.4	32	27.8	.021
water company/leaflet through the post	124	76.5	66	57.4	.001
TV	89	54.9	19	16.5	1.0×10^{-10}
local radio	78	48.1	64	55.7	.218

^a Chi-Square

Participants were also asked to rank the information sources in order of how useful they had found each source for the entire incident. For Pitsford, the water company was ranked highest (41.2%), whereas for Mythe, local radio was ranked highest by far (53.4%).

Advice

For Pitsford, 96.9% of consumers received water advice, compared to 67.3% for Mythe. For both incidents, a large number of consumers believed there were two notices in place at the same time.

We queried how clear the tap water advice was and how well-informed consumers had felt. More Pitsford consumers felt the advice was 'clear' or 'very clear', and their feeling of being informed was more frequently described as 'very informed' (see Table 2). For Pitsford, advice from the water company/leaflet through the post was positively associated with clear advice and feeling informed; no other information source displayed any association.

Table 2: Comparison of clarity of advice and feeling informed between Pitsford and Mythe respondents

Appreciation of advice		Pitsford		Mythe		p ^a
		n	%	n	%	
clarity of advice ^b	very unclear	4	2.5	10	7.1	0.010
	unclear	9	5.6	8	5.7	
	understandable	43	26.9	41	29.1	
	clear	54	33.8	59	41.8	
feeling informed ^c	very clear	50	31.3	23	16.3	3.8x10 ⁻⁴
	very uninformed	5	3.1	12	8.5	
	uninformed	11	6.8	11	7.7	
	informed	90	55.9	97	68.3	
	very informed	55	34.2	22	15.5	

^a Chi-squared for trend

^b Pitsford N=160; Mythe N=141

^c Pitsford N=161; Mythe N=142

Compliance

Pitsford participants were asked to specify their use of unboiled and boiled tap water (see Table 3). Some consumers drank unboiled tap water and used it to make babies' bottles.

Table 3: Use of unboiled and boiled tap water by Pitsford residents

Activity	Use of unboiled water (N=161)		Use of boiled water (N=161)	
	n	percent	n	percent
flush toilet	144	89.4	2	1.2
shower/bathe	142	88.2	5	3.1
wash hands	117	72.7	24	14.9
prepare/cook food with	40	24.8	100	62.1
brush teeth	34	21.1	90	55.9
drink cold	8	5.0	81	50.3
prepare babies' bottles	2	1.2	6	3.7

We measured compliance both for drinking and overall ingestion and compared rates for Pitsford and Mythe. Both drinking water compliance (95.0% vs 70.7%) and overall ingestion compliance (64.6% vs 51.7%) was significantly better for Pitsford, as confirmed by Chi-Square. The high level of compliance with drinking water advice for Pitsford could not be traced to any specific factors.

For Pitsford, Linear Regression revealed that advice from the local radio was positively associated with compliance with ingestion advice, whereas advice from the water company/leaflet through the post was associated with less compliance. Descriptive statistics showed that consumers who received advice from the local radio were more likely to comply with the advice not to use unboiled tap water for brushing teeth and cooking/preparing food, than those that received advice from the water company/leaflet through the post; notably, 88.2% of all consumers that used unboiled tap water to brush their teeth had received advice from the water company/leaflet.

7. Conclusions and Recommendations

In the Pitsford incident, those who used the water company leaflet and/or contacted the water company felt more informed and felt the advice was clearer than those who did not use the water company. This may be attributable to the fact that Anglian Water's communication campaign included vans with hailers and information points in the streets. However, it was the local radio that was associated with higher compliance with advice, possibly by better clarification of the range of unsafe ingestion behaviours, whereas the water company/leaflet had the opposite effect. It is therefore recommended that all sources of information should highlight that the need to boil the water extends to all ingestion activities; and we would advise Anglian Water to pay special attention to instructions regarding brushing teeth.

The use of information sources was significantly higher for Pitsford, with the water company/leaflet through the post being the preferred source and the highest ranked source. Anglian Water managed to maintain a highly visible and authoritative communication campaign during the Pitsford incident. This highlights the need for water companies to establish themselves as the primary information source for all water incidents, so that in case of a future incident, whether it be a natural disaster one or a routine one, media and other agencies refer to their advice.

This is the first project to compare compliance with a routine 'Boil Water' notice to compliance with a natural disaster 'Boil Water' notice. Lower compliance during Mythe may have been due to the scale and chaos of the incident - not only did consumers lose water, but they were also issued two consecutive water notices. Compliance with and understanding of water advice could have been reduced by the issuing of multiple notices; however, 41.4% of consumers at Pitsford also believed that more than one notice was in place. Spelling out the exclusivity of water notices and highlighting the differences between notices may improve compliance rates in future incidents.

8. Dissemination

Pitsford publications

- Knapton, O., Hunter, P.R. & G. Rundblad. (in preparation). Do the causes and circumstances of water notices impact consumer behaviour?

Pitsford presentations

- 'Risk behaviour and compliance following 'Boil Water' notices due to a natural disaster versus a human error incident'. Health Protection Agency (HPA), University of Warwick, September 2009.
- 'Why risk behaviour and compliance during natural disasters differ significantly from human error events and what we can do about it'. American Public Health Association (APHA), Philadelphia, November 2009.
- 'Consumer perception, behaviour and compliance with public health advice on drinking water' (invited talk). CDC/AWWA, Atlanta, 2009.

Mythe publications

- Rundblad, G., Knapton, O & P.R. Hunter. (2010). Communication, perception and behaviour during a natural disaster involving a 'Do Not Drink' and a subsequent 'Boil Water' notice: a postal questionnaire study. *BMC Public Health* 2010, 10:641.
- Rundblad, G. & O. Knapton. (in preparation). Media communication on drinking water and safe behaviour: a comparison of the different stages of a natural disaster.
- Knapton, O. & G. Rundblad. (in preparation). The discourse of a drinking water emergency in UK media: a cognitive approach to discourse analysis.

Mythe presentations

- 'Media communication during a natural disaster'. Society for Risk Analysis Conference, London, 2010.
- 'Communicating safe behaviour to the general public: A comparison of the different stages of a natural disaster'. Communication Medicine and Ethics, Boston, 2010.
- 'Communication about drinking water safety: A cognitive discourse analysis approach'. UK Cognitive Linguistics Conference, Hertfordshire, 2010.
- 'Communication and compliance: a study of the 2007 natural disaster induced incident at Mythe'. KCL/DWI workshop, London, 2010.

Project website

www.PublicHealthCommunication.org.uk