Is your spa pool a risk to health:-the results of a survey of commercial spa pools in hotels, leisure centres and sportsclubs

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INTRODUCTION

- In the UK standalone hot tubs, which do not have balance tanks and swimming pool type treatment systems including sand filtration* together with continuous treatment usually with an oxidising biocide such as chlorine or bromine, are not considered suitable for commercial use such as in hotels, leisure and health clubs etc.
- Spa pools suitable for commercial use, also known as Jacuzzis™, whirlpool spas etc. come in a variety of shapes and sizes and are intended for sitting in rather than swimming, with the water agitated by high velocity water jets and many also have an air jet system.
- The guidelines in place prior to the study did not include *Legionella* as a monitoring parameter although spa pools are the third most common cause of Legionnaires' disease. Spa pools have also been associated with outbreaks of waterborne disease caused by other microorganisms including *Pseudomonas aeruginosa* and non tuberculous *Mycobacteria* (NTMs).
- Investigations into the cause of outbreaks and incidents of waterborne infections associated with such pools raised many areas of concern about their management including inadequate disinfection and poor maintenance.
- A one year study was therefore carried out as a joint exercise between the Health Protection Agency (HPA) London Food Water and Environmental Microbiology Laboratory, the HPA Water and Environmental Microbiology Research Unit, the HPA Statistics Unit and the Environmental Health Departments of 14 Local Authorities in England to look at whether the current monitoring parameters would indicate the risk of legionellosis and the incidence of poor water quality and whether this was directly related to to poor management and / or lack of training.

*diamataceous earth is an acceptable filter medium alternative but is less common

METHODS

- A protocol and questionnaire were developed in collaboration with the local authority environmental health departments.
- Environmental Health Officers (EHOs) were asked to inspect the pool records, to sample from the pool and the balance tank (Figure 1), (balance tanks compensate for the rise and fall in water level as users enter and leave the pool) , and gather the information about management and training as requested on the questionnaire.
- pH, temperature and biocide concentrations were taken at same time as the samples which were examined using standard methods for routine parameters:- *Pseudomonas aeruginosa*, aerobic colony count (ACC) @37 ºC for 24h, *Escherichia coli* and coliforms using colilert in Quantitray™, and *Legionella* spp.

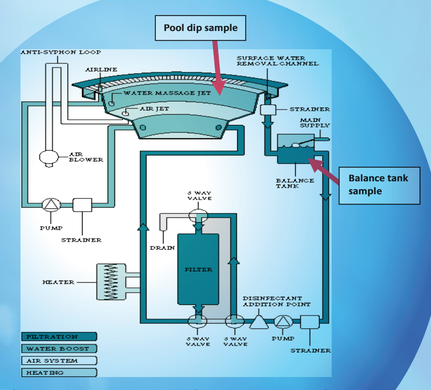

Figure 1. A typical commercial spa pool layout showing targeted sampling points.

STATISTICAL ANALYSIS

- The microbiological results and data from the questionnaires were then entered onto a Microsoft Excel spreadsheet and analysed by the HPA Colindale Statisitics Unit to assess the factors associated with the presence of poor microbiological water quality.
- If aerobic colony count were ≥100 cfu ml-1 or if any *E. coli*, coliforms, *P. aeruginosa*, or *Legionella* spp. were detected the sample was deemed to have failed. A variable was also constructed to denote whether any of the microbiological tests had failed.
- The association between the pool and premises factors and microbiological quality of the water was assessed using two-way cross tabulations with a test of association that takes account of the clustering of samples within premises.

RESULTS

- 229 samples were taken, of which, 62 were from follow up samples which are excluded from the analysis below.
- One hundred and sixty seven initial water samples are therefore analysed from 89 different premises.
- One hundred and fourteen of these samples were from pools (68%), 31 samples were from balance tanks (19%), and the remaining 22 (13%) were taken from other sampling points.
- Fifty six (63%) of premises were described as a Health Clubs, of which 26 (29%) were within Hotels, 5 (6%) were Leisure Centres and 2 (2%) were Sports Centres 25/30 (83.3%) of non hotel based health clubs, 18/26 (69.2%) of hotel based health clubs and 1/5 (20%) leisure centres did not meet the guideline microbiological standards in place at the time of the survey (A failure is ACC ≥100cfu/ml, and /or the presence of coliforms, *E.coli*, *Pseudomonas aeruginosa* or *Legionella* spp.).
- Samples from balance tanks or other points are more likely not to meet the required microbiological guideline standards than pool water samples ($p < 0.001$) (Figure 3)
- The majority of samples (78.6%) were taken from chlorine treated pools with only 34 (21.8%) from bromine treated pools, however pools treated with bromine were significantly more likley to have poor microbiological results (Figure 4) than pools treated with chlorine
- The failure rate for coliforms and *E.coli* was very low with no statistical difference ~~onbserverd~~ between sample sites. Only one pool had detectable *E.coli*.
- *P. aeruginosa* was observed in 16% of samples of which a significantly higher proportion were from "other" sites e.g. drainage sites ($p < 0.001$) whilst only 11 (8%) of *P. aeruginosa* positive samples were from the spa pool water. Levels ranged from 1 to 2.3 x 10^5 cfu/100ml with lower levels (up to 2.6 x 10^3) in the pool water.
- 147 / 167 samples were tested for the presence of legionella, The failure rate was 29.2%, 22.0%, and 21,4% for balance tanks, pool, and other samples respectively.
- There is no evidence that the failure rates differ for the three types of water sample ($p= 0.7$) (Figure 5). Though the balance tank contained the highest count of *Legionella pneumophila* serogroup 1 (3.7 x 10^6 cfu/L).
- One pool tested positive for *Legionella* when all other parameters were negative showing that reliance cannot be placed on compliance with other parameters for water safety assessment.

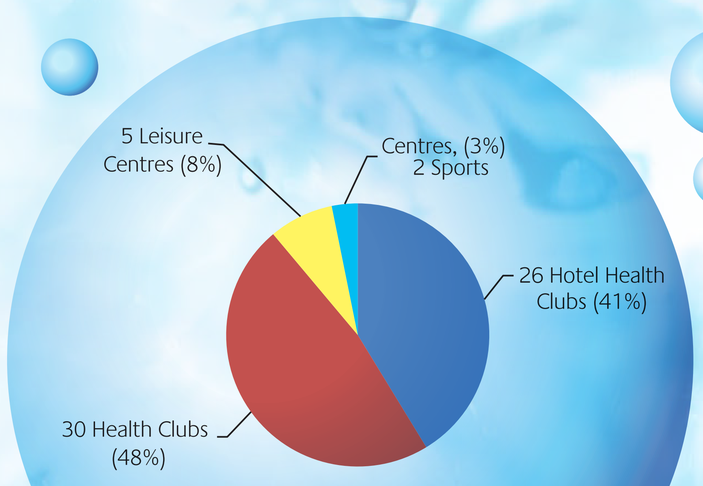

Figure 2. Premises sampled: a total of 89 premises: of which 56 were Health Clubs (26 based in hotels), 5 leisure centres and 2 specialized sports centres were visited by EHOs and sampled

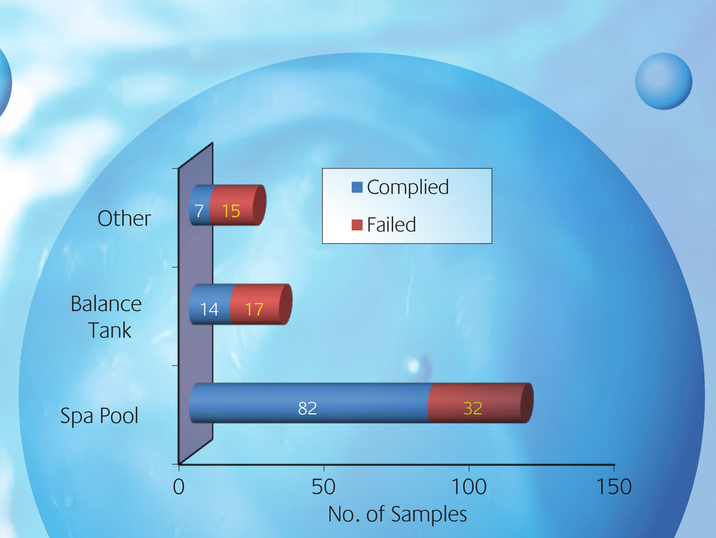

Figure 3. Samples from each site showing numbers which complied and failed microbiological water quality parameters. Balance tanks are significantly more likely to indicate poor water quality than other sample sites (p value 0.0004)

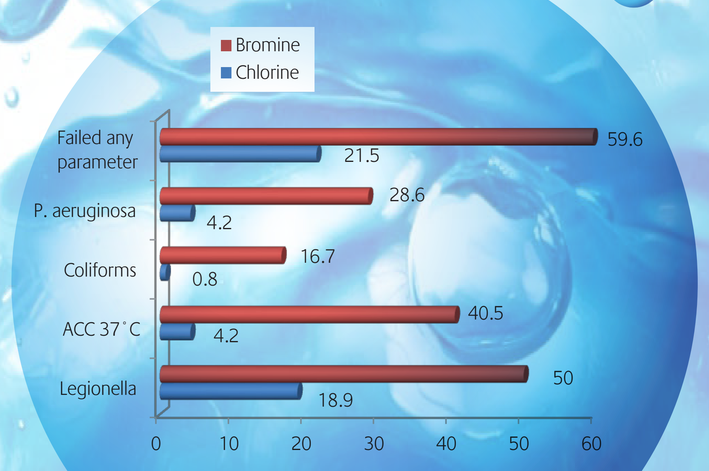

Figure 4. Bromine treated pools were more likely to have poor quality pool water than chlorine treated pools ($p<0.001$ for all parameters).

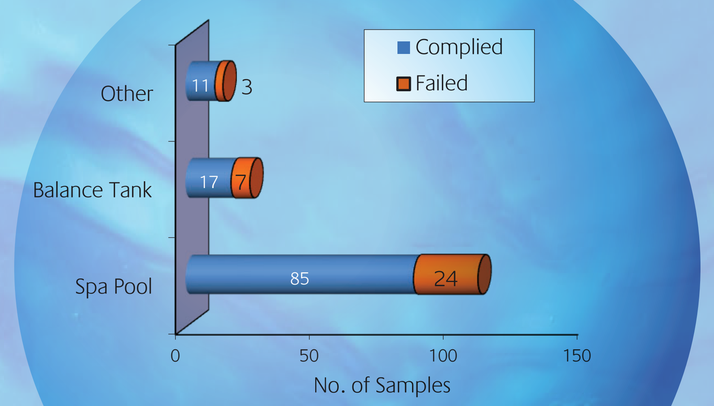

Figure 5. Legionella spp. were isolated from 34 (23%) of initial samples but there was no statistical difference between sample sites and the presence of legionellae.

THE EFFECT OF OTHER FACTORS ON POOL WATER QUALITY

- The presence of a designated responsible person had a positive effect on reducing the likelihood of poor water quality, This is particularly marked for aerobic colony count ($p=0.04$) and to a certain degree *P. aeruginosa* (p-0.14).
- There is a reasonably marked improvement in *Legionella* test results when the premises have a copy of the current Approved Code and Practice and Guidance for minimising the Risk of Legionnaires' disease (L8). for *Legionella* $p = 0.07$,
- There is some suggestion that premises where there is no appropriate training of staff have a higher failure rate across all indicators. ($P=0.16$).
- Having an automated dosing system was significant, where present there is a general reduction in the failure rate for all microbiological tests. This reduction reached "statistical" significance for aerobic colony count($p=0.05$) and *P. aeruginosa* ($p=0.002$) .

CONCLUSIONS

It is acknowledged that spa pools can pose a significant risk to users and those in the vicinity of a poorly managed pool. This Study shows that the water quality in many pools was not acceptable with safe management subject to many interacting factors. Balance tanks are more likely than pool samples to fail to meet target microbiological monitoring levels and when investigating outbreaks efforts should be made to collect samples from these tanks where possible. Bromine treated pools are significantly more likely to fail water quality standards. Awareness of *Legionella* risk factors and having designated persons in charge of the pool, training programmes in place reduces the risk from these pools.

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