An outbreak of pharyngoconjunctival fever affecting 59 children was detected in a municipality of northern Spain in July 2008. The outbreak was related to insufficient doses of water disinfectant in the municipal swimming pool. Adenovirus was detected in the pharyngeal swabs of five of six affected children and the four strains that were sequenced were all Adenovirus type 4.

Methods
Cases were defined as all individuals under the age of 15 years consulting the health centre of the affected town between 15 June and 11 August with conjunctivitis and/or pharyngitis with enlarged cervical lymph nodes. According to the census from 2006, the town had 9,141 inhabitants of whom 1,347 were under 15 years-old. The possible occurrence of cases of pharyngoconjunctival fever in the neighbouring towns and a referral hospital was monitored. Affected patients were interviewed in order to record the following variables: place of residence, age, sex, date of symptom onset, symptoms, presence of complications, swimming pool use and other potential exposures. For each clinical picture, (pharyngoconjunctivitis, pharyngitis without conjunctivitis, and conjunctivitis without pharyngitis), two cases were studied in order to identify viral aetiology, using pharyngeal swabs with viral transport medium (ViralPack, Biomedics, Spain). For adenovirus detection, a real-time polymerase chain reaction (PCR) method was used that amplified a fragment of the hexon gene [6], and the amplicons obtained were sequenced to characterise the adenovirus type. The pH value and the concentration of disinfectant in the water of the four basins of the public swimming pool were determined (Test Cloro and pH 1.1174.0001, Merck, Germany), the automatic pH regulation and disinfectant dosing pump system was inspected and the incident log book was reviewed. Disinfection was performed through bromination in the small inner children’s pool and through chlorination in the remaining pools.

Results
Between 16 June and 11 August, 59 children were diagnosed with pharyngoconjunctival fever and met the case definition. Forty-three of the children (73%) had recently used the municipal swimming pool, which was considered the source of infection (primary cases). Fifteen (25%) of the children had been in close contact with a primary case (secondary cases). The very first case that occurred had not visited the swimming pool and was therefore considered sporadic. The epidemic curve confirmed an outbreak with an epidemic pattern characterised by an accumulation of primary cases, consistent with the hypothesis of a persistent common source, and more isolated secondary cases, resulting from person-to-person transmission mainly in a family environment (Figure). All affected infants and children lived in the area where the swimming pool is situated. They were 34 (58%) boys and 25 (42%) girls. Ten percent of affected individuals were under the age of one year, 29% were between one and four years-old, 59% between five and 13 years-old and one case was 14 years-old (2%). It must be noted that the case definition only included children under the age of 15 years; an estimation of the secondary attack rate among older children and adults in the families or contacts was...
of the outbreak to be unequivocally confirmed. The reports published to date would seem to indicate that swimming pool-related outbreaks of adenovirus infection have become exceptional in the last few decades. However, the outbreak reported in this study was consistent with pharyngoconjunctival fever, as reported in other swimming pool-related outbreaks of non-enteric adenovirus infection [2,3,5,10-12]. Adenovirus type 3 has been most frequently found in these outbreaks [2,3,5,11,12], and to a lesser extent, type 7 [13,14] and type 4 [10]. Adenovirus type 4, the only member of human adenovirus species E, is one of the major causes of adenoviral conjunctivitis and the type considered to be responsible for the outbreak reported here. Clinical manifestation of this virus type varies, ranging from pharyngoconjunctival fever to keratoconjunctivitis, unlike conjunctivitis caused by serotypes 3 and 7, which tend to be milder [15].

It is obvious that the electrical problems at the swimming pool must have affected the disinfectant regulation system severely. However, the record books do not report any disinfection problem. We strongly believe that strict adherence to the existing regulation would have avoided the outbreak.

The reports published to date would seem to indicate that swimming pool-related outbreaks of adenovirus infection have become exceptional in the last few decades. However, the outbreak reported in the present study reveals that these infections continue to pose a risk to swimming pool users when recommended control guidelines are not strictly observed. Adequate standards of hygiene and disinfection must be maintained in these installations to prevent transmission of adenoviruses and other microorganisms, and early investigations could decrease the number of cases.

Adenoviruses are non-enveloped viruses, unusually resistant to physical and chemical agents, which gives them prolonged survival capacity [1]. Recently, these viruses have been observed to be prevalent in rivers, coastal water, swimming pools and water supplies worldwide [8,9]. Adenoviruses have also been detected in swimming pool water in the context of outbreaks of pharyngoconjunctival fever [3,4,10]. Transmission of this virus can occur both through intake of swimming pool water or through direct contact between the water and the conjunctival mucosa or upper respiratory tract [9].

The reports published to date would seem to indicate that swimming pool-related outbreaks of adenovirus infection have become exceptional in the last few decades. However, the outbreak reported in the present study reveals that these infections continue to pose a risk to swimming pool users when recommended control guidelines are not strictly observed. Adequate standards of hygiene and disinfection must be maintained in these installations to prevent transmission of adenoviruses and other microorganisms, and early investigations could decrease the number of cases.

**Discussion**

Swimming pool-related outbreaks of viral infection are highly uncommon. The most frequently involved viruses are adenovirus, norovirus, hepatitis A virus and echovirus, in this order [7].

After the swimming pool opened (on 7 June) for the summer season, there were numerous electrical system failures causing intermittent failure of the water circulation and bromine dosing pumps. The disinfectant concentrations registered on 3 July (the day the outbreak was reported) were insufficient in the small children’s pool (0.45 mg/l of total bromine) and were adequate in the remaining pools. On the same day, swimming in the small pool was forbidden. Once the disinfection system was repaired and normal disinfection concentrations (bromine and pH) were confirmed, swimming was again permitted.

**Cases of pharyngoconjunctival fever, by date of disease onset, Gipuzkoa, Spain, June-August* 2008* (n=59)

*Active surveillance was ongoing until 11 August

**References**


This article was published on 26 February 2009.