

Transmission of Norovirus Among NBA Players and Staff, Winter 2010–2011

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In December 2010, 24 players and staff members from 13 National Basketball Association teams were affected with gastroenteritis symptoms. Four of 5 stool specimens from ill players and staff tested positive for norovirus genogroup II. We document evidence of transmission both within teams and, potentially, between teams in 2 instances.

Noroviruses cause nearly 21 million gastrointestinal illnesses annually and are the most common cause of gastroenteritis outbreaks in the United States [1, 2]. Transmission of norovirus frequently occurs from person to person, either by direct contact with infectious stool or vomit or by touching surfaces contaminated by infectious material. Peak levels of norovirus shedding occur during the acute illness, which generally lasts 1–3 days; however, viral shedding in stool can be detected for a median of 4 weeks following infection by real-time quantitative polymerase chain reaction (RT-qPCR) [3]. Prolonged viral shedding in stool and vomit by infected persons, environmental persistence, and a low infectious dose (≥ 18 viral particles) facilitate person-to-person norovirus transmission [1, 4].

From 28 November 2010 through 8 December 2010, media reports indicated that 20 National Basketball Association (NBA) players from 13 teams located in 11 different states were ill with a “stomach virus.” On 9 December, we began an investigation to confirm the occurrence of and describe the extent of the illnesses,

identify the etiology, and assess evidence for player-to-player and team-to-team transmission.

Methods

NBA team physicians and trainers interviewed staff and players on their team to assess whether they had gastroenteritis (defined as vomiting and/or diarrhea), from 10 November 2010 through 20 December 2010. This study window represented a retrospective 1-month period and a prospective 10-day period. For each individual with gastroenteritis, information on team-related activities while ill and the occurrence of similar illness among household members was obtained. The Centers for Disease Control and Prevention (CDC) and/or state and local health departments contacted NBA team physicians individually by phone and email to coordinate completion of the requested investigation forms. A minimum of 3 contact attempts were made for each NBA team physician who did not return the forms. Data submission was voluntary and obtained with verbal consent from team medical staff. All identifying information on questionnaires was kept confidential.

A case was defined as gastroenteritis in an NBA staff member or player, with illness onset during the study period. Cases were classified either as confirmed (those with a positive fecal RT-qPCR test for norovirus) or probable (those without laboratory confirmation of norovirus). Among teams with multiple ill individuals, the first ill individual was defined as the primary case, and subsequent individuals were defined as secondary cases. Team-to-team transmission events were those in which a team with 1 or more players that either had acute gastroenteritis or were actively shedding (ie, ≤ 1 day after symptom resolution; donor team) played another team with all previously healthy players (recipient team), and within 72 hours of the game, a player or players on the recipient team developed acute gastroenteritis.

NBA staff and players with active symptoms or who were within 1 week of recovery from gastrointestinal illness at the time of the investigation were asked to provide stool specimens for norovirus RT-qPCR testing at CDC by use of methods described elsewhere [1]. Positive specimens were genotyped in the capsid region [5, 6]. Prior to the initiation of the investigation, 1 stool specimen from an ill player had been submitted for norovirus testing through a commercial laboratory; results of this testing were subsequently provided to study investigators.

This public health investigation did not require ethics committee approval.

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Results

Among the 30 NBA team physicians contacted by investigators, 27 (90%) completed the team questionnaire and case report forms, when applicable. In total, 400 players and 378 staff members were assessed for symptoms of gastroenteritis during the study period. Among these, 21 players (5.3%) and 3 staff members (<1%) from 13 different teams (teams A–M) met the case definition (Figure 1).

Five stool specimens were collected from cases, of which 4 tested positive for norovirus genogroup II by RT-qPCR. Three of the 4 norovirus-positive stool specimens were from players on team F and 1 was from a player on team D. Three of these specimens were available for sequencing; 2 were sequenced and 1 was not due to a low viral titer. The norovirus strain in 2 of the 4 positive stool specimens were collected from different players on team F, and sequencing yielded an identical norovirus strain (genogroup II.1).

Four teams had multiple cases (team E, 3 cases; team F, 6 cases; team H, 4 cases; and team J, 2 cases), accounting for a total of 15 case individuals, of which 13 completed a case report form. Of these 13 individuals, 4 were primary cases and 9 were secondary cases. None of the case individuals reported playing in NBA basketball games while ill, but 1 vomited near teammates while in transit to a game. Three (75%) of the 4 primary case individuals reported traveling with and having direct interaction with teammates while ill. Among 9 secondary cases, 2 (22%) reported similar illness in their homes during the week prior to their

illness, and another 2 (22%) reported similar illness in their homes during the week after their illness.

The 13 NBA teams with cases played a total of 49 games against one another during the study period. Two of these games were identified as potential team-to-team transmission events. In these events, both donor teams (teams D and F) had cases with laboratory-confirmed norovirus infection. All 4 NBA staff members and players on the 2 recipient teams (teams E and G) that developed gastroenteritis within 72 hours after the game reported no similar illness in their households during the week before their illness onset (Figure 1; online only).

Discussion

We describe an outbreak of norovirus gastroenteritis that may have affected as many as 13 NBA teams, with the majority of illness occurring during the first week of December 2010. Epidemiologic and laboratory evidence strongly suggests that person-to-person transmission occurred within at least 1 team during this outbreak. Additionally, in 2 instances, the occurrence of illness among previously healthy players with no ill household contacts shortly after they were exposed to ill players from another team also raises the possibility of team-to-team transmission.

Norovirus outbreaks have been previously reported in recreational and athletic settings [7, 8]; however, this is the first known report of a norovirus outbreak within a professional sports association. In an analysis of 10 years of NBA injury reports, it was found that gastrointestinal illness represented the

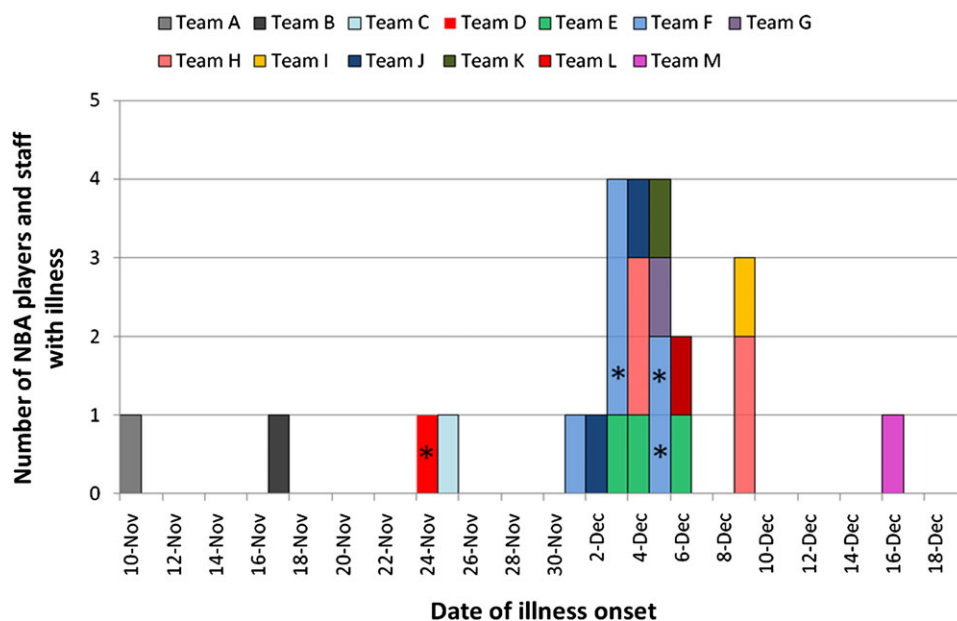


Figure 1. Epidemic curve representing the day of gastrointestinal illness onset among National Basketball Association (NBA) players and staff on various NBA teams, with an asterisk to indicate laboratory-confirmed cases of norovirus infection.

second most common non-game-related injury or illness among players and accounted for 4% of all acute medical conditions [9]. The occurrence of such illnesses among NBA players can potentially have substantial economic consequences, in addition to health concerns.

The rigors of a professional basketball schedule and close interpersonal contact on the court create unique circumstances for norovirus transmission. Norovirus can aerosolize after vomiting, persists on environmental surfaces, and is resistant to common disinfectants, and infected individuals can shed billions of infectious doses [4]. All of these factors may contribute to the rapid spread of norovirus among teammates who spend long periods together in closed spaces while in transit, during training sessions, in locker rooms, and during games. In this investigation, ill players reported vomiting near other teammates, traveling and interacting with healthy teammates while they were ill, and participating in games while they were still ill or within 24 hours of recovery when they were likely still infectious.

In this investigation, the lack of confirmatory microbiologic evidence on most cases, including those from recipient teams suspected in team-to-team transmission events, limited our certainty that these cases arose from a single outbreak. There is also the possibility of underreporting of mild gastroenteritis infections and poor recall of the length of illness. Additionally, this outbreak occurred during the winter norovirus season [10], and some individuals may have independently acquired illness from other exposures not assessed. GII.1 noroviruses were detected in 3% of the outbreaks during the 2010–2011 winter season, which were reported through CDC's national norovirus surveillance system, CaliciNet [11]. The identification of a norovirus strain uncommonly found in the community among 2 members of the same team greatly increases the likelihood that these 2 cases were indeed linked.

In conclusion, our study highlights the multiple opportunities for transmission of highly infectious diseases such as norovirus between players and staff on a team and between teams during competition. To help limit transmission, restriction of player activities and player and/or staff interactions during acute illness and shortly after recovery (24–72 hours) [1], with particular focus on nongame activities, should be considered. In addition, strict personal hygiene including hand washing with soap and running water, which is preferred over hand sanitizer use for reducing norovirus contamination on the hands, and enhanced environmental disinfection of common areas (eg, locker rooms) with a sodium hypochlorite solution or other product effective against norovirus should be implemented [1]. Potential barriers to implementation of these policies in a professional sports setting include economic considerations, difficulty in enforcing individual hygiene practices, and disincentives to self-reporting

symptoms if they result in exclusion. Addressing these barriers to prevention, increasing norovirus awareness, and encouraging early norovirus outbreak reporting to public health authorities could limit sports-related norovirus transmission in the future.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online (http://www.oxfordjournals.org/our_journals/cid/). Supplementary materials consist of data provided by the authors that are published to benefit the reader. The posted materials are not copyedited. The contents of all supplementary data are the sole responsibility of the authors. Questions or messages regarding errors should be addressed to the author.

Notes

Acknowledgment. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Potential conflicts of interest. All authors: No reported conflicts. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

- Centers for Disease Control and Prevention. Updated norovirus outbreak management and disease prevention guidelines. *MMWR Recomm Rep* **2011**; 60:1–20.
- Patel MM, Hall AJ, Vinje J, Parashar UD. Noroviruses: a comprehensive review. *J Clin Virol* **2009**; 44:1–8.
- Atmar RL, Opekun AR, Gilger MA, et al. Norwalk virus shedding after experimental human infection. *Emerg Infect Dis* **2008**; 14:1553–7.
- Teunis PF, Moe CL, Liu P, et al. Norwalk virus: how infectious is it? *J Med Virol* **2008**; 80:1468–76.
- Vinje J, Green J, Lewis DC, Gallimore CI, Brown DW, Koopmans MP. Genetic polymorphism across regions of the three open reading frames of “Norwalk-like viruses”. *Arch Virol* **2000**; 145:223–41.
- Kojima S, Kageyama T, Fukushi S, et al. Genogroup-specific PCR primers for detection of Norwalk-like viruses. *J Virol Methods* **2002**; 100:107–14.
- Becker KM, Moe CL, Southwick KL, MacCormack JN. Transmission of Norwalk virus during football game. *N Engl J Med* **2000**; 343:1223–7.
- Sartorius B, Andersson Y, Velicko I, et al. Outbreak of norovirus in Västana Götaland associated with recreational activities at two lakes during August 2004. *Scand J Infect Dis* **2007**; 39:323–31.
- Starkey C. Injuries and illnesses in the national basketball association: a 10-year perspective. *J Athl Train* **2000**; 35:161–7.
- Mounts AW, Ando T, Koopmans M, Bresee JS, Noel J, Glass RI. Cold weather seasonality of gastroenteritis associated with Norwalk-like viruses. *J Infect Dis* **2000**; 181(suppl 2):S284–7.
- Vega E, Barclay L, Gregoricus N, Williams K, Lee D, Vinje J. Novel surveillance network for norovirus gastroenteritis outbreaks, United States. *Emerging Infect Dis* **2011**; 17:1389–95.