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Reported behavior, knowledge and awareness toward the potential for norovirus transmission by food handlers in Dutch catering companies and institutional settings in relation to the prevalence of norovirus

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ABSTRACT

Norovirus (NoV) in ready to eat food has recently been defined as one of the virus-food commodity combinations with greatest public health concern. The role of food handlers therein has well been recognized. The aim of this study was to identify gaps in food handlers' education and to investigate possible associations between reported behavior, knowledge and awareness of NoV, and environmental presence of NoV. For this, face-to-face interviews were conducted using structured questionnaires in 1023 catering companies (i.e. restaurants mainly), 101 non-hospital health care centers, 52 hospital central kitchens and in 102 hospital in-patient units. In addition, three surface swabs were taken at each setting. Multivariate logistic regression was performed on data restricted to NoV high season months only, in which NoV was present in 21/374 (6%) catering companies and 37/233 (16%) institutional settings ($p < 0.01$). The two independent determinants of presence of NoV on environmental surfaces identified were being situated in an institutional setting and having an attitude to continue food handling while sick with vomiting complaints. Several gaps in education and training were identified, demonstrating that knowledge on NoV was low, although awareness of NoV was significantly higher among food handlers in institutional settings than in catering companies. This is the first time questionnaires and environmental testing have been combined in the same study to identify issues of improvement. Training on all important aspects of NoV according to the recently developed Codex Alimentarius guidelines to control viruses in food is strongly recommended.

1. Introduction

Noroviruses (NoV) are among the most common causes of viral gastroenteritis (GE) worldwide. In the Netherlands, the incidence of NoV illness in 2009 was estimated to be 3800 cases per 100,000 inhabitants, with an estimated burden over 1600 disability-adjusted life years (Verhoef et al., 2012). The virus is highly infectious (Teunis et al., 2008) and often seen in outbreaks with high attack rates in health care settings, cruise ships, catered events, a.o. (EFSA, 2011; FAO/WHO, 2008; Meakins, Adak, Lopman, & O'Brien, 2003; Widdowson et al., 2004). Transmission of NoV occurs via the fecal–oral route directly from person-to-person but also indirectly via surfaces, water or food contaminated by fecal material or vomitus (EFSA, 2011; FAO/WHO, 2008). Infected people can shed NoV as early as 12 h after exposure until three weeks later (Rockx et al., 2002), with consequential possible shedding of the virus before onset of symptoms or after symptoms have subsided. Moreover, asymptomatic infections of NoV is quite common, as measured to be 5% (de Wit et al., 2001) to 12% (Phillips, Tam, Rodrigues, & Lopman, 2010) in non-outbreak situations and up to 19% during an outbreak situation (Vinjé, Altena, & Koopmans, 1997).

NoV in ready to eat food has recently been defined as one of the virus-food commodity combinations with greatest public health

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concern (FAO/WHO, 2008). The role of food handlers in NoV transmission has been illustrated by numerous outbreak investigations (Koopmans, von Bonsdroff, Vinjé, de Medici, & Monroe, 2002). Long-term shedding of viruses by either asymptomatically or symptomatically infected food handlers may easily lead to viral contamination of ready-to-eat products (Boxman, 2013). This is especially true when hand hygiene is insufficient. Hands of food handlers may become contaminated during the shedding of viruses in feces, but also for example during changing diapers, or cleaning toilet areas. The viruses can subsequently be transmitted to food products or surface that has contact with food (Bidawid, Malik, Adegbunrin, Sattar, & Farber, 2004). The education level of food handlers or the presence of certified kitchen managers has been associated with reduced incidence of outbreaks (Hedberg et al., 2006). However, specific educational background on viruses and food safety may be low and differ considerably between people working in catering companies or those working in health care institutions.

Only recently the Codex Alimentarius has finalized guidelines on the application of general principles of food hygiene to the control of viruses in food, giving guidance on how to prevent or minimize the presence of human enteric viruses in food, in particular NoV and hepatitis A virus (FAO/WHO, 2012). The best dissemination of these guidelines would be by incorporation into national guidelines, which may however take some time and requires targeted training.

Therefore, assessing the food handlers' reported behavior, knowledge and awareness of NoV could help identify areas for targeted prevention specifically designed for the different food handler groups. For this reason, the aim of this study was to evaluate reported behavior, knowledge and awareness concerning potential transmission of viral food-borne illness by food handlers to identify gaps in education and training. Face-to-face interviews were conducted using questionnaires among food handlers working in catering companies preparing food for the general population and those in institutional kitchens preparing food for more vulnerable persons. In addition, environmental samples were taken to establish a possible association between determinants of food handlers' reported behavior, knowledge and awareness of NoV and presence of NoV.

2. Materials and methods

2.1. Data collection

2.1.1. Study period and selection of locations

Data for this study was collected between January 2008 and March 2011 in three phases. In the first phase, between January 2008 and March 2009, inspections were performed in a broad range of catering companies, mainly restaurants, by officers of the Dutch Food and Consumer Product Safety Authority (NVWA) in the Netherlands. Data from this year-round NoV prevalence study have been published (Boxman et al., 2011). In the second phase, January 2010–April 2010, and third phase, February 2011–March 2011, inspections were performed in non-hospital and hospital health care institutions, respectively, but also in an equal number of restaurants in their vicinity during the winter seasonal peak of viral gastrointestinal disease only (Table 1).

Non-hospital health care settings included homes for the elderly people (74%) and nursing homes (15%). Hospital settings included central kitchen departments (34%) and de-centralized kitchens (66%). Staff in central kitchen department prepares food which is subsequently distributed to in-patient units, whereas staff, mostly nurses, in decentralized kitchens in in-patient units regenerate food to adequate temperatures and serve drinks.

Table 1
Study phases, periods and number of locations included in study.

Study phase	Period	Catering companies[a]	Institutional settings[b]
Phase 1	January 2008–March 2009	900	26
Phase 2	January 2010–April 2010	71	75
Phase 3	February 2011–March 2011	52	154
Total		*1023*	*255*

[a] Catering companies: i.e. restaurants mainly, but e.g. some take-away companies and canteens were included in 2008–2009.
[b] Institutional settings: i.e. hospital departments in 2011 and non-hospital health care settings in 2008–2009 and 2010.

Food handlers both in catering companies as well as in institutional settings, kitchen supervisors or company owners present at the time of the visit were questioned during a face-to-face interview, using a structured questionnaire. In addition, environmental swabs were collected from each location to test for the presence of viral RNA.

2.1.2. Questionnaire topics

The following 24 questions covering 5 topics were included in the questionnaire (see Table 2, column 1):

a) Intention of employer and employee to continue working while ill
   - Question 1: Have you ever been sick or felt sick while working? Yes/No
   - Question 2: If yes, what were the symptoms? None or non-GE/GE/combination
   - Question 3: Would you continue to work while experiencing GE symptoms, like diarrhea? Yes/No
   - Question 4: Would you continue to work while experiencing GE symptoms, like vomiting? Yes/No
   - Question 5: What do you do after being notified of GE symptoms in one of your employers or colleagues? Let food handler work/Send food handler home
   - Question 6: What do you do after being notified of GE symptoms in your employees' or colleagues' family? Let food handler work/Send food handler home

b) Knowledge of disease and infectivity and awareness of GE viruses
   - Question 7: How long do you think a person is still infectious after recovery of GE symptoms? 1–2 days/3–7 days/7–14 days
   - Question 8: Do you think that vomit is infectious material? Yes/No
   - Question 17: Have you ever heard of GE caused by infection with a virus? Yes/No
   - Question 18: Have you ever heard of NoV? Yes/No

c) Facilities available and personal hygiene;
   - Question 9: Is there a separate bathroom for the staff and the clients in your company? Yes/No
   - Question 10: Does the personnel bathroom have hand washing facilities? Yes/No/No, but close to bathroom (Close)
   - Question 11: What is used to dry hands after using the bathroom? Blower/re-usable cloth towel/single use paper towel
   - Question 12: Is hand washing instruction given to new workers? Yes/No
   - Question 25: Who uses the personnel bathroom that was sampled? Kitchen personnel/health care worker/kitchen personnel and health care worker/everyone including patients

d) Cleaning and disinfection;
   - Question 13: Which cleaning products do you use for the kitchen (surfaces, door knobs)? Normal cleaning product