

THE PREVENTION AND CONTROL OF NOROVIRUS GASTROENTERITIS

A guide book for nursing students

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Awaguli·Paerhati 1702505
Na Wei 1702506
Lijie Shi 1702507

Abstract

<p>Authors</p> <p>Awaguli Paerhati 1702505 Na Wei 1702506 Lijie Shi 1702507</p>	<p>Type of publication</p> <p>Bachelor's thesis</p>	<p>Published</p> <p>Autumn 2019</p>
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<p>Name of Degree</p> <p>Bachelor of Health Care</p>		
<p>Abstract</p> <p>Norovirus is one of the most important cause of human gastroenteritis outbreaks. In the past decades Norovirus has been dramatically affecting the population's health. In most of the developed countries, Norovirus is considered as the cause of acute gastroenteritis in the all age group and the main cause of foodborne illness. Majority of the norovirus outbreaks occur in health care settings (including long-term care facilities and hospitals), where the virus is predominantly spread from person to person.</p> <p>This guideline is for help to control the spread of viral gastroenteritis (norovirus) in the nursing homes or other health care settings and It can be useful learning material in the school.</p> <p>This guidebook can also be used for infection prevention by staff members, physicians, health care epidemiologists, health care administrators, nurses, students, other health care providers, and persons who are responsible for developing, implementing, and evaluating infection prevention and control programs for health care settings. The document can also be used as a resource for societies and organizations that wish to develop more implementation guidance for prevention and control of norovirus gastroenteritis outbreaks in the long-term care or other health care settings.</p> <p>This is a function framework thesis based on our theoretical findings as well as following the principles of the Medical Education Guide to create our guide for Norovirus Prevention and Control Guide, the document contains clear and comprehensive information which is easy to understand.</p>		
<p>Keywords</p> <p>prevention and control of Norovirus gastroenteritis, nursing home, guidance for Norovirus gastroenteritis, elderly people, Norovirus outbreaks, nursing student.</p>		

Tiivistelmä

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Julkaisun otsikko Noroviruksen aiheuttaman gastroenteriitin ennalta ehkäiseminen ja valvonta Opas sairaanhoitajaopiskelijoille		
Tutkinto Sosiaali- ja terveystieteiden ammattikorkeakoulututkinto		
Tiivistelmä Norovirus on yksi yleisimmistä syistä ihmisen gastroenteriitin puhkeamiseen. Norovirus on viime vuosikymmeninä vaikuttanut dramaattisesti väestön terveyteen. Useimmissa kehittyneissä maissa norovirus tunnetaan nykyään iäkkäiden akuutin maha-enteriitin ja elintarvikkeiden kautta leviävän taudin suurimpana syynä. Suurin osa norovirusepidemioista esiintyy terveydenhuoltoympäristöissä (mukaan lukien pitkäaikaishoidot ja sairaalat), joissa virus leviää pääosin henkilöiden välillä. Tämä ohje on tarkoitettu viruksen gastroenteriitin (noroviruksen) leviämisen hallintaan hoitokodeissa tai muissa terveydenhuollon ympäristöissä. Oppaan tavoitteena on antaa hoitotyön opiskelijoille erityisiä tietoja noroviruksesta, yksinkertaisin ohjein. Se voi olla myös hyödyllinen oppimateriaali koulussa. Tätä opasta voivat käyttää myös infektioiden ehkäisyyn henkilökunnan jäsenet, lääkärit, terveydenhuollon epidemiologit, terveydenhuollon hallinnot, sairaanhoitajat, opiskelijat, muut terveydenhuollon tarjoajat ja henkilöt, joiden tehtävänä on kehittää, toteuttaa ja arvioida tartuntojen ehkäisy- ja torjuntaohjelmia terveydenhuollon aloille. Opasta voidaan käyttää myös resurssina yhteiskunnille ja organisaatioille, jotka haluavat kehittää täytöntöönpano-ohjeita noroviruksen maha-suolitulehduksen puhkeamisen ehkäisemiseksi ja torjumiseksi pitkäaikaishoidossa tai muissa terveydenhuollon ympäristöissä. Tämä opinnäytetyö on tutkielma, joka perustuu teoreettisiin havaintoihimme ja lääketieteellisiin tutkimuksiin. Tulos on Noroviruksen ehkäisy ja valvonta opas. Luotu opas sisältää selkeää ja helposti ymmärrettävää tietoa.		
Asiasanat Norovirusgastroenteriitin ehkäiseminen, Norovirusgastroenteriitin valvonta, hoitokoti, ohjeet Norovirusgastroenteriitille, vanhuksille, Norovirus-puhkeamiset, sairaanhoitajaopiskelija.		

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1 INTRODUCTION

Norovirus, an RNA virus of the family *Caliciviridae*, is a human enteropathogenic. Noroviruses are now recognized as the leading cause of acute gastroenteritis across the age spectrum. Norovirus is one of the main reasons causing gastroenteritis throughout in all ages. New global estimates that one of the burdens of Norovirus disease highlights the potential targets of the most affected specific populations and prevention strategies. In the past decades Norovirus has been dramatically affecting the population of the health.

(Robilotti, Deresinski & Pinsky. 2015, 135)

In most of the developed countries, Norovirus is now known as a cause of acute gastroenteritis in the age range and the leading cause of foodborne disease, including outbreaks. The World Health Organization already estimated that noroviruses caused 684 million illnesses and more than 200,000 deaths globally in 2010. (Kirk et al. 2015.)

For instance, The U.S. Centers for Disease Control and Prevention (CDC) estimates that Norovirus causes approximately 21 million cases of acute gastroenteritis each year, responsible for 400,000 emergency department visits, approximately 71,000 hospitalizations because these numbers only come from patients who seek medical attention for viral gastroenteritis symptoms. (Robilotti et al. 2015, 135-140.)

Indeed, by the decline in rotavirus disease after the introduction of the vaccine in 2006, Norovirus has replaced rotavirus as the main cause of severe gastroenteritis in children under 5 years of age in the United States. However, from a global perspective, the largest public health burden caused by Norovirus is undoubtedly an effect more of the developing countries, where diarrhea diseases remain the leading cause of death. According to the recent years of systematic review, it concluded that Norovirus is associated with 18% of acute gastroenteritis worldwide. Of the 175 studies included in the review, 147 studies (84%) have been published since 2008, of which 94 (64%) were made in developing countries. Although specific data on the incidence and disease burden of Norovirus in these countries are limited, some studies have shown that in all cases, norovirus detection may have no causal relationship with disease. (Lopman, Atmar, Baric, Estes, Green, Glass, Hall, Iturriza-Gómara, Kang, Lee, Hopkins, Parashar, Riddle & Vinjé 2015, 3.)

Elderly people are potentially having a high risk of norovirus illness due to the frequent outbreaks of long-term care facilities (LTCFs) and severe health outcomes following infection. Norovirus related hospitalization rates were higher, more severe, and required longer hospitalization and higher costs than among younger patients. Norovirus prevention for older adults is of crucial importance. It is challenging and difficult to prevent norovirus in

long-term health care settings because the prevalence of the Norovirus infection in the community is higher. Persons may spread the virus without being ill, and transmission occurs, just not only through direct or indirect person-to-person contact, but also through food, water, aerosols and surfaces. (Yingxin, Hall & Kirk. 2017.)

The purpose of this guideline is to help control the spreading of viral gastroenteritis (norovirus) and to address the prevention and control of the Norovirus outbreaks in nursing homes and other health care settings.

The aim is to give specific recommendations for implementation, performance measurement and monitoring. Also, it will provide the best interventions to prevent or reduce outbreaks of the Norovirus gastroenteritis in the long-term and health care settings. It can be a useful learning material in schools or to other health care providers, and persons who are responsible for improving, implementing, and evaluating infection prevention and control programs for health care settings.

2 DEFINITION OF NOROVIRUS GASTROENTERITIS

According to the American Society for Microbiology, Norovirus, an RNA virus of the family Caliciviridae, is a human enteric pathogen that causes substantial morbidity across both health care and community settings (Robilotti et al. 2015, 135). Human norovirus, first be found, using an immune electron microscope, a 27-nanometer particle was found in the stool of a patient with norovirus infection in Ohio. (Albert, Richard, Raphael, Thomas, Anthony, & Robert. 1972, 1075–1081). The outbreaks of noroviruses usually take place in hospitals, nursing homes, schools, and nurseries (Green 2007, 949–979). They belong to the caliciviridae family. Until now, norovirus has been found to have 5 viral gene clusters, among which GI, GII and GIV are the 3 viruses that are confirmed to affect human beings. 95% of human infections are caused by the GII genome. There are more than 25 different genotypes in three human population, and new genotypes will appear every 2-3 years. (National Collaborating Centre for Infectious Diseases 2018.)

Most norovirus outbreaks occur in health care settings (including long-term care facilities and hospitals), where the virus is predominantly spread from person to person. (Hall, Wikswo, Manikonda, Roberts, Yoder, & Gould LH. 2013, 1305-1309). The incubation period of norovirus gastroenteritis is 24–48 h and the typical symptoms include vomiting, diarrhea, low fever, abdominal pain, and nausea that usually persist 12–60 h. (Kaplan, Feldman, Campbell, Lookabaugh, & Gary 1982, 1329-1332.) Because Norovirus is ubiquitous all over the world, it can infect people of all ages and can develop multiple times in a person's life. One study showed that Norovirus gastroenteritis has a large economic burden and is likely to outweigh other diseases of concern. (Bartsch, Lopman, Ozawa, & Hall. 2016, 1-16.)

3 EMERGENCE OF NOROVIRUS GASTROENTERITIS

Most outbreaks of gastroenteritis in humans are caused by norovirus. Gastroenteritis caused by norovirus is a foodborne illness that spreads and erupts through contaminated food. (National Collaborating Centre for Infectious Diseases 2018)

In 1968, gastroenteritis broke out in a school in Ohio, Norwalk, USA. In feces samples of infected students and contacts, researchers found a small round virus particle, namely Norwalk virus. Initially, researchers used an electron microscope to analyze the shape and structure of Norwalk virus. (Okada, Sekine, Ando, Hayashi, Murao, Yabuuchi, Miki & Ohashi 1990, 28.) In 1990, researchers of the CDC Atlanta sequenced norovirus genes and found the diversity of the Norwalk-like virus (Ando, Noel & Fankhauser 2000, 336-348). After that, International Committee on Taxonomy of Viruses decided to officially name it norovirus and classify it into Caliciviridae family (L'Homme, Sansregret, Plante-Fortier, Lamontagne, Ouardani, Lacroix & Simard 2009, 66-75).

4 TRANSMISSION OF NOROVIRUS GASTROENTERITIS

Norovirus transmission route is from person to person, through contaminated objects, such as contaminated food or contaminated water. Dissemination between people can be spread through the fecal-oral route, or round about exposed to the surroundings polluted by excreta. Food transmission means eating norovirus contaminated foods, such as foods that are contaminated with Noroviruses during production, transportation, or because food-borne workers infected with Norovirus contaminated food during preparation or cooking. Intaking shellfish such as oysters, fruits and vegetables are particularly prone to the outbreak of Norovirus. Water transmission can be caused by pollution of any kinds of water sources, such as bottled water, well water and other drinking. Outbreaks do not always only have a single route of transmission, often caused by a combination of causes. (Centers for Disease Control and Prevention 2018)

Norovirus has a distinct seasonality and is always called "winter vomiting disease." According to a systematic review published in 2013, 78.9% of norovirus gastroenteritis worldwide and 71.0% of disease outbreaks are now in the cold season, with 52.7% of norovirus gastroenteritis and 41.2% of disease outbreaks occurring in winter. (Ahmed, Lopman & Levy 2013, 3-4.)

5 RISK FACTORS FOR NOROVIRUS GASTROENTERITIS

According to research and analysis, the risk factors for Norovirus outbreaks are eating or drinking, hygiene situation, environment and isolation conditions, cleaning and sterilization, the ratio between workers and patients, workers-patients contact frequency, resident crowd stationarity and dependence, exposure to contaminated secretions and body fluids, the way of feeding, home competence and another variable. Among these risk factors, workers-patients contact frequency, eating or drinking, resident crowd stationarity and dependence these three factors are the most significant univariate for norovirus gastrointestinal. The main risk factor among worker are contacting the gastroenteritis patient and eating. They include exposure to an environment with a source of infection, extensive and intensity patient contact, whether staff use protective equipment. The main risk factor among residents are resident high mobility and dependency, residents with nasogastric feeding, using diuretics. Other risk factors include the number of residents per room, disinfection with chlorine, food such as thin soup, whipped cream mousse and the staff: patient ratio. (Petrignani, Beek, Borsboom, Richardus & Koopmans 2014,166–177.)

In addition, in a six-year study, feces specimens from gastrointestinal patients were collected by the UK Health Protection Agency from laboratories around England and Wales and provided pathogen data for the study. These samples were from inpatients, community members and people involved in the epidemic. Studies have shown that in addition to *Clostridium difficile*, 20% of the elderly over 65 died of norovirus gastroenteritis during this period. This also shows that norovirus gastroenteritis in the aged population increases the hospitalization rate and mortality rate of the elderly and emphasize that the susceptibility or vulnerability of residents in nursing homes is higher than in other groups. (Harris, Edmunds, Pebody, Brown & Lopman 2008, 1546–1552.)

6 SYMPTOMS OF NOROVIRUS GASTROENTERITIS

Norovirus has a relatively short incubation period of 10 to 72 hours, usually 12 to 48 hours. The most common symptoms of Norovirus gastrointestinal are diarrhea and vomiting, followed by nausea and muscle aches, headache, fever, chills and abdominal pain. (Office of Public Health 2010, 1.) The disease usually resolves within 48 hours, but sometimes the symptoms last for up to 3 days. A study showed that elderly people and patients with underlying diseases recover slowly. The results showed that 40% of the elderly over 85 years did not completely recover after 4 days of the onset. (Götz 2001, 622-628.) The symptoms in the immunosuppressed patients subsided in about 7 days (Schwartz, Vergoulidou, Schreier, Loddenkemper, Reinwald, Schmidt, Flegel, Thiel & Schneider 2011, 3).

A retrospective cohort study of Medicare-certified nursing homes in USA Oregon, Wisconsin, Pennsylvania shows that Norovirus is not just a benign self-limiting disease. Residents of nursing homes continue to rise in hospitalization rates and mortality rates for different reasons during the Norovirus outbreak. Elderly people over the age of 90 is a high-risk group. Their risk of death and hospitalization during the period of Noro is increased by 20% to 30%. The condition of the elderly must be closely observed. If necessary, they should be sent to hospital for treatment on time. In addition, the study also found that in the nursing homes where RN staff were understaffed, with fewer than 0.75 daily RN hours per resident, the risk of elderly death was higher during the outbreak, but the hospitalization rate did not increase. (Trivedi, DeSalvo, Lee, Palumbo, Moll, Curns, Hall, Patel, Parashar & Lopman 2012, 1672-1674.)

7 DIAGNOSIS OF NOROVIRUS GASTROENTERITIS

The diagnosis of norovirus depends on a sample of the patient's vomiting or diarrhea (stool) (National Collaborating Centre for Infectious Diseases 2018) Although norovirus can be detected in rectal swabs and vomitus, whole-stool samples are the preferred clinical specimen for the detection of norovirus because they contain a higher quantity of the virus. Because the rapid spread of norovirus is a major public health problem, rapid laboratory diagnosis is essential to assist in the implementation of appropriate control measures to reduce the spread of the virus and the scale of the outbreak. Enzyme immunoassay (EIAs) and reverse transcriptase PCR are simple and rapid methods for norovirus surveillance. (Vinjé 2015, 373-381.)

Stool or vomit from an infected person can be used as a laboratory sample to diagnose norovirus, and sometimes samples from environmental surfaces can be used to identify norovirus. Specimens will be identified by a variety of methods, including direct microscopy, immunoassay, or PCR identification. (National Collaborating Centre for Infectious Diseases 2018)

8 TREATMENT OF NOROVIRUS GASTROENTERITIS

Gastroenteritis caused by norovirus infection is a self-limited disease with no specific treatment. Treatment of gastroenteritis caused by norovirus infection is usually supportive. Fluid loss due to vomiting and diarrhea can be achieved through oral rehydration or, in the most severe cases, intravenous medication to maintain fluid and electrolyte balance in the body. Anti-emetic drugs are also available to children and adults older than 3, and some patients may benefit. For adult patients, antiemetic agents can also be used for antiemetic treatment. Notably, antibiotics do not work in norovirus patients. (National Collaborating Centre for Infectious Diseases 2018)

Norovirus outbreaks were associated with significant concurrent increases in all-cause hospitalization and mortality in nursing homes (Trivedi et al. 2012, 1668-1675).

9 PREVENTION AND CONTROL OF NOROVIRUS GASTROENTERITIS

9.1 Nurse's self-protection

Before the common outbreak of Norovirus every year, or when a small number of infections occur, nurses should be offered courses or training on the prevention and management of Norovirus (Maccannell, Umscheid, Agarwal, Lee, Kuntz & Stevenson 2011, 17). In a study, nursing students performed prevention and control of cross-infection based on MRSA and Norovirus cases set by the teacher. The study compared three different teaching ways; scenario-based learning teams with and without simulation training and teacher. The finding shows that Random events in the scenario-based simulation training enabled students to memorize the details. After the simulation feedback and analysis with teachers, the students have a much better understanding of how to manage cross-infection in the case. (Mikkelsen, Reime & Harris 2008, 664-671.)

According to a finding of Nationally Representative Survey of U.S. Adults, American food-borne diseases are mainly caused by Norovirus, but American adult consumers know very little about Norovirus. 85% of the respondents said they have heard of Norovirus, but they don't know how to prevent and control Norovirus. They don't know how norovirus spreads. Many people mistakenly believe that meat and fowl are the communication way of Norovirus. Therefore, it is very necessary to provide people with the correct Norovirus related education. In addition to work staff, patients and visitors also should be provided the education about how to identify Norovirus symptoms, virus transmission Ways, self-protection, prevention of cross-infection. (Cates, Kosa, Brophy, Hall & Fraser 2015, 484-490.)

During the Norovirus outbreaks controlling time, the nurse has an essential role in the hospital and other health care settings. The spread ways of Norovirus except from person to person, fecal mouth, it also may spread by airborne route. Therefore, exposure prevention measures are not enough. It cannot completely prevent the spread of the virus to patients and medical staff. Thus, precautions that prevent airborne spread of norovirus are also important. (Laetitia, Rémi, Allison, Nathalie, Marc, Yves, Julie & Caroline 2015, 299-304.) If the risk to the employee's work cannot be eliminated through technology, during a procedure of health care, the employee must use Personal Protective Equipment (PPE). Personal protective equipment can prevent the health of workers injured during the work. Properly used PPE will safeguard the staff's health. (Occupational Safety and Health authority in Finland 2019.) Therefore, when nurses enter areas suspected of being infected with Norovirus, in order to reduce the risk of possible occupational exposure, such as exposure to infectious feces, vomit, etc., PPE should be used according to exposure and

standard precautions, including robe, gloves, masks, etc. When caring for patients infected with Norovirus, if the patient has vomiting symptoms, nurses should use surgical or procedure mask and eye protection or a full-face shield to protect themselves. (Maccanell et al. 2011, 15-34.) A mask (surgical type, fluid repellent paper filter mask) should be taken when there is potential for aerosol dissemination. Surgical face masks provide enough protection against droplet transmission of noroviruses. other respiratory protection to prevent infection it also recommended; it can significantly reduce subsequent illness in staff. Gowns and Eyewear Protective should be worn, impermeable gowns or plastic aprons should be taken if potential have about splashing, splattering and spraying of vomit or feces. gowns and plastic aprons will protect clothing and skin from contaminated area. if nurses do not follow this rule it is going to further spread instead of controlling. (Guidelines for the public health management of gastroenteritis outbreaks due to norovirus or suspected viral agents in Australia 2010.)

Hand hygiene should be carried out at all the time. effective handwashing, it can reduce due to gastroenteritis and environmental contamination with norovirus.⁹³ Disposable gloves should be taken if having direct contact with patient, If, gloves are not available, it is need to hands be washed immediately after any contact with patient. According to the Hand Hygiene Australia's Five steps for hand hygiene, health professionals need to follow these steps: before contacting the patient, before doing intervention, after an intervention or risk of the body fluid contact, after contact with the patient, after touching the patient's surroundings. (Guidelines for the public health management of gastroenteritis outbreaks due to norovirus or suspected viral agents in Australia 2010.)

During the outbreak of norovirus gastroenteritis, the incidence of patients in a hospital in Switzerland was 13.9%, and the incidence of medical staff was 29.5%. The total loss of productivity due to work stuff's sick leave is \$12,807. (Zingg, Colombo, Jucker, Bossart & Rue 2005, 263-267.) When nursing students have symptoms of Norovirus infection, sick leave policies for medical stuff also applies to nursing students. The Centers for Disease Control and Prevention (2018) recommends, stop all nursing practicing work for at least 48 hours after the symptoms have completely disappeared. When the nurses recover and return to practicing work, special attention should be paid to hand disinfection before and after exposure to the patient and self-protection.

9.2 The isolation of patients

A study found that anatomical division of infected patients at the beginning and end of Norovirus outbreaks can improve the efficiency of health care institutions in managing epidemics and reduce operational disruption (Haill, Newell, Ford, Whitley, Cox, Wallis, Best &

Jenks 2012, 30-35). Therefore, patients with symptoms of Norovirus infection should be immediately placed in a single room. Contact precautions should be taken. If patients are temporarily unable to be placed in a single room, they should be separated from asymptomatic patients. In addition, in order to reduce the spread of Norovirus, the movement of the patient within the unit should be minimized, unless it is necessary for the care or treatment during the outbreak of Norovirus gastroenteritis. Group activities, such as meal events should also be suspended. Meals should be provided to the patients' rooms and the patients have a meal in their own rooms. (Maccannell et al. 2011, 12-29.)

During the outbreak, the patient needs to be isolated for at least 48 hours after the resolution of symptoms. For patients with several diseases or complications, such as kidney disease, cardiovascular disease, and immune system diseases, it may be necessary to take long-term isolation according to clinical diagnosis and patient's condition. Because their symptoms of diarrhea and viral shedding last a longer period that leads to prolonged disease course. (Maccannell et al. 2011, 29.) Cases have shown that patients with impaired immune function or underlying disease can be infected for up to several months after being infected with Norovirus. One HIV-infected person has persistent diarrhea during hospitalization, norovirus shedding more than 3 months and lead to nosocomial infections. In other patients with leukemia or primary immunodeficiency, patients receiving immunosuppressive therapy and patients with underlying disease show a prolonged period of symptoms and virus shedding after Norovirus infection. (Siebenga, Beersma, Vennema, Biezen, Hartwig & Koopmans 2008, 994-1001; Tominari, Shimamoto, Taniguchi, Taniguchi & Shirasaka 2011, 249-252.) Besides, the duration of viral excretion is related to the age of the patient. In nursing home, patients over the age of 60 have a relatively longer viral excretion time (Lai, Wang, Wu, Hung, Jiang & Wu 2012, 96-101).

The preferred person to care for a symptomatic patient is the staff who has recently recovered from Norovirus infection. According to the study finding, the average duration of immunization after infection with Norovirus is from \approx 4 to 8 years. (Simmons, Gambhir, Leon & Lopman 2013, 1260-1267.)

9.3 Hand hygiene

According to the world health organization's guidelines on hand hygiene, there is ample evidence that hand disinfection can stick to health-related pathogens. (WHO Guidelines on Hand Hygiene in Health Care, 2009). Outbreaks of norovirus in medical Settings can result in significant economic and social costs. Current control measures for norovirus are mostly based on general infection control principles. In recent centuries, the standard of personal hygiene accepted by all religions and cultures has been washing hands with

soap and water. Hand antiseptics reduce the incidence of healthcare associated infections. (Guideline for Hand Hygiene in Health-Care Settings 2002.)

According to descriptive data, correct hand hygiene is the control pathway to block norovirus transmission during a norovirus outbreak. Soap and tap water are recommended for at least 20 seconds after contact with a confirmed or suspected case. An experimental study of norovirus hand contamination found that liquid soap and water wash were superior to ethanol fungicides. For hands contaminated with feces, a high concentration of ethanol-based hand rubbing is recommended, rather than products containing propanol-1-ol. However, the inactivation of specific human norovirus by various common cleaning and disinfection products requires further study. (Robilotti et al. 2015, 134-164.)

WHO guidelines on hand hygiene advise health workers to use medical gloves. The rational use of medical gloves can reduce the risk of contamination of the hands of health workers by blood and other body fluids, as well as the risk of transmission of pathogens. It is important to note that improper use of gloves increases the risk of pathogen transmission and infection. (Guideline for Hand Hygiene in Health-Care Settings 2002.)

9.4 Environmental management

The persistence of norovirus in the environment has been reported in a number of Settings, including health care Settings, food and preparation sites. The type and use of disinfectant have an effect on the killing effect of virus. A solution of hypochlorite (bleach) with a concentration of at least 1000ppm is recommended for appropriate times as the preferred disinfectant for contaminated surfaces and objects.

In norovirus contaminated environments, such as a patient's bathroom, desk, chair, computer, and bedpan, contact surfaces that need to be disinfected. Carpets, curtains and clothes need to be washed and disinfected. Patients' waste requires special disposal. (Robilotti et al. 2015, 134-164.)

The fecal-oral route is the primary mode of transmission of norovirus. Viruses in feces or vomit are transmitted through food, water and environmental contamination. Because norovirus can persist in the environment, complicating thorough disinfection, recurring outbreaks of norovirus can occur. (Robilotti et al. 2015, 134-164.)

The use of waste stabilization tanks, activated sludge, or submerged membrane bioreactors can be used to remove and reduce norovirus from the sleeping system. In addition, insufficient chlorination has been associated with some outbreaks. Sodium bicarbonate

and chlorine are used to improve the safety of food production and reduce the contamination of food by viruses. In the medical environment, human-to-human transmission is the primary mode of transmission of norovirus, occurring between patients and staff. The three main strategies for preventing and controlling norovirus include staff and patient policy development, hand disinfection and appropriate environmental disinfection. In the event of a norovirus outbreak in a medical setting, sick health care workers will be furloughed. Staff are generally prohibited from returning to work within 48 to 72 hours after symptoms disappear. (Robilotti et al. 2015, 134-164.)

9.5 Food safety management

According to The Food-borne Disease Outbreak Surveillance System (FDOSS) collected information from the local health departments about food borne disease outbreaks, when outbreaks happen in which two or more people get the same disease from the same contaminated food or drink. Outbreaks provide more important information about germs and how they are spread and from which foods, than we can easily prevent food poisoning. Transmission about these viruses is basically from person to person, but most of the examples showed that NV are efficiently transmitted in food, water and contaminated environmental surfaces. (Centers for disease control and prevention 2018.)

During the controlling and prevention of Norovirus illness food safety management is an important procedure and it needs good cooperation with each team that related to food and snack shops and food suppliers, selling food place employees (convenience stores, bars, restaurants, community, etc.), provided to the nursing home, kindergarten and church kitchen staff, cooking family service personnel service, also including food vending machine company's employees, increase the awareness of the health management of food workers, if workers with acute gastroenteritis or concealed infections must report to the food safety management personnel of the unit and should be temporarily removed from the post and isolated. (Centers for disease control and prevention 2018.)

In terms of preparing the food it needs well washed fruits and vegetables, high-risk foods should be thoroughly cooked. Sick babies and children or elderly people should be kept away from areas where food is handled and prepared. For facilities, equipment and environments should be cleaned and disinfected. Cross-contamination also should be avoided at all process of the meal, making sure that toxic and toxic chemicals are correctly identified in non-public areas. (Rönnqvist, Aho, Mikkilä, Ranta, Tuominen, Rättö, & Maunula 2014, 5408-5409).

9.6 Health education

Education should be promoted during outbreaks. Norovirus outbreaks can occur in a range of different institutional settings. Providing education to the staff members, patients, and visitors, for the public use media education and internet info on the TV and at the different place give more information about Norovirus symptoms, report all outbreaks of acute gastroenteritis in the appropriate local or state health departments and provide methods of preventing infection. (Guideline for the Prevention and Control of Norovirus Gastroenteritis Outbreaks in Healthcare Settings 2011).

Giving demonstration about improved hand hygiene and surface disinfection and avoiding contaminated food and water that can help control and prevent on the TV and public places. (Aron et al. 2011).

10 CREATING A GOOD GUIDEBOOK

Guidebook writing requires the author to have the ability to summarize source information, and to analyze independently from the information, draw conclusions, and simplify the most important and practical content. When the guide is written, the language must be concise, easy to read and maintain context consistency. Writing is also required to be grammatically correct, and unnecessary noun-verb combinations, and the participles over-using should be avoided in the guide. (Lahti University of Applied Sciences Ltd 2018, 13.)

The content of a good guide must be closely related to the topic. The content of the guide must ensure authenticity and accuracy. The reference must be authoritative. The structure of the guide should also pay attention to coherence. The structure of the full text should be orderly and logically reasonable. In the order of the paragraphs, prioritize the most important parts. Use paragraphs and subtitles to clearly separate each paragraph. Select words according to the reader using as much as possible appropriate words. And give reasonable guidance and advice in the guidebook: What is the purpose and significance of this guide? What are the benefits that users will receive? (Hyvärinen 2005, 1769-1772.)

In addition, a good guidebook must be practical and attractive. First, the target audience must be identified. Then understand their special identities, including gender difference, race, nationality, religion, behavioral feature, civilization, comprehending capacity, and understandings of knowledge, and choose the best method to convey information to the users. Based on this information, the content and layout of the guides are organized so that the target audience understands and remembers the guide information, so that they will carry out according to the guidebook. Attractive guides should be well illustrated, usually using font size 8 and 12 points. The font size at least 2 points larger than the main text can be used to title. And choose the appropriate font style. Besides, use high quality visuals and show the best visual effects for user. In the typography, using columns to make the text more comfortable and clearer visually and understand. (Centers for Disease Control and Prevention 2009, 1-43.)

11 METHODOLOGY OF GUIDEBOOK ABOUT THE PREVENTION AND CONTROL OF NOROVIRUS GASTROENTERITIS GUIDE

11.1 Data search, review and collection

During the spring clinical practice, members of the paper team learned about the outbreak of norovirus in some nursing homes in Finland. We think it is necessary to improve the understanding of norovirus among nursing students in school so that norovirus can be well prevented and controlled in hospitals or nursing homes. Therefore, our team established the thesis topic of prevention and control of norovirus gastroenteritis.

We created a practical paper. We collected data from Google scholar, PubMed and related books to collate knowledge about norovirus. We search for keywords related to the topic are used for data search.

Keywords related to the topic are used for data search:

- prevention and control of Norovirus gastroenteritis
- nursing home
- guidance for Norovirus gastroenteritis
- elderly people, Norovirus outbreaks
- a nursing student

Organize knowledge about Noroviruses, including Norovirus findings, post-infection symptoms, diagnostic methods, routes of transmission, epidemiology, prevention and treatment, and self-protection.

11.2 Functional framework thesis

We follow the principles of the Medical Education Guide to create our guide for the Norovirus Prevention and Control Guide. This guide will be provided free of charge to students in the nursing profession or nurses in clinical work. They can use the electronic guide or print them themselves.

Throughout the creation of the paper, we applied scientific methods, mainly PDSA (plan, execution, research, behavior) cycles and the model for improvement.

The four stages of the PDSA cycle are:

- Plan – the change to be tested or implemented
- Do – carry out the test or change

- Study – based on the measurable outcomes agreed before starting out, collect data. Before and after the change and reflect on the impact of the change and what was learned
- Act – plan the next change cycle or full implementation. (Online library of Quality, Service Improvement and Redesign tools Plan, Do, Study, Act (PDSA) cycles and the model for improvement, 1-8)

We use the PDSA cycle to modify and refine the content of the paper.

DATE	PLAN	DO	STUDY	ACT
Jan-19	Started the paper preparation work.	Determined the paper team members, find the paper advisor.	Read the paper guide, study the paper creation method. Learn about the ethical requirements of the paper.	Think about the type of paper you are going to create, the literature review
Feb-19	We discussed the topic of the paper, asthma.	We established the framework of the paper, assigned tasks, and began to search for information.	Considering from the information we found, it was not enough to support us to create the paper well. We felt difficult to create the paper.	We asked the teacher to rethink and create a new paper.
Mar-19	After discussion with our teacher, we decided to change the form of the paper and create a guide book for norovirus.	We recreate the paper and assign tasks.	We collect data and create papers.	I completed the first part of the paper as planned, the background part of norovirus.
Apr-19	Discuss the progress of the paper and the parts that need to be modified with the advisor.	Modify the paper frame, continue to assign tasks to create the paper.	We collect data and create papers.	We modified the introduction of the paper to create a section on norovirus prevention and control.

May-19	We study other students' paper creation.	We modify the framework of the paper, modify the writing of the cited literature, modify the writing of the references	Collect methods for creating medical guidelines.	We created draft guidelines for norovirus, the English version.
Jun-19	The paper is not complete enough and needs to be expanded.	We relearned how to create a medical guide to continue to supplement and revise the paper.	We continue to collect data to complete the paper and examine the ethical requirements of the paper.	We created a Finnish version of the norovirus guide. We sent the guide to the teacher and got the teacher's feedback.
Jul-19	The paper is not complete enough and needs to be expanded.	We continue to revise and supplement the paper.	We continue to collect data to complete the paper.	We sent the guidelines to the nurse students and got feedback from the nurse students.
Aug-19	Revise the paper according to the feedback from teachers and students.	We continue to revise and supplement the paper.	We continue to collect data to complete the paper.	We created the essay writing process section.
Sep-19	Complete the entire paper.	We continue to revise and supplement the paper.	Refer to paper guide, ethical principles, details modification.	Create the discussion section of the paper and modify the content of the guide.
Oct-19	Finish uploading the final version of the paper	Send the paper to the language tutor for feedback.	Prepare thesis maturity test and thesis defense.	The thesis is complete.

11.3 Thesis ethics and reliability

Before the thesis creation, we carefully read and discussed Ethical Recommendations for Thesis Writing at Universities of Applied Sciences. The goal of this rule is to help our the-

sis writing process, promote responsible research behavior, prevent cheating in the research, and improve the quality of the thesis. Meanwhile, in the process of thesis creation, we repeatedly use the questions of the Student's checklist in the Ethical guidelines for the thesis work to check whether our thesis conforms to the Ethical principles.

1. I have ascertained my possible conflicts of interest
2. I have acquainted myself with the topic of my thesis
3. I have, together with my supervisor, ascertained the resources required by my work
4. I have acquainted myself with the guidelines of research ethics
5. I have acquainted myself with the principles linked with the handling of personal information and data protection and the instructions from my university of applied sciences.
6. I have ascertained together with my supervisor if my thesis requires an ethical advance evaluation and/or research permit, and if needed, I have taken care of these
7. I have signed the required agreements together with my supervisor and my collaborative partners
8. The authorship of my thesis and possible other publications connected with my thesis has been agreed upon
9. Storage and usage rights of the materials for my thesis have been agreed upon in a manner accepted by all parties
10. I have reported on the funding and other significant linkages connected with my thesis
11. I am aware that my thesis will be examined in a plagiarism identification system
12. I understand that my thesis is a public document
13. I have a right to a high-quality thesis process.

These 13 questions provide us with a simple and easy way to check.

In the paper creation, we strictly follow Ethical Recommendations for Thesis Writing at Universities of Applied Sciences, and collect data by scientific research methods, which is in line with the moral standards. Our paper is ethical and honest.

11.4 Implementing the guide

Based on our theoretical findings, we created an A4 size paper, two pages of three origami as our guide product form. We think this form is convenient to use. We tried a variety of colors (red, yellow, green, blue, etc.) and finally chose the title and icon of the guide in blue font, which can help readers read calmly. The text part uses the bold and black font, the text looks clearer at a glance. The guide also uses simple pictures, which are in the form of pictures to better understand the text and have no copyright issues.

The language is simple and easy to understand, the overall layout is lively and comfortable, the color is lively and rigorous. The guidelines are designed to help students or nurses prevent and control norovirus in their clinical practice or work. These guidelines are for Finnish nursing students or nurses, and we translated them into Finnish. Due to our limited Finnish proficiency, we have also asked some professional teachers for help, so there may still be some language problems. For this, we are deeply sorry.

11.5 Evaluating the guidebook

We decided to collect feedback from our health care professional nursing teacher and nursing students at Lahti University of Applied Sciences. We collected feedback from seven different people, one of whom was a health care professional nursing teacher and the other six were nursing students. To appreciate participants' privacy it was promised, the feedback to be destroyed when the summary had been done.

From <Opinnäytetyön ohje ammattikorkeakoulututkinto > (Lahti University of Applied Sciences Ltd 2018, 13), < Millainen on toimiva potilasohje? > (Hyvärinen 2005, 1769-1772), < Simply put a guide for creating easy-to-understand materials > (Centers for Disease Control and Prevention 2009, 1-43), we have summarized the essential elements of a good guidebook, and listed some relative questions. These questions mentioned the appearance, layout, font, the practicality of the guidebook, the comprehensiveness of the content, the correctness of the language and its ease of understanding, the simplicity and logic of the guide language. We emailed our guidebook and these questions to the participants, then collated the feedback from their answers. Turning to the feedback of guidebook, almost all responses are positive. According to the feedback, the guide is not only concise but also including clear and comprehensive information for their needs. The paragraphs of the guide are reasonably arranged and logical. In additions, it is educational, practical, and the content is well summarized. In particular, the images and layouts clearly

show the information that users need to know are the most important. The font size and color are well organized. Even if there is an international nursing student, she also can understand the content of the guidebook through pictures and simple text.

A suggestion from a participant is that there are several medical words that are not particularly precise. Therefore, we asked the Finnish teacher at Lahti University of Applied Sciences to help. She helped us modify and improve this part. Another comment was that they hoped the images could be more interesting and vivid. However, because most of the images need the author's authorization, the copyright issue for us is complicated to obtain, so we did not change the images.

12 DISCUSSION

Worldwide, norovirus is the main reason of the gastroenteritis outbreak, this illness is based on the different level, type, and severity effecting and changing, at the end impacts and the global burden of deaths and illness to the generation to generation, across the region, countries and communities. Foodborne disease affects all ages, especially under 5 years old children and elderly persons who are living in low-income subregions of the world. (Miyagishima 2015). Norovirus is estimated to cause approximately 200,000 deaths every year worldwide, of which 70,000 or over are among children in developing countries. (Lopaman et al. 2015,3).

Norovirus infections common symptoms include nausea, vomiting, watery diarrhea, abdominal pain, and sometimes loss of taste. Other symptoms are fever, headache and body aches. A person usually develops gastrointestinal symptoms 12 to 48 hours after being exposed to the norovirus. Norovirus spreads easily and quickly in different ways including contaminated food, contaminated water, contaminated surface and sick people (Centers for the disease control, 2018)

As the author reported and described, outbreaks of Norovirus have been significantly increasing in health care and non-health care settings in the past few years, in with this guidebook we help to address both health care institutions, communities and long-term care on preventing and controlling the transmission of Norovirus infections through an evidence-based review. The guidebook also includes specific recommendations for implementation, performance measurement, and monitoring.

The guidebook is intended for use for infection prevention staff members, physicians, health-care epidemiologists, health-care administrators, nurses, students, other health-care providers, and persons who are responsible for developing, implementing, and evaluating infection prevention and control programs for health-care settings. The document can also be used as a source for societies and organizations that wish to develop more implementation guidance for prevention and control of norovirus gastroenteritis outbreaks for health care settings.

The guidebook created clear and comprehensive information. The document is easy to understand and practical. The images and layouts clearly show the most important information and immediately attract the readers' interest. Moreover, the font size and color are well organized. The language is simple and friendly, easy to understand the information.

In the future, nursing students or other health care providers can use this guidebook to get more useful information and educate the public to prevent and control the norovirus outbreaks.

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APPENDICES



**NOROVIRUKSEN
AIHEUTTAMAN
GASTROENTERITIN
ENNALTA
EHKÄSEMINEN**

**Opas
Sairaanhoidaja-
opiskelijoille**

Taudin kuvaus

Norovirus on puhtaasti ihmisten virus, kun taas useimmat muut ripulin aiheuttajat ovat yleisiä myös eläinkunnassa. Norovirus kuuluu kalikiviruksiin. Se aiheuttaa taudin, jonka oireisiin kuuluvat oksennukset, ripuli, vatsakivut ja usein kuume. Se on hyvän hygienian maissa, kuten Suomessa, yleisin äkillisten suolistoinfektioiden aiheuttaja. Tautia esiintyy joka vuosi, mutta vuosittainen vaihtelu on verrattain suurta. Norovirus tauti on yleisin aikuisilla. Norovirus taudin vilkkainta aikaa on tammikuun ja toukokuun välinen aika, ei kesäkausi, kuten useiden muiden ripulitautien.

Oireet

Päänsärky, kuume,
väsymys,
vilunväristykset,
Lihassärky,
ripuli, oksentelu.

Diagnosi

Virus tunnistetaan yleensä geenimonistustekniikalla (PCR-testillä) potilasnäytteestä, vedestä tai ruoasta.

Norovirus taudin tarttuminen ja epidemiat

- ✦ Ensijaisesti juomavedestä tai elintarvikkeista, jotka ovat saastuneet ihmisulosteella.
- ✦ Kypsentämättömistä kasviksista.
- ✦ Tartunnan voi saada myös pinnoilta, joita sairas on koskettanut.
- ✦ Norovirus aiheuttaa epidemioita herkästi myös sairaaloissa ja laitoksissa huolimatta näissä noudatettavasta käsihygieniasta.

Norovirus taudin suojaaminen

Pese kädet usein käsisäippualla 20-30 sekunnin ajan ja vältä koskettamasta suuta.

Käytä usein (valkaisu pohjainen puhdistusaine) esineiden desinfiointiin tarkoitettua puhdistusainetta tai muuta soveltuvaa tuotetta.

Poista ja pese likaantuneet vaatteet ja linavaatteet välittömästi.

Käytä maskia, suojavaateetusta ja käsiä, kun hoidat potilaita vähentääksesi altistusta oksennukselle tai ulosteelle.

Jos olet sairas jää kotiin. Potilastyöstä tulee olla pois 48 tuntia oireiden päättymisen jälkeen.

Oikea käsihygienia on yksi tärkeimmistä tavoista estää noroviruksen leviäminen norovirus-epidemioiden aikana. Saippuaa ja vesijohtovettä suositellaan vähintään 20–30 sekunnin ajan kosketuksesta vahvistetun tai epäillyn tapauksen kanssa. Ulosteen saastuttamat kädet on suositeltavaa pestä etanoliipohjaisella käsienspesuaineella. Käsi-desifiointi allaolevan ohjeistuksen mukaisesti.

KÄYTÄ KÄSIHUUHDETTA KÄSIEN PUHDISTAMISEEN.
PESE KÄDET VEDELLÄ JA SAIPPUALLA, KUN NE OVAT NÄKYVÄSTI LIKAISET.

3 Vaiheet kestävät yhteensä 20–30 sekuntia.



Ota kourallinen huuhdettua vettä ja hiero tasaisesti kaikkialla käsien. Hiero kämmeniä vastakkain.



Laita oikean kämmen vasemman käden selkämyllylle ja hiero sormia liittäen. Laita vasen kämmen oikean käden selkämyllylle ja hiero sormia liittäen. Hiero kämmeniä vastakkain sormet ristissä. Koukista sormet ja hiero niitä yhtä aikaa vastakkaiseen kämmeneen.



Purista peukaloa vastakkaisen käden kämmenellä ja hiero pyörin liikkuen. Hiero sormenselältä edestä kämmeniä vastakkaisista kämmenistä vastan pyörin liikkuen. Käsi on puhtaat ja turvalliset, kun ne ovat kuivuneet.

Maailman terveysjärjestö (WHO) antaa julkaisemansa ohjeistusta WHO:n ohi kukaan vakuutusyhtiö, miksi menä ajamaan. Virustasallin tulomista on arvostaan lajilla. WHO:n missään tapauksessa se kansainvälisen muuttamis- ja työssä ohjeistusta vakuutus.

(WHO:n käsihygieniakuulusteet)

Eristysuojaimien käyttö

roiskevaara huomioidaan.

- Desinfioi kädet
- Pue suojatakki/esiliini
- Pue maski
- Pue suojakäsineet

Vierailu infektion aikana.

- Vierailua oireilevien potilaiden luona vältettävä.
- Mahdollisissa vierailutilanteissa tulee pukeutua suojatakkiin ja käsineisiin (jos potilas oksentelee, on käytettävä maskia ja desinfioitava kädet.) ja käsien desinfiointi.

Osastolla huomioitavat asiat.

- Norovirusinfektio-potilaat sijoitetaan yhden hengen huoneeseen.
- Ota yhteyttä infektioiden valvontaryhmään.
- Tartunnan saaneet eivät osallistu ryhmätuokioihin. Ateriat tarjollaan heille potilashuoneisiin.

Epidemian seuranta.

Sairastuneet kirjataan **epidemiaselvityslomakkeelle**.
Lomake lähetetään epidemian päättymisen jälkeen hygieniahoitajalle.

Lisätietoja noroviruksesta.

- https://www.terveyskirjasto.fi/terveyskirjasto/tk.koti?p_artikkeli=dlk00738
- <https://thl.fi/en/web/infektioaudit/taudit-ja-mikrobit/virustaudit/norovirus>
- <https://seura.fi/terveys/skiko-norovirus-toiminnan-kun-pahoinvointi-alkaa/>
- <https://www.vaasa.fi/noroviruksen-kotihoito-ohjeet>
- https://www.who.int/ith/mode_of_travel/communicable_diseases/en/
- <https://www.ruokavirasto.fi/>
- <https://www.avainapteekit.fi/oma-terveys/vatsa/ios-norovirus-iskee-toimi-naein>
- https://www.terveyskirjasto.fi/kotisivut/tk.koti?p_artikkeli=dlk00738