



Major article

An observational study of frequency of provider hand contacts in child care facilities in North Carolina and South Carolina



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Background: Children enrolled in child care are 2.3–3.5 times more likely to experience acute gastrointestinal illness than children cared for in their own homes. The purpose of this study was to determine the frequency surfaces were touched by child care providers to identify surfaces that should be cleaned and sanitized.

Methods: Observation data from a convenience sample of 37 child care facilities in North Carolina and South Carolina were analyzed. Trained data collectors used iPods (Apple, Cupertino, CA) to record hand touch events of 1 child care provider for 45 minutes in up to 2 classrooms in each facility.

Results: Across the 37 facilities, 10,134 hand contacts were observed in 51 classrooms. Most (4,536) were contacts with porous surfaces, with an average of 88.9 events per classroom observation. The most frequently touched porous surface was children's clothing. The most frequently touched nonporous surface was food contact surfaces (18.6 contacts/observation). Surfaces commonly identified as high-touch surfaces (ie, light switches, handrails, doorknobs) were touched the least.

Conclusion: General cleaning and sanitizing guidelines should include detailed procedures for cleaning and sanitizing high-touch surfaces (ie, clothes, furniture, soft toys). Guidelines are available for nonporous surfaces but not for porous surfaces (eg, clothing, carpeting). Additional research is needed to inform the development of evidence-based practices to effectively treat porous surfaces.

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In 2010, 61% (12.2 of 20 million) of U.S. children under the age of 5 years were enrolled in child care, spending an average of 35 hours per week in the facilities.^{1,2} As dependency on out-of-home child care increases, the opportunity for children to experience acute gastrointestinal illness (AGI) also increases.^{3–5} Lu et al⁶ reported that children in child care facilities are 2.3–3.5 times more likely to experience AGI than children cared for in their own home. In child care environments, young children are in close proximity to one another and share toys and other items (eg, diaper change tables), which may result in transmission of pathogens that cause AGI.⁶

Hand contact with surfaces, particularly high-touch surfaces, has been reported to pose a great risk of pathogen transfer.^{7–10} Several studies have reported high rates of fecal coliforms on child care provider hands, suggesting the need to study hand contact events in child care facilities.^{11–13} Audits of the frequency of hand contact events have been performed in health care settings,^{14,15} but no published study has quantified child care provider hand contacts. The purpose of this study was to determine the frequency surfaces were touched by child care providers to identify surfaces that should be cleaned and sanitized.

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Conflicts of interest: None to report.

METHODS

All data collection protocols and instruments were approved by the Institutional Review Board of Clemson University, North Carolina State University, and RTI International. Data were collected between September 2010 and February 2011.

Sample selection

There were 508 child care facilities (115 in North Carolina, 393 in South Carolina) contacted up to 3 times via telephone to participate in the study. The South Carolina sample was recruited from a list of licensed child care facilities ($n = 393$) in 10 upstate South Carolina counties. In North Carolina, the sample was recruited from a list of licensed child care facilities in 5 counties.

The inclusion criteria were as follows: continuous operation for at least 1 year prior to study, not exclusive to drop-in service or special needs children, enrollment of at least 1 infant (0-12 months) and 3 toddlers (13 months-2 years), and provision of daily lunch and snack service to toddlers. There were 18 North Carolina and 22 South Carolina child care facilities that met the inclusion criteria and agreed to participate.

Data collector training

Seven individuals were trained on study protocols, including conducting practice observations. To assess the level of agreement among data collectors, observer interrater reliability testing was conducted. Each data collector viewed a 5-minute video of a child care provider and child and audio recorded surfaces touched by the provider and the location as specified by the study protocol. Each data collector was required to be at least 85% accurate to the gold standard observer, an RTI International research consultant who had experience conducting observations in child care classrooms. All data collectors passed the interrater reliability testing, with 4 of the 7 collectors completing a second round of testing.

Observation protocol

Child care providers were informed that data collectors would be observing them while they worked, but they were blinded to the purpose of the study, which was to record their hand contact with surfaces. One provider was observed in up to 2 classrooms at each facility and included an infant room, toddler room, preschooler classroom, and combined room if there were no separate infant and toddler rooms (common in family daycare homes). If >1 provider was present, the lead provider was observed. In each classroom, the provider's hand contacts were observed and recorded on a digital voice recorder (iPod, Apple, Cupertino, CA) for a 45-minute period. This method was chosen because narrative records are open ended and flexible, allowing us to record as much as possible about what occurred, whereas using a checklist would have limited us to pre-defined choices.

Data collectors audio recorded the type of surface touched and the location in the room (eg, handwash sink, diaper change area). To allow providers to acclimate to the presence of observers, each observer conducted a classroom audit (generally 15 minutes in length) immediately before the observation. Results of the classroom audit data are reported in a separate publication.¹⁶ Green et al¹⁷ applied a similar method for an observation study of restaurant workers, allowing subjects 10-15 minutes to acclimate before observations began.

Observation data were transcribed and coded by 2 trained research assistants. Each hand contact was initially categorized by type of surface (porous surface, nonporous surface, bare skin). Porous surfaces were defined as "surfaces that have tiny openings which allow liquid to be absorbed or to pass through," and nonporous surfaces were defined as "surfaces that have no openings to allow liquid to be absorbed or pass through."¹⁸ Bare skin and hair were defined as a body part not covered by clothes. Coders then assigned each hand contact to 1 of 38 object codes (20 nonporous surfaces, 12 porous surfaces, 6 bare skin and hair) to

describe the surface touched. Frequencies of hand contacts were computed by room type and surface type or item touched using SAS 9.2 (SAS Institute, Cary, NC).

RESULTS

Characteristics of participating child care facilities

Table 1 shows the characteristics of the 37 child care facilities that participated in the study. Of the child care centers, 43% ($n = 30$) were classified as for-profit and 48% were classified as nonprofit facilities; the remaining 10% did not answer this question. All family daycare homes ($n = 7$) were for-profit and independently owned and operated. Most centers (83%-93%) provided initial training on hygiene and sanitation practices to new employees compared with only 43%-57% of homes, which is not surprising given that most homes reported having only 1 employee, usually the owner or operator. Among all the facilities in the study, most directors (78%) reported having policies or written procedures for surface washing.

Hand contacts

Observation data from 51 classrooms in 37 facilities were analyzed. Three of the 40 facilities visited were excluded from the analysis because of poor audio quality or the provider was not in the classroom for most of the observation period. Of the 37 facilities, 16 facilities were in North Carolina and 21 were in South Carolina; 30 were centers and 7 were homes.

A total of 10,134 provider hand contacts were recorded. Of the contacts observed, 4,536 were with porous surfaces; 4,054 were with nonporous surfaces; and 1,544 were with bare skin or hair. The number of hand contacts per observation ranged from 6-437, with an average of 198.7 contacts/observation. Porous surfaces were the most commonly touched surfaces (89.5 contacts/observation) followed by nonporous surfaces (78.9 contacts/observation) and then bare skin or hair (30.3 contacts/observation) (data not shown).

Table 2 shows the total hand contacts by classroom type and type of surface touched. Porous surfaces were most commonly touched across all 4 classroom types except for the preschooler rooms (children ages 3-4 years) where nonporous surface contacts were the most commonly touched. Total hand contacts ($n = 4,219$) were highest in toddler rooms and lowest in preschooler rooms ($n = 764$).

Figure 1 shows the mean frequencies of hand contact by surface in all 37 facilities. Of the 10 most commonly touched surfaces, 5 were porous surfaces (children's clothes, papers or books, porous cleaning items, child care providers' clothes, children's hands), and 5 were nonporous surfaces (food contact surfaces, physical education shared, hard surface toys or games, nonporous shared classroom, hard fixtures). Of the 10 least touched surfaces, 8 were nonporous, 1 was bare skin, and 1 was porous. Children's clothes were touched most frequently (34.2 contacts/observation). Food contact surfaces were the second most frequently touched surface (18.6 contacts/observation). Children's hands were the most frequently touched bare skin or hair surface (9.8 contacts/observation).

Examining results by room type, the most frequently touched surface in infant, toddler, and combined rooms was children's clothes (629 contacts, 630 contacts, and 382 contacts, respectively), whereas in preschooler classrooms the most frequently touched surface was providers' clothes (85 contacts). For the infant and toddler rooms, the next most frequently touched surfaces were porous cleaning items, such as wet wipes and tissues ($n = 236$ and $n = 358$, respectively). In combined rooms, the most frequently

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