

ORIGINAL ARTICLE

Infection Control Practices in Assisted Living Facilities: A Response to Hepatitis B Virus Infection Outbreaks

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BACKGROUND. The medical needs of the approximately 1 million persons residing in assisted living facilities (ALFs) continually become more demanding. Moreover, the number of ALF residents is expected to double by 2030. ALFs are not subject to federal oversight; state regulations that govern ALF infection control are variable. In 2005, two outbreaks of acute hepatitis B virus (HBV) infection in ALFs in Virginia were associated with sharing fingerstick devices used in blood glucose monitoring.

OBJECTIVE. To characterize infection control practices, determine compliance with guidelines, and identify educational and policy needs in ALFs in Virginia.

METHODS. Following the outbreaks of HBV infection, educational packets were sent to ALFs in Virginia to inform them of infection control guidelines and recommendations regarding glucose monitoring. A follow-up survey consisting of on-site interviews was conducted in a random sample of ALFs. Differences among infection control practices, according to the size and ownership of the ALFs, were assessed.

RESULTS. Fifty of 155 ALFs in central Virginia were surveyed. Of the 45 ALFs that had used fingerstick devices, 7 (16%) had shared these devices (without cleaning) between residents. Sharing practices for glucose monitoring equipment did not differ by facility size or ownership. Of all 50 ALFs, 17 (34%) did not offer employees HBV vaccine. HBV vaccine was less frequently offered at ALFs that had fewer than 50 residents, compared with ALFs with at least 50 residents ($P < .01$), and HBV vaccine was less frequently offered at ALFs that were individually owned, compared with those that were not individually owned ($P = .02$).

CONCLUSIONS. Despite outreach and long-standing recommendations, approximately 1 in 6 facilities shared fingerstick devices, and more than one-third of ALFs surveyed were considered noncompliant with federal guidelines (Occupational Safety and Health Administration Bloodborne Pathogens Standard). Public health and licensing agencies should work with ALFs to implement infection control measures and prevent disease transmission.

Infect Control Hosp Epidemiol 2009; 30:209-214

As the US population continues to age, the number of persons residing in assisted living facilities (ALFs) increases. In 1998, there were an estimated 611,300 beds in ALFs, compared with nearly 1 million beds in 2004.^{1,2} Projections indicate that the number of ALF residents will likely double by 2030.² On admission, residents must be ambulatory and not require skilled nursing care. Nonetheless, many residents require assistance in the management of complex medication regimens and regular monitoring of chronic medical conditions, such as diabetes and dementia.³ Recent outbreaks of infectious diseases, including hepatitis B virus (HBV) and norovirus, highlight the need for greater awareness of and adherence to basic infection control practices among ALF management and staff.^{4,5}

ALFs operate under a social model, unlike nursing homes, which operate under a medical model.¹ Licensing require-

ments for ALFs are variable.^{6,7} In Virginia, for example, ALFs are licensed by the Virginia Department of Social Services, and state regulations did not include specific requirements regarding infection control training or practices prior to 2006. In contrast, nursing homes typically have federal oversight and are licensed by state health departments.

In August of 2005, the Virginia Department of Health and the City of Richmond Health Department responded to outbreaks of HBV infection in 2 separate ALFs. Deficiencies in blood glucose monitoring practices were noted, and the Virginia Department of Health became concerned that similar conditions might be present in other facilities. This prompted an educational intervention in the form of a mailing to facilities throughout the state, as well as a follow-up on-site survey of a sample of ALFs in central Virginia. The objectives of this survey were to characterize existing practices with

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Received June 20, 2008; accepted October 4, 2008; electronically published February 4, 2009.

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respect to blood glucose monitoring and infection control, promote safe practices, assist with compliance with the Occupational Health and Safety Administration (OSHA) Blood-borne Pathogens (BBP) Standard (29 CFR 1910.1030), and identify training and policy needs. Here, we describe the results of the outbreak investigations, our outreach efforts, and the findings of our survey.

METHODS

Outbreaks and Educational Intervention

The outbreak investigations included serologic testing for HBV and assessment of infection control practices in the 2 independent ALFs. Groups targeted for serologic testing included diabetic residents, roommates of the index case patients, residents who received wound care or percutaneous injections, and staff involved in providing direct care to residents. Persons whose serum was positive for IgM antibody to HBV core antigen were considered to have acute HBV infection.

The first outbreak took place in an ALF with 84 residents. Two case patients with symptomatic acute HBV infection were initially identified and reported to the Virginia Department of Health. The case patients were both diabetic, and they lived in adjacent rooms. Of the 39 persons tested, 7 (including the 2 index patients) were found to have acute HBV infection. The second outbreak investigation took place in an ALF licensed for 120 residents. The index case was a diabetic resident, who died of complications from acute HBV infection. In this second outbreak, of the 29 persons tested, 4 (including the deceased index patient) were classified as having acute HBV infection.

In both outbreaks, all persons with acute HBV infection were residents who were diabetic and who had their blood glucose levels monitored by ALF staff. For the first outbreak, the attack rate among diabetic residents was 35%. Observations made from the infection control assessments indicated that, in both facilities, there was routine sharing of glucose monitoring equipment, including glucometers and spring-loaded fingerstick devices (the lancet was reportedly changed between uses, but the housing was reused); fingerstick devices and glucometers were not cleaned between uses, and some had dried blood visible on their surfaces; and there were no infection control policies or procedures in effect. Additionally, in 1 facility, staff used glucose monitoring equipment that belonged to residents to monitor their own blood glucose levels.

In collaboration with the Virginia Department of Social Services and the Centers for Disease Control and Prevention (CDC), we prepared and mailed an educational packet of materials to administrators of all 640 ALFs in Virginia in September 2005. The packet included a cover letter that described the recent outbreaks and outlined safe glucose monitoring practices, a recent CDC article that summarized sim-

ilar outbreaks, and posters that highlighted recommended practices.^{4,8}

Survey Sampling Methods

The sampling frame for the survey consisted of 155 ALFs within the Virginia Department of Social Services Henrico licensing region. This region is comprised of urban, suburban, and rural areas of central Virginia. Using sampling without replacement, a random sample of ALFs was drawn. We sought to achieve a sample size of 50 ALFs. In April 2006, 81 ALFs were invited to participate in the survey, via a letter signed by commissioners of the Virginia Department of Health and the Virginia Department of Social Services. In September 2006, after the first round of ALFs had been exhausted, the invitation letter was sent to the next 27 facilities in the sampling frame.

Survey Data Collection and Analysis

We used a study-specific questionnaire to collect information on facility demographics, staff and resident characteristics, diabetes management, infection control, and training. ALFs that were not individually owned were classified as having corporate ownership. Staff and resident characteristics included the numbers of full-time and part-time direct care staff, the number of residents at the time of interview, the number of beds for which the facility was licensed (capacity), and the current number of diabetic residents. A distribution of ALF capacity within the Henrico licensing area was generated and divided into 3 equal groups that we defined as small (<17 beds), medium-sized (17–50 beds), and large (>50 beds).

Questions that pertained to diabetes management included access to a diabetes educator or specialist; the type of glucose monitoring equipment used (eg, fingerstick devices, safety lancets and needles, and meters) and sharing practices; and the location of glucose monitoring. The primary components of infection control measured were disposal of sharp objects, HBV vaccination programs, procedures related to blood spills and the management and prevention of injury due to sharp objects, and infection control training. A facility was considered to be noncompliant with the OSHA BBP standard if it did not offer employees HBV vaccine, did not use regulated means for disposal of sharp objects, or did not have a policy regarding blood spill cleanup.

The survey materials were pilot tested at 3 facilities. Data were collected from April through November 2006 by means of interviews with facility administrators and/or nursing supervisors and a walk-through observational survey of the facility. On-site visits concluded with an educational meeting to discuss findings and recommendations for improvement.

All analyses were conducted using SAS, version 9.1 (SAS). Descriptive analyses (eg, to determine frequencies and median values) were performed. Differences between proportions were assessed using the χ^2 test and the Fisher exact test,

when appropriate. The Wilcoxon rank sum test was used to compare median scores.

RESULTS

Survey Response

We mailed a letter to a total of 108 ALFs to inform them of the study and request their participation. We were able to reach a contact person by telephone at 72 ALFs. Of these 72 ALFs, 21 refused to participate or did not schedule an appointment after multiple attempts, and the remaining 51 were surveyed. The 57 nonparticipating ALFs had a median licensing capacity of 18, significantly less than that of participating ALFs, which was 50 ($P = .001$). One ALF did not have any current diabetic residents, but it had diabetic residents in the recent past, so it was retained in the analysis. One ALF, licensed for 18 residents, did not have any diabetic residents currently or in the recent past, and it was therefore excluded from analysis.

Facility Characteristics

ALFs were surveyed in 17 counties or cities in central Virginia, including the Richmond metropolitan area. The distribution of the 50 ALFs surveyed, by size and type of ownership, is presented in Table 1. The majority of facilities surveyed were large and corporate owned. The median number of residents in the ALFs was 41 (range, 3–111 residents). The median number of residents in ALFs affiliated with a corporation was 47, significantly higher than that for ALFs owned by individuals, which was 17 ($P = .003$). Facility staffing characteristics varied with respect to capacity (Table 2). Of note, 19 (38%) of the 50 ALFs, including the majority of small and medium-sized facilities, did not have a full-time licensed practical nurse or registered nurse on staff.

Glucose Monitoring Practices and Equipment

For the ALFs surveyed, the median prevalence of diagnosed diabetes was 14% (range, 0%–50%). All of the facilities surveyed offered residents assistance with blood glucose monitoring. Glucose monitoring took place primarily in residents' rooms or common areas, such as a nurses' station or medication area, as well as unconventional settings, such as a kitchen or laundry room.

At the time of the survey, 10 (20%) of the 50 ALFs surveyed were sharing fingerstick devices and/or glucometers between residents who underwent glucose monitoring; 5 ALFs (10%) were sharing both devices between residents. Of 45 ALFs that used fingerstick devices, 7 (16%) shared them among residents. These 7 facilities ranged in size from 16 to 94 residents, with 2 to 24 residents sharing each fingerstick device. The facilities that shared fingerstick devices typically did not clean them between residents but disposed of the lancet after each use. Of the 50 ALFs surveyed, 8 (16%) had shared glucometers, and 4 (50%) of these 8 did not clean them between

TABLE 1. Characteristics of Assisted Living Facilities (ALFs) in Virginia, 2006

Characteristic	No. (%) of ALFs (<i>n</i> = 50)
Ownership	
Individual	16 (32)
Not individual	
All	34 (68)
Corporation	22 (44)
Limited liability corporation	8 (16)
Partnership	2 (4)
Unincorporated association	2 (4)
Facility size	
<17 Beds (small)	10 (20)
17–50 Beds (medium-sized)	15 (30)
>50 Beds (large)	25 (50)
Affiliated with skilled-care facility	6 (12)
Access to diabetes educator and/or specialist	15 (30)
Written policy	
On needlestick exposure	31 (62)
On blood spill cleanup	30 (60)
On facility cleaning and/or disinfection	23 (46)

residents. Table 3 shows that the sharing of fingerstick devices and/or glucometers did not differ by facility size or ownership type.

Safety lancets and safety needles are specifically designed to prevent possible injuries from sharp objects. Single-use safety lancets were used in 19 (38%) of the 50 ALFs surveyed, and safety needles were used in 11 (22%) of 49 ALFs surveyed. The use of these safety devices did not differ by ALF ownership type (Table 3), but large ALFs were significantly more likely to use safety devices, compared with small and medium-sized ALFs ($P = .01$).

Infection Control, Bloodborne Pathogens Standard Compliance, and Training

Glove use for all procedures involving direct care with residents and among cleaning staff was reported among all facilities but not always observed during the walk-through survey. Of note, one-third of ALFs surveyed did not have a sink close to their medication areas or nursing stations. For the 10% of ALFs that did not have a standard container for disposal of sharp objects, makeshift containers included a bleach bottle and a plastic food storage container.

Of the 50 ALFs surveyed, 34 (68%) reported having written guidelines with regard to OSHA BBP standard compliance. The number of ALFs with written policies with regard to individual components of the OSHA BBP standard is presented in Table 1. HBV vaccine, a major component of the OSHA BBP standard, was offered to employees in 33 ALFs (66%). However, none of the ALFs offered recommended postvaccination testing to determine vaccine response, and less than 50% of ALFs that provided vaccine did so at the facility itself. OSHA BBP standard compliance, as defined in

TABLE 2. Data on Full-Time Direct Care Staff in 50 Assisted Living Facilities in Virginia, 2006

Staff classification	Median no. of full-time direct care staff, by facility size			
	Small (<17 beds) ($n = 10$)	Medium ($17-50$ beds) ($n = 15$)	Large (>50 beds) ($n = 25$)	Any size ($n = 50$)
LPN or RN	0	0	2	1
Certified nursing assistant	0	0	9	2
Medication technician	2	4	8	5
Any type of direct care staff	3	6	18	11

NOTE. LPN, licensed practical nurse; RN, registered nurse.

our study, was significantly higher among larger ALFs than among other ALFs ($P < .001$) and significantly higher among those owned by or affiliated with a corporation or association than among other ALFs ($P = .01$) (Table 3).

Infection control training was required for direct care staff in 38 ALFs (76%). The percentage of larger facilities that reported providing infection control training was higher than that of smaller facilities (Table 3). The quality and content of infection control training was highly variable and primarily consisted of annual BBP training. Although the training was not quantified, ALFs typically trained employees upon hire and on an annual basis as part of in-service training. ALFs depended on their own administrators or directors of nursing, outside nurse educators, or videos for their infection control and BBP training programs.

DISCUSSION

ALFs have long served the needs of aging individuals—many with chronic health conditions. The role of ALFs continues to grow. Yet, to our knowledge, this is the first published report to examine infection control practices specific to this setting. Our survey was motivated by concerns that stemmed from 2 outbreak investigations in which we documented HBV transmission among diabetic residents. During the follow-up

survey, we were surprised that, despite our attempts at educational outreach, facilities still reported sharing fingerstick devices between residents who underwent blood glucose monitoring. We also found that many ALFs lacked written infection control policies and that compliance with OSHA requirements was lacking, especially compared with acute care facilities.^{9,10} Taken together, our findings point to the need for greater attention to infection control planning and practices in ALFs.

The 2 outbreak investigations identified a total of 11 new cases of HBV infection, including 1 case in which the patient died. Outbreaks of HBV infection associated with glucose monitoring have a long history.^{4,11-13} Until recently, most such outbreaks occurred in acute care and nursing home settings, but recent reports, such as ours, may reflect increasing levels of diabetes care in the assisted living setting and subsequent risk for infection. In the outbreaks we investigated, all of the infected residents were diabetic and had been exposed to shared fingerstick devices and/or glucometers. Likewise, in approximately 1 in 6 ALFs surveyed, sharing of fingerstick devices was noted, and we intervened to correct these practices.

The risk of transmitting BBPs from shared glucose monitoring equipment should be obvious. By their nature, fin-

TABLE 3. Survey Data on Infection Control Practices and Compliance with Bloodborne Pathogens (BBP) Standard in 50 Assisted Living Facilities (ALFs) in Virginia, 2006

Characteristic	ALFs, by size			<i>P</i> , size	ALFs, by type of ownership		<i>P</i> , type of ownership
	<17 beds ($n = 10$)	$17-50$ beds ($n = 15$)	>50 beds ($n = 25$)		Individual ($n = 16$)	Not individual ($n = 34$)	
Shared glucose monitoring devices	1 (10)	2 (13)	7 (28)	.46 ^a	2 (13)	8 (24)	.47 ^a
Did not use safety devices ^b	10 (100)	15 (100)	16 (64)	.01 ^a	14 (88)	27 (79)	.70 ^a
Did not comply with OSHA BBP standard ^c	10 (100)	11 (73)	6 (24)	$<.001^a$	13 (81)	14 (41)	.01 ^d
Did not require infection control training	5 (50)	5 (33)	2 (8)	.01 ^a	6 (38)	6 (18)	.16 ^a

NOTE. Data are no. (%) of ALFs that responded yes. OSHA, Occupational Safety and Health Administration.

^a Determined by the Fisher exact test.

^b Includes safety lancets and auto-disabling needles.

^c OSHA BBP standard noncompliance defined as not offering employees hepatitis B virus vaccine, not using regulated means for disposal of sharp objects, or not having a policy regarding blood spill cleanup.

^d Determined by the χ^2 test.

gerstick devices come in close proximity to blood every time they are used. Furthermore, a recent study showed that approximately 30% of glucometers in routine hospital use had detectable blood contamination present on the device surface.¹⁴ Even microscopic amounts of blood on glucose monitoring equipment may contain infectious viral particles that can be transferred to a healthcare provider or another patient. For these reasons, the CDC and the Food and Drug Administration have recommended, since 1990, that fingerstick devices not be shared between patients. In addition, the CDC now recommends that glucometers be assigned to individuals or, if this is not possible, that the device be cleaned after every use.⁴ States that permit ALFs to conduct glucose monitoring must work with facilities to ensure that these procedures are performed correctly, because serious harm, including death, can be the consequence of unsafe care.

Our survey documented a number of deficiencies with regard to infection control and OSHA compliance. For example, smaller ALFs owned by individuals were less likely than other ALFs to have infection control plans that complied with major aspects of the OSHA BBP standard.¹⁵ Additionally, even if ALFs offered infection control training programs, the programs were variable in their content and quality. Comprehensive infection control programs in nursing homes have been documented to reduce the rate of infections among residents.¹⁶ We recommend that ALF staff complete in-service education focused on infection control and recommended disease prevention practices. To that end, we have successfully worked with the Virginia Department of Health and the Virginia Department of Social Services to develop educational materials, including a train-the-trainer program for ALF inspectors.

Lack of adequate infection control training contributes to the already higher risk of acquiring disease that healthcare workers have. In addition, many healthcare personnel in long-term care facilities are unvaccinated for HBV.¹⁷ In our survey, the majority of small and medium-sized ALFs either did not offer the HBV vaccine to their employees or did not have documentation regarding their employees' HBV vaccination status. Lack of awareness of BBP transmission risks was illustrated during our outbreak investigation: staff reported sharing lancet devices not only between residents but also to perform fingersticks on themselves.

Our study had limitations. Although the participation rate among the successfully contacted facilities was good, small and medium-sized facilities were underrepresented in the final sample. Another potential limitation was that our findings were primarily based on self-report, because we were unable to fully observe staff practices during our on-site visits. We were also unable to formally evaluate the effects of the educational mailing. Taken together, the above limitations might have affected survey measures. However, it seems unlikely that a more comprehensive sample and assessment of practices would have found better compliance with existing recommendations and guidelines than what we reported. An

additional consideration is that our findings may not be broadly representative of conditions in ALFs nationally.

Infection control standards should be met consistently wherever healthcare procedures are performed. The desire to promote a homelike or community atmosphere in ALFs must not undermine this principle. Therefore, public health and licensing agencies should work with ALFs to ensure implementation of infection control measures to prevent disease transmission, commensurate with the levels of assistance and care that they are providing to their residents. Specific infection control guidelines, including those associated with diabetes care as well as all applicable elements of the OSHA BBP standard, should be strongly considered for incorporation into state regulations and measures taken to enforce compliance with requirements.⁴ Not only will this help to prevent the spread of BBPs, but also it will increase our defenses against other infectious agents, such as influenza viruses. Attention to these issues will help ALFs meet the growing challenge of providing safe, high-quality care to our aging population.

ACKNOWLEDGMENTS

We acknowledge Deborah Lloyd of the Virginia Department of Social Services and Ryan Novak of the Centers for Disease Control and Prevention for their assistance with our study.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article.

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Presented in part: American Public Health Association Meeting; Washington, D.C.; November 3–7, 2007 (Abstract 146571); and the Council of State and Territorial Epidemiologists Meeting; Atlantic City, New Jersey; June 24–28, 2007 (Abstract 2007).

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

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