OUTBREAK OF HEPATITIS B VIRUS INFECTION AMONG RESIDENTS OF A LONG-TERM CARE FACILITY

by

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ABSTRACT

Between May 2002 and June 2003, three residents of a nursing home were diagnosed with acute HBV infection; a fourth resident who was noted to have chronic HBV infection had died in February 2002. During July 2003, serologic testing was performed on all persons (n=192) residing in LTCF-A. Eleven (6%) residents, including two of the three residents previously identified, had serologic evidence of acute HBV infection. Four infected residents had symptoms or laboratory studies consistent with acute hepatitis B (fever and jaundice or alanine aminotransferase levels> 5 times upper limit of normal) documented in their medical charts between May 2002 and May 2003; however, only one had been diagnosed with hepatitis B at the time of illness. A retrospective cohort study that included all the nursing home residents demonstrated that the attack rate among persons who received fingerstick glucose monitoring was significantly higher than the attack rate among residents without this exposure (18% vs 3%, relative risk [RR]=6.9, 95% confidence interval [CI]=1.9 – 25). Persons who received other percutaneous exposures, including medications, surgical and podiatry procedures, and phlebotomy, were not more likely to have serologic evidence of acute HBV infection.

Interviews with staff and direct observation of glucose monitoring practices indicated that single use disposable lancets were always used, and insulin vials were not shared among patients. On each wing of the facility, a single glucometer was used for all patients receiving fingersticks; glucometers were not routinely cleaned between patients. Most diabetics had standing orders for fingerstick glucose monitoring, up to 4 times per day. On some days, a single healthcare worker was

responsible for performing >20 fingerstick procedures during a single workshift. In addition, respondents to an anonymous survey of the nursing staff indicated that healthcare workers did not always change gloves between patients when performing fingerstick procedures.

INTRODUCTION

Hepatitis B virus (HBV) is transmitted through the bloodborne, sexual, and perinatal routes. It is stable in the environment for at least seven days (1), and can be transmitted through blood-contaminated objects even in the absence of visible blood. Small amounts of HBV are highly infectious, and needlestick injury with hepatitis B is one-hundred times more likely to result in infection in a susceptible person than needlestick injury with HIV (2;3). Transmission of hepatitis B has been documented in healthcare settings from patient-to-provider (4-6) as well as from provider-to-patient (5;7-15). Patient-to-patient transmission has also been well-documented, in numerous settings—hemodialysis clinics (16-18), hospitals (4;5;13;19-21), outpatient clinics (22;23), and nursing homes (24;25); and via numerous vehicles—jet gun injectors (22), acupuncture needles (26), multi-dose medication vials (4;16) and fingerstick glucose testing devices (19;24;25;27).

BACKGROUND

On June 5, 2003, the North Carolina Department of Health and Human Services (NC-DHHS) informed the Centers for Disease Control and Prevention (CDC) of a cluster of acute hepatitis B virus (HBV) infections among residents of a long-term care facility (LTCF-A) in Stanly County, North Carolina. Between May 2002 and June 2003, three residents of a 190-bed nursing home were diagnosed with acute HBV infection; a fourth resident who was noted to have chronic HBV infection had died in early 2002. All 4 patients were diabetic and received routine blood glucose monitoring. In June 2003, an additional 2 persons with acute HBV infection

were identified among 22 residents who underwent blood glucose monitoring and lived on the same halls as the previously identified HBV-infected patients.

On August 15, 2003, the North Carolina State Epidemiologist invited CDC's Division of Viral Hepatitis (DVH) to assist in the investigation of HBV transmission at LTCF-A. The objectives of the investigation were to determine the magnitude of the outbreak, identify the risks for infection, and recommend control measures to prevent further transmission. This paper documents the investigation.

METHODS

Descriptive Epidemiology

Demographic Survey

We compiled general LTCF-A population characteristics through chart reviews of persons residing in the facility at the time of the investigation, as well as through review of discharge and admission lists.

Definitions

LTCF-A residents were classified as having acute or chronic hepatitis B, or as hepatitis B susceptible or immune, according to their serologic status (Table 1). LTCF-A residents who tested positive for immunoglobulin M (IgM) antibody to hepatitis B core antigen (anti-HBc) were defined as having acute HBV infection. LTFC-A residents who tested positive for hepatitis B surface antigen (HBsAg) and total anti-HBc, but negative for IgM anti-HBc were considered to have chronic HBV infection. Residents who tested negative for total anti-HBc were considered susceptible to HBV infection. Persons testing positive for total anti-HBc alone or in

combination with antibody to HBsAg (anti-HBs) were considered immune to HBV infection.

Case Finding

Serologic survey: Between July 11 and July 16, 2003, blood was drawn from every resident of LTCF-A, and sent to the CDC for HBV testing. A subset of the samples were also tested by the NC-DHHS laboratory.

Chart reviews: For LTCF-A residents whose serologic results indicated acute or resolved HBV infection, as well as for the chronically-infected resident who died in February 2002, we performed chart reviews to date illness onsets. Physician notes, nursing notes, and laboratory reports were reviewed for illnesses and laboratory abnormalities (elevated alanine aminotransferase [ALT], aspartate aminotransferase [AST], or bilirubin) consistent with HBV infection. Chart reviews were also performed for patients who died at the facility in the year prior to the investigation, in order to determine if any of these patients had been ill with hepatitis B.

North Carolina Hepatitis B Registry: The North Carolina Hepatitis B Registry holds names, dates-of-birth, and illness onsets, of all acute hepatitis B patients reported on or after 1987, and all chronic hepatitis B patients reported on or after 1988. We used the registry as another avenue of determining dates of illness onsets. NC-DHHS personnel searched the North Carolina Hepatitis B Registry for name and date-of-birth matches with residents who had serologic evidence of acute, chronic, or resolved HBV infection. Additionally, in an attempt to determine if former LTCF-A residents had been infected with HBV, NC-DHHS personnel

searched the registry for matches with residents who died at, or were discharged from, the facility in the year preceding the investigation.

Ongoing surveillance: Ongoing surveillance for new cases of hepatitis B was conducted by reviewing hospital discharge summaries and results of liver function tests of patients who were hospitalized after the July blood draw. Surveillance for new cases continued until the time of the investigation team's return to Atlanta in mid-September.

Retrospective Cohort Study

We performed a retrospective cohort study to identify exposures associated with HBV infection, and to identify possible modes of HBV transmission at LTCF-A. Since the incubation period of hepatitis B ranges six weeks to six months, and IgM anti-HBc remains detectable as long as six months after the development of symptoms (see Appendix A, *Acute Hepatitis B Virus Infection with Recovery*), the time frame for the study was set for the year ending approximately 6 weeks before the July blood draw, i.e., the year from June 1, 2002 through May 31, 2003.

Study Cohort

The study cohort was composed of LTCF-A residents, who had resided in the home at any time during the study period, and who were shown by serologic testing either to have acute HBV infection or to be susceptible to HBV infection.

Data Collection

LTCF-A patient charts were reviewed to collect demographic and diagnosis data as well as potential risk factors for HBV infection, such as hospitalizations, out-patient specialty care, and history, frequency, and timing of percutaneous exposures

(see Appendix B, *Chart Review Form*). In order to evaluate if patient functionality was associated with HBV infection, we collected scores that were assigned by LTCF-A staff who assess residents for dementia, mobility, and ability to perform hygiene functions. Patient functionality assessment is performed on a quarterly basis using a standardized scoring system.

Environmental Assessment

We toured the facility and gathered information on room assignments. Information on staffing practices was gained through interviews with LTCF-A management and nursing directors. General infection control practices at LTCF-A were assessed by observing staff members, interviewing clinical and administrative staff, and conducting an anonymous nurses survey (see Appendix C, *Staff Survey on Possible Hepatitis B Exposures within LTCF-A*). Information on infection control practices and devices used for fingerstick glucose monitoring and administration of medications during the study period was gathered through interviews with the director of nursing at LTCF-A, as well as the general nursing staff. Blood glucose testing was observed during the busiest times for this practice: 6:30 AM and 4:30 PM. Insulin administration was observed during the busiest time for this practice: 6:30 AM.

Laboratory Methods

Serum specimens were tested at the CDC's Viral Hepatitis Reference Laboratory. All samples were tested for total anti-HBc. Samples positive for total anti-HBc were subsequently tested for HBsAg, IgM anti-HBc, and anti-HBs. The NC-DHHS laboratory tested a subset of samples for total anti-HBc, HBsAg, IgM

anti-HBc, and anti-HBs. Reverse transcriptase-polymerase chain reaction (RT-PCR) was used to amplify a segment of HBV DNA from specimens that contained HBsAg. Each amplified 354 base-pair DNA segment was sequenced and compared to others in this outbreak.

Data Analysis

All statistical calculations were performed using SAS version 8.1. A p-value of <=0.05 was considered statistically significant. For the descriptive analyses, comparisons of age and length-of-stay of LTCF-A residents by hepatitis B status (acutely-infected, chronically infected, infected in the past, susceptible), were made by Kruskal-Wallis testing. Comparisons of age and length-of-stay by race were performed using Wilcoxon 2-sample tests.

For the retrospective cohort study, Wilcoxon 2-sample tests were used to compare infected to non-infected residents with regard to age, length of stay, and measures of dementia and mobility. Attack rates for selected exposures were determined, and their statistical significance was judged by Pearson chi-square tests, or Fisher's exact test in cases in which cell sizes were 5 or less. Exposures which were associated with illness by univariate analysis were analyzed for colinearity using Pearson correlation coefficients. A model containing non-colinear variables was then analyzed by logistic regression. A more parsimonious model was obtained by backward elimination of variables. Dose-response variables were constructed to determine if selected exposures showed dose-response effects. The analyses were repeated on a subset of the data in which residents who had questionable serologic results were removed.

RESULTS

Descriptive Epidemiology

Demographic Survey

LTCF-A is part of a chain of 45 nursing homes located in North Carolina, Virginia, and Kentucky, which provides both long-term and recuperative care. During the year preceding our investigation, 52 (54%) of the 96 patients discharged from LTCF-A were discharged to home, and 32 (59%) of those discharged to home had stays at LTCF-A of less than one month.

Case Finding

Serologic survey: All 192 residents present at LTCF-A between July 11 and July 16, 2003 were tested. Results from the serologic survey by the CDC laboratory indicated that 11 (6%) of the 192 residents tested had acute infection. Of these 11 acutely-infected residents, 4 had samples containing hepatitis B surface antigen (HBsAg), indicating the presence of HBV in blood. Sixteen residents had serologic evidence of past, resolved HBV infection (total anti-HBc-positive, but HBsAg-negative and IgM anti-HBc negative); and 165 had serologic evidence of susceptibility to HBV infection (total anti-HBc-negative). No resident had a serologic profile consistent with chronic HBV infection (HBsAg-positive, total anti-HBc-positive, IgM anti-HBc negative).

Of the 22 samples which were tested both by the CDC and by the NC-DHHS laboratories, 3 had conflicting results. For these three samples, the CDC found acute infection (total anti-HBc-positive, IgM anti-HBc positive, HBsAg-positive) and the NC-DHHS found chronic (total anti-HBc-positive, IgM anti-HBc negative, HBsAg-

positive). Two of the three residents with discrepant results were diabetic, one was not. The non-diabetic resident was African-American, while the other two residents were Caucasian.

Demographic and medical characteristics by HBV serologic status (as determined by the CDC laboratory) of the 192 residents are shown in Table 2. The median age of the residents was 83 (range, 39 to 100 years); 136 (71%) were female, and 32 (17%) were African-Americans. The median length of stay among the 192 residents was approximately 618 days (1.7 years), with a range of 7 days to greater than 28 years.

African-American residents did not differ significantly from Caucasians with regard to age or length-of-stay at LTCF-A. However, they did differ by other measures. With regard to sex, African-Americans were proportionately more female: 84% of African-Americans as compared to 68% of Caucasians were female ($p = 0.06$).

Fifty-five (29%) of the 192 residents were diabetic. Women were not significantly more likely to be diabetic compared to men, but African-Americans were significantly more likely to be diabetic when compared to Caucasians—15 (47%) of 32 African-Americans were diabetic as compared to 40 (25%) of 160 Caucasians ($p=0.01$).

African-American residents were more likely to have serologic evidence of past (resolved) HBV infection compared to Caucasians. Among African-Americans, 8 (31%) of 26 had evidence of past infection, compared to 8 (5%) of the 155 Caucasians ($p<0.0001$). Among diabetics, 8 (17%) of the 47 compared to 8 (6%) of 134 non-diabetics had evidence of past infection ($p=0.02$). However, when stratified

by race, having diabetes was not significantly associated with evidence of previous HBV infection in either racial group.

Chart reviews, chronically-infected resident: One former resident with hepatitis B had been reported in early 2002 (prior to our serologic review) to the North Carolina Department of Health. She was one of the four infected residents referenced in the first paragraph of this report, and was a diabetic who was hospitalized during January 2002 with jaundice. HBV serologic testing at that time indicated chronic infection (HBsAg-positive, total anti-HBc positive, and IgM anti-HBc negative). Her LTCF-A medical summary made note only of "auto-immune hepatitis."

Chart reviews, acutely-infected residents: Three of the eleven residents with acute HBV infection had clinical or laboratory evidence that allowed approximation of the onset of illness. All three of the residents were diabetic, and their illness onsets could be approximated as September 2002, October 2002, and May 2003. Only one of the three residents was given serologic testing for hepatitis during her illness, and even though the results of these tests were positive for acute hepatitis B and negative for hepatitis C, the diagnosis given in her chart was "active hepatitis C".

Chart reviews, residents with resolved infection: Three of the sixteen residents found to have resolved HBV infection had clinical or laboratory evidence that allowed approximation of the time of illness. The first of the three had documentation of resolved infection prior to entering LTCF-A. Another had laboratory abnormalities that indicated she may have had illness onset in February 2002. The third resident, was found to be acutely-infected on serologic testing

performed in May 2002.

Chart reviews, residents who died during study period: Three of the 61 residents who died at LTCF-A between June 2002 and July 2003 had ALT test results that were at least twice the upper limit of normal during that year. None received specific serologic tests for HBV infection, or had a clinical diagnosis of hepatitis indicated on their LTCF-A chart.

North Carolina hepatitis B registry search: Identity-matching with the North Carolina Hepatitis B Registry revealed that one patient with acute hepatitis B onset in May 2002 (a resident with resolved infection in July 2003) had been reported. No additional LTCF-A residents or former residents were identified in the registry.

Ongoing Surveillance: We found no evidence of ongoing transmission of HBV at LTCF-A from our review of hospital discharge summaries, death reports, and lab test results for residents who were hospitalized or died during the period July 16 through September 14, 2003.

Retrospective Cohort Study

164 of the 192 residents who participated in the July blood draw were eligible for the study cohort; 15 residents were excluded because they had serologic evidence of previous HBV infection (and were immune), and 13 were excluded because they had been admitted to the facility after the end of the study period, i.e., after May 31, 2003 (one of these 13 also had serologic evidence of previous HBV infection).

Between residents with acute HBV infection and residents who were not infected, there were no significant differences with regard to age, or scores for dementia, mobility and ability to perform personal hygiene between residents.

However, residents who were acutely-infected had resided in the home longer (median years of stay: 3.9) than residents who were not infected (median years of stay: 1.7) ($p < 0.01$).

Five residents with acute HBV infection resided on a single hall (200 hall) at some time during their incubation period, and four of the five resided on that hall during the entire study year. However the remaining residents with acute infection lived on 4 other halls of the facility, and all 4 of the facility's 4 nursing stations provided care for at least one infected resident.

A comparison of attack rates by selected characteristics or percutaneous exposures is presented in Table 3. The attack rate among women was significantly higher than among men, as was the attack rate among African-Americans compared to Caucasians. The attack rate among those who received blood glucose fingersticks, insulin injections, and dental care was significantly higher than among those who did not receive these percutaneous exposures. Influenza vaccine was nearly significant at a p-value of 0.07. PPD was also significantly associated with infection, but only 4 residents had not received a PPD because this test is required by the state for each resident. Persons who received phlebotomy, vaccination, IM/IV/SQ injections of medications other than insulin (including influenza vaccination), skin testing for tuberculosis, care for a decubitus ulcer or skin tears, hospitalization, podiatry, or ophthalmologic care were not significantly more likely to have acute HBV infection compared to those who were not exposed to these procedures. No resident who had acute HBV infection received hemo- or peritoneal dialysis, or tetanus vaccination.

Fingersticks were administered to 27.8% of residents during the study period, including 95.1% of diabetics. Eight of 11 residents with acute HBV infection (all of the diabetics among those infected) received fingersticks for blood glucose monitoring. Insulin was administered to 18.4% of residents during the study period, including 69.0% of diabetics. Diabetics with acute HBV infection did not have a significantly more total number of fingersticks or total number of insulin injections during the study period when compared to susceptible diabetics who did not become infected. The number of fingersticks or insulin injections performed during each of the three nursing shifts was not significantly higher among those who had HBV infection.

The three non-diabetic residents with acute HBV infection were all African-American, and none had received fingerstick monitoring according to the medical charts. One of these three residents received care for a pressure sore, and all had at least one phlebotomy. None had symptoms or laboratory studies suggestive of acute HBV infection other than the HBV serologic testing, making identification of a narrower time period when exposures might have occurred impossible.

When stratified according to diabetes status (presence or absence of diabetes), African-American diabetics did not have a significantly higher attack rate compared to Caucasian diabetics (33% vs. 15%, relative risk [RR] 2.3, 95% confidence interval [95%CI] 0.7-7.7). However, African-American non-diabetics had a higher attack rate compared to Caucasian non-diabetics (21% vs. 0%, $p<0.01$). When stratified by race, African-American diabetics did not have a significantly higher attack rate compared to African-American non-diabetics (33% vs. 21%, RR=1.6, 95%CI=0.4-6.1).

However, Caucasian diabetics did have a significantly higher attack rate compared to Caucasian non-diabetics (15% vs. 0%, $p<0.01$).

In evaluating colinearity between length-of-stay and all significant demographic and medical exposures, we found that flu vaccine and dental care were significantly correlated with length-of-stay ($p < 0.0001$, and $p < 0.003$, respectively). The correlation between flu vaccine and length-of-stay can be explained by the LTCF-A practice of offering annual flu vaccine in the fall, thus persons coming into the home after October 2003 would not have received flu vaccine. Likewise, LTCF-A offered regular dental care after the resident had been in the home for 6-months. An evaluation of colinearity between ever residing on the 200 hall and all significant demographic and medical exposures resulted in no evidence of correlation.

We performed logistic regression analysis in a model containing the variables for sex, race, length-of-stay (which was categorized as >= 1 year and < 1 year, in order to make an approximate divide between those residents who were present in the home for the whole study period from those who were not), residence on 200 hall any time during the study period, as well as for the exposures, blood-glucose fingerstick monitoring, and receipt of insulin (Table 4, Model 1). We did not include PPD because nearly every resident had experienced this exposure, nor flu vaccine or dental care, which were likely proxies for length-of-stay. Backward elimination of variables resulted in the more parsimonious model containing race, ever residing on the 200 hall, and exposure to fingerstick monitoring (Table 4). Construction of dose-response variables for number of insulin injections and blood-glucose fingerstick events, found neither to show a dose-response effect.

Univariate analysis on a dataset that excluded the three residents whose serologic status differed between CDC and NC-DHHS laboratories, found the following variables to be significant: African-American race, and exposure to blood-glucose fingerstick monitoring, insulin, and dental care. As with the full dataset, infected residents had resided at LTCF-A longer than susceptible residents (median lengths-of-stay, 4.3 and 1.7 years, respectively) ($p=0.01$). Dental care was highly correlated with length-of-stay ($p < 0.0001$). Logistic regression, with backward elimination on a model containing all the variables included in Model 1, resulted in a model containing only race and exposure to blood-glucose fingerstick monitoring (Table 4, Model 2).

Environmental Assessment

Description of the Facility and Staffing

LTCF-A is a one-story, 190-bed facility, in which 8 halls are arranged around 4 nurses stations (see Appendix C: *Map of LTCF-A*). The majority of resident rooms are shared by two people of the same sex, with the exception of the small number of rooms either shared by married couples or having a single occupant. Each set of two rooms is arranged around a single bathroom, and LTCF-A management attempts to assign rooms so that only members of the same sex share a bathroom.

On most days, nursing station 1 serves halls 100 and 200, nursing station 2, halls 300 and 400, and nursing station 3, halls 600, 700, and 800. The fourth nursing station, called the Specialized Program for Alzheimer's and Related Kare (*sic*) (Spark) station, serves the 500 hall, or Spark Unit. The Spark Unit is a locked hall, where ambulatory patients who have dementia are free to roam. Outside the Spark

Unit, patients who are mobile can move freely from hall to hall. The doors to patient rooms are kept open, although some rooms have cloth strips attached across the doorways to discourage entrance by mobile patients.

Three nursing shifts (shift 1: 7am – 3pm, shift 2: 3 pm – 11 pm; shift 3: 11 pm – 7 am) are normally scheduled, but full-time and part-time staff may work for part of a shift, more than one full shift, or parts of two shifts. At least one RN or LPN staffs each nursing station during shifts 1 and 2; during shift 3, one of the 4 nursing stations is usually not staffed by an RN or LPN. Typical staffing consists of 7 nurses (RNs or LPNs) on shifts 1 and 2 working on the halls; 1 nurse for each of the halls 100 - 500 and a 6th nurse who works both hall 600 and 700. There is also a 7th nurse, who is the RN supervisor. On shifts 1 and 2, there are normally 15 Certified Nursing Assistants (CNAs), 5 of whom work on halls 100 and 200, 5 of whom work on halls 300 and 400, 3 who work on halls 600, 700, and 800, and 2 who work the Spark Unit. On the 3rd shift, there are usually 3 nurses, 1 for halls 100 and 200, 1 for halls 300, 400, and 700, and one for halls 500, 600, and 800, as well as 11 CNAs, 3 on halls 100 and 200, 3 on halls 300 and 400, 3 on halls 600, 700, and 800, and 2 on the Spark Unit.

RN and LPN duties are nearly identical at this facility. Both RNs and LPNs administer oral, subcutaneous, and intramuscular medications. A phlebotomist, who has been employed at the facility for over two years, works full-time and performs all blood draws. A single LPN is employed full-time as the "procedure nurse" and performs all dressing changes. Only LPNs with special training, and RNs perform IV placements. RNs, LPNs, and CNAs perform fingerstick blood glucose monitoring. The facility-designated infection-control nurse began training CNAs to perform

fingerstick blood glucose monitoring in December 2002 in response to the large number of fingersticks required (as many as 25 for a single nurse during the third shift), and a shortage of 3rd shift LPNs and RNs to perform the task. On several occasions, the shortage became so severe that on-call nurse-managers, such as the Director of Nursing, were required to come into the facility help with the 6:30 AM glucose monitoring. Since December 2002, over 30 CNAs have been trained to perform fingerstick blood glucose monitoring, although by July of 2003, only 10-12 routinely perform the task.

Description of Fingerstick Blood Glucose Monitoring and Insulin Administration

During the study period, fingerstick blood glucose monitoring was ordered on diabetic patients on schedules that varied from four times per day to once every six weeks. Fingersticks were performed by RNs, LPNs, or CNAs, using a Precision PCx™ glucometer, and single use, disposable lancets which were deposited, after use, in the sharps container located on the nursing cart. Since July 2003, following recommendations of the North Carolina Statewide Program for Infection Control and Epidemiology (NC-SPICE), the glucometer was cleaned with Clorox wipes between each patient, however, during the study period, the glucometer was cleaned only once per day, or when visibly soiled.

During our observations in August and September 2003, most fingerstick testing was done at certain times during a shift. One glucometer was located at each of the four nursing stations, and a single nurse or nursing assistant performed the blood glucose monitoring for his or her nurses station in a single sweep through the

halls associated with that station. For staff at a single nursing station performing fingersticks on shift 3, as many as 25 patients might require fingerstick procedures at approximately 6:30 AM. Each fingerstick procedure required many steps, including steps to ensure the proper recording of data into the glucometer memory. In our observations, nurses washed hands, changed gloves, and cleaned the glucometers between each patient.

Insulin injections were only performed by nurses (RNs or LPNs), after the fingerstick monitoring had been completed. Separate insulin vials were assigned to each patient, and nurses stated that it would be unlikely for a vial to be used for multiple patients because a supply of extra insulin vials was readily available in the refrigerator in the medication room.

Nursing Staff Anonymous Survey

At the time of the nursing survey, there were 23 registered nurses and 23 licensed practical nurses employed by the facility. LTCF-A administration distributed the nursing staff survey questionnaires, and it is not clear how many of the 46 nurses received copies. Nine questionnaires were returned to us.

All 9 respondents reported that they had never forgotten to change gloves between patients after performing a procedure involving blood or body fluids. Seven had never seen another staff member forget to change gloves. However, two respondents stated that they had seen another staff member fail to change gloves between patients after performing such a procedure, including between patients during fingerstick glucose monitoring. Two respondents indicated that the high patient load compromised his/her ability to completely observe universal precautions.

One respondent felt that reductions in nursing staff per shift, along with the presence in LTCF-A of patients requiring more complicated medical care made it harder to follow correct infection control practices. All respondents stated they now cleaned glucometers between each use. Five respondents reported that they had previously cleaned glucometers when visibly soiled, rather than between each patient. All respondents answered "No" to the question, "Have you ever suspected that your patients were involved in nonconsensual sex?"

HBV DNA Sequence Comparison

HBV DNA suitable for sequence analysis was amplified from specimens taken from all four residents who were HBsAg-positive. The 354 base-pair DNA segment analyzed was identical for 3 of the 4 residents. The fourth resident's specimen contained a similar but not identical DNA sequence. This patient was the only HBsAg-positive non-diabetic resident, and was one of the subjects who was found to be chronically-, rather than acutely-infected by the NC-DHHS laboratory.

DISCUSSION

The CDC laboratory identified 11 LTCF-A residents with serologic evidence of acute HBV infection. In addition, two more residents with serologic evidence of resolved infection had laboratory or physical findings reported in charts that might have indicated acute HBV infection in the recent past. The attack rate for HBV infection was significantly higher among diabetics compared to non-diabetics, and among residents who received blood-glucose fingerstick monitoring. Other percutaneous exposures which could potentially transmit HBV were not associated with an increased risk of HBV infection.

HBV transmission during percutaneous procedures performed as part of routine care of diabetics in long-term care facilities has previously been reported. In previously reported investigations, control efforts have focused on reducing percutaneous exposures to the minimum necessary to provide appropriate medical care and improving infection control practices and infection control education. In long-term care facilities that have reported HBV transmission associated with diabetes care, interruption of HBV transmission has been observed after implementation of these recommendations.

No apparent breach of recommended infection control procedures was observed by members of the investigation team during observations of diabetes care procedures in LTCF-A. However, these observations were made after day-to-day infection control practices had likely been altered, and practices were likely influenced by the fact that the observation was taking place. Opportunities during fingersticks for blood contamination of shared supplies such as glucometers were noted, especially during the extensive manipulation of supplies involved with performing the fingerstick procedures. There are numerous ways that inapparent blood contamination of gloves and medical equipment such as glucometers and medical supply carts can occur. HBV concentrations in the blood of persons with acute or chronic infection are often very high, and may exceed 200 million viral particles per milliliter. The possibility that gloves might not always have been changed between patients was noted in the anonymous survey of nurses, and time pressures to complete procedures and a lack of understanding of HBV transmission risk might have led to breaks in normal infection control procedures.

Multivariate analysis of both a dataset containing the full retrospective cohort dataset, and one containing the dataset minus three infected residents whose laboratory results were questionable, resulted in African-American race remaining significant even after backward elimination in logistic regression modeling. There are several possible explanations for this finding. First, there may have been room or hall cohorting of African-American residents, and residents who were living in close proximity to one another were more likely to become infected by an infected room or hallmate. A second possibility is that of false positive IgM anti-HBc results. Since all residents positive for IgM anti-HBc were also positive for total anti-HBc, false-positive results likely occurred in persons who had sustained past infection. Seroprevalence surveys have shown that past HBV infection is as much as four times more likely in African-Americans than in Caucasians (28), so it would not be surprising to find more African-Americans with evidence of past and chronic infection than Caucasians.

In LTCF-A, all infections occurred in women. Although this finding became insignificant in backward elimination in logistic regression modeling, it is worth exploring why all infected residents might have been female. As with the African-American residents, room and hall cohorting of women may explain this finding. In LTCF-A, nearly all residents have a roommate, women are always paired with another woman in a room (husbands and wives are the exception). Bathrooms are shared between two rooms, and both sets of roommates are usually the same sex. Therefore, residents who share close living quarters with a resident who has acute or chronic HBV infection are likely to be of the same sex, and might have a higher risk

for exposures related to close personal contact or breaks in infection control. The possibility of transmission during sexual contact was also investigated, but was considered unlikely for several reasons: Sexual transmission would not explain the strong association between infection and diabetes care, and seems unlikely to have not been witnessed or suspected by LTCF-A staff, family members or non-demented LTCF-A residents.

In addition to the absence of infections in men at LTCF-A, individuals who did not receive dental care and the influenza vaccine also experienced no infections. Dental care and influenza vaccine were also highly correlated with length-of-residence in the facility; residents with acute infection had received these exposures because they all had resided in the facility for at least six months, thus qualifying them for regularly-scheduled dental care, and they all were in the facility in October of 2002, when the flu vaccine was administered to all residents. Dental care and flu vaccine are not related to diabetes or diabetic care, so these exposures cannot be linked to other exposures significantly associated with acute infection, thus it is unlikely that they played a role in this outbreak in which diabetic care was so strongly associated with infection.

Several explanations for the serologic evidence of HBV infection among the three non-diabetic residents are possible. First, each may have had an undocumented percutaneous exposure to another HBV infected patient, including exposure during activities of daily living (and therefore undocumented in LTCF-A records). All three of these women lived in close proximity to acutely-infected diabetic residents: one shared a room with an acutely-infected resident, another shared a bathroom with a

different acutely-infected resident, and the third lived one room away from an acutely infected resident at the time that resident's liver enzymes became elevated. Second, the percutaneous exposure and subsequent infection may have occurred before the study period. The kinetics of IgM anti-HBc responses in HBV infection are not fully defined in the elderly (because they are so rarely infected), and IgM anti-HBc may last longer than 6 months in some patients. Third, the IgM anti-HBc test may be an error. IgM anti-HBc false positives are occasionally observed, and the frequency of false-positive serologic tests in elderly persons might be higher due to the higher prevalence of potentially cross-reacting antibodies, such as rheumatoid factor, among the elderly.

Our inability to determine the approximate date of HBV infection, and therefore the likely time of HBV exposure, represents a significant limitation of the analysis. Two out of the 4 residents who were positive for both IgM anti-HBc and HBsAg had illness onsets which could be approximated as October 2002 and May 2003, respectively. Whether these two residents represent two points along a chain of transmission, or along two separate chains is unknown. That these two residents, as well as the third of four residents who were HBsAg-positive, had identical HBV DNA sequences suggests a single original source for the three.

The discrepancies in serologic results between the CDC and NC-DHHS laboratories also hampered our ability to determine the possible infectious source(s) for the outbreak. A non-diabetic resident who was HBsAg-positive did not have an identical HBV DNA sequence when compared to the sequence amplified from specimens taken from the three diabetic, HBsAg-positive residents. By NC-DHHS

results, this non-diabetic resident was chronically infected, and thus may have acquired infection at a different time, and presumably through a different mechanism, compared to the diabetics. However, the small difference in HBV DNA sequence observed in this resident compared to the other chronically infected residents cannot conclusively indicate different sources of HBV infection.

CONCLUSIONS

The analyses presented in this paper indicate that LTCF-A residents who received blood-glucose fingerstick monitoring associated with diabetes care were at significantly higher risk of HBV infection compared to those who did not have these procedures. Exposures to HBV-contaminated blood likely occurred during unrecognized or undocumented breaks in recommended infection control procedures. No breaks in infection control techniques were observed during the investigation, however we observed procedures put into place after new infection control recommendations had been made in July 2003. We noted that the complexity of manipulating supplies and shared monitoring equipment might allow opportunities for cross-contamination of shared diabetes care supplies and glucose monitoring equipment.

This outbreak highlights the necessity for medical staff to be frequently tested on their understanding of standard precautions. There may exist a misconception that gloves are used for protection of the medical personnel alone, rather than for the protection of the patient. Likewise, physicians should be made aware that blood-glucose fingerstick monitoring has risks, and that monitoring schedules should be tailored to patient needs. Elderly patients, living in settings in which diet it carefully

controlled, may not need frequent glucose monitoring in order to maintain adequate diabetic control.

PUBLIC HEALTH RECOMMENDATIONS

1. Health care workers in long-term care facilities must demonstrate knowledge of universal precautions guidelines and proficiency in application of these guidelines during procedures that involve possible blood or body fluid exposures.
2. Health care workers in long-term care facilities should be offered frequent educational sessions on the risks of bloodborne pathogen transmission, emphasizing that chronic HBV infection (as well as chronic HCV or HIV infection) is often asymptomatic, and can serve as a source of infection for other residents over time.
3. Gloves should always be worn during fingerstick glucose monitoring, administration of insulin, and during any other procedure that involves potential exposure to blood or body fluids. Gloves that have touched potentially blood-contaminated objects or fresh fingersticks should be changed before touching clean surfaces such as the glucometer.
4. Gloves should be removed and discarded in appropriate receptacles after every procedure that involves any potential exposure to blood or body fluids, including fingerstick monitoring and insulin injections.
5. Handwashing should be performed immediately after removal of gloves and before touching other medical supplies intended for use on other residents.

6. Glucometers should be wiped clean after each fingerstick procedure. If frequent and thorough cleaning of glucometers in cannot be assured, separate glucometers for each long-term care facility resident should be considered.
7. Medications and supplies should not be shared among patients.
8. The number of fingersticks and insulin doses should be reduced to the minimum necessary for diabetes management. Reduction of the number of percutaneous exposures would reduce the opportunity for exposure to HBV.
9. All long-term care facility staff should receive a full hepatitis B vaccination series if previously unvaccinated. Post vaccination titers should be checked one to two months after vaccination, and documented.
10. Physicians need to consider the diagnosis of acute HBV infection in patients who develop illness with a component of hepatic dysfunction or elevated AST or ALT.
11. Health departments performing hepatitis B surveillance need to determine if acute and chronic hepatitis B cases are being accurately and consistently reported through the mandatory reporting systems.

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Table 1. Interpretation of HBV serologic profiles

HBsAg	anti-HBs	Total anti-HBc	IgM anti-HBc	Interpretation	Category
(+/-)	-	+	+	New HBV infection	Acute
-	(+/-)	+	-	Resolved HBV infection	Resolved (Immune)
+	-	+	-	Chronic HBV infection	Chronic
		-		Never infected	Susceptible

Table 2. Demographic and clinical characteristics of 192 LTCF-A residents by serologic status*, LTCF-A, July 11, 2003 – July 16, 2003

	Acute infection (n=11)	Resolved infection (n=16)	Susceptible to infection (n=165)	Total (n=192)
Median age (yrs) †	79.0	82.3	83.0	82.8
Female sex	11 (100%)	10 (62.5%)	115 (69.7%)	136 (70.8%)
African-American race	6 (54.6%)	8 (50%)	18 (10.9%)	32 (16.7%)
Median LOS‡ (days)	1439	627	522	618
Range LOS‡ (days)	313 - 5250	23 - 5041	7 - 10271	7 - 10271
Diabetic	8 (72.7%)	8 (50%)	39 (23.6%)	55 (28.7%)
Received finger-sticks§	8 (72.7%)	9 (56.3%)	42† (25.5%)	59† (30.7%)
Received insulin§	6 (54.6%)	6 (37.5%)	25 (15.2%)	37 (19.3%)

*These results represent the findings of the CDC's Division of Viral Hepatitis Laboratory, in which no chronically-infected residents were detected.
† Age as of July 16, 2003.
‡Length-of-stay as of July 16, 2003.
§During the period July 16, 2002 through July 16, 2003.

Table 3. Risk of acute HBV infection among HBV susceptible residents, by selected characteristics and percutaneous exposures. LTCF-A, June 1, 2002 through May 31, 2003.

Exposure	Infected/Exposed (%)	Infected/Unexposed (%)	RR [95%CI]*
Gender = female	11/118 (9.3)	0/46 (0)	Undefined (p = 0.04)
Race = African-American	6/23 (26.1)	5/141 (3.5)	7.4 [2.4 – 22.1]
Diabetes	8/43 (18.6)	3/121 (2.5)	7.5 [2.1 – 27.0]
Blood glucose fingersticks‡	8/45 (17.8)	3/117 (2.6)	6.9 [1.9 – 25.0]
Resided on 200 hall any time during study period	5/29 (17.2)	6/135 (4.4)	3.9 [1.3 – 15.9]
Insulin†	5/30 (16.7)	6/133 (4.5)	3.7 [1.2 – 11.3]
IM, SQ or IV medications†	4/52 (7.7)	7/111 (6.3)	1.2 [0.4 – 4.0]
Phlebotomy‡	10/137 (7.3)	1/25 (4.0)	1.8 [0.2 – 13.6]
Influenza vaccination†	11/122 (9.0)	0/41 (0)	Undefined (p = 0.07)
PPD†	11/159 (6.9)	0/4 (0)	Undefined (p = 1.0)
Decubitus ulcer†	5/44 (11.4)	6/119 (5.0)	2.3 [0.7 – 7.0]
Skin tear†	3/50 (6.0)	8/113 (7.0)	0.9 [0.2 – 3.1]
Hospitalization	3/75 (4.0)	8/88 (9.1)	0.4 [0.1 – 1.6]
Dental Care‡	11/103 (10.7)	0/59 (0)	Undefined (p = 0.008)
Podiatry‡	3/28 (10.7)	8/134 (6.0)	1.8 [0.5 – 6.4]
Ophthalmology‡	1/23 (4.4)	10/139 (7.2)	0.6 [0.1 – 4.5]

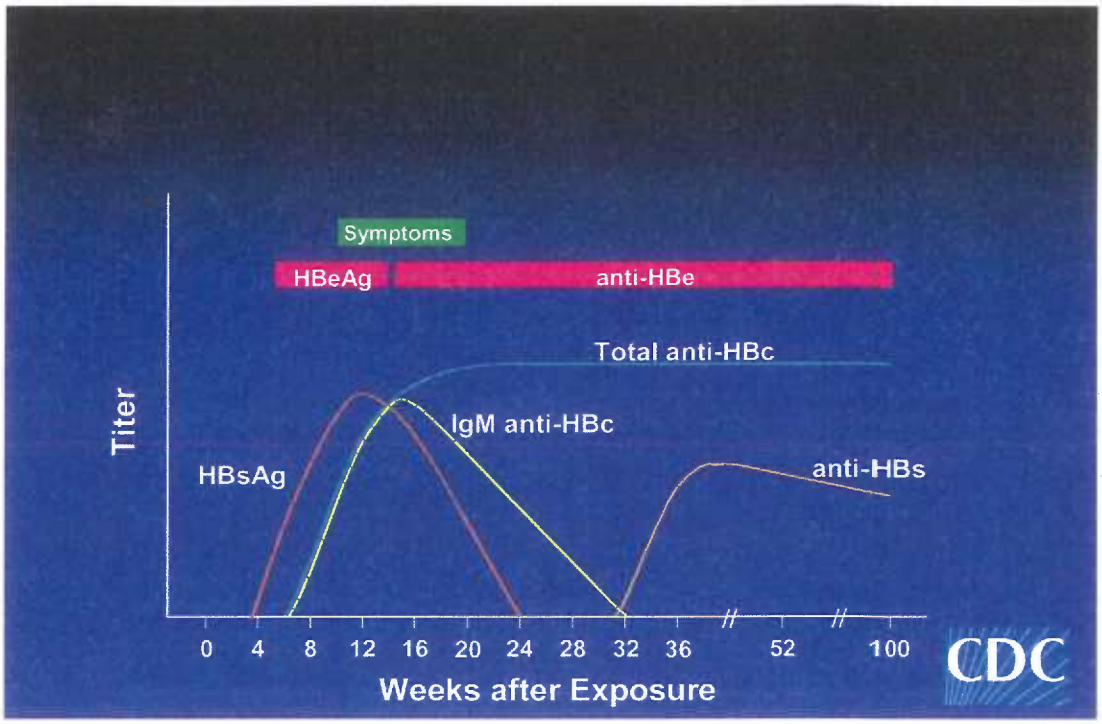
* Relative risk [95% confidence interval]
† Calculation performed with one missing value
‡ Calculation performed with two missing values

Table 4. Adjusted odds ratios for acute HBV infection among HBV susceptible residents: logistic regression model containing selected characteristics and percutaneous exposures. LTCF-A, June 1, 2002 through May 31, 2003.

Exposure	Dataset 1* Full Model Adjusted Odds Ratio [95% CI]	Dataset 1* Model after Backward Elimination Adjusted Odds Ratio [95% CI]	Dataset 2† Full Model Adjusted Odds Ratio [95% CI]	Dataset 2† Model after Backward Elimination Adjusted Odds Ratio [95% CI]
Gender = female	Undefined	--	Undefined	--
Race = African-American	7.1 [1.4 – 36.6]	9.3 [2.2 – 39.1]	8.0 [1.2 – 52.6]	11.3 [2.3 – 55.2]
Years of residence >= 1	1.7 [0.2 – 17.5]	--	6.0 [0.6 - 64.5]	--
Resided on 200 hall any time during study period	26.0 [2.5 – 272.5]	4.6 [1.1 – 19.8]	14.8 [1.2 – 176.5]	--
Blood glucose fingersticks ‡	20.2 [1.5 – 266.3]	8.4 [1.9 – 38.0]	9.1 [0.5 – 163.9]	7.9 [1.4 – 43.9]
Insulin§	2.6 [0.3 – 21.9]	--	3.2 [0.6 – 64.5]	--

* Dataset containing 11 infected and 153 susceptible residents
† Dataset containing 8 infected and 153 susceptible residents (3 residents with discrepant lab results removed)
‡ Calculation performed with two missing values
§ Calculation performed with one missing value

APPENDIX A: Acute hepatitis B virus infection with recovery: Typical serologic course.



APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

PERCUTANEOUS EXPOSURES

Fingersticks

===from Medication and Treatment: Medication Administration Records===

5. Fingersticks Yes _____ No _____

For standard daily schedule (BID), please indicate times of day. For weekly frequencies, please indicate day of week, i.e., M, T, W, R, and/or F, as well as time of day. For months, please circle number of monthly sheets in which this schedule appears (even if only one day into month 2, circle 2). If there is a month in which the schedule is changed, select the predominant schedule for that month.

Schedule (1)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (2)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (3)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (4)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (5)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (6)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (7)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (8)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

Medications

===from Medication and Treatment: Medication Administration Records===

6. Insulin: Yes _____ No _____

Times: For standard daily schedule (BID), please indicate times of day. For weekly frequencies, please indicate day of week, i.e., M, T, W, R, and/or F, as well as time of day. For sliding scale, please give a ballpark of how often insulin was given.

Months: please circle months in which this schedule appears. If there is a month in which the schedule is changed repeatedly, please select the predominant schedules for that month.

Schedule (1)_____ Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (2)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (3)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (4)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (5)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (6)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (7)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

Schedule (8)_____Times_____

2002 2003

jun jul aug sep oct nov dec jan feb mar apr may

APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

7. Other SQ/IM/IV Medications or Line Flushes:

===from Medication and Treatment: Medication Administration Records===

Additional SQ/IM/IV Meds Yes _____ No _____

						# times
a.	_____	Route:	IV	IM	SQ	_____
b.	_____	Route:	IV	IM	SQ	_____
c.	_____	Route:	IV	IM	SQ	_____
d.	_____	Route:	IV	IM	SQ	_____
e.	_____	Route:	IV	IM	SQ	_____
f.	_____	Route:	IV	IM	SQ	_____
g.	_____	Route:	IV	IM	SQ	_____

8. In-House Phlebotomy

===from Lab & X-Ray: Light blue forms===

In-House Phlebotomy Yes _____ No _____

times _____

9. Out-Patient Phlebotomy

===from Lab & X-Ray: Forms other than typical light blues===

If location is not readily apparent, just give name of lab.

Out-Pt. Phlebotomy or Other Yes _____ No _____

Location (1)_____

times: _____

Location (2)_____

times: _____

10. Wound Culture

===from Lab & X-Ray ===

Out-Pt. Phlebotomy or Other Yes _____ No _____

Location (1)_____

times: _____

Location (2)_____

times: _____

APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

PPD/Vaccinations

===from Lab & X-Ray: Resident Immunization Record===

11. PPD Yes _____ No _____
    Date: _____
12. Flu shot Yes _____ No _____
    Date: _____
13. Tetanus Toxoid or Antitoxin Yes _____ No _____
    Date: _____
14. Pneumococcal Yes _____ No _____
    Date: _____
15. Other Vaccines/Skin Tests Yes _____ No _____
    Date: _____

APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

SKIN PROBLEMS AND THEIR TREATMENTS

===from Medication and Treatment: Treatment Record and Personal Care Flow Record

16. Decubitus ulcer? Yes_____ No _____

Months in which any ulcer appears on chart:

	2002						2003				
jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may

Months in which dressing changes appear in chart:

	2002						2003				
jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may

Debridement: Yes _____ No _____

Any other treatment? Yes _____ No _____

If yes, describe_____

17. Skin Tears? Yes _____ No _____

Months in which treatment of skin tears appear on chart:

	2002						2003				
jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may

18. Other skin problems Yes _____ No _____

a. Description_____Treatment_____

Months in which problem appears on chart:

	2002						2003				
jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may

b. Description_____Treatment_____

Months in which problem appears on chart:

	2002						2003				
jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may

APPENDIX B: CHART REVIEW FORM

CDC: ID# NCB _____

SPECIALTY CARE

===from from Prog. Notes/Consults: Report of Consultation Records===

1. Specialty Care

a. Dental: Yes _____ No _____ # times: _____

b. Podiatry: Yes _____ No _____ # times: _____

c. Ophthal.: Yes _____ No _____ # times: _____

d. Wound Ost: Yes _____ No _____ # times: _____

e. Surgical/Invasive: Yes _____ No _____ # times: _____

PATIENT FUNCTIONALITY

===from Care Plans Charts: MDS, and Patient Care Plan. Choose closest to, and before, 5/31/03===

19. MDS

Date_____

a. Dementia assessment (scores on items listed)

B4_____ B5 (e)_____ C6_____

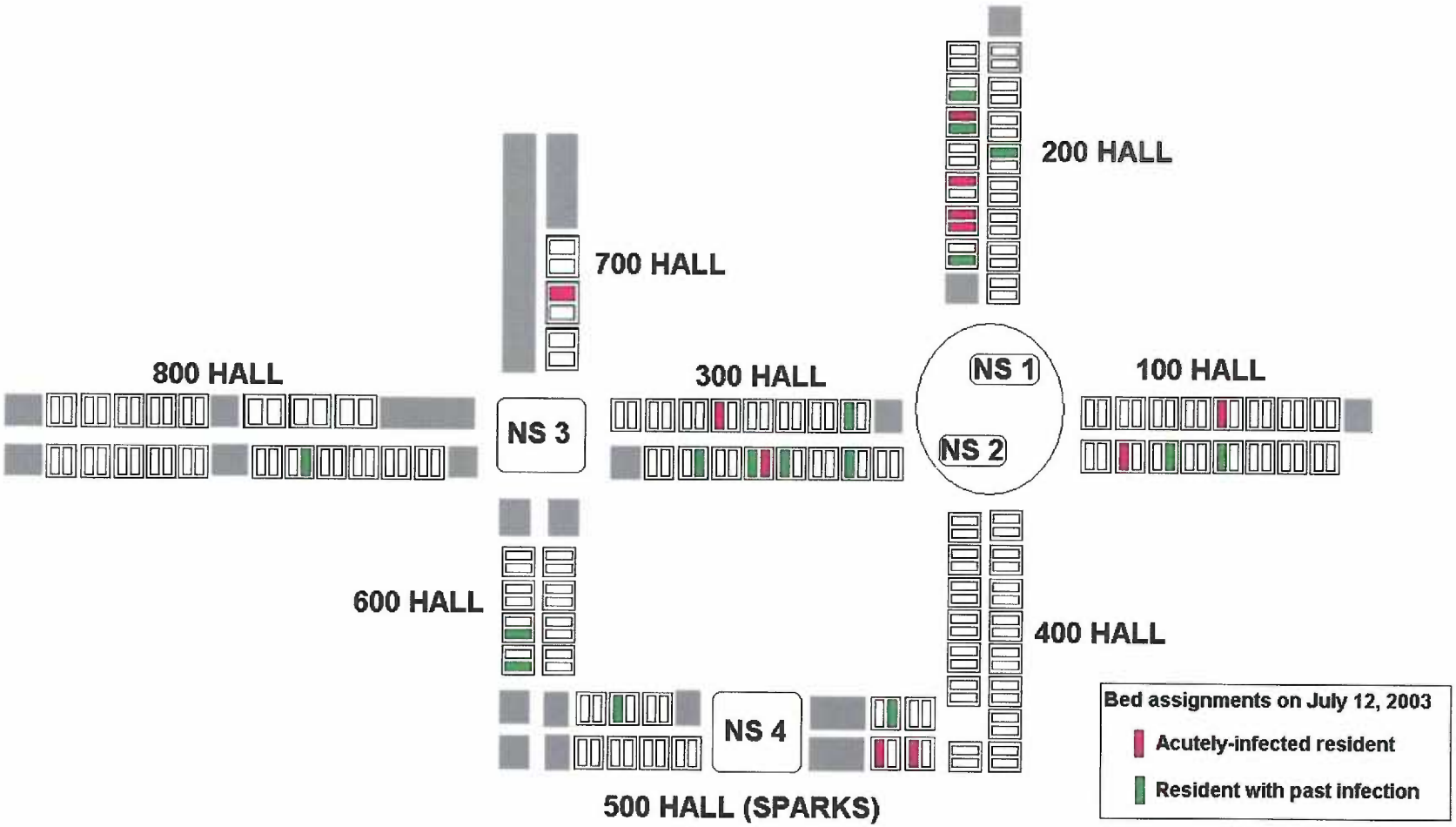
b. Mobility assessment (scores on "self" subcategories of Item G1)

a_____ c_____ d_____

c. Ability to perform personal hygiene (score on "self" subcategories of Item G1)

j_____

APPENDIX C: MAP OF LTCF-A



APPENDIX D
Staff Survey on Possible Hepatitis B Exposures within LTCF-A

Staff Survey on Possible Hepatitis B Exposures Within the Nursing Home

Please fill out the following survey and put it in the box. The survey is anonymous, and will only be read by members of the State and CDC investigative team – we will not identify individual staff members from the survey. We will use the data to get a general sense of nursing/staff/other practices within the facility. Please be honest about reporting situations in which the usual infection control practices were not followed, even if it was an accident. Please circle or write in answers to the questions below. Thanks for your assistance.

A. ***Employment history***

1. How many shifts per week do you work on average? Which shift(s) do you work? (1^{st}, 2^{nd}, 3^{rd})

2. On which unit(s) do you usually work? _____

B. Patient Care (Questions refer to the past 1 year.)

3. On an average shift, how many patients do you care for? _____

4. On an average shift, how many (give your best guess) patients require:

   Wound care? _____. Intravenous lines? _____. Fingerstick monitoring? _____. Injections? _____.

5. Do you ever perform dressing changes? **Yes** **No**

6. Do you administer injected (IV, IM, SQ) medications? **(always, frequently, sometimes, rarely, never)**

7. In the past 1 year, have you ever used any medication vials that are used for more than 1 patient (saline, heparin, insulin, etc.)? **Yes** **No**

8. Do you wear gloves during any physical contact with patients? **Yes** **No**

9. If not, for what types of contact do you **not** use gloves?

10. Are there situations where you might wear the same pair of gloves for multiple patients? **Yes** **No**

    For what types of procedures?

11. Have you ever forgotten to change gloves between patients after performing a procedure involving blood or body fluids (phlebotomy, wound care, fingersticks, injections, etc.)? **Yes** **No**

12. Have you ever seen another staff member forget to change gloves between patients after performing a procedure involving blood or body fluids? **Yes** **No**

13. Have you accidentally used cutting or clipping instruments such as fingernail clippers or razors without disinfecting the instrument between patients? **Yes** **No**

If so, what instrument(s)

14. Have you seen other staff use cutting or clipping instruments without disinfecting the instrument between patients? **Yes** **No**

If so, what instrument(s)?

15. Have you ever accidentally given an injection using a needle that had been previously used on another patient? **Yes** **No**

16. Have you ever had to use a medication designated for one patient or ward for another patient or ward?

Yes **No**

If so, please specify

17. Have you ever seen a colleague use a medication designated for one pt/ward for another pt/ward?

Yes **No**

18. When do you clean or disinfect glucometers?

Between each patient **Between each shift** **Once per day** **Less often** **When visibly soiled**

19. What do you use to clean the glucometer?

Water/soap **Alcohol wipe** **Bleach solution or wipes (Clorox)** **Dry cloth** **Other**_____

20. In the past year, have you ever used a different stategy for glucometer care, than the strategy you are currently using? **Yes** **No**
    - If so, when did you clean or disinfect glucometers?

Between each patient **Between each shift** **Once per day** **Less often** **When visibly soiled**

    - What did you use to clean the glucometer?

Water/soap **Alcohol wipe** **Bleach solution or wipes (Clorox)** **Dry cloth** **Other**_____

21. Have you or another staff member forgotten to disinfect a shared supply item in the last year?

Yes **No**

22. How many blood sugar fingersticks do you do per shift (on average)? _____.

23. Have you used a lancet device at the nursing home other than the type used now? **Yes** **No**

24. Do you do all scheduled fingersticks on the unit at the same time? **Yes** **No**

25. Have you ever performed fingersticks on more than one patient without changing gloves?

Yes **No**

26. Have you observed another staff member performing fingersticks without changing gloves?

Yes **No**

27. Have you ever suspected that your patients were involved in nonconsensual sex? **Yes** **No**

28. With whom (another patient, outside visitor etc.)? _____.

29. Have you ever felt that a high patient load has compromised your ability to completely observe universal precautions and/or other infection control measures. If yes, please explain. **Yes** **No**

_____

_____

_____

30. Can you think of any other circumstances where possible transmission of blood-borne pathogens may have occurred? Please explain.

_____

_____

Thanks for your help! Please place the survey in the box, and feel free to come to us (the State and CDC investigative team) with any concerns or questions you have regarding the survey. We are located in the 700 hall conference room.