Clark County School District Retrospective Immunization Study: 2009-2010 School Year

Public Health Report

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This report represents the findings of the Southern Nevada Health District in the retrospective immunization analysis of Clark County School District data for the 2009-2010 school year.

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EXECUTIVE SUMMARY

The Southern Nevada Health District conducted a retrospective immunization survey using Clark County School District immunization data from the 2009-2010 school year. Immunization records were available for 22,778 kindergarten students and 23,965 first grade students. Results were stratified by zip code, race, ethnicity, and socioeconomic status (SES) and were similar for kindergarten and first graders.

At kindergarten entry, immunization coverage met or exceeded national averages and Healthy People 2020 goals for all vaccine except for two doses of varicella vaccine. Coverage exceeded 95% for one dose of hepatitis A, varicella, and 4:3:1 series (4 doses of diphtheria, tetanus, and pertussis-containing vaccine [DTP], 3 doses of polio, and one dose of measles, mumps and rubella vaccine).

Of concern was the low rate of on-time vaccination during the first three years of life. Only 67% of newborns received the first dose of hepatitis B vaccine within three days of birth. There was a large decline in DTP vaccination rates for the first three doses and a large difference between students of high socioeconomic status (85% falling to 62%) compare to low socioeconomic status (77% falling to 47%). By 18 months of age, only 63% of high SES and 51% of low SES students had received all four doses of DTP vaccine.

Immunization levels among children in Nevada are among the lowest in the nation according to the National Immunization Survey. Our results show that race, ethnicity, and socioeconomic status are major determinants of vaccination rates among children in the first years of life in Clark County. Mapping by zip codes shows that there are no Vaccines for Children providers in areas that have some of the highest proportions of minorities and those of low SES.

Increasing vaccination rates will require a concerted effort by the entire community to improve access to vaccination. Enforcement of daycare immunization entry requirements has the potential to result in improvement of childhood immunization rates early in life.

OBJECTIVE
To determine the immunization coverage rates of children between birth and 36 months of age for children who were enrolled in kindergarten or first grade in the Clark County School District (CCSD) for the 2009-2010 school year.

BACKGROUND
Immunization is credited with making substantial reductions of a number of infectious diseases in the United States over the past century. Coupled with improved hygiene, vaccines have resulted in a greater than 99% decrease in diseases such as smallpox, diphtheria, polio, measles, mumps, rubella, and *Haemophilus influenzae* Type b meningitis.[1] As of 2012, twelve different vaccines covering sixteen different diseases are recommended for children under eighteen years of age.[2]

Recommended childhood immunization schedules are released annually by the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP).[3] Although the recommended schedule of immunizations was updated in 2003 and twice in 2004, the changes would have no effect on our analysis.

Since 1993, ACIP has established the vaccination schedule for the Vaccines for Children (VFC) program.[4] In Nevada, children are eligible for enrollment in VFC if they are eligible for or enrolled in Medicaid, are uninsured or underinsured, or are American Indian or Alaska Native.[5] The VFC program includes coverage for all vaccines required for school entry in Nevada.

While ACIP recommendations are generally followed by the medical community, there is no legal mandate for any childhood vaccination unless the child is entering daycare or the school system. Immunization requirements are set forth by Nevada law and require that a child provide proof of immunization against diphtheria (four doses), hepatitis A (two doses), hepatitis B (three doses), mumps (two doses), pertussis (four doses), poliomyelitis (three doses), rubella (two doses), rubeola (two doses), tetanus (four doses), and varicella (one dose) unless exempted for medical or religious reasons.[*] A two-dose requirement for varicella was not implemented until the 2011-2012 school year.[6]

The Clark County School District (CCSD) is the fifth-largest school district in the country, with a total enrollment of 309,476 students in 352 schools (213 of which are elementary schools) for the 2009-2010 school year. It encompasses all of Clark County, NV, including five municipalities and a total of 7,910 square miles.[7] In accordance with NRS 392.040.2, CCSD requires that children must be five years of age on or before September 30 to be admitted to kindergarten and must be six years of age on or before September 30 to be admitted to first grade.

[*] Public school enrollment laws: Nevada Revised Statutes (NRS) 392.435 through NRS 392.448, inclusive and Nevada Administrative Code (NAC) 392.105
Private school enrollment laws: NRS 394.192 through NRS 394.199, inclusive and NAC 394.250
Daycare enrollment laws: NRS 432A.230 through NAC 432A.280, inclusive and NAC 432A.500 through NAC 432A.510, inclusive

CCSD also administers the United States Department of Agriculture's National School Lunch Program (NSLP), a federally-subsidized meal program that provides free or reduced-cost lunches to low-income children in public and private schools. Eligibility for NSLP is based on federal poverty guidelines, which take into account both household income and household size. Reduced-price meals are available to children at 185% or less of the poverty guidelines and free meals were available to children in households earning 130% or less of the poverty guidelines. For the 2009-2010 school year, children in a family of four earning $40,793 or less were eligible for reduced-cost lunches and children in a family of four earning $28,665 or less were eligible for free lunches.[8]

METHODS

The Clark County School District provided anonymized, electronic immunization records for each student enrolled in kindergarten or first grade during the 2009-2010 school year to the Southern Nevada Health District (SNHD). The records contained the date of birth, gender, grade, race/ethnicity, qualification for the NSLP, vaccine exemption status, and dates of immunization for the vaccines required for school enrollment. The records were imported into a Microsoft Access 2003 (Microsoft Corporation; Redmond, WA) database for management and analysis; additional analysis and visualization was performed using Microsoft Excel 2007 (Microsoft Corporation; Redmond, WA).

Students were excluded from the analysis if 1) their date of birth was on or before October 1, 2001, as these students would be part of prior National Immunization Survey (NIS) birth cohorts, 2) shots were recorded as occurring before the birth of the student, or 3) multiple doses of the same vaccine were recorded as being given on the same day (indicating a data entry error that could affect coverage rate calculations). All remaining students were included in the analysis.

The demographic characteristics of the students were analyzed and maps were produced using ArcMap 10.0 (Environmental Systems Research Institute, Inc. ; Redlands, CA). Racial/ethnic groups used in the analysis are the combined race/ethnicity groups provided by the school district: Asian, non-Hispanic; American Indian or Alaska Native, non-Hispanic; black, non-Hispanic; Hispanic, any race; and white, non-Hispanic. Population data by race/ethnicity were abstracted from a local demographic research publication.[9] To allow for inter-group comparisons, racial/ethnic group vaccination rates were directly adjusted for socioeconomic status (SES) using the total analyzed student population as the standard.

Students were categorized as being low-income if they qualified for free or reduced-cost lunches under the NSLP. This included students who qualified during NSLP enrollment and those who qualified by enrollment in other income-based food assistance programs in Nevada regardless of NSLP enrollment. Students who did not qualify for the NSLP were categorized as being high-income.

Coverage rates at 36 months of age were calculated for four doses of diphtheria, tetanus, and pertussis-containing vaccine (DTP), three doses of polio vaccine, one dose of measles, mumps and rubella vaccine (MMR)[†], one dose of hepatitis A vaccine, three doses of hepatitis B vaccine, one dose of varicella vaccine, and completion of the 4:3:1series[‡]. Children were considered up-to-date if they had received the recommended number of doses at 36 months of age; the timing of the administration of the individual doses was not considered in this evaluation. The ACIP vaccination schedules for 2003 and 2004, including the number of recommended doses, are presented in Figures 1-3. Coverage rates for the on-time administration of the birth dose of the hepatitis B vaccine were calculated; the dose was considered to be given on time if it was administered within three days of birth.

For comparison to NIS estimates, coverage rates at 27 months (the midpoint of the age range surveyed by the NIS) were calculated for four doses of DTP, three doses of polio vaccine, one dose of MMR, three doses of hepatitis B vaccine, one dose of varicella vaccine and the completion of the 4:3:1 series. Students were compared to the NIS cohort in which they would have most likely been included to allow for comparison to similarly-aged children. First grade students were compared to the 2006 National Immunization Survey, and kindergarten students were compared to the 2005 National Immunization Survey. NIS estimates were available at the state and national level for both 2005 and 2006; in addition, Clark County-specific estimates were available for 2005.

Coverage rates at kindergarten entry were calculated for four doses of DTP, four doses of polio vaccine, two doses of MMR, one dose of hepatitis A vaccine, three doses of hepatitis B vaccine, and one dose of varicella vaccine. Children were considered up-to-date if they had received the required number of doses by 90 days after the beginning of the school year; timing of the administration of the individual doses was not considered in this evaluation. Coverage rates were also compared to Healthy People 2020 goals.

RESULTS

School Entry Compliance

At kindergarten entry, immunization coverage among CCSD students equals or exceeds national averages and Healthy People 2020 goals for all vaccines except varicella (2 doses). In addition, coverage exceeds 95% for one dose of hepatitis A, one dose of varicella, and the 4:3:1 series (Table 1).

Medical and religious exemption rates were low overall, varied by race/ethnicity, and income and were lowest among Hispanic students. For kindergarten and first grade students in the 2009-2010 school year, 174 CCSD students (0.4%) had medical exemptions and 437 had religious exemptions (0.9%), an overall exemption rate of 1.3%, with 2.5 times as many religious exemptions as medical exemptions. Medical and religious exemption rates in high-income students were two-and-a-half times those of low-income students (Table 2). The highest rates are in the high-income white population, with 2.9% of students having some type of exemption.

†† Components of the MMR vaccine recorded individually were combined into one MMR dose for the purposes of analysis if they were given on the same date

‡ The 4:3:1 series contains four doses of the DTP vaccine, three doses of polio vaccine, and one dose of MMR vaccine

White and American Indian/Alaska Native students had the highest rates of exemptions and Hispanic students had the lowest rates of exemptions. Students with vaccine exemptions are generally not completely unvaccinated (Table 3). Sixty-five to seventy-five percent of students with medical exemptions are up to date with vaccination requirements at school entry; MMR and varicella are exceptions, with two-dose coverage rates at school entry of 39.7% and 24.7%, respectively. Immunization coverage for students with a religious exemption is considerably lower with rates roughly a third of those with medical exemptions.

Vaccination Rates

Vaccination coverage at 36 months of age was similar in both grades (Table 4). Of all students, 77.0% had completed the 4:3:1 series by their third birthday. Within this series, the lowest immunization rates were found for the DTP vaccine, with 79.5% of students receiving three or more doses by 36 months of age. The immunization rates for the other vaccines in the series, MMR (1 or more doses) and polio (3 or more doses), were 91.4% and 89.8%, respectively.

Of the non-4:3:1 series vaccines, coverage rates were highest for hepatitis B, with 87.4% of students receiving three or more doses by 36 months of age. Varicella coverage rates were slightly lower, with 84.9% of students receiving one dose by 36 months of age. Finally, hepatitis A coverage rates were the lowest of all vaccines evaluated, with 71.2% of students receiving one dose and 26.9% of students receiving two doses by 36 months of age.

For nearly all vaccines, immunization coverage rates at 36 months of age were higher in high-income populations than in low-income populations. MMR coverage rates were the highest of all vaccines evaluated across all racial/ethnic and income groups. Hepatitis A vaccination coverage (both one and two doses) rates varied among low-income populations compared to high-income populations (Table 5). The greatest difference was seen in DTP coverage, with 83.7% of high-income students and 76.4% of low-income students receiving four doses by 36 months of age. Closely related to this difference is the 4:3:1 series difference, with 80.7% of high-income students and 74.0% of low-income students completing the series by 36 months of age.

Differences in coverage by income were frequently much greater when evaluated by race/ethnicity. The smallest differences were identified in the Hispanic community and the largest differences were seen between low-income and high-income whites and Asians. The differences were most pronounced for 4 or more doses of DTP vaccine, with all racial/ethnic groups except Hispanics showing a greater than 10% difference in coverage rates between low-income and high-income students. As an example, 84.1% of high-income white students had received 4 or more doses of the DTP vaccine by 36 months, but only 69.2% of low-income white students had done so, a difference of 14.9%.

When the crude rates are adjusted by socioeconomic status to account for differences in the income structure of the population, differences in the vaccination coverage by racial/ethnic group still remain. Across all vaccines, adjusted rates were highest for Hispanic students. In general, coverage rates among white and Asian students were similar and are lower than among Hispanic students.

Rates among black and American Indian and Alaska Native students were similar, and were lowest overall (Table 6). Geographic differences in 4:3:1 immunization coverage at 36 months within Clark County (Figure 4) were still present after direct adjustment for race/ethnicity and SES (Figure 5).

All coverage rates determined from CCSD data fell within the corresponding confidence intervals of NIS estimates for Nevada. Additionally, coverage rates of first grade students fell within the corresponding confidence intervals of NIS estimates for Clark County on the 2005 NIS, although the point estimates were lower than CCSD rates on five of six vaccines evaluated. Compared with the NIS nationwide estimates, coverage rates for Clark County were significantly lower for both years and all five vaccines and the vaccine series evaluated (Table 7).

For the birth dose of hepatitis B, two-thirds of students (66.5%) received the first dose of hepatitis B vaccine within three days of birth. The 2006 NIS reported immunization rates within three days of birth of 56.7% (±7.3) for Nevada and 50.1% (±1.1) nationwide. The Healthy People 2020 goal is 85%.

For the first four doses of DTP, approximately one-fifth of high-income students and one-fourth of low-income students who were previously on-schedule did not remain on schedule at each dose. At 18 months, only 62.7% of high-income students and 50.6% of low-income students had received all four doses at the recommended intervals (Figures 6 through 9).

Noteworthy was the large decline in on-time vaccination rates during the first year of life. For children of high SES, 84.9% received the first DTP by three months of age, but only 73.4% received the second dose by five months of age, and only 62.1% received the third dose by seven months of age. For those of low SES, there was an even greater fall off, and the gap between high SES and low SES children increased between each dose. The large decline in on-time vaccination was seen in all racial/ethnic groups with the largest declines and gaps among black children (Figures 7 and 9)

Demographics

The records of 47,120 students were provided by CCSD. Of these, 377 (0.8%) were excluded from the analysis; of the excluded records, 328 (87.0%) had multiples of the same shots recorded on the same date, 38 (10.1%) had dates of birth before October 1, 2001, and 11 (2.9%) had shots recorded as occurring before the student's date of birth. The analysis was conducted on the records of 46,743 students and covered 899,502 individual vaccinations.

Students enrolled in kindergarten and first grade were similar in terms of race/ethnicity and socioeconomic status. Hispanic students of all races are the largest racial/ethnic group, comprising nearly 45% of the student population. One-third of students are white, non-Hispanic, and 13% of students are black, non-Hispanic. Non-Hispanic American Indian and Alaska Native students are the smallest racial/ethnic group, comprising less than 1% of the population (Table 8).

Racial/ethnic groups generally tended to cluster in certain areas (Figures 10-14). There are many zip codes in which a majority of the student population is from minority groups (i.e. is non-white) (Figure 15) but where the majority of the overall population is not from minority groups (Figures 16 and 17) (2011 Las Vegas Perspective). The same is true for the Hispanic population, in which there majority of the student population is Hispanic although a majority of the overall population is not (Figures 18 and 19).

Slightly more than half the students qualified for free or reduced lunch and were thus considered low-income. The percent of students eligible for free or reduced lunch varied by race, with fewer than one-third of white and Asian students qualifying, and three-quarters of black and Hispanic students qualifying (Table 9). The percentage of students qualifying for the free or reduced lunch program varied by zip code (Figure 20) and many areas with high percentages of qualifying students were not served by either a VFC provider or a Regional Transportation Commission (RTC) bus route (Figure 21).

Discussion

School Entry Compliance

The implementation of vaccination requirements for school attendance is recommended by the Community Preventive Services Task Force based on "strong evidence of effectiveness in increasing vaccination rates and in decreasing rates of vaccine-preventable disease and associated morbidity and mortality."[10] The simple promulgation of regulations, however, is not sufficient to affect immunization rates; the regulations must be enforced to be meaningful. The enforcement of these immunization requirements by the Clark County School District and low vaccination exemption rates have led to coverage rates that generally exceed both the national average and the Healthy People 2020 goals. The one exception to this is for the second dose of varicella vaccine, as only one dose is required for school entry in Nevada. Single dose coverage for varicella exceeded 95%, the Healthy People 2020 goal for two doses; no goal was set for a single dose.

Although conditional admittance to school is allowed for undervaccinated children if "the parent or guardian submits a certificate from a physician or local health officer that the child is receiving the required immunizations", this conditional admittance also requires that if proof of immunization is not provided within 90 days, "the child must be excluded from school and may not be readmitted until the requirements for immunization have been met."[11] The enforcement of this policy by CCSD ensures compliance with the immunization regulations and is one of the major reasons that school-entry immunization rates meet or exceed national averages and goals.

As school-level data were not provided for this analysis, it was not possible to look for the clustering of unvaccinated children at a geographic level smaller than a zip code. However, differences in coverage rates clearly vary by zip code, and it is assumed that this would also be true at the school level, with the possibility of unvaccinated children clustering in a certain school either by chance or by the similarity of the populations attending that school (for example, a school with a high proportion of a low-income students would be more likely to have lower immunization rates).

Direct comparisons of exemption rates between states are inherently difficult given the differences in legal requirements and processes for obtaining an exemption in each state. These challenges are compounded by the inconsistent methodology utilized by states to collect data reported to the CDC for the annual survey of kindergarten immunization coverage.

National data show generally higher rates of religious exemptions than medical exemptions (for states that only offer those two type of exemptions), which is consistent with CCSD findings but not with CDC findings for Nevada.[12] If the reported numbers are correct for the state, it would imply that medical exemption rates in the remaining counties in the state were much higher than Clark County. A more likely explanation is that the number of exemptions reported to the CDC was incorrect.

It is important to note that even though exemption rates are low overall, clusters of children with high number of exemptions may occur in an individual school by random chance or by common demographic factors, posing a much higher risk of a sustained outbreak.

Vaccination Rates
The low rates of immunization in children 0-36 months of age are likely the result of a number of independent and interrelated factors. The absence of medical offices, urgent care centers, Federally Qualified Health Centers, and Vaccines for Children (VFC) providers in many high minority, low-SES zip codes strongly suggests that problems with access to medical services is a serious problem.

While these factors have been reported in the literature for some time[13] and key informant interviews have been conducted in Nevada[14], a study has not been conducted locally with parents to identify the major barriers responsible for Southern Nevada's suboptimal immunization coverage. This analysis was based on immunization records and cannot be used to determine the reason for the low rates.

Surprisingly, Hispanics have the highest rates of immunization among both high and low SES groups. In general, the NIS has shown the highest immunization rates among white and Asian children, with the lowest rates in black and American Indian/Alaska Native children; the rates in Hispanic children typically fall between these groups.[15] Differences between high-income and low-income Hispanics are smaller than within other racial groups, which is consistent with national data.

In 2005, the National Immunization Survey included Clark County in the local area survey, collecting and reporting county-specific data in addition to statewide data. A Clark County-specific survey was neither included in the 2006 survey nor in surveys conducted in subsequent years. In most cases, NIS point estimates for both Clark County and Nevada were lower than vaccination coverage in the CCSD student population, although all CCSD coverage rates fell within the confidence interval of the NIS. One exception is for the birth dose of hepatitis B, where the NIS reported a statistically-significant underestimation of this rate for Clark County.

While the NIS results are based on a weighted adjustment of a population-based sample of immunization, our retrospective survey is based on the actual data for the complete population of kindergarten and first grade students, providing a degree of accuracy that cannot be matched by the NIS.

A serious problem related to the use of NIS coverage estimates is the tendency of states to ignore the sampling error and use point estimates to rank states. In a 2005 evaluation of the use of the NIS to rank states' immunization coverage, Barker *et al.* argued that "If NIS data are used to rank states, one should consider presenting confidence intervals for rank and the results of comparisons of one state with another graphically".[16] The point estimate that would rank Nevada as 49th in the country would actually place the rank between 30th and 51st if the confidence interval were considered. As such, announcements such as "Nevada's immunization ranking improves from 51st in the nation to 45th"[17] are misleading, do not present an accurate picture of the trends in immunization coverage in the state, and should not be used as a guide to evaluate immunization progress in Clark County or the state of Nevada.

The methodology used to calculate NIS estimates samples households with children 17 through 37 months of age using landline telephones; wireless-only households are not sampled.[18] According to the National Health Interview Survey, adults living in or near poverty were more likely to be a wireless-only household than higher income adults, and Hispanic adults were more likely than non-Hispanics to live in a wireless-only household. In addition, wireless-only households were more likely to be uninsured, have experienced financial barriers to obtaining healthcare and not have a medical home.[19] Depending on the percentage of wireless-only households, bias would be introduced into the survey which could result in the survey not being generalizable to the population it is intended to represent (assuming the characteristics of wireless-only households in Southern Nevada are the same as were identified nationwide).

At the time of the 2005 and 2006 NIS data collection, between 5% and 10% of households had only wireless phone service; the bias introduced into the survey by excluding these groups would be small. By 2011, this number had climbed to one-third of households, with 36.4% of children living in households with only wireless service.[20] Given that the factors associated with immunization coverage are also associated with being a wireless-only household, the role of bias will likely continue to increase in successive NIS surveys without a change in survey sampling methodologies, making the survey less reliable over time. The retrospective immunization study presented here does not suffer from such bias.

Our study identified a large decline in immunization rates that began immediately after the first dose of DTP and continues to decline after the second and third doses. These declines existed within all racial/ethnic groups. As the rates decline, the gap between high SES and low SES children widens. The declines are serious and of public health concern. With only 32-52% of children seven months of age having received three DTP vaccinations, Southern Nevada children are undervaccinated and at risk for outbreaks of these preventable diseases.

Because *Haemophilus influenzae* Type b vaccine is not required for entry to kindergarten or higher grades, CCSD does not record this vaccine in its database, therefore we were unable to evaluate *Haemophilus influenzae* Type b immunization rates in this study. However, the low DTP vaccination rates strongly implies that *Haemophilus influenzae* vaccination rates are similarly low, leaving a substantial number of infants susceptible to this devastating, preventable disease.

Given the generally low rates of vaccine exemptions and (comparatively) high hepatitis B birth dose coverage, Southern Nevada's immunization rates do not appear to be the result of an unwillingness of parents to have their children immunized. This high rate of compliance with school vaccine requirements is evidence of widespread support by the community for mandatory vaccination. However, this philosophical support for vaccination has not translated into children receiving their vaccines at the ACIP-recommended ages, indicating that there are serious problems with access to vaccination services throughout the community. The cumulative effect of delayed immunization is a growing number of young children who are not fully protected against vaccine-preventable diseases and pose a risk of a large and sustained outbreak of any of these diseases in the population.

The racial/ethnic and SES disparities seen in immunization coverage at 36 months of age began at birth and continue up to 36 months of age. Overall, lower SES groups take longer to reach immunization coverage rates of their higher-income counterparts. For example, 51.1% of higher-SES black students have received 4 doses of the diphtheria-pertussis-tetanus-containing vaccine by the recommended 18 months of age; lower SES black students do not reach this level of immunization coverage in the population until 24 months of age. The disparities between high and low SES groups and between racial/ethnic groups are not eliminated until school entry when vaccination is mandated.

Demographics

The student population in this analysis differed from the overall Clark County population in regard to racial/ethnic distribution. The black, American Indian and Alaska Native, and Asian populations comprise roughly the same percent of students in the school population as in the overall county population. Hispanics comprise a much larger percentage of the student population than of the overall population (45% and 28%, respectively), while whites comprise a much smaller percentage of the student population than the overall population (33% and 55%, respectively). Because of the large differences between the geographic distributions of Hispanic students and the overall Hispanic population, total population data are insufficient to use in the planning for pediatric medical and immunization services. For example, in the 89156 zip code, only 29.9% of the residents are Hispanic, while 61.0% of kindergarteners and first graders are Hispanic. As 74.4% of these students are considered low-income and there are no VFC providers in this zip code, this has significant implications for the provision of public health and immunization services to this community and must be considered when making policy, administrative, and operational decisions. It was surprising to identify VFC providers located in wealthier areas of Clark County that were not on Regional Transportation Commission (RTC) bus routes, as these providers would be least accessible to the population subgroups most likely to be enrolled in the VFC program.

While the overall rates of free and reduced lunch eligibility in Clark County at the zip code level vary considerably, there are obvious pockets of need, with greater than 90% qualifying in some zip codes.

Geographic clustering of people by racial/ethnic groups and socioeconomic status can explain some of the geographic patterns of vaccination coverage observed at the population level. However, there are still geographic differences when racial/ethnic groups and socioeconomic status are controlled for, indicating that there additional factors beyond these that affect vaccination coverage.

Limitations

There were several limitations to this study. First, the most important limitation is that the study assessed only the vaccines required for school entry and not all childhood vaccines. For example, the vaccines against rotavirus and *Haemophilus influenzae* Type b are recommended vaccines that are not required for school entry, and as such, are not entered into CCSD systems. This information is important in assessing the overall vaccination status of children, but is unavailable.

Second, while this study may have provided a more accurate picture of immunization than a cross-sectional survey with a large sampling error, the accuracy came at the cost of timeliness. As this study was retrospective in nature, it evaluated the early-childhood immunization rates in the community several years after the children were vaccinated, which limited the ability of public health officials to identify and respond to problems within the community. The same issue exists for National Immunization Survey, as immunization data may be collected up to three years after the administration of the vaccine.

Third, it was not possible to ensure accurate data entry, as this was an analysis of secondary data over which the investigators had no control. In some cases, data entry errors would be identified if the error resulted in a student being denied entry to school. In other cases, the results of the data entry error would be inconsequential for the school district; for example, if the year of the varicella vaccination were entered incorrectly, the student would still be recorded as having one dose of vaccine prior to school entry and would not be denied enrollment.

Finally, the results of this study may not be generalizable to private schools and homeschooled children in Clark County because the underlying student populations may be significantly different than the CCSD student populations. Homeschooled students do not fall under the same immunization mandates as public and private school children, and vaccination rates may be very different than identified in this study. As homeschooled students make up less than 0.5% of the student population in kindergarten and first grade in Clark County,[21] their vaccination rates would not significantly affect overall community vaccination rates. Although children enrolled in private schools must comply with the same immunization mandates as children enrolled in public schools, no assumptions can be made about the similarity of the immunization history at 0 to 36 months.

Conclusions

Enforcement of school immunization requirements by the Clark County School District has resulted in high levels of immunization in the kindergarten and first grade students and is a driving force in protecting the community from outbreaks of vaccine-preventable disease. CCSD is commended for maintaining these high standards of childhood immunization.

This analysis highlights serious and important problems with immunization rates in children under 12 months of age throughout the community. These problems are manifested in early, cumulative losses in up-to-date immunization status which continue until school entry. Immunization rates in children under 36 months of age are among the lowest in the nation, and present a serious risk to the safety of the Southern Nevada community. In addition to overall low rates, there are significant socioeconomic and racial/ethnic disparities which continue from birth until school entry.

Recommendations

The data used to conduct this analysis represented a major data collection and data entry effort on the part of the Clark County School District to record individual shot information in their student health information system. As much of this information may already have been captured in the state's immunization registry, we recommend that the Nevada State Health Division, CCSD, and SNHD explore the possibility of directly importing demographic and immunization data from the State immunization registry into the CCSD data system. This would eliminate redundant data entry, potentially saving thousands of hours of work currently being performed by school nurses and administration staff throughout CCSD.

Although these types of retrospective immunization studies provide a delayed picture of childhood immunization, they provide the most detailed and accurate assessment of childhood immunization in Southern Nevada. We recommend that the Southern Nevada Health District develop an agreement with the Clark County School District to perform annual retrospective immunization studies to provide longitudinal and cross-sectional analyses.

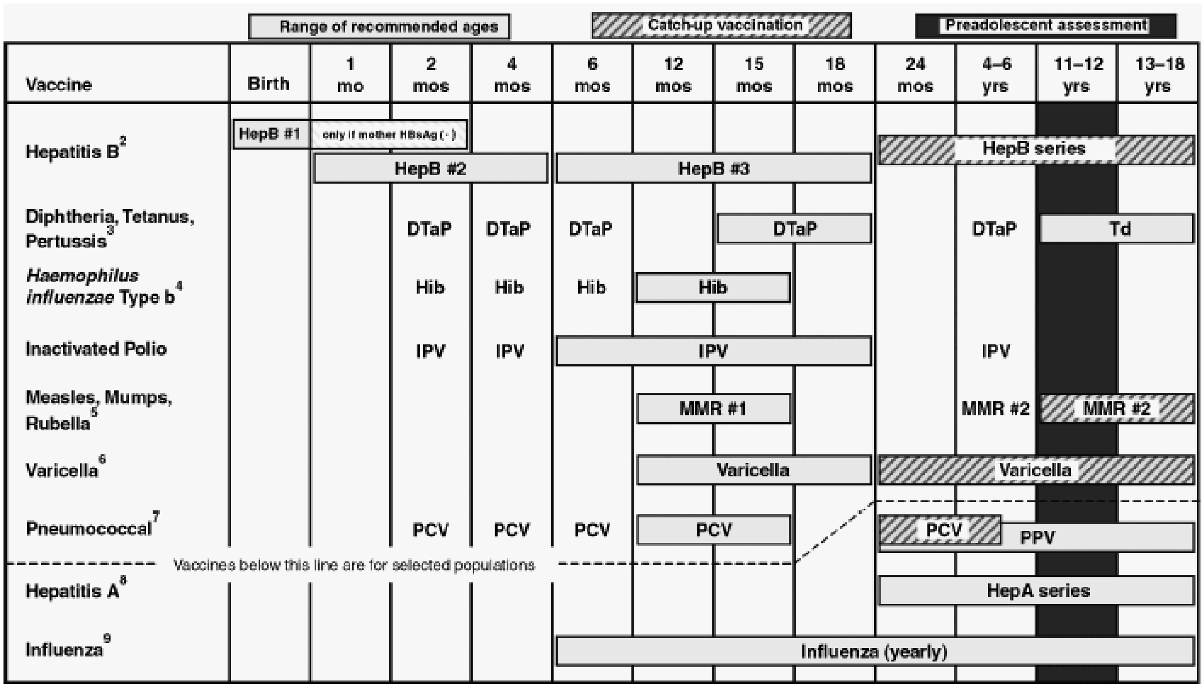
As an immediate step to increase immunization in children 0 to 36 months of age, SNHD should enhance efforts to enforce existing daycare immunization requirements. In addition to the clustering of unvaccinated or undervaccinated children posing a risk of outbreaks, daycares provide an opportunity to reach and vaccinate large numbers of children and are already regulated by the Southern Nevada Health District.

The findings of this retrospective immunization study suggest that there is a serious lack of access to primary care health services in Southern Nevada. The low immunization rates documented will not be remedied without community resolve and focused planning that maximizes use of health care services.

Figures and Tables

Figure 1. Advisory Committee on Immunization Practices recommended immunization schedule, 2003

FIGURE. Recommended childhood and adolescent immunization schedule[1] — United States, 2003



1. Indicates the recommended ages for routine administration of currently licensed childhood vaccines, as of December 1, 2002, for children through age 18 years. Any dose not given at the recommended age should be given at any subsequent visit when indicated and feasible. ▨ Indicates age groups that warrant special effort to administer those vaccines not given previously. Additional vaccines may be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and the vaccine's other components are not contraindicated. Providers should consult the manufacturers' package inserts for detailed recommendations.

2. **Hepatitis B vaccine (HepB).** All infants should receive the first dose of HepB vaccine soon after birth and before hospital discharge; the first dose also may be given by age 2 months if the infant's mother is HBsAg-negative. Only monovalent HepB vaccine can be used for the birth dose. Monovalent or combination vaccine containing HepB may be used to complete the series; 4 doses of vaccine may be administered when a birth dose is given. The second dose should be given at least 4 weeks after the first dose except for combination vaccines, which cannot be administered before age 6 weeks. The third dose should be given at least 16 weeks after the first dose and at least 8 weeks after the second dose. The last dose in the vaccination series (third or fourth dose) should not be administered before age 6 months. Infants born to HBsAg-positive mothers should receive HepB vaccine and 0.5 mL hepatitis B immune globulin (HBIG) within 12 hours of birth at separate sites. The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 6 months. These infants should be tested for HBsAg and anti-HBs at 9–15 months of age. Infants born to mothers whose HBsAg status is unknown should receive the first dose of the HepB vaccine series within 12 hours of birth. Maternal blood should be drawn as soon as possible to determine the mother's HBsAg status; if the HBsAg test is positive, the infant should receive HBIG as soon as possible (no later than age 1 week). The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 6 months.

3. **Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP).** The fourth dose of DTaP may be administered at age 12 months provided that 6 months have elapsed since the third dose and the child is unlikely to return at age 15–18 months. **Tetanus and diphtheria toxoids (Td)** is recommended at age 11–12 years if at least 5 years have elapsed since the last dose of Td-containing vaccine. Subsequent routine Td boosters are recommended every 10 years.

4. ***Haemophilus influenzae* type b (Hib) conjugate vaccine.** Three Hib conjugate vaccines are licensed for infant use. If PRP-OMP (PedvaxHIB® or ComVax® [Merck]) is administered at age 2 and 4 months, a dose at age 6 months is not required. DTaP/Hib combination products should not be used for primary vaccination in infants at age 2, 4, or 6 months but can be used as boosters following any Hib vaccine.

5. **Measles, mumps, and rubella vaccine (MMR).** The second dose of MMR is recommended routinely at age 4–6 years but may be administered during any visit provided that at least 4 weeks have elapsed since the first dose and that both doses are administered beginning at or after age 12 months. Those who have not received the second dose previously should complete the schedule by the visit at age 11–12 years.

6. **Varicella vaccine.** Varicella vaccine is recommended at any visit at or after age 12 months for susceptible children (i.e., those who lack a reliable history of chickenpox). Susceptible persons aged $\geq$13 years should receive 2 doses given at least 4 weeks apart.

7. **Pneumococcal vaccine.** The heptavalent **pneumococcal conjugate vaccine (PCV)** is recommended for all children aged 2–23 months and for certain children aged 24–59 months. **Pneumococcal polysaccharide vaccine (PPV)** is recommended in addition to PCV for certain high-risk groups. See *MMWR* 2000;49(No. RR-9):1–37.

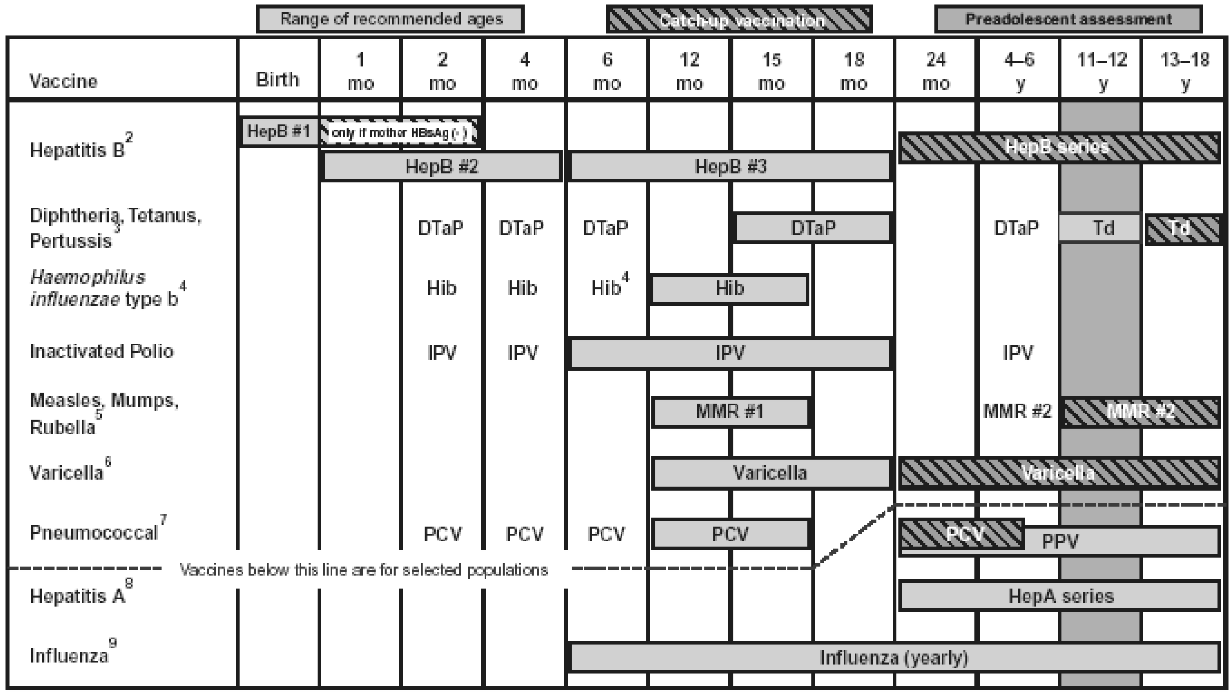
8. **Hepatitis A vaccine.** Hepatitis A vaccine is recommended for children and adolescents in selected states and regions, and for certain high-risk groups. Consult local public health authority and *MMWR* 1999;48(No. RR-12):1–37. Children and adolescents in these states, regions, and high-risk groups who have not been immunized against hepatitis A can begin the hepatitis A vaccination series during any visit. The two doses in the series should be administered at least 6 months apart.

9. **Influenza vaccine.** Influenza vaccine is recommended annually for children aged $\geq$6 months with certain risk factors (including but not limited to asthma, cardiac disease, sickle cell disease, HIV, and diabetes, and household members of persons in groups at high risk (see *MMWR* 2002;51[No. RR-3]:1–31), and can be administered to all others wishing to obtain immunity. In addition, healthy children age 6–23 months are encouraged to receive influenza vaccine if feasible because children in this age group are at substantially increased risk for influenza-related hospitalizations. Children aged $\leq$12 years should receive vaccine in a dosage appropriate for their age (0.25 mL if 6–35 months or 0.5 mL if $\geq$3 years). Children aged $\leq$8 years who are receiving influenza vaccine for the first time should receive 2 doses separated by at least 4 weeks.

Source: Advisory Committee on Immunization Practices. Recommended Childhood and Adolescent Immunization Schedule. *MMWR* 52(04);Q1-Q4. Retrieved April 18, 2012 from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5204-Immunizationa1.htm

Figure 2. Advisory Committee on Immunization Practices recommended immunization schedule, January-June 2004

FIGURE. Recommended childhood and adolescent immunization schedule[1] — United States, January–June 2004



1. Indicates the recommended ages for routine administration of currently licensed childhood vaccines, as of December 1, 2003, for children through age 18 years. Any dose not given at the recommended age should be given at any subsequent visit when indicated and feasible. [hatched box] Indicates age groups that warrant special effort to administer those vaccines not given previously. Additional vaccines may be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and the vaccine's other components are not contraindicated. Providers should consult the manufacturers' package inserts for detailed recommendations. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS). Guidance on how to obtain and complete a VAERS form is available at http://www.vaers.org or by telephone, 800-822-7967.

2. Hepatitis B vaccine (HepB). All infants should receive the first dose of HepB vaccine soon after birth and before hospital discharge; the first dose also may be given by age 2 months if the infant's mother is HBsAg-negative. Only monovalent HepB vaccine can be used for the birth dose. Monovalent or combination vaccine containing HepB may be used to complete the series; 4 doses of vaccine may be administered when a birth dose is given. The second dose should be given at least 4 weeks after the first dose except for combination vaccines, which cannot be administered before age 6 weeks. The third dose should be given at least 16 weeks after the first dose and at least 8 weeks after the second dose. The last dose in the vaccination series (third or fourth dose) should not be administered before age 24 weeks. Infants born to HBsAg-positive mothers should receive HepB vaccine and 0.5 mL hepatitis B immune globulin (HBIG) within 12 hours of birth at separate sites. The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 24 weeks. These infants should be tested for HBsAg and anti-HBs at age 9–15 months. Infants born to mothers whose HBsAg status is unknown should receive the first dose of the HepB vaccine series within 12 hours of birth. Maternal blood should be drawn as soon as possible to determine the mother's HBsAg status; if the HBsAg test is positive, the infant should receive HBIG as soon as possible (no later than age 1 week). The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 24 weeks.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP). The fourth dose of DTaP may be administered at age 12 months provided that 6 months have elapsed since the third dose and the child is unlikely to return at age 15–18 months. The final dose in the series should be given at age ≥4 years. Tetanus and diphtheria toxoids (Td) is recommended at age 11–12 years if at least 5 years have elapsed since the last dose of tetanus and diphtheria toxoid-containing vaccine. Subsequent routine Td boosters are recommended every 10 years.

4. *Haemophilus influenzae* type b (Hib) conjugate vaccine. Three Hib conjugate vaccines are licensed for infant use. If PRP-OMP (PedvaxHIB® or ComVax® [Merck]) is administered at ages 2 and 4 months, a dose at age 6 months is not required. DTaP/Hib combination products should not be used for primary vaccination in infants at ages 2, 4, or 6 months but can be used as boosters after any Hib vaccine. The final dose in the series should be given at age ≥12 months.

5. Measles, mumps, and rubella vaccine (MMR). The second dose of MMR is recommended routinely at age 4–6 years but may be administered during any visit provided that at least 4 weeks have elapsed since the first dose and that both doses are administered beginning at or after age 12 months. Those who have not received the second dose previously should complete the schedule by the visit at age 11–12 years.

6. Varicella vaccine (VAR). Varicella vaccine is recommended at any visit at or after age 12 months for susceptible children (i.e., those who lack a reliable history of chickenpox). Susceptible persons aged ≥13 years should receive 2 doses given at least 4 weeks apart.

7. Pneumococcal vaccine. The heptavalent pneumococcal conjugate vaccine (PCV) is recommended for all children aged 2–23 months and for certain children aged 24–59 months. The final dose in the series should be given at age ≥12 months. Pneumococcal polysaccharide vaccine (PPV) is recommended in addition to PCV for certain high-risk groups. See *MMWR* 2000;49(No. RR-9):1–35.

8. Hepatitis A vaccine. Hepatitis A vaccine is recommended for children and adolescents in selected states and regions, and for certain high-risk groups. Consult local public health authority and *MMWR* 1999;48(No. RR-12):1–37. Children and adolescents in these states, regions, and high-risk groups who have not been vaccinated against hepatitis A can begin the hepatitis A vaccination series during any visit. The two doses in the series should be administered at least 6 months apart.

9. Influenza vaccine. Influenza vaccine is recommended annually for children aged ≥6 months with certain risk factors (including but not limited to asthma, cardiac disease, sickle cell disease, HIV, and diabetes), and household members of persons in groups at high risk (see *MMWR* 2003;52[No. RR-8]:1–36), and can be administered to all others wishing to obtain immunity. In addition, healthy children aged 6–23 months are encouraged to receive influenza vaccine if feasible because children in this age group are at substantially increased risk for influenza-related hospitalizations. For healthy persons aged 5–49 years, the intranasally administered live-attenuated influenza vaccine (LAIV) is an acceptable alternative to the intramuscular trivalent inactivated influenza vaccine (TIV). See *MMWR* 2003;52(No. RR-13):1–8. Children receiving TIV should be administered a dosage appropriate for their age (0.25 mL if 6–35 months or 0.5 mL if ≥3 years). Children aged ≤8 years who are receiving influenza vaccine for the first time should receive 2 doses (separated by at least 4 weeks for TIV and at least 6 weeks for LAIV).

Source: Advisory Committee on Immunization Practices. Recommended Childhood and Adolescent Immunization Schedule --- United States, January--June 2004. *MMWR* 53(01);Q1-Q4. Retrieved April 18, 2012 from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5301-Immunizationa1.htm

Figure 3. Advisory Committee on Immunization Practices recommended immunization schedule,, July-December 2004

FIGURE. Recommended childhood and adolescent immunization schedule[1] — United States, July–December 2004

Range of recommended ages | Catch-up vaccination | Preadolescent assessment

Vaccine	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	24 mo	4–6 y	11–12 y	13–18 y
Hepatitis B[2]	HepB #1	only if mother HBsAg (-)							HepB series			
		HepB #2			HepB #3							
Diphtheria, Tetanus, Pertussis[3]			DTaP	DTaP	DTaP		DTaP			DTaP	Td	Td
Haemophilus influenzae type b[4]			Hib	Hib	Hib[4]	Hib						
Inactivated Poliovirus			IPV	IPV	IPV					IPV		
Measles, Mumps, Rubella[5]						MMR #1				MMR #2	MMR #2	
Varicella[6]						Varicella			Varicella			
Pneumococcal[7]			PCV	PCV	PCV	PCV			PCV			
									PPV			
Influenza[8]					Influenza (yearly)				Influenza (yearly)			
Vaccines below this line are for selected populations												
Hepatitis A[9]									HepA series			

1. Indicates the recommended ages for routine administration of currently licensed childhood vaccines, as of April 1, 2004, for children through age 18 years. Any dose not given at the recommended age should be given at any subsequent visit when indicated and feasible. [hatched box] Indicates age groups that warrant special effort to administer those vaccines not given previously. Additional vaccines may be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and the vaccine's other components are not contraindicated. Providers should consult the manufacturers' package inserts for detailed recommendations. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS). Guidance about how to obtain and complete a VAERS form is available at http://www.vaers.org/ or by telephone, 800-822-7967.

2. Hepatitis B vaccine (HepB). All infants should receive the first dose of HepB vaccine soon after birth and before hospital discharge; the first dose also may be given by age 2 months if the infant's mother is HBsAg-negative. Only monovalent HepB vaccine can be used for the birth dose. Monovalent or combination vaccine containing HepB may be used to complete the series; 4 doses of vaccine may be administered when a birth dose is given. The second dose should be given at least 4 weeks after the first dose except for combination vaccines, which cannot be administered before age 6 weeks. The third dose should be given at least 16 weeks after the first dose and at least 8 weeks after the second dose. The last dose in the vaccination series (third or fourth dose) should not be administered before age 24 weeks. Infants born to HBsAg-positive mothers should receive HepB vaccine and 0.5 mL hepatitis B immune globulin (HBIG) within 12 hours of birth at separate sites. The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 24 weeks. These infants should be tested for HBsAg and anti-HBs at age 9–15 months. Infants born to mothers whose HBsAg status is unknown should receive the first dose of the HepB vaccine series within 12 hours of birth. Maternal blood should be drawn as soon as possible to determine the mother's HBsAg status; if the HBsAg test is positive, the infant should receive HBIG as soon as possible (no later than age 1 week). The second dose is recommended at age 1–2 months. The last dose in the vaccination series should not be administered before age 24 weeks.

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4. *Haemophilus influenzae* type b (Hib) conjugate vaccine. Three Hib conjugate vaccines are licensed for infant use. If PRP-OMP (PedvaxHIB® or ComVax® [Merck]) is administered at ages 2 and 4 months, a dose at age 6 months is not required. DTaP/Hib combination products should not be used for primary vaccination in infants at ages 2, 4, or 6 months but can be used as boosters after any Hib vaccine. The final dose in the series should be given at age ≥12 months.

5. Measles, mumps, and rubella vaccine (MMR). The second dose of MMR is recommended routinely at age 4–6 years but may be administered during any visit, provided at least 4 weeks have elapsed since the first dose and both doses are administered beginning at or after age 12 months. Those who have not received the second dose previously should complete the schedule by the visit at age 11–12 years.

6. Varicella vaccine (VAR). Varicella vaccine is recommended at any visit at or after age 12 months for susceptible children (i.e., those who lack a reliable history of chickenpox). Susceptible persons aged ≥13 years should receive 2 doses given at least 4 weeks apart.

7. Pneumococcal vaccine. The heptavalent pneumococcal conjugate vaccine (PCV) is recommended for all children aged 2–23 months and for certain children aged 24–59 months. The final dose in the series should be given at age ≥12 months. Pneumococcal polysaccharide vaccine (PPV) is recommended in addition to PCV for certain high-risk groups. See *MMWR* 2000;49(No. RR-9):1–35.

8. Influenza vaccine. Influenza vaccine is recommended annually for children aged ≥6 months with certain risk factors (including but not limited to asthma, cardiac disease, sickle cell disease, HIV, and diabetes), health care workers, and other persons (including household members) in close contact with persons in groups at high risk (see *MMWR* 2004;53;[RR][in press]) and can be administered to all others wishing to obtain immunity. In addition, healthy children aged 6–23 months and close contacts of healthy children aged 0–23 months are recommended to receive influenza vaccine, because children in this age group are at substantially increased risk for influenza-related hospitalizations. For healthy persons aged 5–49 years, the intranasally administered live, attenuated influenza vaccine (LAIV) is an acceptable alternative to the intramuscular trivalent inactivated influenza vaccine (TIV). See *MMWR* 2003;52(No. RR-13):1–8. Children receiving TIV should be administered a dosage appropriate for their age (0.25 mL if 6–35 months or 0.5 mL if ≥3 years). Children aged ≤8 years who are receiving influenza vaccine for the first time should receive 2 doses (separated by at least 4 weeks for TIV and at least 6 weeks for LAIV).

9. Hepatitis A vaccine. Hepatitis A vaccine is recommended for children and adolescents in selected states and regions and for certain high-risk groups. Consult your local public health authority and *MMWR* 1999;48(No.RR-12):1–37. Children and adolescents in these states, regions, and high-risk groups who have not been immunized against hepatitis A can begin the hepatitis A vaccination series during any visit. The 2 doses in the series should be administered at least 6 months apart.

Source: Advisory Committee on Immunization Practices. Recommended Childhood and Adolescent Immunization Schedule --- United States, July--December 2004. *MMWR* 53(16);Q1-Q3. Retrieved April 18, 2012 from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5316-Immunizationa1.htm

Figure 4. 4:3:1 series completion rates at 36 months of age, Clark County School District kindergarten and first grade students, 2009-2010 school year

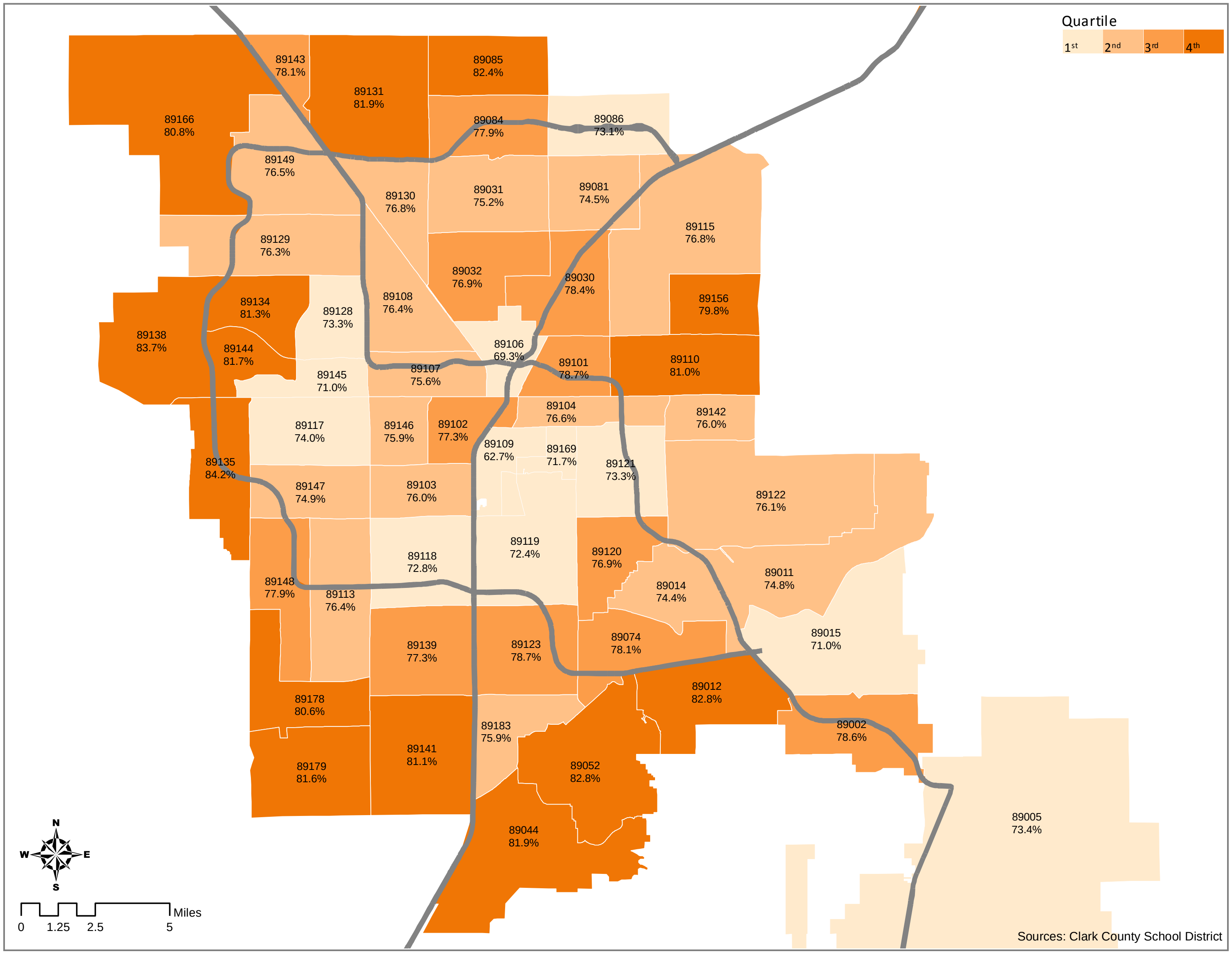

Figure 5. SES and racial/ethnicity adjusted 4:3:1 series completion rates at 36 months of age, Clark County School District kindergarten and first grade students, 2009-2010 school year

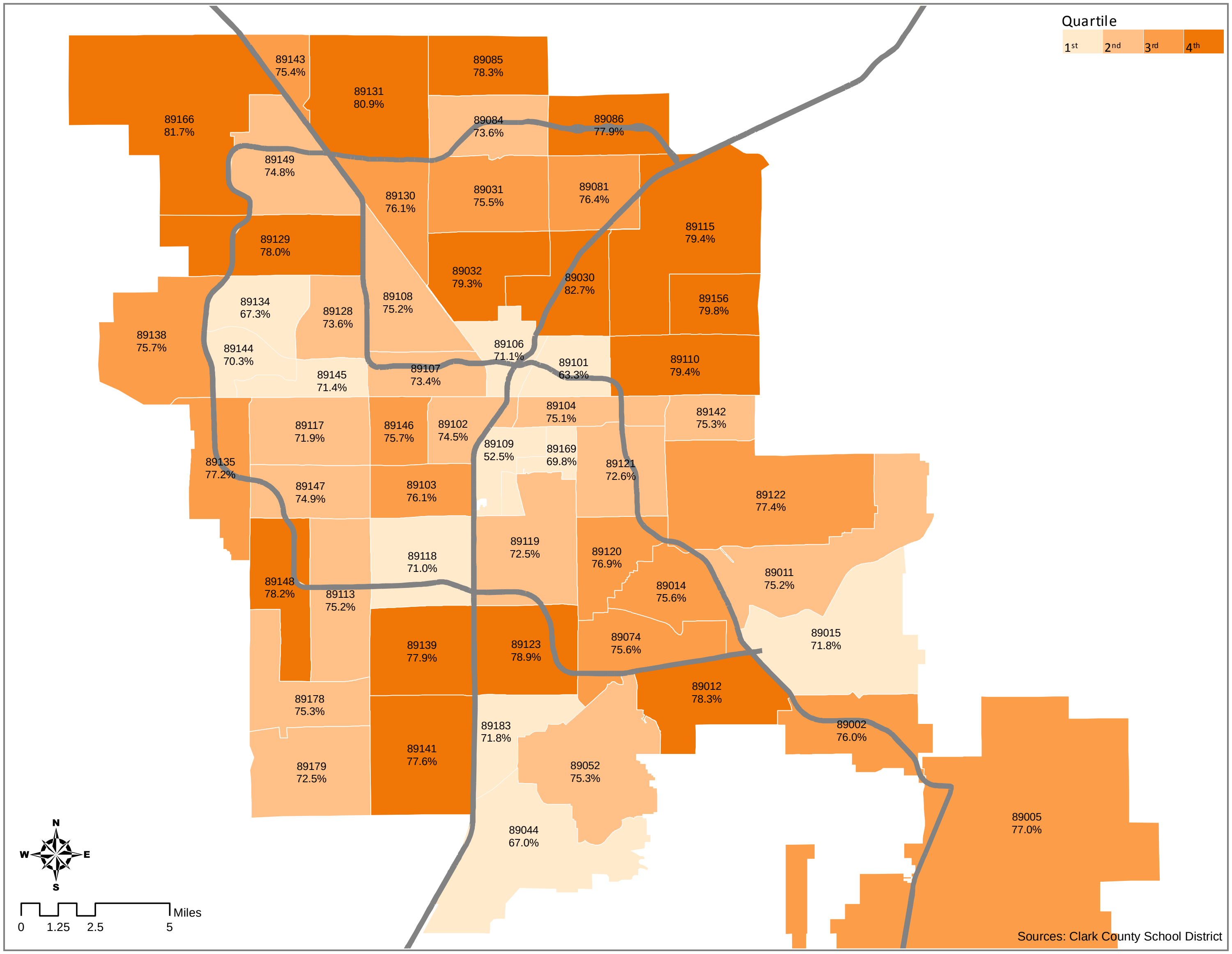

Figure 6. Percent of children vaccinated with doses one through four of DTP, Clark County School District kindergarten and first grade students, 2009-2010 school year

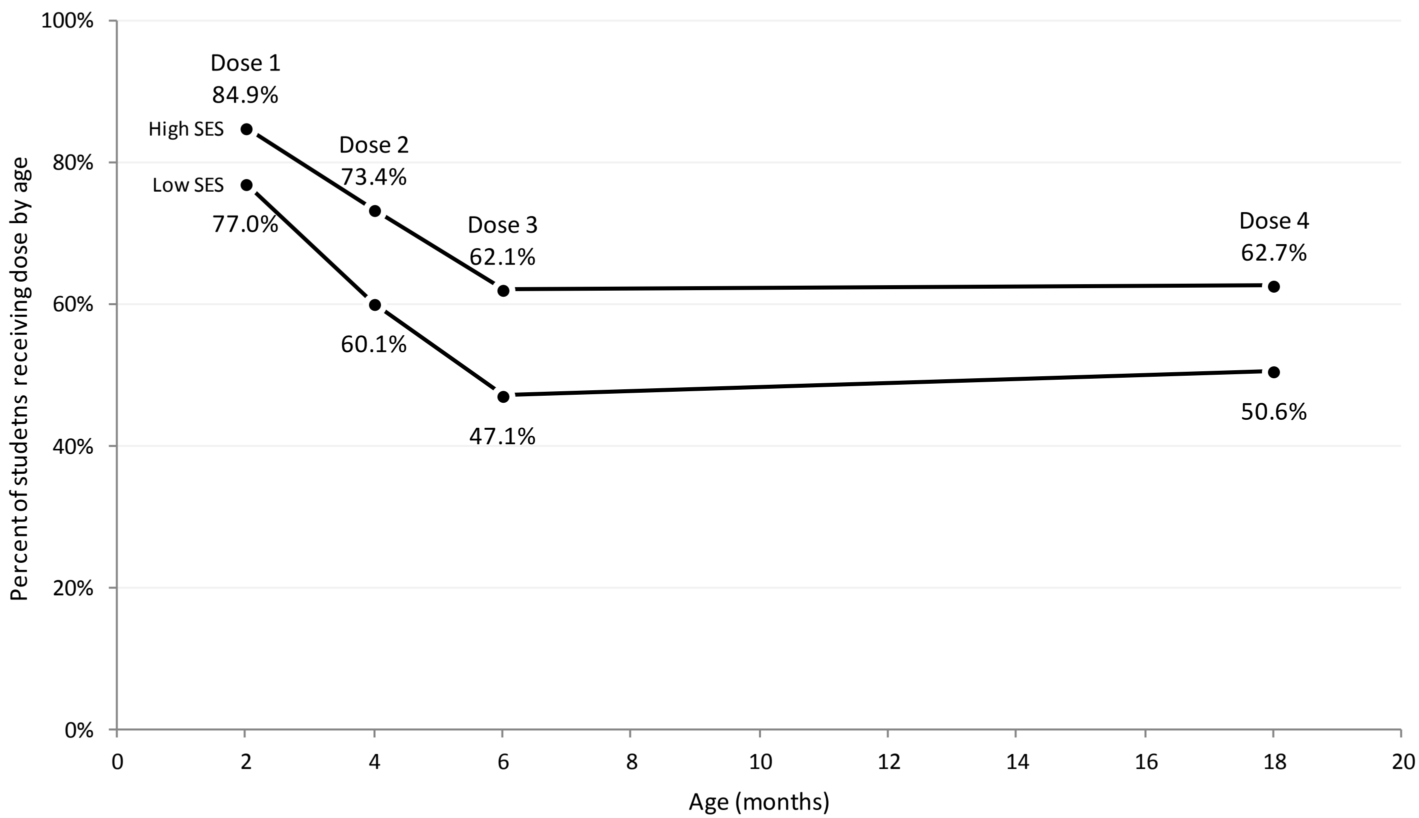

Figure 7. Percent of children vaccinated with doses one through four of DTP at the recommended age by race/ethnicity and SES, Clark County School District kindergarten and first grade students, 2009-2010 school year

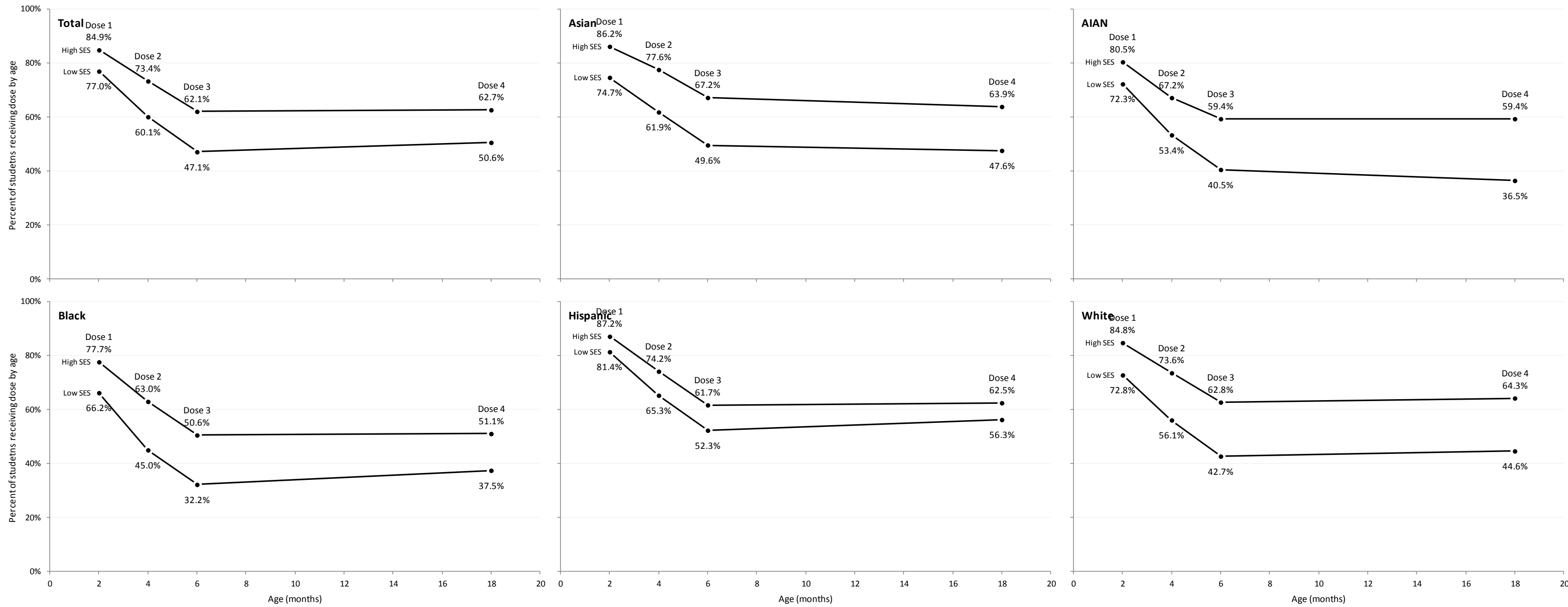

Figure 8. Percent of children vaccinated with doses one through four of DTP by month age by SES, Clark County School District kindergarten and first grade students, 2009-2010 school year

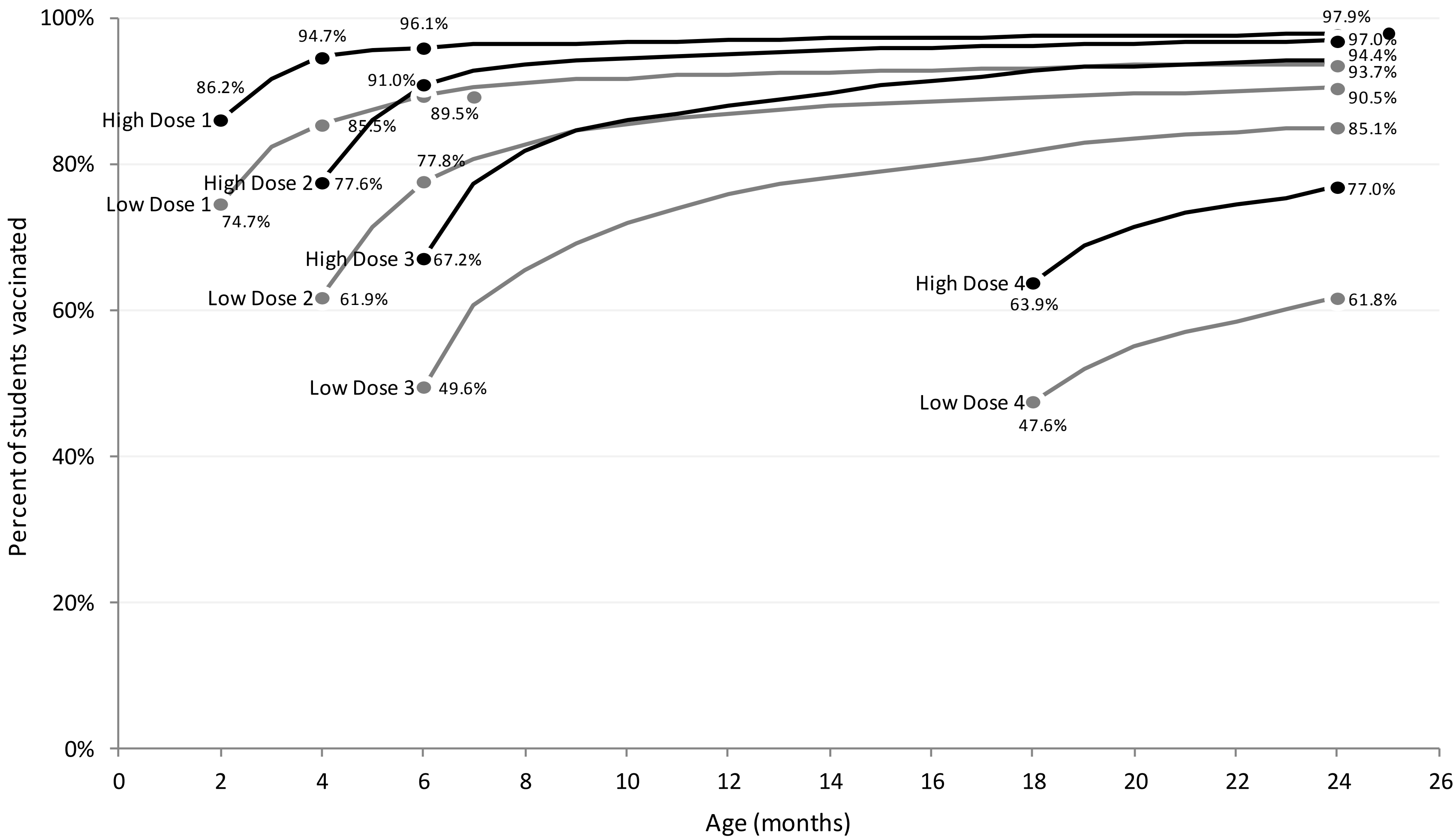

Figure 9. Percent of children vaccinated with doses one through four of DTP by month age by race/ethnicity and SES, Clark County School District kindergarten and first grade students, 2009-2010 school year

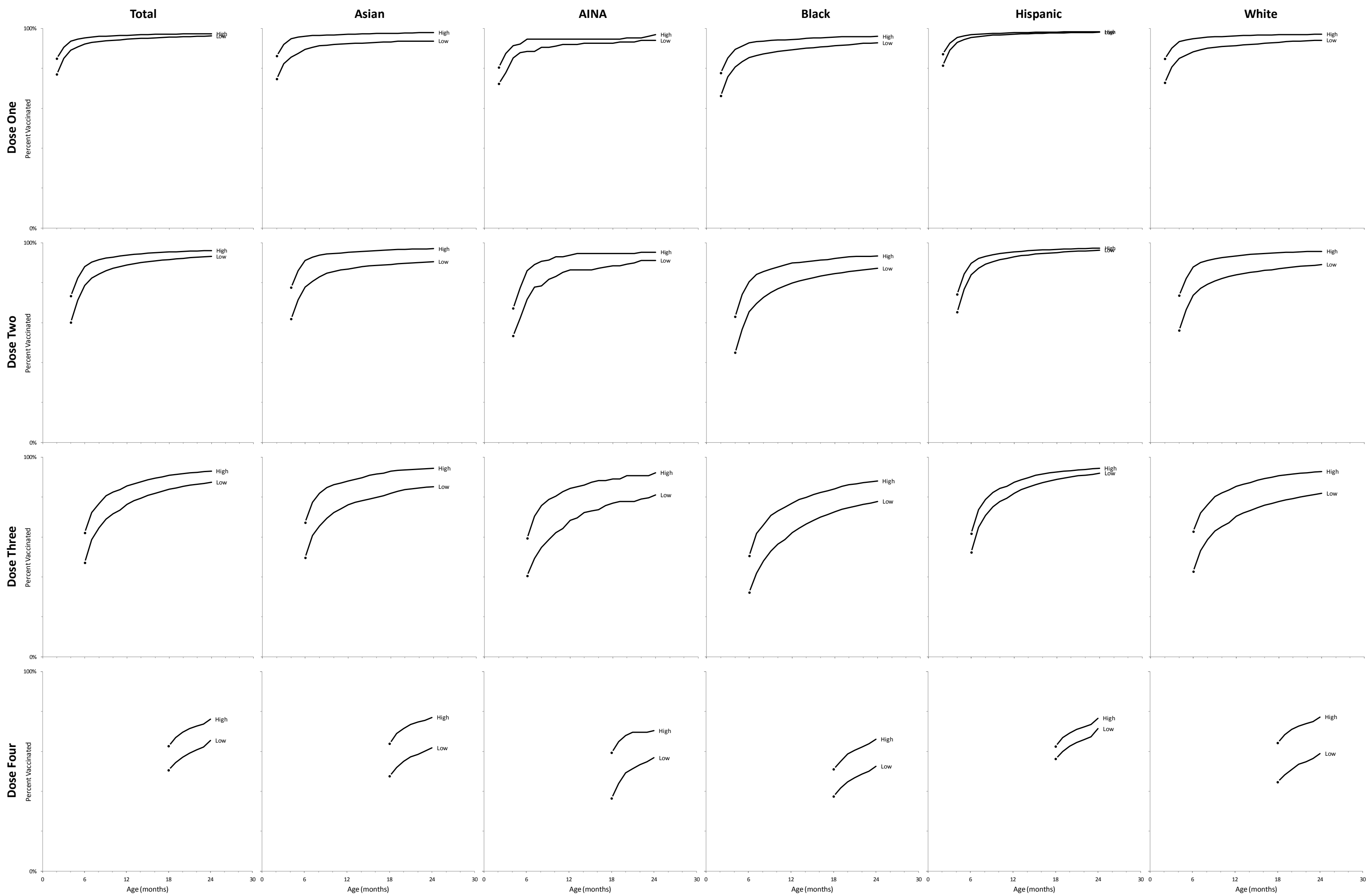

Figure 10. Map of the percent of American Indian or Alaska Native students by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

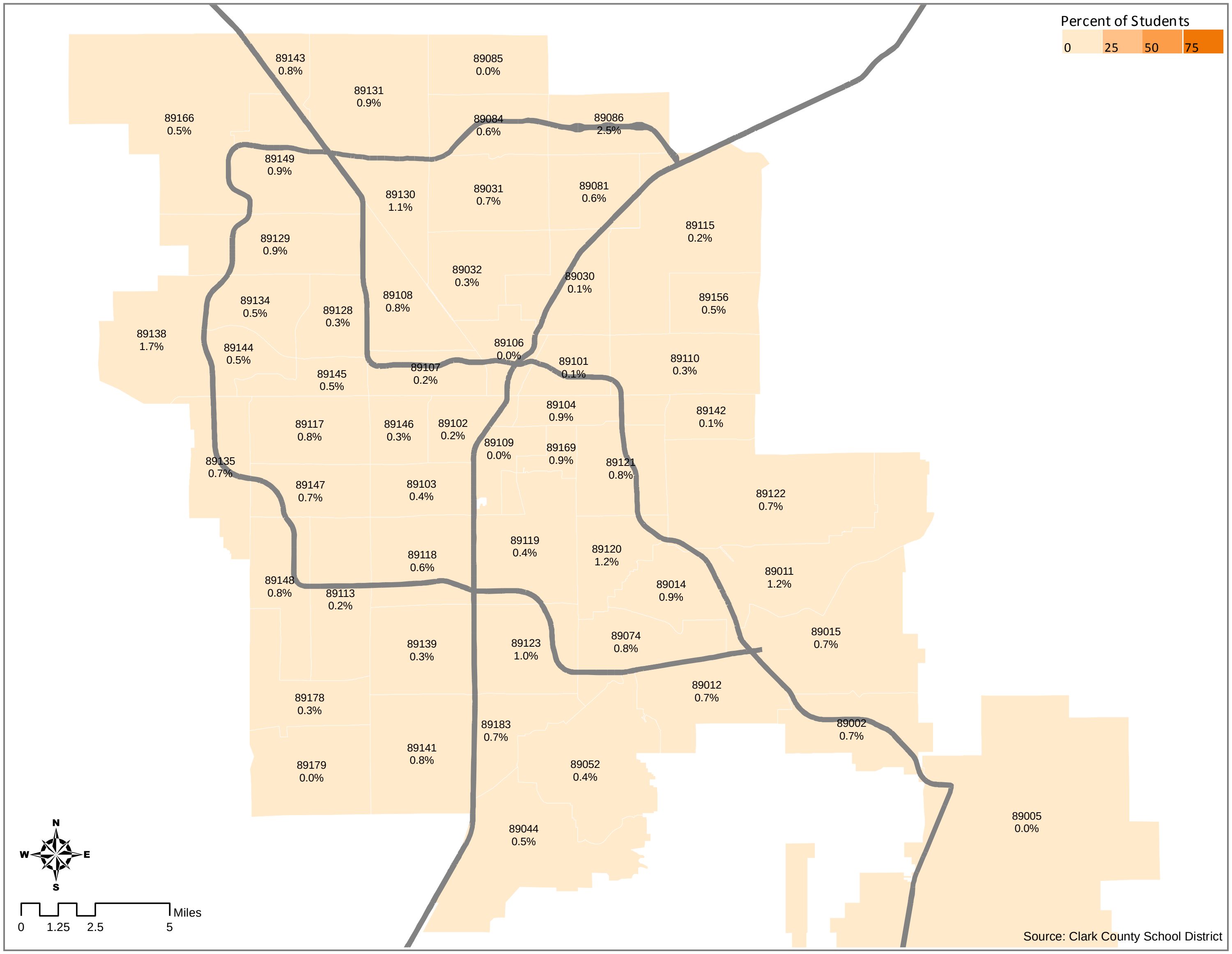

Figure 11. Map of the percent of Asian students by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

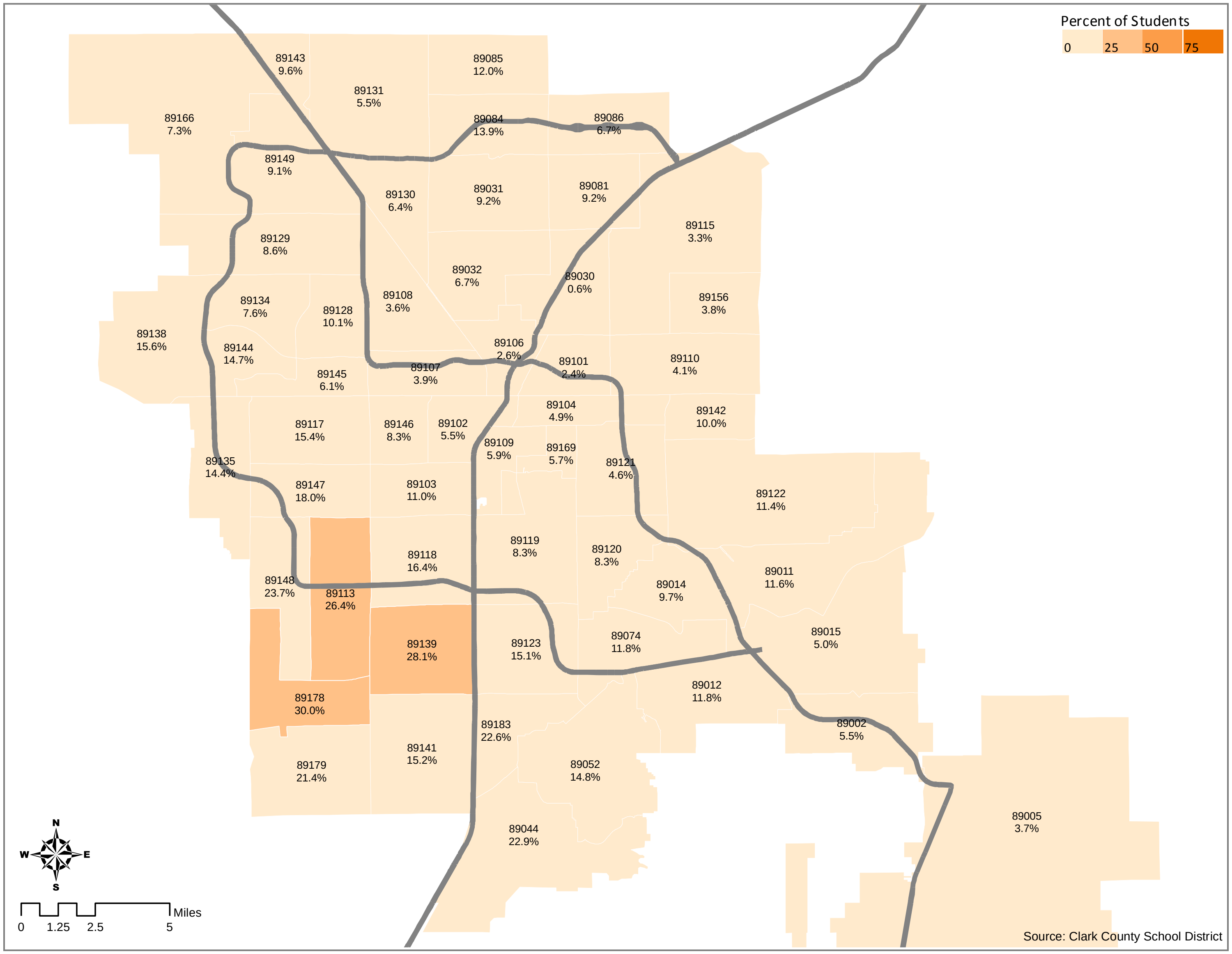

Figure 12. Map of the percent of black students by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

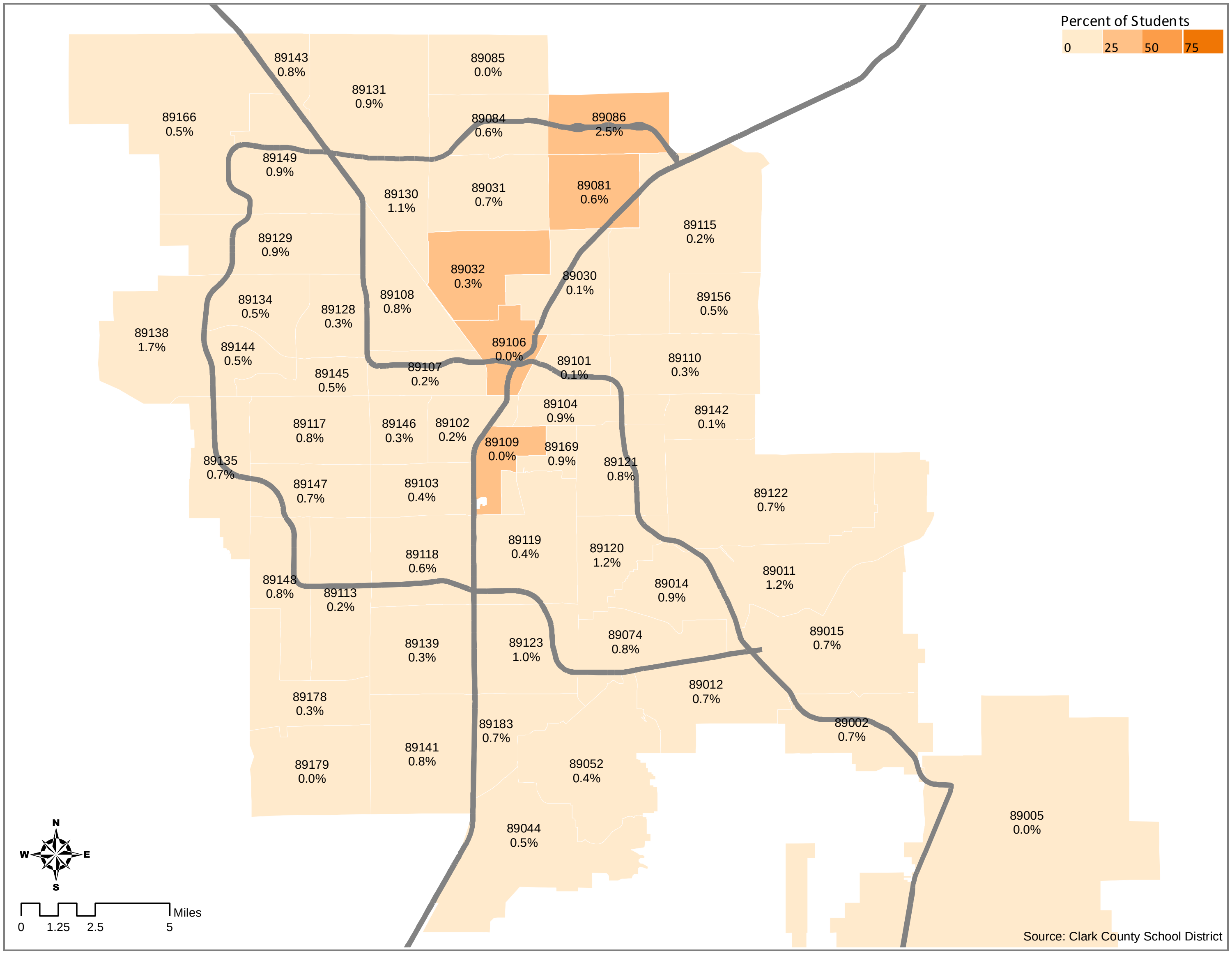

Figure 13. Map of the percent of Hispanic students by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

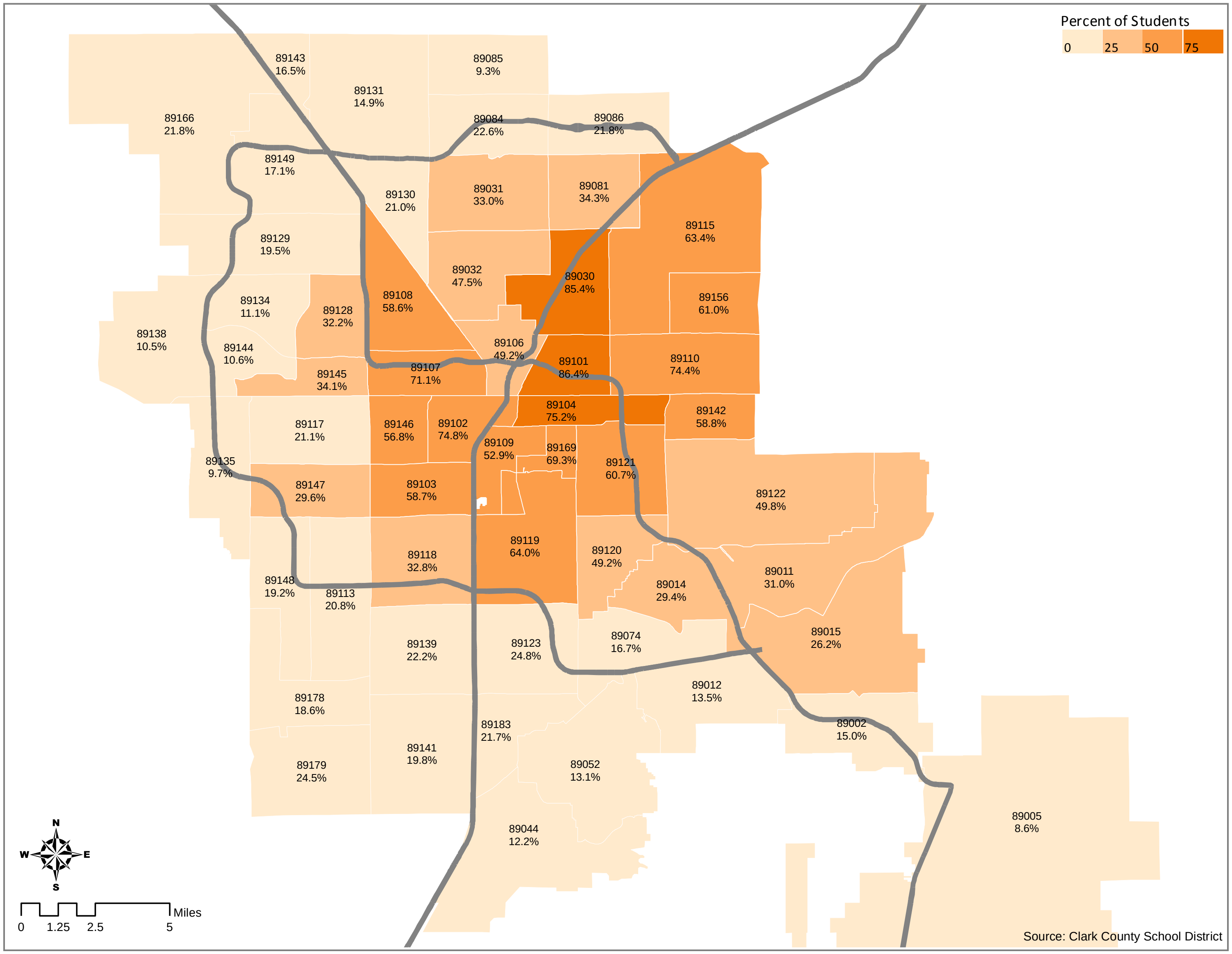

Figure 14. Map of the percent of white students by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

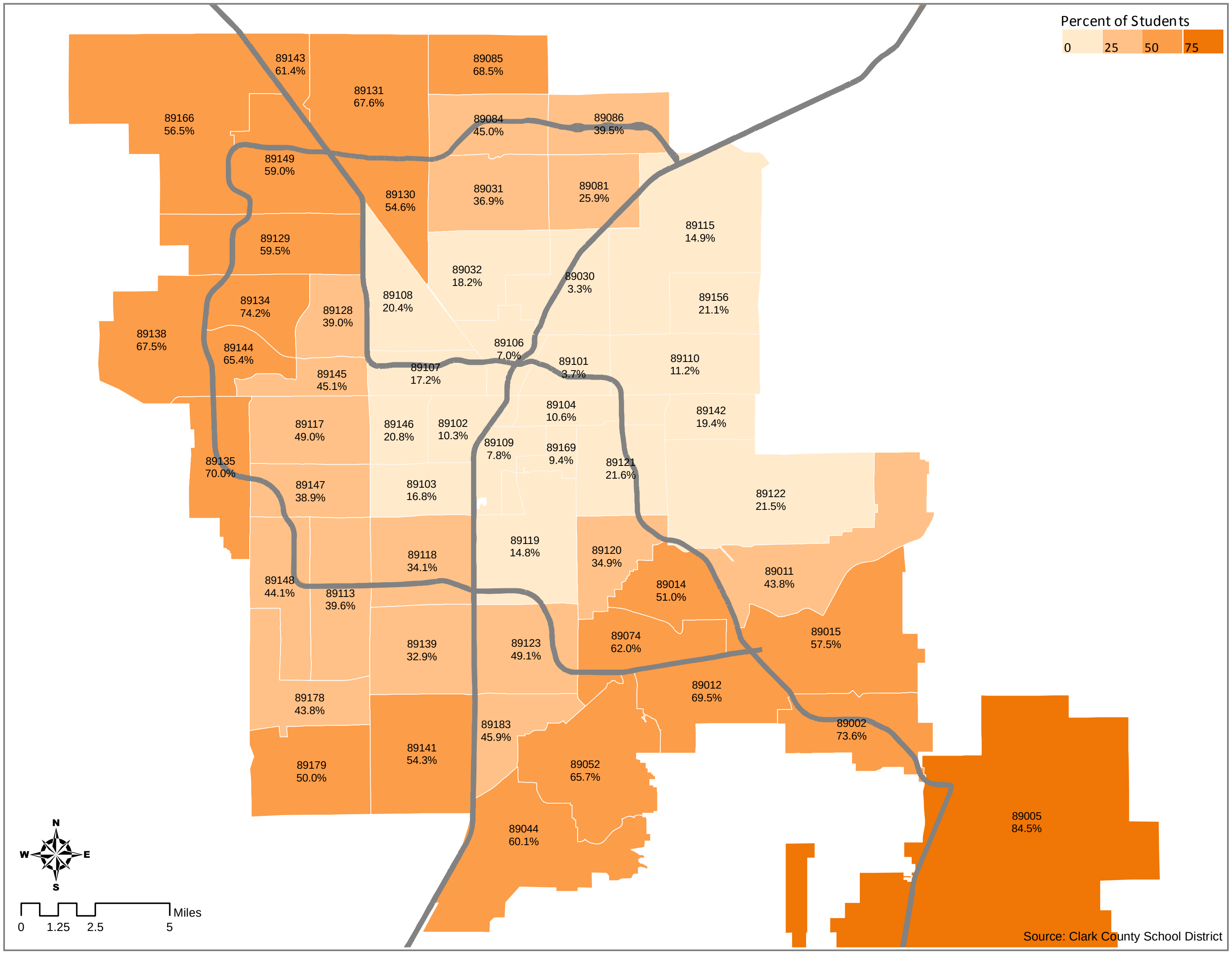

Figure 15. Map of zip codes where minority students comprise a majority of the Clark County School District kindergarten and first grade student population, 2009-2010 school year

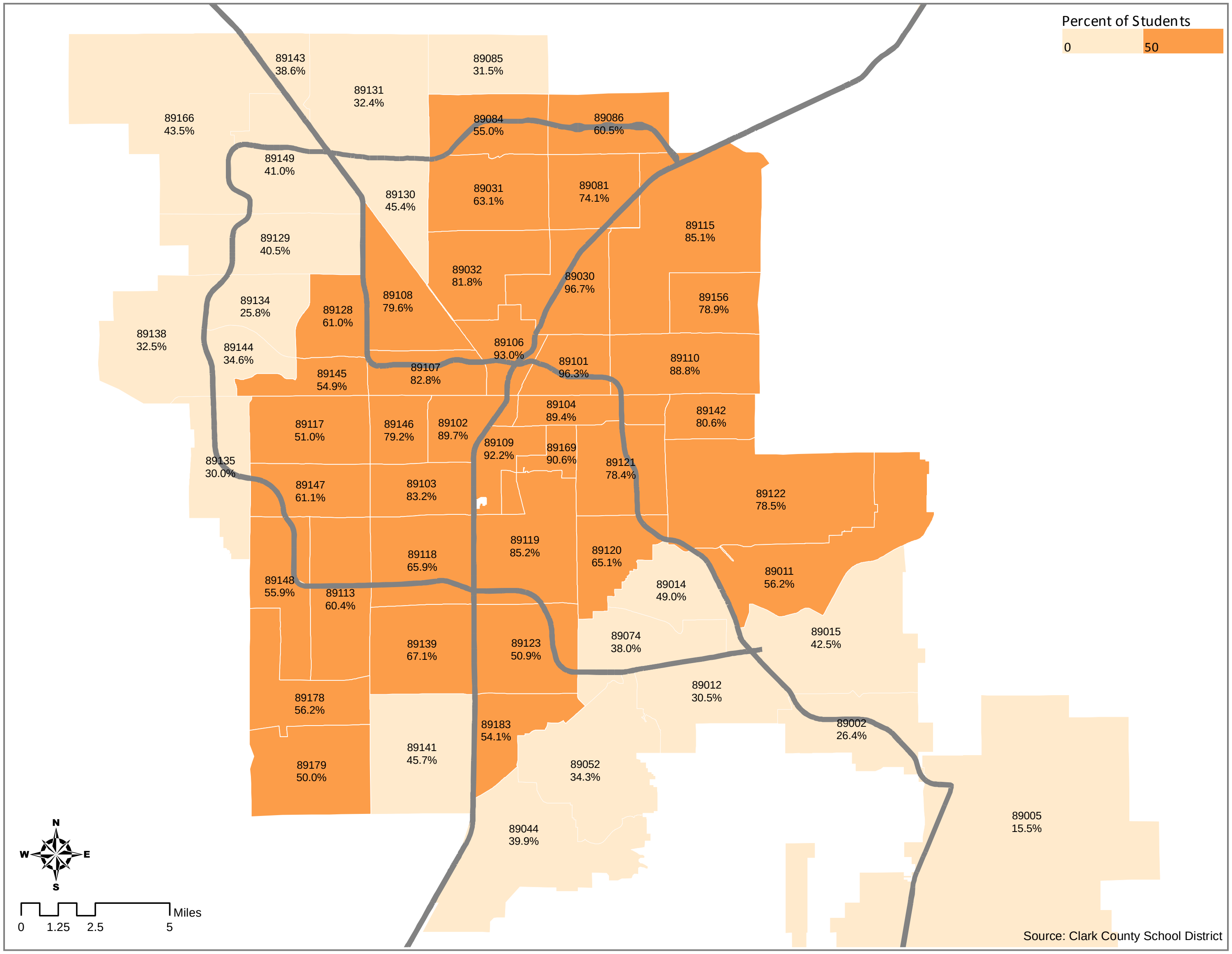

Figure 16. Map of zip codes where minorities comprise a majority of the overall population, Clark County 2010

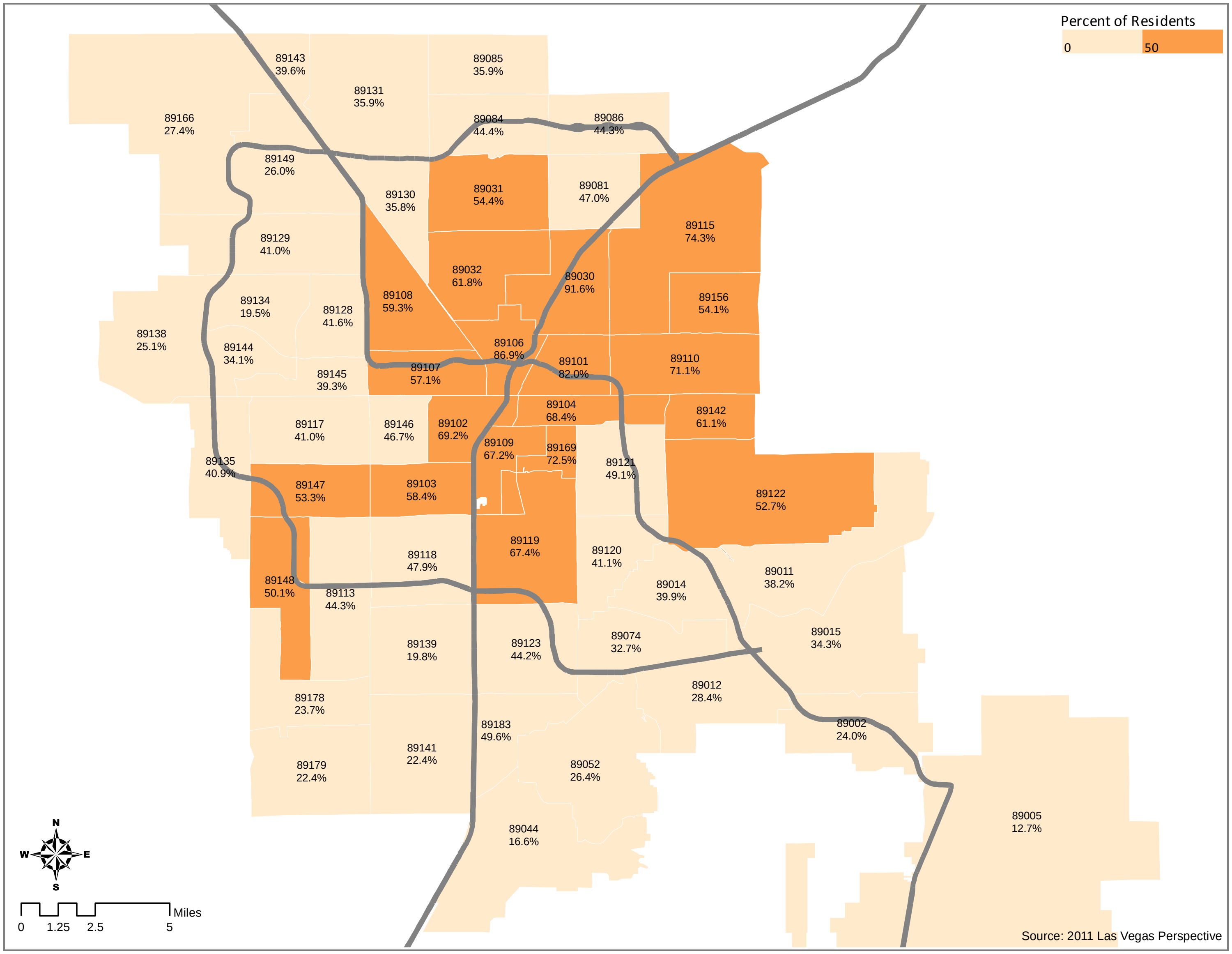

Figure 17. Map of zip codes where minority students comprise a majority of the Clark County School District kindergarten and first grade students, 2009-2010 school year (left) and map of zip codes where minority students comprise a majority of the resident population (right)

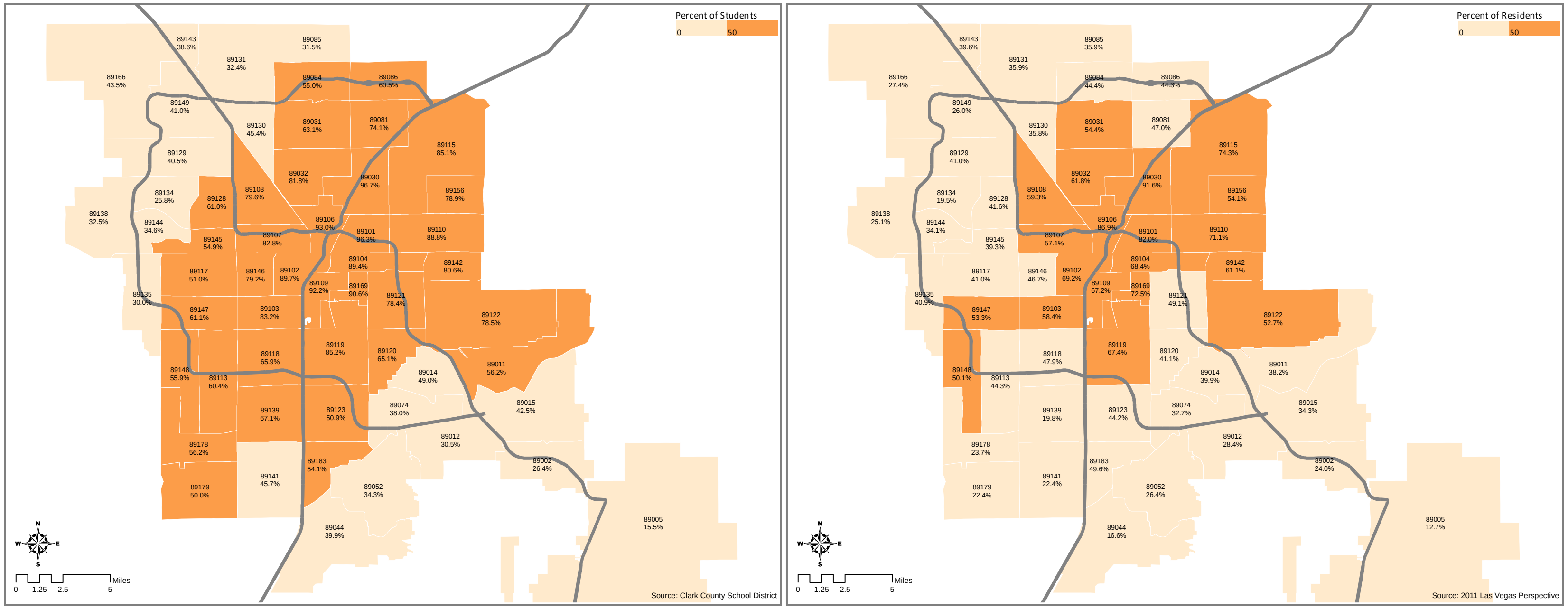

Figure 18. Map of the percent of Hispanic residents by zip code, Clark County 2010

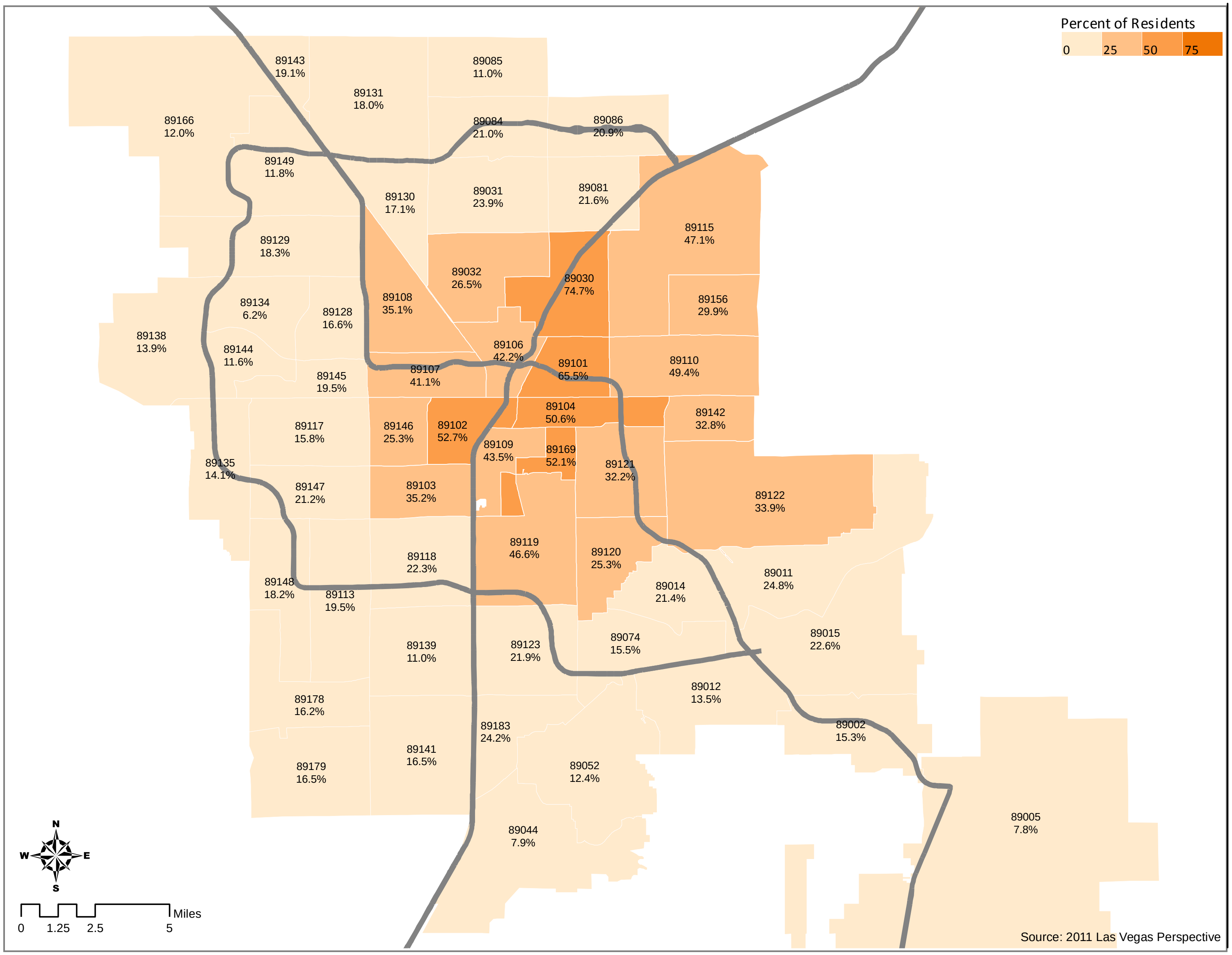

Figure 19. Maps of percent Hispanic Clark County School District kindergarten and first grade students, 2009-2010 school year (left) and Hispanic residents(right),

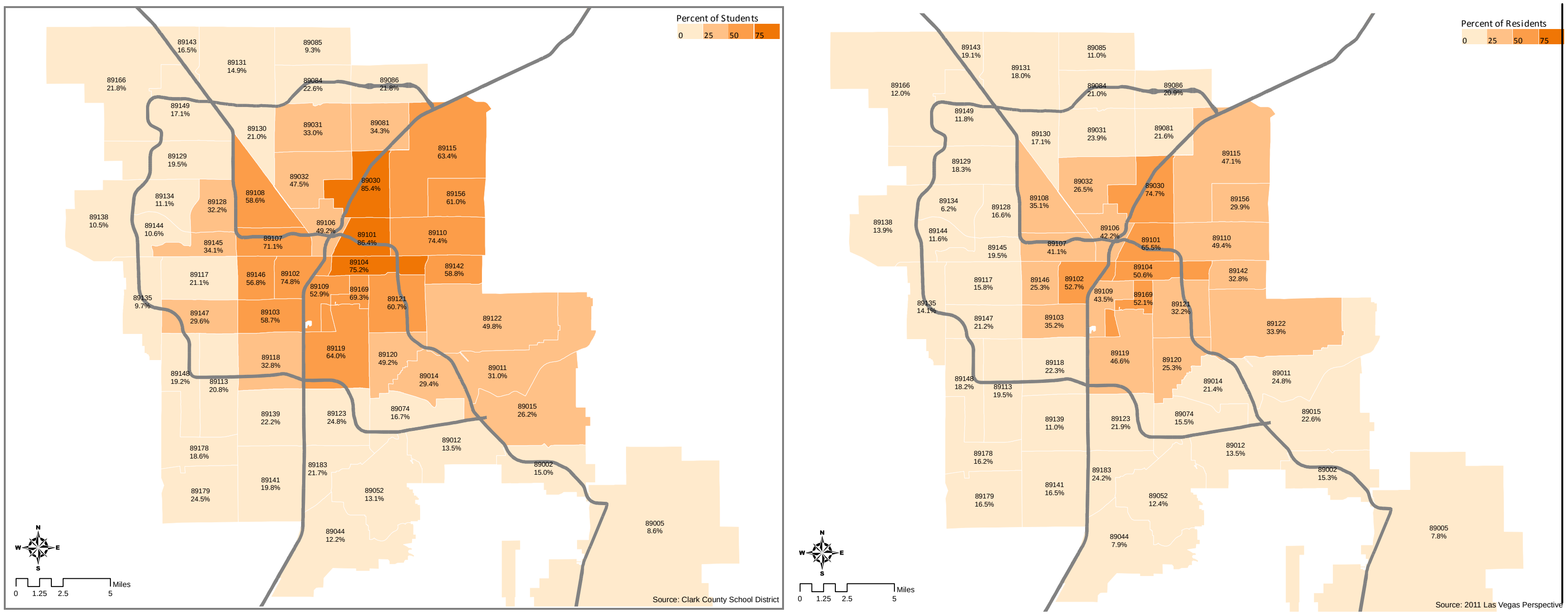

Figure 20. Map of the percent of students categorized as low-income by zip code, Clark County School District kindergarten and first grade students, 2009-2010 school year

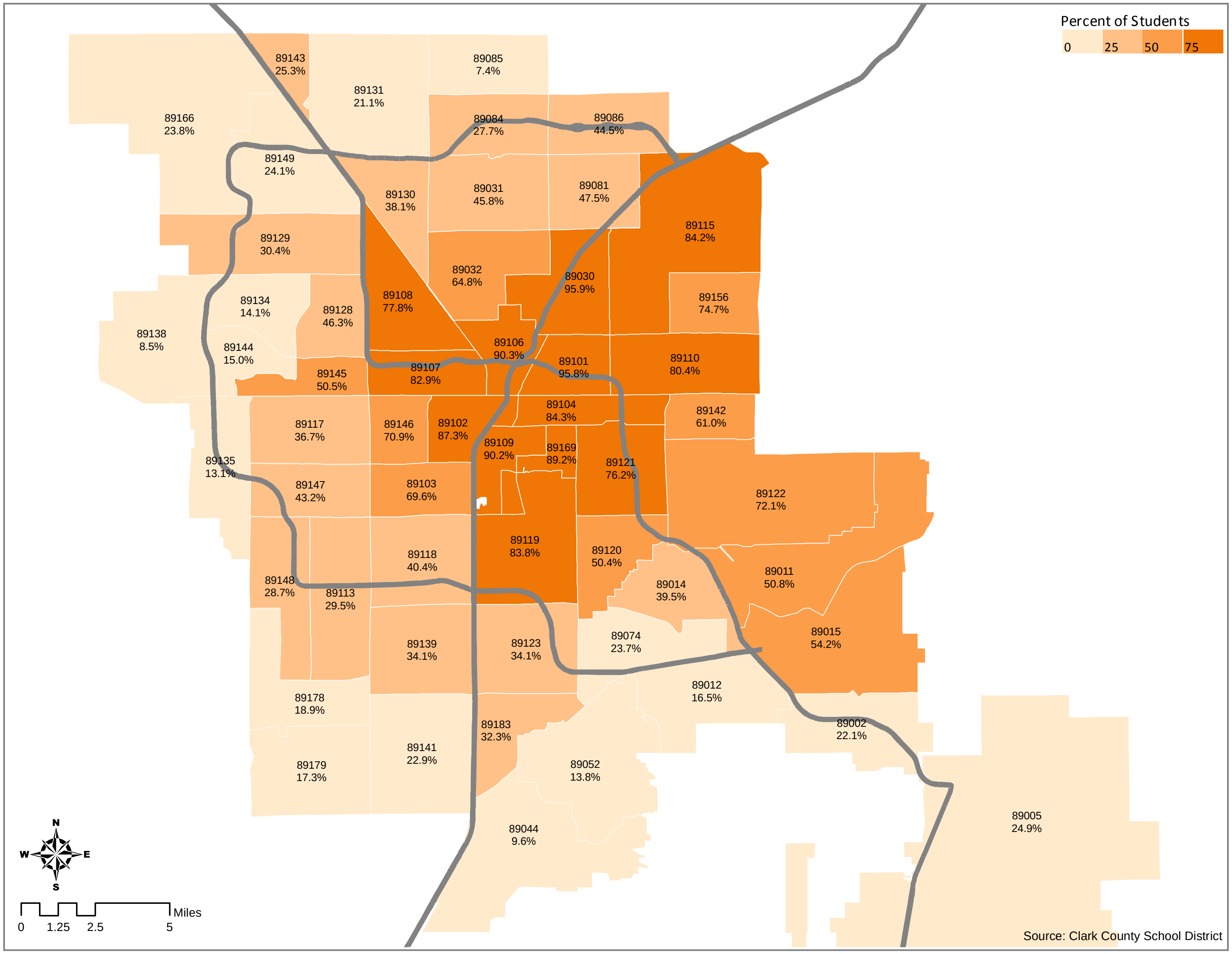

Figure 21. Percent of students considered low SES, locations of VFC providers (as of February 2012), and RTC bus routes, Clark County School District kindergarten and first grade students, 2009-2010 school year

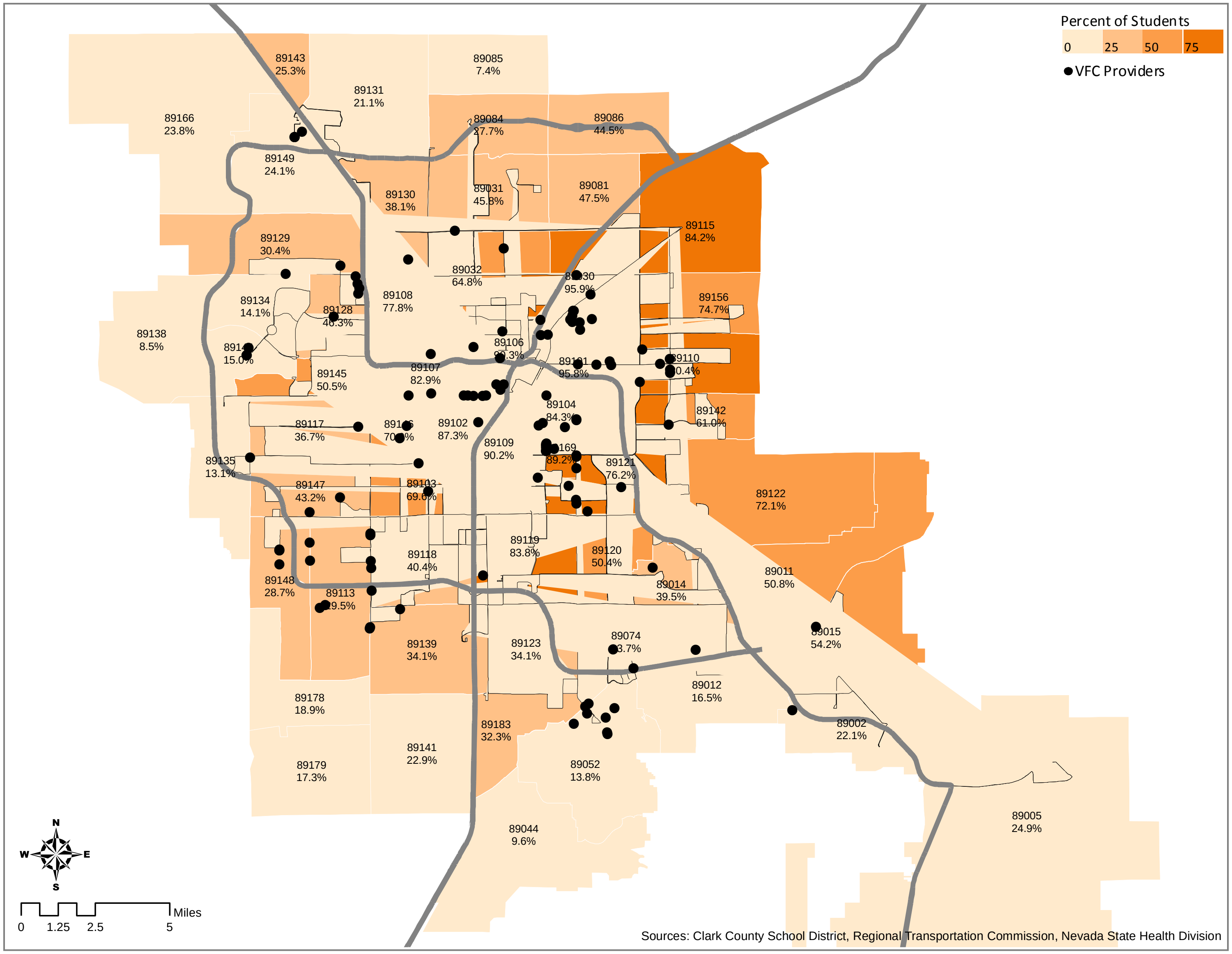

Table 1. Percent of children up-to-date on vaccinations at school entry, 2009-2010 CCSD kindergarten and first grade students, national coverage estimates and Healthy People 2020 goals

	2008-2009 Kindergarten Enrollees			2009-2010 Kindergarten Enrollees			Healthy People 2020 Goal†
Vaccine	CCSD	NIS Estimate NV*	NIS Estimate US**	CCSD	NIS Estimate NV***	NIS Estimate US****	
DTP							
≥ 4 doses	95.9	96.0	95.3	96.0	97.1	93.2	95
Hepatitis A							
≥ 1 dose	97.1	N/A	N/A	98.2	N/A	N/A	N/A
≥ 2 doses	87.7	N/A	N/A	90.1	N/A	N/A	N/A
Hepatitis B							
≥ 3 doses	96.5	97.8	96.5	96.8	97.6	94.3	95
MMR							
≥ 2 doses	95.7	92.7	94.8	95.8	94.1	92.4	95
Polio							
≥ 3 doses	97.9	98.0	95.8	97.7	98.3	93.7	96
Varicella							
≥ 1 dose	97.8	N/A	N/A	98.1	N/A	N/A	N/A
≥ 2 doses	61.6	72.5	93.7	62.3	74.9	90.9	95
Combined							
4:3:1	95.8	N/A	N/A	95.9	N/A	N/A	N/A

* Source: http://www2.cdc.gov/nip/schoolsurv/schoolrpt110.asp?st1=922549
** Source: http://www2.cdc.gov/nip/schoolsurv/nationalAvg.asp?SY=SY09
*** Source: http://www2.cdc.gov/nip/schoolsurv/schoolrpt109.asp?st1=922549
**** Source: http://www2.cdc.gov/nip/schoolsurv/nationalAvg.asp?SY=SY10
† Source: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=23

Table 2. Medical and religious exemption rates, all students, by race/ethnicity and income, Clark County School District kindergarten and first grade students, 2009-2010 school year

	Low-Income			High-Income			Total		
	Medical	**Religious**	**Total**	**Medical**	**Religious**	**Total**	**Medical**	**Religious**	**Total**
Race/Ethnicity†	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Asian	4 (0.3)	16 (1.2)	20 (1.5)	9 (0.3)	8 (0.3)	17 (0.6)	13 (0.3)	24 (0.6)	37 (0.9)
American Indian/Alaska Native	2 (1.4)	2 (1.4)	4 (2.7)	0 (0.0)	3 (2.3)	3 (2.3)	2 (0.7)	5 (1.8)	7 (2.5)
Black	15 (0.3)	27 (0.6)	42 (0.9)	3 (0.2)	26 (1.5)	29 (1.7)	18 (0.3)	53 (0.9)	71 (1.2)
Hispanic (all races)	20 (0.1)	18 (0.1)	38 (0.2)	13 (0.3)	23 (0.5)	36 (0.8)	33 (0.2)	41 (0.2)	74 (0.4)
White	18 (0.4)	80 (1.8)	98 (2.2)	90 (0.8)	234 (2.1)	324 (2.9)	108 (0.7)	314 (2.0)	422 (2.7)
Total	59 (0.2)	143 (0.5)	202 (0.8)	115 (0.6)	294 (1.4)	409 (2.0)	174 (0.4)	437 (0.9)	611 (1.3)

† Any student reporting Hispanic ethnicity was categorized as Hispanic

Table 3. Vaccination rates at 36 months and school entry for children by exemption status, Clark County School District kindergarten and first grade students, 2009-2010 school year

	Medical Exemption (n=174)		**Religious Exemption (n=437)**		**No Exemption (n=46,132)**	
Vaccine	**36m**	**School Entry**	**36m**	**School Entry**	**36m**	**School Entry**
DTP						
≥ 4 doses	58.6	71.8	14.4	19.4	80.2	96.7
Hepatitis A						
≥ 1 dose	43.1	73.6	9.8	18.1	71.8	98.5
≥ 2 dose	15.5	57.5	2.1	8.9	27.1	89.7
Hepatitis B						
≥ 3 doses	63.2	72.4	17.2	19.7	88.1	97.5
MMR						
≥ 1 dose	66.7	76.4	19.9	24.0	92.1	99.7
≥ 2 dose	1.7	39.7	0.5	9.2	1.7	96.8
Polio						
≥ 3 doses	70.7	75.9	19.7	21.5	90.5	98.6
Varicella						
≥ 1 dose	54.0	66.1	16.2	20.8	85.6	98.8
≥ 2 dose	1.7	24.7	0.2	5.0	1.7	62.6
Combined						
4:3:1	52.9	64.9	12.8	17.8	77.6	96.7

Table 4. Percent of children vaccinated at 36 months of age, Clark County School District kindergarten and first grade students, 2009-2010 school year

Vaccine	Kindergarten	1st Grade	Total
DTP			
≥ 4 doses	79.5	79.6	79.5
Hepatitis A			
≥ 1 dose	73.8	68.8	71.2
≥ 2 doses	28.5	25.5	26.9
Hepatitis B			
≥ 3 doses	87.9	86.9	87.4
MMR			
≥ 1 dose	91.6	91.2	91.4
Polio			
≥ 3 doses	89.9	89.7	89.8
Varicella			
≥ 1 dose	85.6	84.2	84.9
Series			
4:3:1	76.9	77.1	77.0

Table 5. Percent of children vaccinated at 36 months of age by race/ethnicity and income group, Clark County School District kindergarten and first grade students, 2009-2010 school year

	Asian		AIAN		Black		Hispanic		White		Total		
Vaccine	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**All**
DTP													
≥ 4 doses	70.1	83.2	68.2	80.5	64.7	76.0	82.2	85.8	69.2	84.1	76.4	83.7	79.5
Hepatitis A													
≥ 1 dose	55.4	70.7	64.9	71.9	59.6	66.0	76.9	77.3	60.6	72.1	70.1	72.6	71.2
≥ 2 doses	20.4	28.8	21.6	18.8	16.7	22.0	33.9	31.0	16.9	24.3	27.4	26.2	26.9
Hepatitis B													
≥ 3 doses	81.6	88.8	79.7	83.6	78.1	85.2	90.3	90.8	81.9	88.5	86.3	88.7	87.4
MMR													
≥ 1 dose	85.3	92.3	87.2	90.6	84.8	90.1	93.6	94.0	85.9	92.7	90.4	92.7	91.4
Polio													
≥ 3 doses	85.3	92.7	85.1	88.3	80.2	88.6	92.5	93.2	82.5	91.2	88.3	91.6	89.8
Varicella													
≥ 1 dose	67.5	80.1	65.5	76.6	62.5	73.5	80.0	83.2	80.2	85.5	84.1	85.8	84.9
Series													
4:3:1	77.0	84.8	76.4	83.6	79.6	84.0	87.1	88.0	66.4	81.0	74.0	80.7	77.0

Table 6. Percent of children vaccinated at 36 months of age by race/ethnicity, crude and SES-adjusted, Clark County School District kindergarten and first grade students, 2009-2010 school year

	Asian		AIAN		Black		Hispanic		White		Total
Vaccine	**Crude**	**Adj.**	**Crude**	**Adj.**	**Crude**	**Adj.**	**Crude**	**Adj.**	**Crude**	**Adj.**	**Crude**
DTP											
≥ 4 doses	78.9	79.5	73.9	77.0	67.8	72.8	83.0	84.8	79.8	79.9	76.4
Hepatitis A											
≥ 1 dose	65.8	66.4	68.1	69.9	61.4	64.2	77.0	77.2	68.8	68.9	72.6
≥ 2 dose	26.0	26.4	20.3	19.6	18.1	20.5	33.3	31.8	22.2	22.2	27.4
Hepatitis B											
≥ 3 doses	86.4	86.7	81.5	82.5	80.1	83.2	90.4	90.6	86.6	86.7	86.3
MMR											
≥ 1 dose	90.0	90.3	88.8	89.7	86.3	88.6	93.7	93.9	90.7	90.8	90.4
Polio											
≥ 3 doses	90.3	90.6	86.6	87.4	82.5	86.2	92.7	93.0	88.7	88.7	88.3
Varicella											
≥ 1 dose	82.3	82.7	79.7	81.6	80.8	82.8	87.3	87.8	84.0	84.0	84.1
Series											
4:3:1	76.0	76.6	70.7	73.5	65.5	70.4	80.7	82.3	76.8	76.9	74.0

Table 7. Percent of children vaccinated at 27 months, Clark County School District kindergarten and first grade students, 2009-2010 school year, 2005 and 2006 National Immunization Survey estimates of vaccination coverage for children 19-35 months of age, and Healthy People 2020 (HP 2020) goals

	CCSD	2005 NIS Estimate*			CCSD	2006 NIS Estimate**		HP 2020
Vaccine	**1st Students**	**Clark**	**NV**	**US**	**K Students**	**NV**	**US**	**Goal**
DTP								
≥ 4 doses	73.6	70.8±7.5	73.5±5.9	85.7±0.9	72.8	73.8±6.7	85.2±0.9	90
Hepatitis B								
≥ 3 doses	84.5	80.5±6.0	83.2±4.7	92.9±0.6	85.1	80.3±6.2	93.3±0.6	90
MMR								
≥ 1 dose	87.8	84.4±5.8	85.7±4.6	91.5±0.7	87.9	85.1±5.4	92.3±0.6	90
Polio								
≥ 3 doses	86.9	84.9±5.6	86.3±4.4	91.7±0.7	86.8	85.8±5.0	92.8±0.6	90
Varicella								
≥ 1 dose	80.1	82.4±5.8	84.4±4.5	87.9±0.8	80.9	80.3±6.2	89.2±0.7	90
Series								
4:3:1	70.4	68.5±7.6	71.2±5.9	83.1±1.0	69.6	71.5±6.8	83.1±0.9	N/A

* Source: http://www2a.cdc.gov/nip/coverage/nis/nis_iap.asp?fmt=v&rpt=tab02_antigen_iap&qtr=Q1/2005-Q4/2005
** Source: http://www2a.cdc.gov/nip/coverage/nis/nis_iap.asp?fmt=v&rpt=tab03_antigen_state&qtr=Q1/2006-Q4/2006

Table 8. Demographic characteristics of Clark County School District kindergarten and first grade students, 2009-2010 school year

	Kindergarten		1st Grade		Total	
Category	**n**	**%**	**n**	**%**	**n**	**%**
Total	22,778	-	23,965	-	46,743	-
Race/Ethnicity†						
Asian	1,996	8.8	2,136	8.9	4,132	8.8
American Indian/Alaska Native	132	0.6	144	0.6	276	0.6
Black	2,927	12.9	3,207	13.4	6,134	13.1
Hispanic (all races)	10,208	44.8	10,400	43.4	20,608	44.1
White	7,515	33.0	8,078	33.7	15,593	33.4
Socioeconomic Status						
Low-income	12,253	53.8	14,182	59.2	26,435	56.6
High-income	10,525	46.2	9,783	40.8	20,308	43.4
Year of Birth						
2001	0	0.0	95	0.6	95	0.2
2002	43	0.2	6,780	40.0	6,823	17.2
2003	6,205	27.2	10,087	59.5	16,292	41.0
2004	16,530	72.6	3	0.0	16,533	41.6

† Any student reporting Hispanic ethnicity was categorized as Hispanic; all other race categories do not include Hispanic students

Table 9. Percent of students categorized as low-income by race/ethnicity and grade, Clark County School District kindergarten and first grade students, 2009-2010 school year

	Kindergarten		1st Grade		Total	
Race/Ethnicity†	**n**	**%**	**n**	**%**	**n**	**%**
Asian	575	28.8	765	35.8	1340	32.4
American Indian/Alaska Native	69	52.3	79	54.9	148	53.6
Black	1,993	68.1	2,438	76.0	4,431	72.2
Hispanic (all races)	7,619	74.6	8,405	80.8	16,024	77.8
White	1,997	26.6	2,495	30.9	4,492	28.8
Total	12,253	53.8	14,182	59.2	26,435	56.6

† Any student reporting Hispanic ethnicity was categorized as Hispanic; all other race categories do not include Hispanic students

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