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Smallpox Vaccination Outcomes and Adverse Event Surveillance of 18 Counties in North Central Florida

Smallpox Vaccination Outcomes and Adverse Event Surveillance of 18 Counties in North Central Florida

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Abstract
Based on the directive from President George W. Bush to prepare the nation better for a possible smallpox attack, Florida enacted Operation Vaccinate Florida- Stage I (OVF I). Between February 10, 2003, and March 31, 2003, Florida vaccinated 4,434 individuals against smallpox. During this period a smallpox vaccine surveillance study was conducted in 18 counties in North Central Florida. The study was conducted via journal log, which participants completed daily by recording all symptoms, vaccination site stage development, and demographic information. The study included 350 vaccinees from Alachua, Baker, Bradford, Clay, Columbia, Dixie, Duval, Hamilton, Gilchrist, Lafayette, Levy, Flagler, Marion, Nassau, Putnam, Union, St. Johns, and Suwannee Counties. All symptoms experienced by study participants were normal and expected. Itching was experienced by 99.3% of the participants and site stage development was typical for the vaccinia virus. Naïve vaccinees had a longer mean vaccine site duration compared to non-naïve vaccinees.
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Introduction

After September 11, 2001 the United States government declared an increased need for bioterrorism awareness and training. A perceived threat of an intentional release of the smallpox virus was identified. In response to this apparent threat, President George W. Bush initiated a nationwide smallpox vaccination campaign. This campaign targeted persons that have the highest probability of coming into contact with the virus and include: healthcare workers, public health and hospital personnel and emergency response teams. Each participant in Florida chose voluntarily to receive the vaccine and was excluded if any contradictions (i.e. pregnancy, suppressed immune system, skin conditions, etc) existed.

There are risks and side effects associated with the vaccine (Sibley, 2002). Some of these are considered non-serious reactions and are expected to occur. These expected non-serious reactions include: low grade fever, itching at the vaccination site, muscle aches, chills, nausea, fatigue, and joint pains (Frey, Couch, Tacket, et al, 2002; Sibley, 2002; Smallpox Fact Sheet, 2003). Other more severe reactions can occur and range from serious to life threatening. In previous vaccination sessions approximately 1,000 of every 1 million naïve vaccinees incurred a serious reaction that required medical treatment. These reactions included: erythema multiforme, inadvertent inoculation, and generalized vaccinia. It is estimated that 1 or 2 out of 1 million vaccinees could die from the vaccine (Smallpox Fact Sheet, 2003).When the smallpox vaccine is properly administered as a preexposure prophylactic, it is 95%-98% effective in preventing smallpox (Sibley, 2002). The vaccine effectiveness decreases when administered as postexposure prophylaxis and vaccine effectiveness also decreases the longer the duration after exposure (Sibley, 2002).

Florida began its vaccination campaign (OFVI) in February 2003. A coalition of eighteen counties in North Central Florida agreed to have all smallpox vaccination participants complete a daily journal that would record the following facts: demographics, site stage duration, mild and severe reactions, loss of work, and medical care sought. The duration of the surveillance project was from February 10, 2003 to May 1, 2003 and included 350 participants.

Methods

An 18-county consortium in North Central Florida was developed for this project and included: Alachua, Baker, Bradford, Clay, Columbia, Dixie, Duval, Hamilton, Gilchrist, Lafayette, Levy, Flagler, Marion, Nassau, Putnam, Union, St. Johns, and Suwannee counties. Each of the 18 volunteer counties offered the smallpox journal to all individuals receiving the smallpox vaccine during OVF1. Each county also designated an individual (nurse, doctor) to monitor the vaccinee recipients' health status and aid in journal completion.

The vaccine journal was developed based on previously documented reactions of the Dry Vax® smallpox vaccine manufactured by Wyeth Laboratories Inc., Marietta, Pennsylvania. The journal was developed to obtain information about vaccinees demographics, medical reactions to the vaccine, daily behavior modifications, and monitor stage development of the vaccine site. The smallpox vaccine journal was developed and approved by key stakeholders, including the Florida Department of

Health and directors of participating county health departments. Due to the time constraints of the vaccination program the vaccine journal was unable to be pre-tested.

The journal was designed as a daily log to be completed by the individual vaccinee, site change nurse, or via telephone. The journal was completed daily until the scab fell off (point when no longer infectious to others). Each day the vaccinee would document all symptoms that occurred during the previous 24-hrs. Participants had the ability to record the occurrence of up to 37 symptoms each day (Table 1). Additional information was asked the day the scab fell off in "yes/no" format. Only symptoms experienced by over 10% of the vaccinees were included in the analysis.

Participation in the study was limited to smallpox vaccine recipients living in the eighteen county consortium, who received the smallpox vaccine during OVFI, and who returned their journal log. Journals were made available at the time of vaccination and were either given directly to the vaccinee or kept in the vaccinees' chart to be completed during the daily dressing check. A total of 350 journals were returned from all eighteen counties. Participation in the study was voluntary.

The study was conducted throughout the duration of OVF1, from February 10, 2003 to May 1, 2003. The data collected in the journals were collected and analyzed using Epi Info 2002 and SPSS version 12.0. The response rate, frequencies, measures of central tendency and dispersion, and chi-square tests for significance were calculated. An alpha level of 0.05 was used to determine significance. An index was used to better ascertain overall health effects on study participants. Overall health effects, characterized as 'symptom-days', the sum of all symptoms experienced in N number of days a vaccinee is followed, was calculated for each participant in the study group. Each symptom experienced was treated as an independent symptomatic day. This method accounts for differences in follow up time by treating each independent symptom frequency as 1 symptom-day (Figures 1 and 2).

Results

The sample population consisted of 350 vaccinees out of a possible 472, yielding a response rate of 74.2% for the consortium and represented 9.4% of Florida's vaccinees in OVF I. Of the participants, 305 (89.4%) were white, 232 (66.5%) were female, and 253 (72.3%) ranged between 40-59 years of age (Figure 3).

Of the 350 participants, 315 (90.0%) had successful takes, as assessed and documented by a nurse or physician. Of the 35 individuals who had unsuccessful takes, 13 (37.1%) chose to be revaccinated.

Of the 350 participants, 5 (6.8%) reported either missing work or school and 4 (5.5%) reported missing recreational activities. Six (2.0%) of the vaccinees sought medical attention during the post vaccination period. No vaccinee reported a personal contact (e.g. household member, sexual partner, or work contact) with lesions of undetermined etiology.

The mean vaccination length, the mean length of duration between vaccination and scab drop, among the study participants (N=350) was 24.35 days and the range was 50-8 days. The mean vaccination length for naïve vaccinees (n=15) was 27.5 days and ranged from a minimum of 12 to a maximum of 50 days. The mean vaccination length among previous vaccinees (n=101) was 21.2 days and ranged from a minimum of 8 days to a maximum of 40 days. There was a statistically significant difference in mean vaccination length between primary and secondary vaccinees ($p = 0.001$), with a difference of 6.3 days between means.

The presence of a papule, the first stage of the vaccination site, occurred days 1-6; the mode occurred on day 2 with 52 (55.8%) vaccinees reporting papules (Figure 4.1). The vesicle, the second stage of the vaccine site, occurred from day 2-7; the mode occurred on day 5 with 62 (53.2%) vaccinees reporting vesicles (Figure 4.2). The pustule, the third stage of the site development, was reported as occurring from days 3-19; the mode occurred on day 6 among the 64 (84.4%) vaccinees reporting pustules (Figure 4.3). The scab, the final stage of site development, was recorded as occurring from days 1-35; the mode occurred on day 14 with 58 (89.7%) vaccinees reporting scabs (Figure 4.4).

The study group symptoms included: itching at vaccine site (99.3%), sore arm at vaccine site (37.3%), swollen lymph nodes (24.9%), headache (24.9%), redness >2/3inch at vaccine site (16.6%), fatigue (16.0%), allergic rash from tape dressing (14.2%), muscle aches (13%), and size of vaccine site >1/2inch (10.1%). Vaccinees reported the majority of symptoms between days 4-8 (Figure 5). There was not a significant difference in the number of symptoms reported by the naïve vaccinees when compared to the number of symptoms reported by pre-vaccinees. The study participants reported a total of 564 symptom-days during the study period.

Discussion

Past studies report that 21% of naïve individuals sought medical attention (Smallpox Fact Sheet, 2003). This current study followed both naïve and prevaccinated individuals. A low percentage

(6.8%) of the study participants missed work or school due to symptoms and only 2% sought medical attention. Reasons for the lower number of vaccinees seeking medical attention may include: better screening methods were used to eliminate individuals at a high risk for adverse reactions, primary vaccinees were discouraged from participating, and daily site checks by a medial professional may have reduced the number of patients that otherwise would have sought outside medical advice.

Participant's vaccination sites were monitored daily for site stage development. The site stage developments observed in this study was similar to vaccination studies performed before smallpox eradication. In previous studies, papules formed on days 2-3, vesicles formed on day 3-5, pustules formed on day 5-7, and scabs formed on day 10-12 (Sibley, 2002). In this post smallpox eradication study, the majority of the papules formed on day 1-3, the majority of vesicles formed on days 2-7, the majority of the pustules formed on days 5-10 and the majority of the scabs formed on days 9-22.

Naïve vaccinees experienced longer mean site duration than secondary vaccinees. The longer mean site duration among naïve participants is consistent to what would be expected immuniologically.

No unexpected reactions or symptoms were seen in the participants during this study. Allergic rashes from the vaccine site dressings occurred in 14.2% of the patients. Unlike previous vaccination studies the dressing sites were required to be covered with extreme diligence. This diligence in covering the vaccine site and disposing of soiled material properly demonstrated its effectiveness, as no secondary transmissions were identified during the study period.

The investigators had a unique opportunity to observe how a sample of the civilian population in 2003 would respond to the smallpox vaccine compared to previous populations. The daily log provided a means for monitoring the health status of vaccinees and provided insight into the site stage progression that has not been documented previously for 21st century population.

References

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Table 1. List of Symptoms Presented to Vaccinees on Journal Log

Headache	Rash anywhere on body
Chills	Difficulty staying awake
Fever	Difficulty breathing
Muscle Aches	Hoarseness
Joint Paint	Wheezing
Loss of Appetite	Hives
Fatigue	Paleness
Swollen/tender lymph nodes	Weakness
Sore arm where vaccine given	Fast heartbeat
Swelling at site of vaccine >2/3inch	Dizziness
Redness at site of vaccine >2/3inch	Eye infection
Size of pustule >1/2inch	Inadvertent inoculation
Problems sleeping	Generalized Vaccinia
Allergic rash from tape/dressing	Erythema multiforme
Itching at site of vaccine	Eczema vaccinaum
Sores anywhere else on body	Secondary infection at vaccine site
Abdominal pain	Postvaccinal encephalitis
Other	Death
No symptoms	

Figure 1. Total Number of Symptom-Days Recorded for Prevaccinated Smallpox Vaccinees in an Eighteen County Region of North Central Florida, 2003.

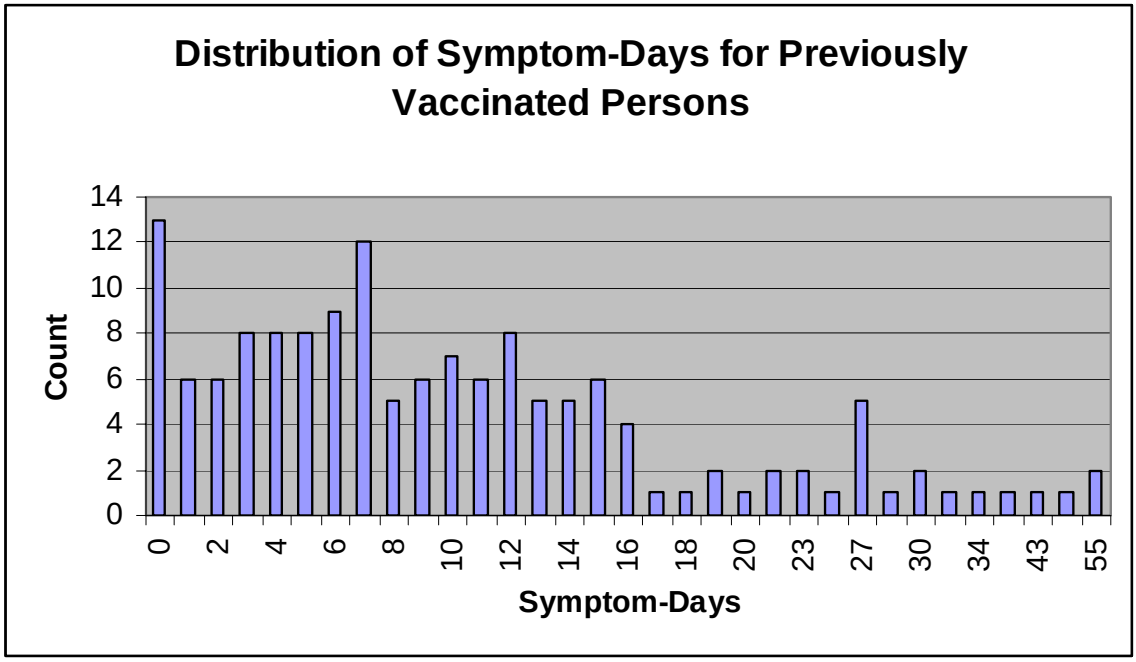


Figure 2. Total Number of Symptom-Days Recorded for Primary Smallpox Vaccinees Among an Eighteen County Region of North Central Florida, 2003.

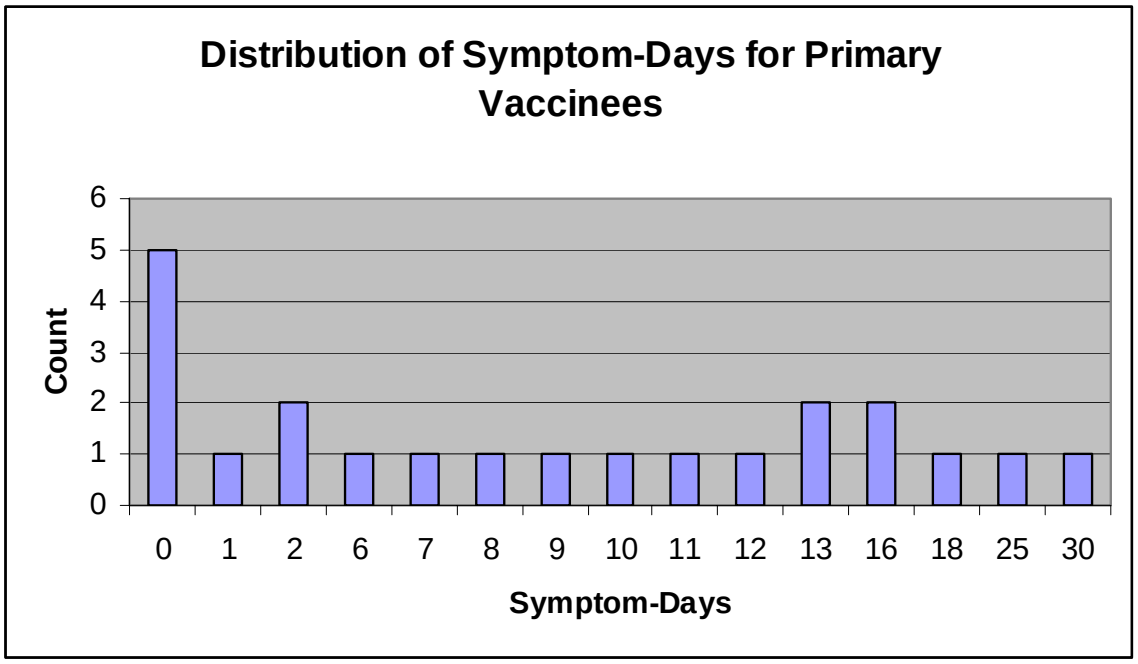


Figure 3. Age range for Smallpox Vaccine Recipients in an Eighteen County Region of North Central Florida, 2003

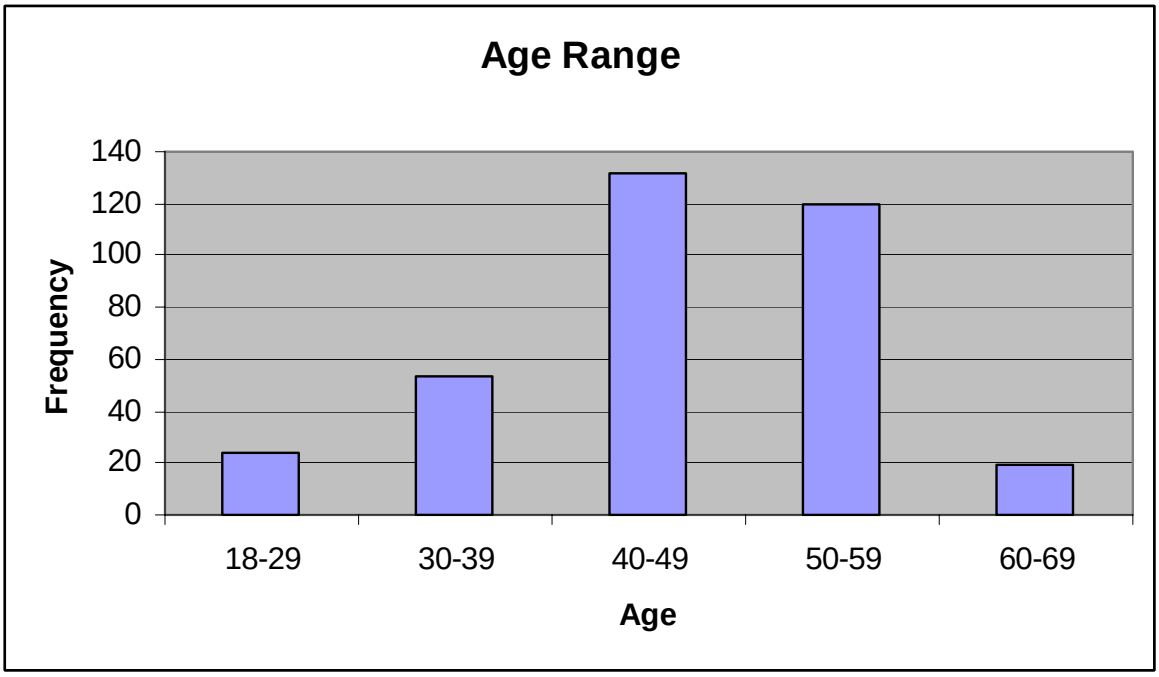


Figure 4. Smallpox Vaccine Site Development in an Eighteen County Region of North Central Florida, 2003

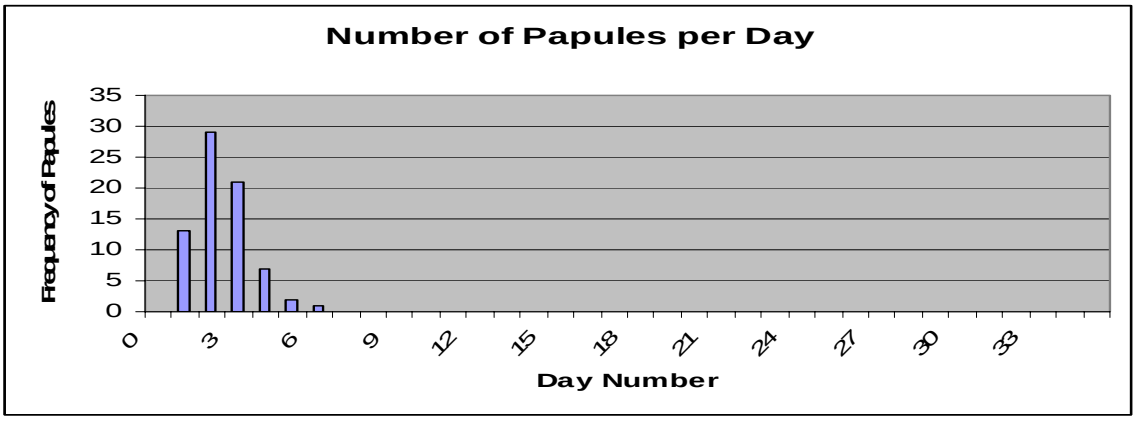


Figure 4.1

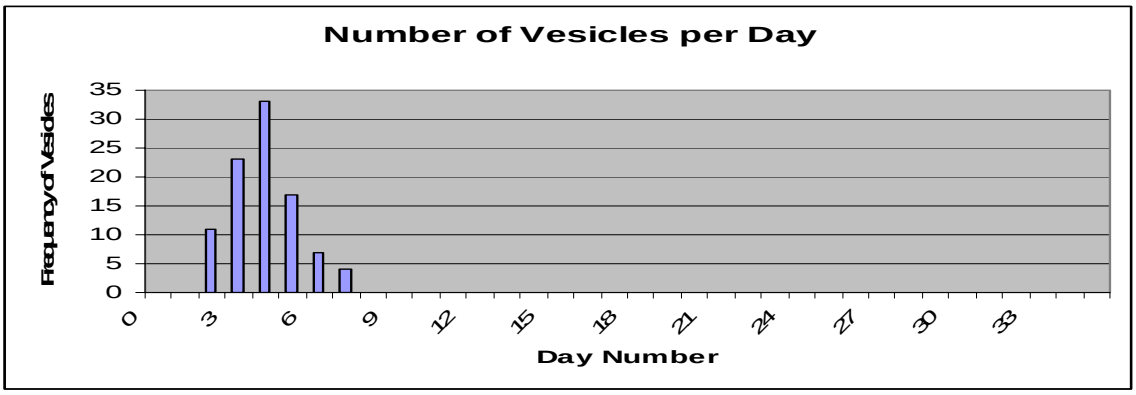


Figure 4.2

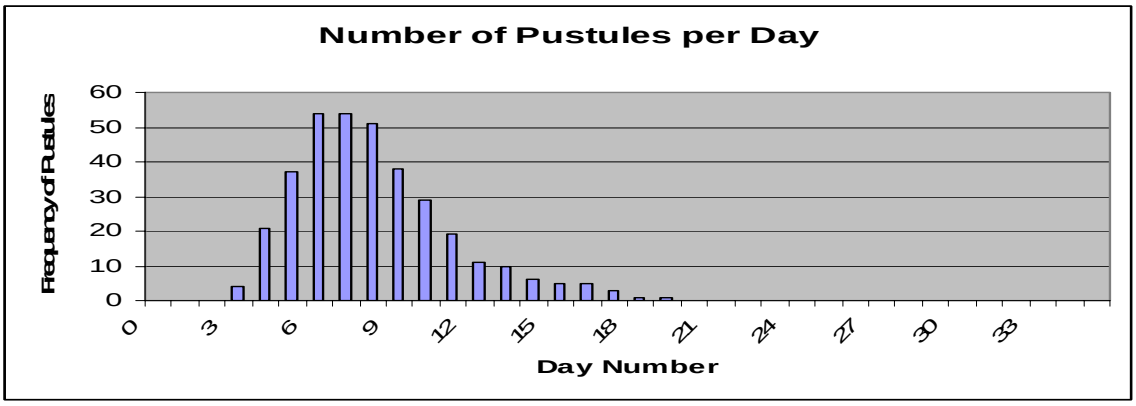


Figure 4.3

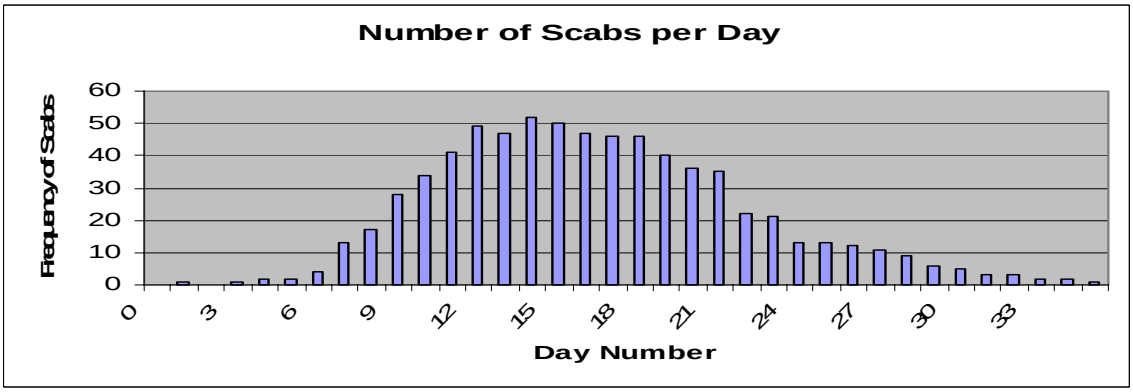
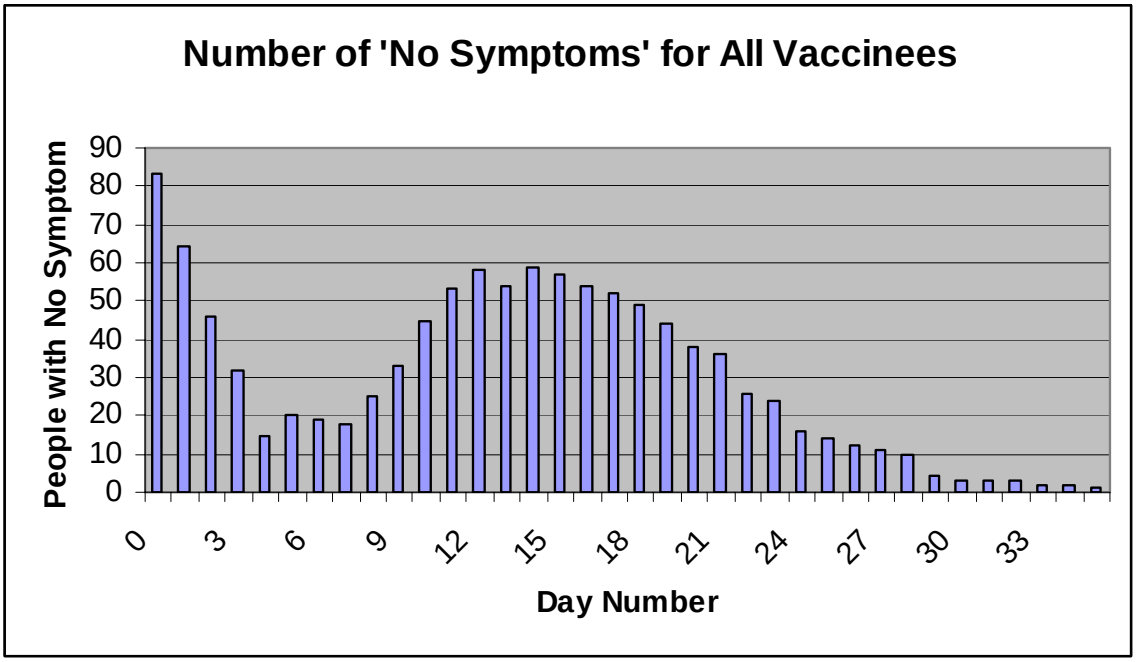


Figure 4.4

Figure 5. 'No Symptoms' For All Vaccinees by Day Number for Eighteen County Region in North Central Florida, 2003



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