

During the week of December 17-24, 1960, information regarding a diphtheria outbreak in Plainview, Texas was received from Dr. Van Tipton of the Texas State Health Department. During the following week, 40 new cases were reported, and at this time Dr. J. E. Peavy, Commissioner of Health, Dr. Tipton, and Dr. Mary R. Dye, Plainview city health officer, gave permission for an observer from CDC to be sent to the area. Within 19 hours, Dr. Theodore Doege of the Diphtheria Unit arrived in Plainview to meet with Dr. Dye.

This report summarizes the findings of studies undertaken in the Plainview area following the outbreak. Data in the report were obtained from the city health unit, private physicians, investigations, interviews of patients and families, Public Health Service reports, and 1960 records of the Diphtheria Unit, CDC.

### Background

Plainview, a city of 18,800 in the Texas Panhandle, is the center of a rich, irrigated agricultural area, where cotton, grain, castor beans, and cattle are the chief crops. This productive area, Plainview and surrounding Hale County, has the highest per capita income in Texas. Of Plainview's population, about 12,500 are white, 4,500 (25 percent) are Latin American, and 1,800 (8 percent) are Negro. During the peak harvest-time in the autumn, an estimated 4-7,000 additional Latin American migrant workers enter the Hale County area. The total indigent population is estimated at 5,600.

About half of the Latin families of Plainview are semi-permanent residents, workers in the large cotton compresses or elsewhere. Other Latin families "follow the crops" as migrant agricultural laborers, some using their Plainview quarters as a base for travel within Texas or to other states. Most Latin families, during harvest season, have one or more members doing agricultural work.

City-county health services are directed by Dr. Mary Dye, with the help of Mr. Hoyt Curry. The health unit is small, the city employing but one nurse. A weekly well-baby clinic is held by Dr. Dye in a school of the largest Latin settlement, and a charity health nursery provides complete well-baby care to families of the Negro area.

A well-staffed city-county hospital of adequate capacity provides private and charity care. About 25 physicians practice privately within the city, including about 10 general practitioners, 2 pediatricians, 3 internists, 2 surgeons, a urologist, 2 obstetricians, and a psychiatrist.

Hale County's last diphtheria outbreak was in 1950, when 12 cases were reported. Single cases occurred in 1954 and 1955, and no case had been reported since those years prior to the 1960 outbreak.

A total of 57 clinical cases occurred in Hale County during the period November 2, 1960 - January 1, 1961, 56 in Plainview and 1 in surrounding Hale County. Seventeen cases were confirmed bacteriologically, and the remaining cases represent the presumptive diagnoses of Plainview physicians. Except for a proven death, the outbreak was clinically mild.

The outbreak occurred in two phases, separated by a lull during which no proven case occurred (Figure 1). During the first phase, November 2-19, 10 cases occurred, 8 in Latin children. Of these 8 cases, 4 attended the same elementary school. The first case, a 10 year old child went "trick-or-treat"-ing on Halloween night, in spite of a runny nose and sore throat of several days' duration, and her illness was diagnosed as diphtheria 2 days later. A day later, three more cases were found in a Latin family living nearby. The other 6 cases of the first phase have been tentatively related to this initial cluster of 4.

Between the first and second phases an 18-month old child died a death of suffocation compatible with diphtheria. No autopsy or bacterial culture was attempted; this case has been tentatively linked with one case and 3 carriers of the second phase.

The start of the second phase was marked by the discovery of 15 cases in mid-December, 11 in a single white family. During the next two weeks 31 additional cases were reported, the last case on January 1, 1961. Eventually children of 6 schools (3 elementary, 2 junior high, 1 high) were involved. A scatter map shows that cases occurred in persons of all ages and in all areas of Plainview. It is apparent that from a relatively limited Latin area, the infection spread to involve a more widespread population, but no definitely proven links in this spread have been established.

#### Epidemiological Findings - Plainview Cases

Fifty-six cases occurred in Plainview and an additional case south of the city. The 56 cases occurred over a 9 week period (Figure 1). Through culture of case contacts, 26 asymptomatic carriers were found.

Of the Plainview cases, 35 were white and 21 Anglo-Latin. The first cases of the outbreak were almost exclusively in Latins, while white cases predominated during the "second phase." No cases occurred in Negroes. This fact is attributed to 1) a relatively small Negro population; 2) segregation of school children and geographic isolation of the Negro community; 3) good immunization of preschool children by the nursery in this community.

Distribution of cases by age is shown below. Forty-three percent of cases were in children 6 years or under, and about 75 percent of cases were in children under 15 years. The oldest reported case was 53 years, the youngest a two months old boy, the son of an unimmunized mother. Cases in Latins tended to occur at a younger age than in whites. Eight cases

0-4	7	12	19
5-9	6	3	9
10-14	6	7	13
15-19	1	6	7
20-29	0	3	3
Over 29	1	4	5
Total	21 (4.7)*	35 (2.8)*	56 (3.0)*

\*Rate/1000 population

Immunization data on cases and 25 of the carriers are shown below. Of 56 cases, 42 (75 percent) had no history of immunization, and 8 gave a history of receiving 1 or 2 shots. The six persons who gave histories of receiving a primary series all had illnesses described by their physicians as "mild."

<u>Status</u>	<u>No. Cases</u>	<u>No. Carriers</u>
Fully Immunized	0	1
Lapsed	6	4
Inadequate	8	1
None	42	19
Total	56	25

Severity of each case was estimated by the attending physician. One known and one suspected death occurred. The known death occurred in a 4 year old unimmunized white girl, who was ill several days preceding initial medical care and had post mortem evidence of myocardial damage. The suspected death was in the 18 month old Latin child described previously. Forty-four cases (79 percent) were described as clinically "mild," 6 cases were "moderately severe," and 4 cases were "severe." All cases described as "severe" or "moderately severe" were in persons without histories of any preceding immunizations.

To date 17 Plainview cases have been confirmed bacteriologically by the Texas State Laboratory. Of these 17 isolates, 12 were toxigenic and 5 nontoxigenic. All Plainview isolates typed by CDC to date have been intermedius, but a mitis strain was isolated from one of the Hale County cases north of Plainview.

Twelve families had 42 of the 56 Plainview cases. Of the 12 families, 10 families were Latin or Lower White.

#### Case Interrelationships - Causative Factors

As far as can be determined, no single common source or index case was responsible for this explosive outbreak, in spite of a suggestive

were likewise responsible for the spread of infection to a greater population. In about 36 cases (65 percent), tentative sources of infection were determined, most of these being other known cases or carriers.

The role of migrant Latin families in the outbreak is uncertain. Again, however, the fact that 9 of the first 10 cases occurred in Latins implies a factor in the origin of the outbreak associated, in some way, with the Latin population. Several pertinent findings suggest that migrant Latin families might have been such a factor.

1) Turnovers as high as fifty percent occur in pupils within classrooms of Lamar Elementary School, which the first cases attended. Such changes in classroom populations are due mainly to travels of migrant Latin agricultural families during the harvest season.

2) Children of Latin families which had moved previously from other areas of Texas were classmates, preceding the outbreak, of the first 4 diphtheria cases discovered. The Latin families came from the Harlingen-Brownsville, Asherton, San Antonio and Florence-Temple areas (Figure 3), all of which reported one or more cases of diphtheria during 1960. Intermedius strains, isolated from Plainview cases, have also been isolated from cases occurring in San Antonio.

3) At least one of the many Latin families moving in late September into Siesta Courts, near the initial case, had children with colds and sore throats. This family, one of many from South Texas working in the Plainview area during the harvest, came from Del Rio, a town reporting a diphtheria case early in August (Figure 3).

4) Diphtheria cases occurred in 5 Panhandle counties other than Hale, during the months preceding the Plainview outbreak. Extensive interchange of harvest workers among these counties would tend to facilitate spread of the diphtheria organism to families and school children of all counties.

Although the evidence incriminating migrant Latin families remains indirect, it is cited in order to emphasize the potentialities of a communicable disease problem within the migrant Latin population, should such a problem ever arise.

#### Control Efforts - Immunizations

Efforts to control the outbreak consisted of 1) an attempt to raise the level of immunity of all preschool and school children, 2) attempts to identify, treat, and isolate cases and carriers.

Seven of the first 10 cases of the outbreak were in students of

thought that this limited immunization program had aborted the outbreak.

However, a resurgence of cases occurred during mid-December, and therefore a mass immunization program was instituted starting the week before Christmas. A central clinic in the City Auditorium was organized, and school children were brought by bus to this clinic for immunization. The Auditorium Clinic was planned and staffed by the health unit, aided by public-minded mothers.

Although about 3000 immunizations were given to children and adults in the Auditorium Clinic during the week before Christmas, concern remained that preschool children of poorer population groups were not being reached as effectively as school children. Thorough immunization of the latter group had been assured when the schools, upon advice of Dr. Dye, made starting a primary series, or receiving a booster, mandatory to re-entering school on January 3 after Christmas vacation. The concern for preschool groups was based on past experience, and on a survey of 24 randomly selected families in the Latin-Negro areas. The survey showed that 72 percent of 45 school children and 65 percent of preschoolers had received one or more immunizations since the start of the outbreak.

Following the New Year's weekend, therefore, a second week of central clinics was scheduled, during which immunization of preschoolers was emphasized. The goal of reaching 100 percent of all children in Plainview with one or more immunizations was set. The problem of publicizing the clinics and reaching the entire population was approached by using every medium of communication in Plainview. Clinic schedules were announced by sound truck each day in all areas of the city, in either Spanish or English. Taped English and Spanish spot announcements for clinics were given daily by radio. A daily newspaper schedule was published, and special announcements urging immunizations were made by ministers of the mission churches. Within the three major Latin and Negro areas, community leaders or the city nurses canvassed door-to-door to ask about family immunizations. Families coming to the Auditorium Clinic were asked to send down other families with small children living in their neighborhood.

An estimated 25,000 immunizations were given in Plainview from November 1 to February 24. About 11,700 immunizations were given by the health unit in the Auditorium Clinic, and the remainder were given by physicians of the city. Multiple clinics were scheduled (Figure 1), so that unimmunized children could be started, and remaining doses of primary series' given. Immunizing agents were furnished by the Texas State Laboratories. Aluminum-phosphate-precipitated DPT antigen was used for children under 8, and adult-type D-T antigen for persons over 8. Injections were given mainly by the syringe-needle method, washing and sterilizing each needle and syringe between shots.

The concentrated immunization efforts described above provided a unique opportunity to test the Hypospray Jet Injector using, for the first time, a precipitated, multiple-antigen type vaccine. About 1,000 immunizations were given during each of two follow-up clinics.

Use of the injector proved very satisfactory. Only two persons, with a minimum of equipment, were able to inoculate an almost unlimited number of persons in one hour. Complete mobility (limited to availability of an electrical socket) and a definite "novelty effect" were other advantages of the injector. The latter effect, which undoubtedly increased interest and participation in the clinics, was enhanced by newspaper and TV pictures of the gun in use during the clinics.

Against the very definite advantages of speed and portability in mass inoculation programs afforded by the gun may be balanced only minor "bugs." E.g., prolonged use of the gun led to clogging of the nozzle, affecting the injected stream so as to make the gun unusable. Replacing the clogged nozzle appeared to solve this problem.

Two surveys of subjective reaction to injections with the gun were organized. During the first follow-up clinic, the responses of 203 randomly selected persons were obtained. Every third person over 7 years of age, injected with the gun, was interviewed to determine his pain response. The pain of an "ordinary" needle injection was used as a reference, and each person was asked standard questions and given a choice of descriptive terms (Table 1). Results of this survey (Figure 2) show that about half of persons interviewed felt less pain than with needle injections, and about 13 percent felt "nothing at all." About one-quarter of persons experienced pain about "the same" as a needle, and for about one-fifth the jet injector "hurt more."

#### Diphtheria-Polio Immunization Survey

During the intensive immunization program, a combined polio-diphtheria immunization survey was undertaken by the Plainview Health Department, with the cooperation of the Texas State Health Department and CDC. The survey's purposes were three-fold: 1) to determine, if possible, the diphtheria immunization levels in the city preceding the outbreak, and to relate these levels, if possible, to the outbreak; 2) to determine how well the mass immunization efforts of the preceding months had reached the city's population; 3) to determine current polio immunization levels. The necessity for data on immunization levels in areas which experience diphtheria outbreaks has long been critical.

CDC Quota Sampling Survey techniques were utilized, and the city was divided into 4 major areas: Latin-Negro (Area 1), Lower White (Area 2), Middle White (Area 3) and Upper White (Area 4). Data were obtained on diphtheria immunizations for persons of all ages in 428 dwelling units, both as of November 1 (pre-outbreak), and as of mid-February (post-outbreak). All Latinhousehold heads were asked two additional questions in order to gain

diphtheria immunization levels preceding the outbreak were extremely low in the Latin-Negro and Lower White groups. In these areas up to 83 percent of preschool and school children surveyed lacked any diphtheria immunization, and in these groups 80 percent of the cases in Plainview's children occurred (Figure 4). Children of the Middle and Upper White groups were better protected, 95 percent of children in the latter group having had 3 or more immunizations preceding the outbreak. Only 8 cases occurred in these two groups.

The survey data show that mass immunizations undertaken by private physicians and the health unit literally reversed the low diphtheria immunization levels existing before the outbreak. Thus, in the Latin-Negro-Lower White groups, mainly through school or central clinics, 83 percent or more of children under 15 received one or more immunizations, and were started towards active immunity. Children and adults of all groups experienced marked increases in immunization levels as a result of the mass vaccination program.

Polio immunization levels were noted to be generally somewhat higher than corresponding diphtheria immunization levels. However, from half to two-thirds of preschool Latin-Negro-Lower White children lack a polio immunization at present in sharp contrast to preschool children of the Middle and Upper White groups, of whom 63 to 95 percent have had three or more immunizations.

Further efforts will be made by the health unit to complete primary diphtheria-tetanus immunizations started during the outbreak and in follow-up clinics. Primary immunizations against diphtheria, pertussis, tetanus, small-pox and polio have now been made mandatory for school admission. Also, plans have been formed by the health unit to start immunization of all children against polio before summer, 1961, since certain susceptible and unprotected groups of children yet remain.

Preliminary data obtained from 85 Latin families indicate that families in Plainview at the time of the survey tended to be relatively stable, rather than migrant. Of 14 families in which one or more members were said to do agricultural work, this work was usually confined to Hale County for 8, while 6 families described travel to other states: as far east as South Carolina, and as far north as Chicago and Minnesota. All 14 families were in Plainview at the time of the immunization campaign.

### Summary

During November and December, 1960, an outbreak of intermedius-type diphtheria occurred in Plainview, Texas. Fifty-six cases, including one known death, occurred predominantly in unimmunized children. Earliest cases were in Latin school children, and later cases concentrated in Latin and Low White groups.

Although more than half of the cases appear to be inter-related,

Texas constitute a suspect but unproven factor.

Late in December a mass immunization program was started, and thereafter no further cases were reported. About 25,000 diphtheria immunizations were given in a central clinic and by private physicians, and an energetic effort was made to reach all population segments. The jet injector was tested with a precipitated multiple-antigen type vaccine, and a survey of subjective reactions undertaken.

A combined diphtheria-polio immunization survey demonstrated that pre-outbreak diphtheria immunization levels in the groups predominantly infected were extremely low. These low immunization levels are postulated to have been a major factor in the outbreak. Through the city's immunization program, about 85 percent of all children have now been started towards diphtheria-tetanus immunity. Low polio immunization levels among children of low-income groups remain a hazard.

The outbreak demonstrates important communicable disease and general public health problems affecting all segments of Plainview's population, which are exposed to mass movements of agricultural workers from other Texas areas.

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The opportunity to study this outbreak, afforded by the Texas State Department of Health and Dr. Mary Dye, is gratefully acknowledged. In addition, the studies described above would not have been possible without the complete and wholehearted cooperation of Plainview, especially its city health, school and hospital staffs, and its physicians.

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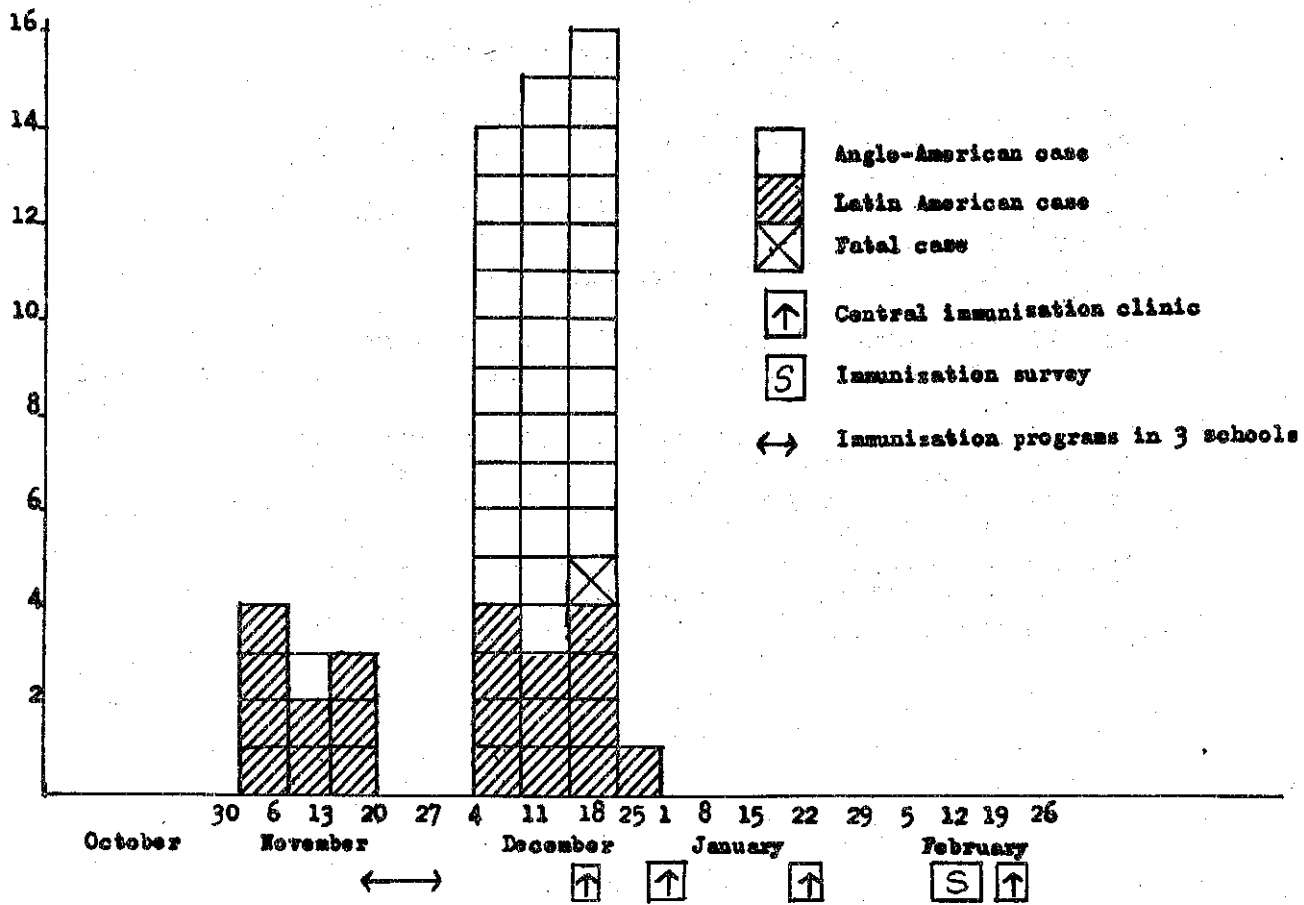
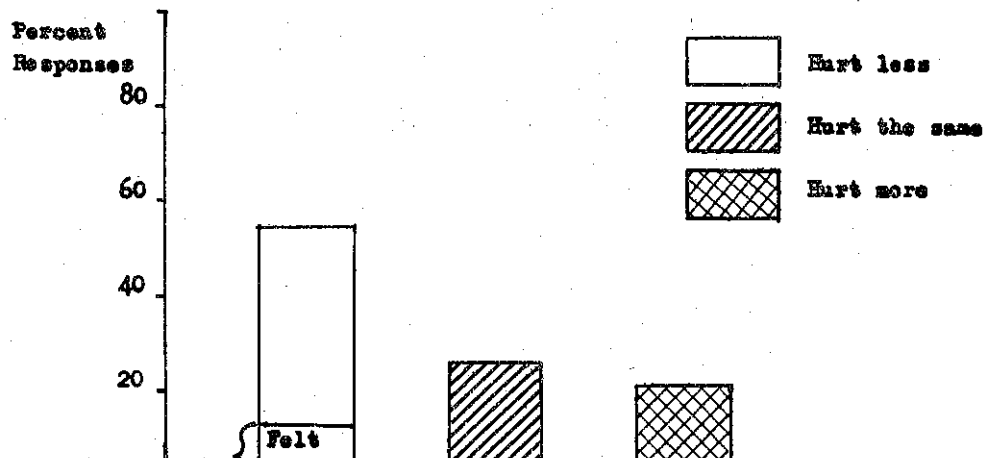
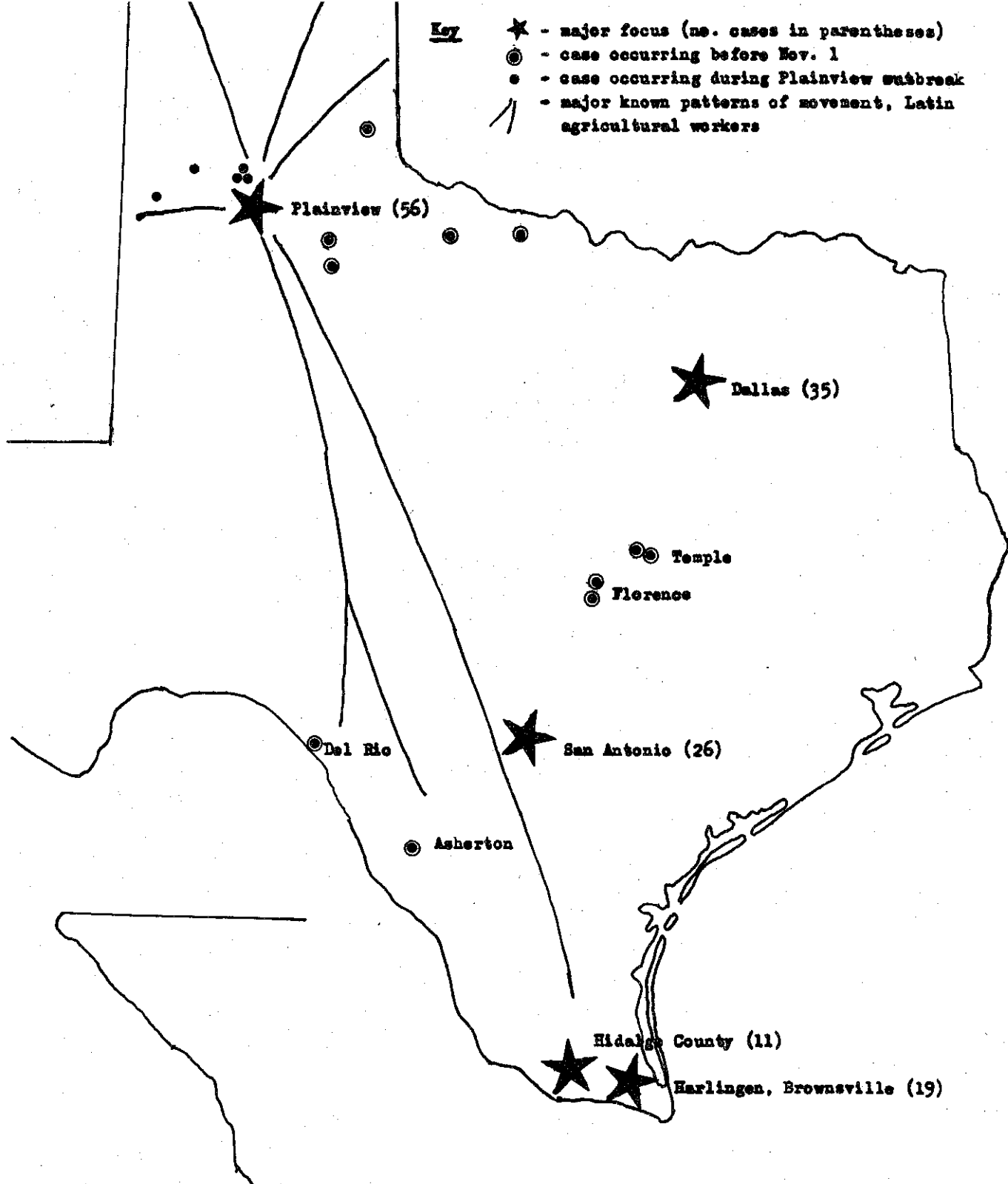


Figure 2  
Sensation of Jet Injector<sup>o</sup>  
Plainview, Texas - February, 1961

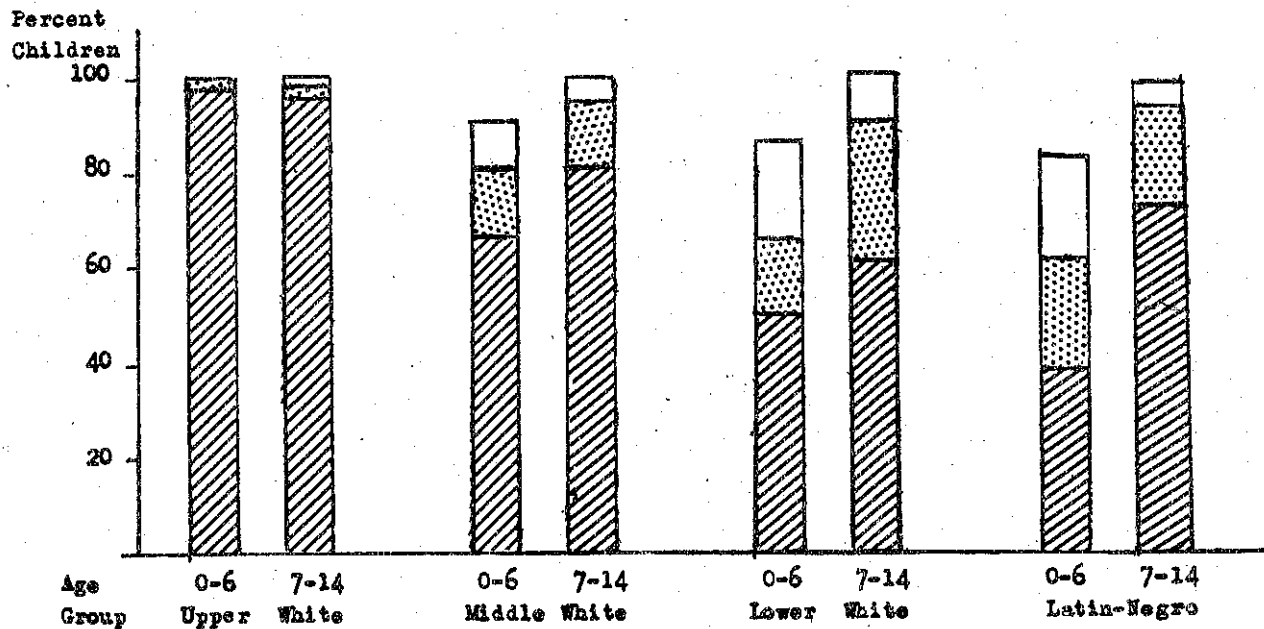
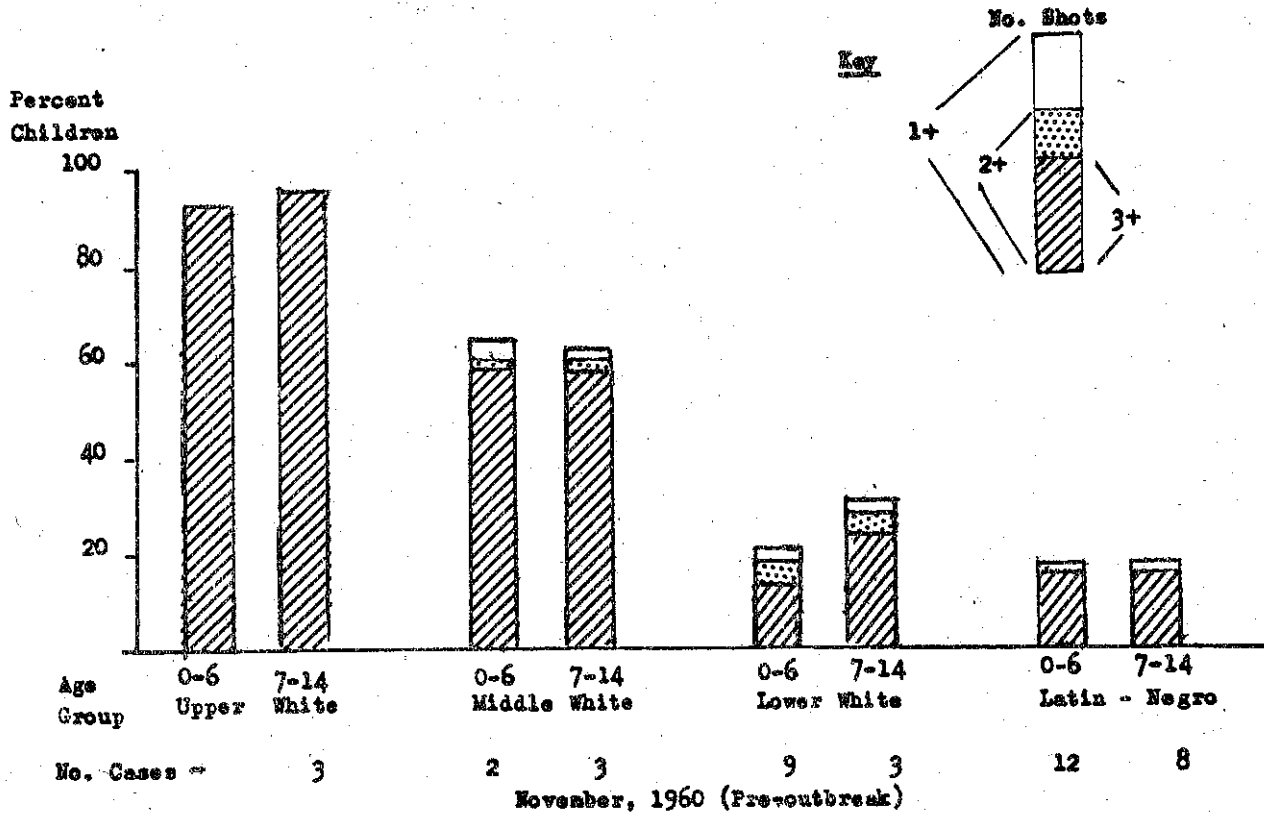


Key

- ★ - major focus (no. cases in parentheses)
- ⊙ - case occurring before Nov. 1
- - case occurring during Plainview outbreak
- // - major known patterns of movement, Latin agricultural workers



Diphtheria Immunization Survey - Summary, 1960  
 November, 1960 and February, 1961



February, 1961

Age \_\_\_\_\_  
Sex \_\_\_\_\_

1. Did the shot hurt as much as a needle?

\*Hurt more

\*Hurt about the same

Hurt less

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. If it hurt less, how did it feel?

Burning or stinging

Pinching

Pinprick

Nothing at all

Other

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*If answer is "yes" to either of these questions, no other information is needed. Please check appropriate line.

