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THE CONTROL OF EPIDEMIC  
INFLUENZA IN A LARGE IN-  
STITUTION.

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# THE CONTROL OF EPIDEMIC INFLUENZA IN A LARGE INSTITUTION.\*

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IN these days of microscope and  $x$ -ray, one hardly dares to believe in the existence of things seen with the unaided eye; but as the labors of the bacteriologist, pathologist, and chemist have so signally failed in promoting our knowledge of either the cause or treatment of epidemic influenza I have summoned courage to recount a purely clinical observation, the results of which seem at least suggestive of how this scourge may successfully be dealt with.

In order that the measures employed at the University of Pennsylvania may be intelligible, let me first briefly describe the conditions at that institution at the time of the epidemic, and then tell what was done and the results achieved.

We had at the University of Pennsylvania one of the largest, if not the largest, units of the Students' Army Training Corps in the eastern United States, numbering when complete approximately twenty-

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five hundred men. At the time the epidemic struck Philadelphia, the organization of this unit had scarcely begun; only a handful of men had been admitted to the corps, and there were but two officers and no physician attached to the unit.

The University of Pennsylvania is situated in a densely populated section of Philadelphia, and we have a large number of students living in various parts of the city who go back and forth to their homes daily. The dormitories, which were used by the military authorities as barracks, consist of a large number of small houses built around the sides of a large open campus or courtyard. Each house is three stories in height, and there are from four to six rooms on each floor. Besides the dormitory buildings, several fraternity houses were also used as barracks; and two of the latter were used as an emergency hospital during the epidemic. At the beginning of our work there were perhaps three or four hundred men sleeping in the dormitories—the majority of the students not yet being admitted to the corps were living in boarding houses in the neighborhood—and there were already some sixty or more known cases of influenza among the students living in the neighborhood of the university.

I will not take up your time describing the difficulties met by the medical officers—only one of whom had ever had any previous military experience—in organizing the medical service for a corps of this size, while making as high as three hundred physical examinations a day of recruits and at the same time fighting the most frightful epidemic that ever occurred in Philadelphia, equipping completely and running an emergency influenza hospital for which neither nurses nor orderlies were available,

and all this with a staff insufficient for a post of such size in ordinary times.

The medical staff of the unit as eventually organized consisted of Dr. John W. Hunter, who acted as physician to our emergency hospital, and had oversight of the actual treatment of the sick; Dr. Frank B. Hancock, who was in charge of the sanitation of the barracks, and also of the physical examination of recruits; and myself as executive officer of the staff. Besides these, several of the internes from the University Hospital gave as much time as could be spared from their routine duties, and were of material assistance in many directions.

On account of the ubiquity of the epidemic it was impossible to obtain for our hospital either nurses or servants. For nursing we relied entirely on medical students. As soon as the seriousness of the situation was realized the commanding officer of the corps stopped all teaching for the third and fourth year medical classes in order that the students might be free to aid in the fight. I must confess that I was astonished at both the skill and the devotion of these young men. Called to do work of which they had no practical knowledge, at considerable personal risk they gave themselves wholeheartedly and uncomplainingly to the duty before them. Not only did they carry out faithfully the orders of the physician, watching most carefully the progress of each patient, and reporting intelligently and promptly any alarming change, but, what surprised me especially, they showed both cheerfulness and carefulness in cleaning bedrooms, mopping floors, emptying bedpans, washing dishes, and performing similar important but uninteresting tasks.

The measures employed in fighting the scourge may be conveniently divided into those intended to

prevent the spread of the infection and those employed in treating the already sick.

*Prophylaxis.*—As already mentioned, the efforts directed toward stamping out the influenza conflagration before the whole university should be involved were under the immediate supervision of Dr. Frank B. Hancock. His selection for this task was peculiarly fortunate, not only because of his untiring energy, but because of his previous experience fighting infectious diseases during his service as naval surgeon some years ago.

Our first efforts were directed toward cleaning up the dormitory and college buildings, for while we realized that the boarding houses were fruitful sources of infection, they were not under military control, and the problem of how to deal with them was more complicated. We believed that the most important single factor in the spread of the disease was the infected individual, and consequently the most important prophylactic measure was his immediate detection and isolation. It will not suffice in so highly contagious a disease to wait until the man is sick enough to report for treatment, as there may be an interval of twenty-four or forty-eight hours during which he can infect half a dozen roommates. We therefore had daily rounds made of every room in the dormitory for the express purpose of discovering any case of any indisposition. When a sick man was found he was immediately sent to our hospital for diagnosis, and if suffering with influenza was held in the hospital. Later, when we had established regular sanitary inspection, these inspectors also ordered all suspicious cases to the hospital, so that we really had two searches daily.

Each case of influenza discovered was immediately reported to the sergeant in charge of the sanitary

squad, who closed and locked the room until it was disinfected. The method of disinfecting these rooms was first to mop the walls and floor with a 1:1000 solution of corrosive sublimate; spray the furniture, walls, bedding, etc., with a formaldehyde solution, in such quantity that approximately one pint for each thousand cubic feet of air space was used; and close the room for twenty-four hours.

As much as has been written on the subject of droplet—that is, direct contact—infection, I am convinced that this is not the only mode of spreading the contagion. In an interesting paper in the *American Journal of Public Health* (January, 1919, page 25), Colonels Lynch and Cumming, as a result of their studies in several military camps, reached the conclusion that in the larger proportion of cases the infection was hand-borne, chiefly, they believed, from washing dishes in a common receptacle without boiling. The failure of face masks, either when employed wholesale, as in San Francisco, or in the thousands of individual cases throughout the country, is notorious, and would seem to argue in favor of the importance of the hands as a means of carrying the contagion. I may add that our experience in the hospital, as described below, also confirms this view. Believing strongly in this indirect contagion, we insisted not only on the immediate confiscation of all common drinking vessels and towels, but on the daily disinfection of all hand basins and toilets. In addition, the buildings were given a thorough cleaning, such as they had not had in many a day.

These measures were feasible in the dormitories by virtue of our military control of those buildings, but as soon as a portion of the limited force at our disposal could be spared from what we deemed the more pressing necessity we turned to the problem

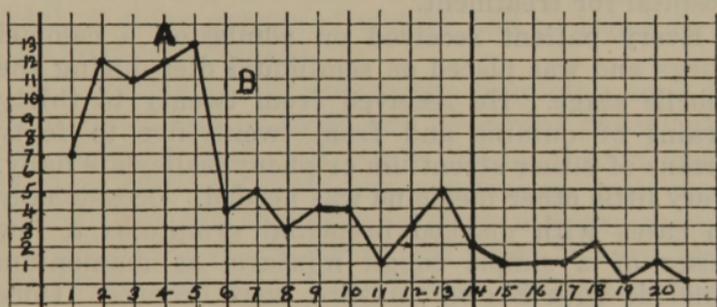
of the boarding houses in the immediate neighborhood. Two of the internes from the University Hospital, Doctors McMaster and Schmidt, made a map showing the location of every known case of influenza occurring near the university, whether treated at our own hospital, at the University Hospital, or by outside physicians. It was immediately evident that some of these boarding houses were hotbeds of infection. For instance, Dr. Schmidt reported one day on two houses as follows: "At — Locust Street there were nine cases of influenza, four of whom have been admitted to the emergency hospital of the S. A. T. C. One went home and died of pneumonia, and the others have apparently recovered. At — Walnut Street there are eight students, one of whom has been admitted to the emergency Hospital and the other seven have had mild symptoms."

While we had no formal authority over any of these boarding houses, nor over the students in them (as they had not at that time been inducted into the corps), we found, usually, that the boarding-house keepers were anxious to cooperate as soon as they were informed of the conditions, and we were allowed to disinfect the house; in the one instance where we encountered opposition we adopted the tactics of informing the other boarders of the situation, and the next day the landlady was begging for a squad of formalizers. It should be emphasized in this connection that the fumigation of bedrooms is not enough. The bathroom must be disinfected, and one must also descend into the kitchen and see that the dishes are properly washed.

We did not believe that the classroom was a common source of trouble, and consequently all classes were allowed to continue as usual, except the two

upper medical classes and the dental school. The medical class was closed because we wished to avail ourselves of the services of the students, the dental school house because the dental clinic was evidently fraught with extraordinary danger, both to the patient and to the student who treated him. Two other buildings were temporarily closed, namely, the swimming pool and the students' clubhouse, known as Houston Hall, where the students are wont to congregate during their leisure time.

The number of cases admitted to our influenza hospital—and it must be remembered that every sick student who had been inducted into the corps had to report at this hospital, and the great majority of the rest did so by preference—diminished so promptly and markedly after the institution of these measures that it is difficult to avoid the conclusion that there was more than an accidental connection between the two. The accompanying diagram shows graphically the daily admissions into the emergency hospital.



Curve showing daily admissions to emergency hospital. Figures on abscissa indicate days; figures on ordinate number of new admissions. At A began the daily search of dormitories for cases of influenza; at B began the cleaning and disinfection of the whole dormitories.

As shown in this diagram, within forty-eight

hours of the beginning of our sanitary campaign there was a drop from an average of twelve to four admissions per day. This is all the more striking in view of the fact that at this time in the city at large the epidemic was increasing; it did not reach its zenith until the 12th or 13th of October, by which time we considered it practically stamped out at the university. It was due chiefly, I believe, to our sanitary measures that the total death rate at the university was only 1 per thousand of population, as compared with 8 per thousand in the rest of the city.

*Treatment of the Sick.*—Our therapeusis was very simple but, I believe, important. Every man was put to bed immediately and kept there, not being allowed to get up for any purpose so long as he was febrile. Our rule was to keep patients in the hospital until their temperatures had been normal for three days. At the end of this time they were sent to a convalescent house where they were kept for another week, reporting daily at the hospital for treatment.

Every patient received on admission a calomel purge and was placed on semiliquid diet during the febrile stage. He received from twenty to thirty grains of quinine and from twenty-five to forty grains of either strontium or phenyl salicylate daily. Very little other medicine was needed. Occasionally in cases with marked bronchial symptoms a few doses of a simple cough mixture, as ammonium chloride with Brown mixture, were ordered. Once in a while, when the headache and backache were more than ordinarily severe, a few small doses of acetanilide were given. In this connection I may express my conviction that aspirin is a much more dangerous and less efficient remedy for the relief

of these pains than is acetanilide; personally I am of the opinion that the frightful mortality of influenza in the military camps was in part due to the freedom with which aspirin was used. Fever as such was never treated. In one or two cases ice bags were applied to the head for the purpose of relieving headache due to a high temperature; but I do not recall that we ever employed any antipyretic measure, either medicinal or hydrotherapeutic. A considerable number of our patients ran temperatures of 103° to 104° for a day or two but we soon ceased to be disquieted in any way by high temperatures. In only a few instances did we feel the need of any circulatory stimulant and in such cases we preferred digitalis or strychnine to alcohol. In view of some of the statements that have been made concerning the value of alcohol in influenza, I may say that we used in our emergency hospital during the three weeks of its existence a total of three ounces of whisky and no other form of alcoholic stimulant.

We treated in our emergency hospital a total of 88 patients and of these two developed pneumonia, one of whom died. Of course the number of cases is very small to draw any conclusions, but when we consider the mortality in other military camps, the difference seems almost too great to have been accidental. At Fort Riley (Stone and Swift, *Journal of the American Medical Association*, 1919, lxxii, page 487) seventeen per cent. of the cases developed pneumonia, of whom thirty-five per cent. died, a total mortality of 5.9 per cent. At Camp Pike (*Ibid*, page 556) there was 31 per cent. of pneumonia cases and a total mortality of 3.8 per cent.

At Camp Cody (*Ibid*, page 1056) there was

19 per cent. of pneumonia cases and a total mortality of 7.3 per cent. It cannot be claimed that the infection in Philadelphia was of a milder type than in other parts of the country, for at the League Island Navy Yard Hospital, which is a Government property immediately adjoining the city limits, there was 8 per cent. of deaths, and the Philadelphia Hospital for Contagious Diseases treated 117 sailors and marines of the Fourth Naval District with more than 15 per cent. of deaths. In the Philadelphia Hospital for the Insane 443 of the inmates developed influenza, with a mortality of 15 per cent.

Practically all of the deaths following influenza are due to pneumonia, and the striking fact about our results is not that we had 1 per cent. of deaths, but that we had only 2.3 per cent. of pneumonia. This I believe was due chiefly to three things: First, that the majority of our patients had separate rooms; second, to the use of quinine from the beginning of the infection; and third, that we did not use aspirin. In further support of my idea that our treatment played some part in our results is the fact that one of our pneumonia cases (the one which proved fatal) was diagnosed as such within twenty-four hours of his admission.

I may at this place, although perhaps not strictly the logical one, refer to the measures adopted for the protection of our nurses in the hospital. As I have intimated above, I have little faith in the face-mask. In fact, I believe that the type usually employed (a piece of gauze held to the face by tape or string) is a menace rather than a help. Nevertheless, partly as an added precaution and partly as a concession to popular superstition, we provided our nurses with the only form of mask

which I have seen that seems at all practical. This, which is probably familiar to the surgical members of the Society, is a light wire frame on the order of the Esmarch chloroform inhaler held in place by means of spectacle sides fitting back of the ears. In the frame we used a double thickness of surgical gauze soaked in a 1:1000 solution of mercury bichloride. The gauze was renewed daily. The men were also provided with surgical gowns which they wore in the sick-room. These were sterilized daily. Our main confidence, however, was placed in hand-washing. Every time the patient or anything pertaining to him was touched, the nurse immediately afterward, before doing anything else, washed his hands and rinsed them in antiseptic solution and dried them on paper towels.

Neither Dr. Hunter nor myself used face-masks or gowns, but relied solely on hand-washing to protect us, naturally, however, avoiding as far as possible getting in contact with the patient's breath. It is a record for which we are grateful that out of forty men coming in intimate contact with these patients, either as nurses or physicians, only one developed influenza.

*Conclusions.*—I am well aware that it is very dangerous reasoning to draw positive conclusions from an observation so limited as that here reported, but I think at least I am justified in saying that the following conclusions are suggested even if they are not proven:

1. That the most important prophylactic measure in combating epidemic influenza is the complete isolation of the patient; this should be done at the onset of symptoms and not wait until he is so sick that he takes to his bed of himself.

2. That the hands are an important means of con-

veyance of the infection and that no efforts at protection of the individual or limiting the spread of the disease which does not take into consideration the possibility of hand-borne infection is complete.

3. That proper isolation of the patient in influenza means not merely isolating him from healthy persons, but also from other cases of the same disease.

4. That quinine has value as a prophylactic against pneumonia. In support of this view I may also call attention to the work of Cohen and his collaborators (*Pennsylvania Medical Journal*, May, 1919, page 506) who found that if quinine was exhibited in appropriate doses the blood was rendered germicidal to pneumococci.

1905 CHESTNUT STREET.



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