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Problems of medical care in Omaha area following atomic attack

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PROBLEMS OF MEDICAL CARE IN OMAHA AREA FOLLOWING ATOMIC ATTACK

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INTRODUCTION

Why should physicians be interested in the biologic, physical, and psychologic consequences of a thermonuclear attack? The answer to this should be evident; for no other group of people is as deeply involved in and committed to the survival of mankind and also no other group is as accustomed to the labor of applying the practical solutions to life threatening difficulties. Physicians are aware that a good prognosis depends on accurate evaluation and intelligent therapy to a medical problem. Therefore the object of this thesis is to present some of the facts of thermonuclear warefare.

Descriptions of a thermonuclear attack and its sequelae are limited partly because of government classification and partly because few nuclear weapons have been exploded over major cities.

It is impossible to foresee the type of nuclear attack that may be launched. The attack may be one large bomb or several small ones. It is also impossible to estimate the size of bombs that will be made for use in the future. For purposes of getting a fairly accurate idea of the amount of destruction that can be done with nuclear warfare

a 20 megaton bomb attack will be assumed to take place at Offutt Air

Force Base. A 20 megaton bomb is certainly not the largest bomb made now so we cannot feel any degree of security that the destruction if an attack should take place would not do more damage than described for a 20 megaton bomb. The charts and diagrams may be extraploated to the conditions of other cities and areas. It is not attempted in this thesis to provide a plan of survival in face of an atomic attack; but rather to give an idea of the magnitude of the threat that thermonuclear war presents and to call attention to the fact that there are some situations in which prevention is the only effective therapy.

II. EFFECTS OF ASSUMED NUCLEAR ATTACK ON OMAHA

The hearings before the Radiation Subcommittee of the Joint Congressional Committee on Atomic Energy in 1959 were devoted in large part to an analysis of a "limited" attack of 1446 megatons on selected targets in the United States. (1) This attack has been used as the basis for this discussion. It should be brought to mind again that what was considered realistic in 1959 could be greatly exceeded at this time.

The attack is assumed to occur in late fall, in fair weather, during a working day, and to provide twenty to thirty minutes warning, equivalent to intercontinental-ballistic-missile flight time from the Soviet Union to eastern United States. It is further assumed that there is only one strike, so that fallout, fire and other effects decay proportionately with time.

The assumed 20 megaton ground blast would create a crater 250 to 300 feet deep and 0.5 mile in diameter. An air blast would not create a crater but would destroy almost two times the area destroyed by a ground blast. The area of total destruction including heavily reinforced concrete buildings and deep blast shelters would have a four mile radius. (2) This would include the towns of Bellevue, LaPlatte, Fort Crook, Gilmore,

and Avery.

In a six mile radius all frame or brick buildings and any basement shelters would be totally destroyed. Lung damage from blast alone would cause 100 per cent casualties. This could include these towns listed above plus Oreapolis and a small southern part of Omaha.

At a ten mile distance reinforced concrete buildings would be partially repairable, but all other structures would be demolished. Deep blast shelters would be of no use. This would roughly effect Omaha south

of Dodge Street and the smaller towns of Papillion, Plattsmouth, and Ralston in addition to those listed above.

Fifteen miles away would still damage frame buildings beyond repair. Serious damage would be done in this area by flying objects carried by shock waves. Human bodies, cattle, stone, and glass would be very hazardous missiles. This would include all of Omaha and Council Bluffs and Millard as well as those listed above. At this distance, in an exposed population, casualties from missles are estimated to run as high as 15 per cent. (3)

Casualties from blast result in three ways. The primary effects of blasts are overpressures which

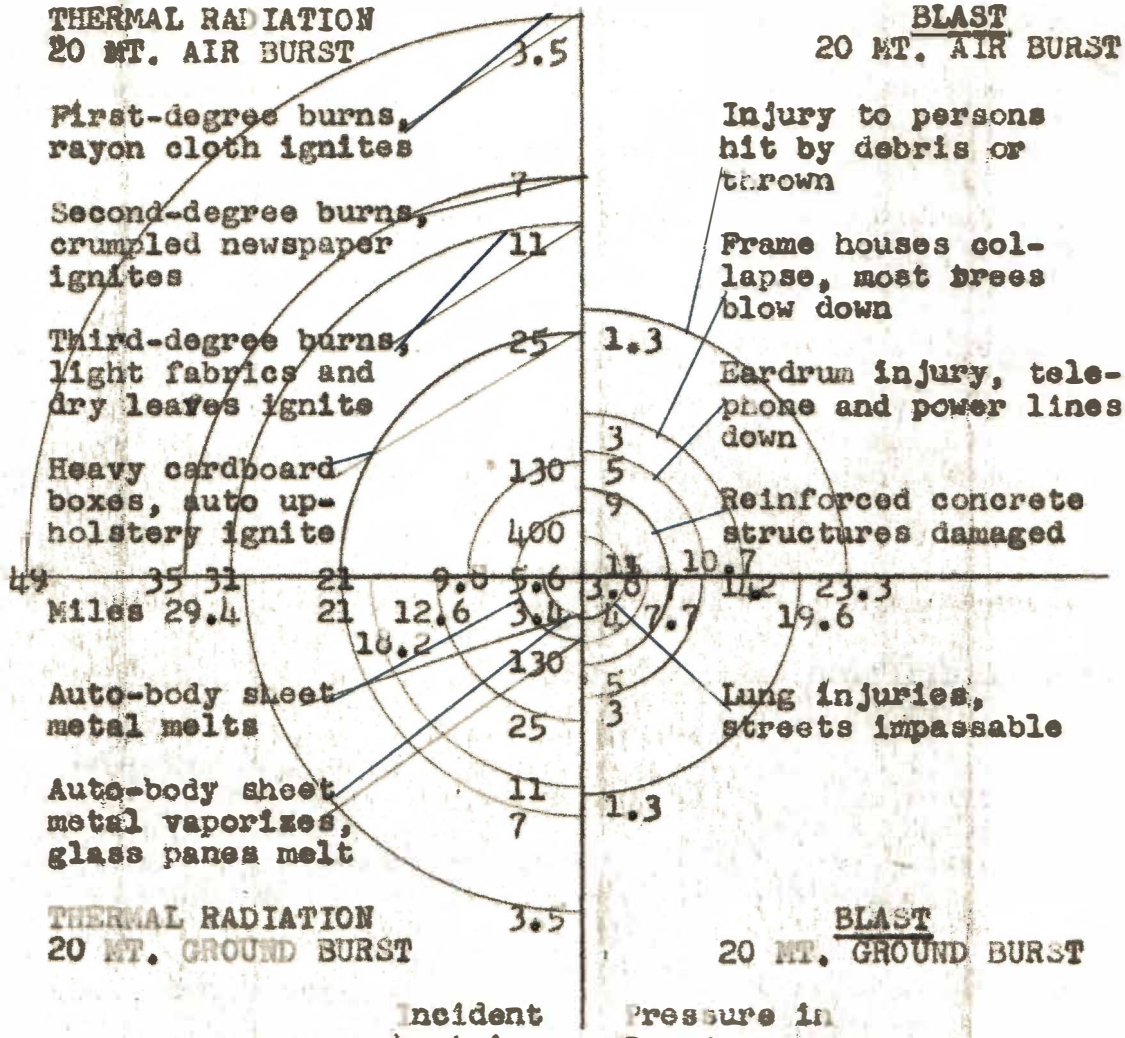

Figure 1: Effects of the Detonation of a 20 megaton Fusion Bomb as a Function of Distance from Ground Zero. (9)

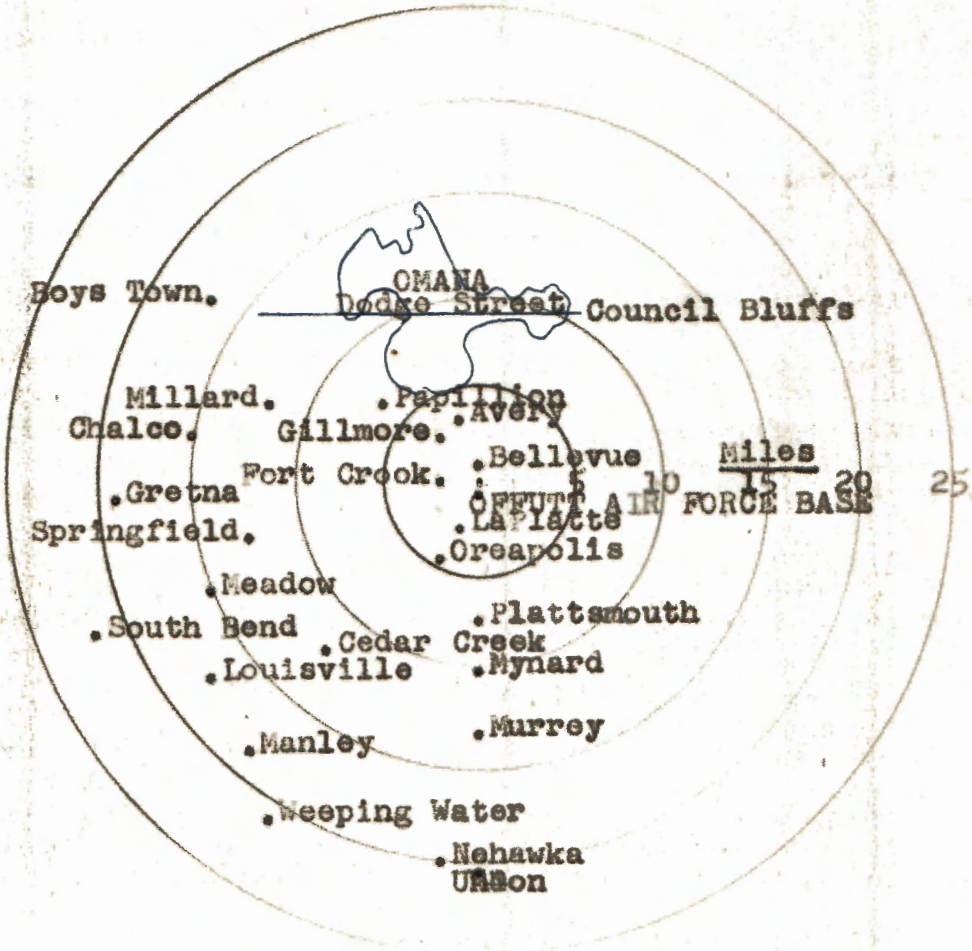

Figure 2: Offutt Air Force Base and Surrounding Towns.

would rupture eardrums and lungs. The second was would be damage by falling building and missiles projected by pressures, winds, and gravity. Small pieces of glass or concrete would be hazardous for as far as eighteen miles. Therefore a person could not be safe from gravity and wind driven debre even if they were lying flat in a gully. There would also be risk for those in basements since the house may collapse on them. The third hazard is the tremendous blast and wind. This blast could injure a man 20 miles away even though at this distance thermal exposure would be more of a hazard than the blast if the person was not in shelter.

Thermal energy is released from a bomb in two pulses. The first is the ultraviolet flash which is not a hazard. The second is the infrared pulse which contains 35 percent of the bomb's energy. Up to 21 miles from a 20 megaton surface burst a person would receive second degree burns and his clothing as well as other similar materials would ignite. As far as 40 miles away a reflex glance at the fireball would produce retinal burning and total blindness. (2) The distance of damage produced by thermal effects would be increased by an air burst and decreased by fog, smoke or rain.

In typical American cities there is estimated to

be 5 to 25 potential ignition points per acre and a dry country side would have many more than this. (2) As the bomb explodes a huge pressure wave initially traveling at a speed greater than sound spreads out from the center of the explosion; followed by wind over 1000 miles per hour. The wind creates a low pressure area and surrounding air rushes in thus fanning and spreading the many fires started by the thermal heat wave. Thus in a radius of 15 to 20 miles ; wood, gasoline, etc. would ignite and huge fire storms would travel towards the bomb area at 100 to 200 miles per hour. In 1943 in Hamburg after a series of air raids the temperature was estimated at 800 degees Centigrade. (4) Days arter the raid shelters in tne area were opened and because of their intense heat and oxygen getting into them; immediately burst into flames. Deaths inside these shelters during the raid were dus to heat stroke, dehydration and carbon monoxide poisoning. It was pointed out after the raid on Hamburg that only those who fled their shelters in the early stages of fire had any hope of being safe. (4) Those who stayed in their home shelters without sufficient oxygen supply were killed. Near the periphery of a fire storm an underground shelter would provide sufficient insullation but occupants would sufficate unless they had a

additional oxygen supply.

From what has been said thus far we can estimate the number of casualties from blast and heat in the OffuttAir Force Base area. This would be assuming that everyone was in a shelter at the time of the blast and thus protected from radiation. In the four mile radius of total destruction an estimated number of people that would be killed outright would be 10,000 plus the number of military personel on the base at the time. Because of government classification this number could not be obtained. Withing the 16 mile radius of fire storm it is estimated that at least 500,000 would be killed outright or die of anoxia in their blast shelters. Beyond the 16 mile radius many more ppople could be killed by flying debre and many non fatal injuries would certainly result.

Radiation effects constitute the main hazard to persons living outside the area of blast and thermal damage. The initial burst of neutrons and high-energy gamma rays is locally lethal but limited to the blast destroyed area. Some materials would be activated by this initial burst and later be dangerous as fallout. Ten per cent of the total bomb energy becomes radio-active fission products distributed in two ways. From a ground burst, over 20 per cent is made up of

very fine particles which are carried into the stratosphere with the mushroom cloud. These travel with upper-level winds and descend over a period of months to years with the long lived isotopes potentially releasing much radioactivity when it falls back down. The other 80 per cent begin to fall out within minutes to 48 hours, the rate of descent proportional to size of the particles. It is to be emphasized that an air burst would not have any or very little fallout.

Calculations of fallout have taken into consideration a 40 mile per hour wind. (1) Of course with less wind than this the fallout would be more and with more than 40 mile per hour wind the fallout would be less per area.

All the heavy particles would fall out in approximately a four mile radius circle in approximately one hour. This would be relatively unimportant as there would be no survivors in this area after the blast and thermal effects. It is estimated that particles of 50 to 400 micron would be most hazardous as it would take them between three-fourths of an hour andsixteen hours to fall from 80,000 feet. (2) With a 40 mile per hour wind a 340 micron particle would fall approximately 22 miles from ground zero. Thus they would be traveling at 5 degrees and 0.1 degree angles from

horizontal and could easily enter an open window. From this pattern an area of 4000 square miles would follow a 20 megaton explosion and unshielded persons at the edge of this area would receive 450 rem (LD_{50} dose) in 48 hours. It has been estimated that an average radiation over the 4000 square mile area would be 4000 r per hour. An individual shelter with twenty inches of concrete would reduce the cumulative two week dose from 10955 to 45 r if one stayed in the shelter continuously. One half time outside the shelter during the next two weeks would add 215 r, and three-fourths time spent outside for the remainder of the year would add 380 r. (1) This total of 640 r is compatible with human life but would certainly have long term som-atic and genetic effects. These figgures again were assuming that the radiation dosage s equal over the entire 4000 square miles. Therefore if one was closer to the bombed area the dosage would be greater and if one was on the periphery of this area the dosage would be much less. Also one would have to take into consideration the huge dose that a person may get before he gets to the fallout shelter.

Most official papers give the LD_{50} as 400 to 500 r. This means to 50 per cent of people will survive if given 400 to 500 r over a short period of time.

The young and old are much more succeptible to radiation and have an LD_{50} of approximately 225rr. The long somatic and genetic effects are not considered in these estimates. It is thought that 50 to 100 r increase incidence of cancer and leukemia (5,6) and double the gene mutation rate. (7,8) Short term effects of fallout may be put in three classes: (1) whole-body radiation produced by penetrating radiation; (2) superficial burns produced by soft radiation and (3) injury produced by radionuclides in organs of the body. Each of these types of radiation may produce both acute signs and also later manifestations.

Following is a summary of probable short term effects of acute whole-body irradiation? (2)

0 to 50 r -- No obvious effect, except possibly minor blood changes.

80 to 120 r -- Vomiting and nausea for about one day in 5 to 10 per cent of exposed persons; fatigue but no serious disability.

130 to 170 r -- Vomiting and nausea for about one day, followed by other symptoms of radiation sickness in about 25 per cent of persons; no deaths anticipated.

180 to 220 r -- Vomiting and nausea for about one day, followed by other symptoms of radiation sickness in about 50 per cent of persons; no deaths anticipated.

270 to 330 r -- Vomiting and nausea in nearly all persons on first day, followed by other symptoms of radiation sickness; about 20 per cent deaths within two to six weeks after exposure; survivors convalescent for about three months.

400 to 500 r -- Vomiting and nausea in all persons on first day, followed by other symptoms of radiation sickness; about fifty per cent of deaths within one month; survivors convalescent for about six months.

550 to 750 r -- Vomiting and nausea in all persons within four hours after exposure, followed by other symptoms of radiation sickness; up to 100 per cent deaths; few survivors convalescent for about six months.

1000 r -- Vomiting and nausea in all persons within one to two hours; probably no survivors;

5000 r -- Incapacitation almost immediately; all persons dead within one week.

In an attempt to have some broad symptomatic rules of thumb for determining the prognosis of irradiated persons early without aid of laboratory or trained technicians three groups have been established: Group I (survival improbable), Group II (survival possible), and Group III (survival probable). Group I consists of those persons who have immediate and

continual vomiting continual vomiting followed rapidly by prostration, diarrhea, anorexia and fever. Intensive therapy will not be of aid to these persons. Group II are those persons who have a short early period of vomiting followed by a period of apparent well being. Lymphocytes are depressed for months, neutrophils are depressed and drop to zero in nine or ten days, and remain below 1000 for the next week. These persons have bleeding in two to four weeks. At the end of this period purpura, diarrhea, and infection take a high per cent in spite of vigorous treatment. Group III persons may or may not have nausea on the first day. Lymphocytes reach low levels in 48 hours. Granulocytes may become depressed in two to seven weeks or even later. Platelets reach the lowest count on about the thirteenth day. The main medical problems in this group is impairment of wound healing.

Additional problems can easily be foreseen in those persons requiring insulin and other drugs that would have to be given by hypo during the vomiting periods. These persons would aquire infection easily and heal slowly. Malnutrition, excessive fatigue and emotional stress would also contribute to recovery problems.

In Hiroshima many cases of microencephaly and

an increased incidence of mental deficiency appeared in children who had been in utero four months at the time of bombing. Half the number of mentally defective children born in the post-attack period were from mothers who had major immediate radiation exposure in the range of 200 to 300 r. The history of abnormal termination of gestation in 45 of 177 pregnant Nagasaki survivors illustrates the dose dependency of embryo damage. The terminated pregnancies included all 19 within 1.8 miles of the hypocenter, 15 out of 20 between 1,8 and 11.2 miles and 11 of 138 beyond that. (10)

Altered ecology of involved areas would also be an important factor. The heat and blast and fire would kill many of the trees and plants. Also in addition the fallout would kill much of the plant life because it is extremely sensative to radiation. Lack of vegetation would cause flooding, dust bowls, etc. Mammals and birds are also very sensative to radiation in contrast to insects and bacteria. For example cockroaches are not damaged by 40000 r of gamma radiation. Only 20 per cent of an Escherichia Coli population is killed by 20,000 r of gamma radiation. Virus and fungi are even more resistant.

The long term survival of the human population after this ecologic upheavel would be precarious.

Before man would be overtaken by malnutrition due to lack of domestic plant and animals he would be faced with the threat of epidemic infections and disease because of the resistance bacteria, virus and fungi have to radiation.

III. THE PHYSICANS ROLE IN THE POSTATTACK P8RIOD

A thermonuclear attack poses a series of questions to physicians. How many fatally injured? How many physicians will be killed or injured too seriously to care for others that are injured? How many medical supplies will be left and now accessable will theybe? There are so many valeables that could exist in a thermonuclear attack that it is almost an impossibility to be specific as to how severe the attack would be and what problems would have to be faced.

I think it would be a conservative estimate to say that 40 per cent of Omaha's population would be killed outright if a 20 megaton bomb was dropped on Offutt Air Force Base. Probably at least 50 per cent would be injured thus leaving 10 per cent of the population uninjured. It again would probably be a conservative estimate to say that only 75 per cent of the injured would die. Using the figure of 300,000 for Omaha's population this would mean that 120,000 would be killed outright, 150,000 would be injured and of these injured at least 105,000 would die. Also using the figure of 500 for the number of Omaha physicians this would leave approximately 50 physicians to care for 150,000 injured persons. Of course as the first few days post attack came the number of injured would decrease because

they would die. Assuming 25 per cent of the injured do live this would mean that there would be 50 doctors to take care of 45,000 injured people who could live if they had medical attention. At this physician-doctor ratio, and if each doctor were to work 20 hours per day and see six patients each hour, it would take 8 to 10 days to see them all for the first time. This estimate is assuming that every physician will be willing to expose himself to high or lethal levels of radiation and will be able to identify the areas in which he is most needed. The ratio of total patients to physicians in both the immediate and later postattack periods will be affected by the number of persons not physically injured in the attack who will demand the physicians time. This includes those with pre-existing illness requiring continuing medical attention and those with acute illness secondarily related or unrelated to the attack; it also includes those who merely believe they are injured. The symptoms of radiation sickness are such that many persons exposed only minimally are likely to confront the physician with weakness, nausea, vomiting, and diarrhea. These patients too will require diagnosis and treatment, further reducing the physician availability to the acutely injured. It can be assumed that most of the fatally injured persons will never

see a physician before they die. Many of those injured who might survive with adequate care will also die, and many other injured persons will have to accomplish their survival without medical aid.

What facilities and equipment will still be intact for the doctor to use on the patients who are fortunate enough to have the aid of a doctor? None of the existing hospitals in Omaha are beyond 15 miles of Offutt Air Force Base. Thus for all practical purposes none of the existing facilities would be of any use. In an attempt to meet the problem of hospital destruction the Federal Civil Defense Administration has planned to provide 6,000 two-hundred bed improvised hospitals for the nation as a whole.(11) At the present time 12 such units have been placed in Nebraska, exactly where is not disclosed to the public. (12) Assuming that all 12 of these units were available to the Omaha area this would still provide hospital care for only approximately 5 per cent of those who lived past the first few post attack days to say nothing of the very small per cent of the immediately need it would facilitate. If all those who were injured but still alive would be brought to one of these hospitals there would be room for approximately one per cent to be hospitalized.

Estimation of medical supplies remaining is extremely

difficult. At the present time most large concentrations of drugs and equipment are in hospitals and wholesale drug warehouses of the large metropolitian areas and would be destroyed. Of course again the drugs and equipment available would be largely determined by how many of the nearby metropolitian areas would also be attack.

As of 1956 The Federal Civil Defense Administrations plan was to disperse $500,000,000 worth of medical supplies in some 100 warehouses in frange areas around major cities throughout the nation.(11) If these stockpiles were completed and kept up to date, if they escape blast and fire storm damage, if transportation facilities remain intact and roads stay open and if manpower is available to istr bute them in an organized manner, they will be sufficient to treat 5,000,000 casualties in the United States for three weeks.(11) The Holifield estimate for the nation as a whole is 40,000,000 injured. Therefore this large estimate will provide for less than 15 per cent of the anticipated injured in case of a general attack on the entire United States.

The absolute number of physicians, beds and supplies is only one aspect of the problem. Their distribution, in relation to the geography ic distribution of the injured, is an equally critical consideration. To move

physicians, ancillary personnel and beds into attacked areas presupposes good communications and transport. Furthermore, the reluctance of physicians to leave their shelters and their own patient populations to enter areas of higher radiation danger may be supported by national policy. Any surviving physician who leaves a fallout shelter for more than a few hours in the immediate postattack period may himself suffer radiation injury. On the other hand, the attempt of injured persons to make their way to relatively undamaged areas may precipatate grave social conflict. Psychologic disorganization is likely under postattack conditions. In Nagasaki a surviving physician observed that "those who survived the bomb were, if not merely lucky, in greater or lesser degree selfish, self-centered, guided by instinct and not by civilization". (13)

The question of immediate concern to physicians, given the almost enevitable acute shortage of medical care, is whether or not reaction of panic and violence will developp in competition for access to remaining medical facilities.

In the attempt to develop methods of clinical practice and medical care in the postattact period, the experience of the armed forces in combat zones has guided plannang. This involves establishment of an organization

providing for an orderly process of medical management, sorting of the sick and wounded to the presenting type and urgency of the problem, deciding on priority of treatment and evacuating those requiring extensive care to better equipped installations. The applicability of this military model is limited. In a thermonuclear attack there is no clear-cut front line and safe rear area for blast and fire effects are widespread and radiation is almost ubiquitous.

In the postattack period the physician will encounter many major disruptions of the human environment. These include destruction of transportation, communication and electricity, contamination and depletion of food supplies, destruction of housing and fuel, destruction and pollution of public water supplies and disruption of garbage and sewage as well as other sanitary facilities. These circumstances will, at the same time, create new medical problems and alter management of such familiar entities as burns, fractures and blood loss. In some ways the situation will resemble those in underdeveloped areas in which too few physicians lacking essential resources must handle large population. The problems peculiar to nuclear attack will be superimposed.

The specific medical problems facing the surviving

physicians will large include blast injuries, lacerations, fractures, thermal injuries, surface burns, retinal burns, respiratory tract damage and radiation injuries, including acute radiation syndrome and delayed effects. Many persons will have infectious disease due to lowered resistance of masses of people and therefore epidemic outbreaks.(14) Others will have psychologic breakdown due to fear, grief, and pain. (15) In addition to all those people the docter will still have the ordinary diseases as heart attacts, cancer, etc. to treat.

Major public concern has been with radiation injury even though thermal and mechanical trauma will be of much greater significance. It has been estimated (16) that the radius at which the initial ionizing radiation is at the sublethal 300 rem level increases only by a factor of five from a one-kiloton to a twenty megaton airburst. The same increase, increases the radius of blast-induced pressures of 2.5 pound per square inch by a factor of 27. Thermal energy sufficient to cause second degree burns increase by a factor of 64, from a radius of 0.5 miles to a radius of 32 miles. It has been concluded that burn injury is likely to couse the greatest number of casualties in any nuclear explosion.

Optimal therapy for serious burns requires sedation, oxygen, and large amounts of intravenous fluids. For

example a person weighing 70 kilograms that is 30 per cent burned would require over 6000 ml. in the first twenty-four hours after injury to prevent and combat hypovolemia shock.(17) Antibiotics, tetanus ppphylaxis and local wound care will also be necessary. Even if the physician is well instructed in the care of burns, it is difficult to see how he will cope with hundreds of such patients when he is lacking important diagnostic and therapeutic facilities.

In the patients with thermal injuries, diagnosis and triage may be difficult and preclude prompt judgement and decision. Thousands of patients will also have fractures, ruptures of internal organs, penetrating wounds of the skull or thorax and infections. Many will suffer from one of the above plus being severely burned. How the diagnosis are going to be made in the absence of adequate diagnostic equipment is an important problem because good diagnosis will be of great advantage in triage. Patients with fatal or nearly fatal injuries may be neglected to provide care to the persons who have a better chance of recovery. Triage is made more difficult by the presence of radiation injury. The early clinical pictures of psychogenic nausea and diarrhea and of moderate, sublethal and lethal radiation injury overlap, and the medical history will be of little

use since few patients will be able to report their exposure accurately. The necessity of making quick judgements involving life and death decisions for individual patients after only cursory examination, and the possible decision to ignore the critically ill and those near dying, would represent a profound and difficult reversal in the attitudes and performance of the physician.

In the face of these difficulties; many civil defense plans will place considerable reliance on nurses and on the training of large numbers of laymen in self care and first aid measures and that some of the more seriously injured persons will be saved. An example would be acute hemorrhage. Complicated problems involving a mixture of thermal , blast, and other traumatic injuries will be beyond the competence of most nurses and laymen and unfortionately will be of frequent occurrence. Careful consideration makes it clear that first aid is essentially a "holding" operation, effective only on the assumption that adequate medical care will be provided later. Yet the simple logistics of physicians, beds, and supplies make it easy to see that further medical care will not be available within a reasonable time period. (17)

In the postattack period the control of epidemic disease will be an ever present challange. As has been

mentioned before disease organisms and vectors carrying these disease agents will not be hindered with a dose of radiation that would decrease the resistance of the human population significant enough amount to allow an epidemic .

Another very serious problem will be to dispose of the dead. These corpses would provide excellent breeding grounds for vectors and organisms that could cause an epidemic. It has been suggested by the United States Army Mortuary Service that due to the latent period of radio injury, and upward curve in the death rate should be evident at two weeks postattack, reach a maximum at four to six weeks and gradually subside during the following six months. (18)

Prompt disposal of corpses will be essential for many reasons. Beside the obvious public health problems an equally important reason is psychologic. There is evidence (19) that profound emotional disorders and somatic manifestations follow the sight and smell of decomposing bodies. The bodies that were exposed during the blast would be largely incinerated up to approximately ten miles. In the areas beyond ten miles which would be approximately from Dodge Street and north the problem of disposing of the dead would exist. It is suggested that regular procedures of the peacetime

mortuary service be carried out, including collection, identification, record-keeping, religious rites and burial. Little need be changed from mormal routine except adjustment to greater number of dead. (18) Taking care of the dead will be greatly altered by transportation difficulties and high amounts of radioactivity in collecting some of the dead.

When the United States Army entered Manila in 1944, it was faced with the task of burying 39,000 bodies of Japanese and Filapinos killed during the preceding week. (20) It was soon found that American troops could not withstand the psychologic aspects of this work and with a few exceptions, nausea, vomiting and loss of appetite occurred after a few days. Local laborers were recruited at double pay to place the dead in large pits. The burial of these 39,000 took eight weeks and they were not hindered with radio activity problems. As mentioned before it would be a conservative number to say that 105,000 of the injured 150,000 would die and have be be buried.

What is the physician supposed to feel is his duty to his fellow men? Should he endanger his life by getting an overdose of radioactivity in helping the acutely injured immediately after the attack or should he stay under cover and make sure that his life isnnot endangered

so that he can help in the many chronic situations? I am sure that this can not be answered but as the situation arises if it arises, each physician will have to do whatever he can justify in his own mind. There will be chronic situations that physicians can advance as a whole. One example of this would be therapeutic abortions for the women who are pregnant and have received enough exposure to result in certain malformations of the fetus. (21, 22)

Neither the Hippocratic Oath nor personal morality will give an easy answer to these problems that will face the physician in the postattack period. A review of these trusted and cherished guides in the light of thermonuclear war makes them seem sidly obsolete, as if they reflected the human innocence of an earlier era.

IV. PSYCHIATRIC AND SOCIAL ASPECTS OF DEFENSE SHELTERS

Fallout shelters have reached much fame among some people. In the first place fallout shelters would be of no use up to approximately 15 miles from the blast. If all people had fallout shelters equipped with food for approximately three weeks they would be of much value. Since it costsatleast $150 to build and equip a fallout shelter the poorer class of people cannot afford one.(23, 24) Then there are the large per cent of people who do not think it necessary to build a shelter and would be without one. It is only too easy to see what would happen if a few people had fallout shelters equipped with enough supplies for their won families. They would either end up sharing it with desperate friends and neighbors or otherwise by some means turn away their friends and neighbors in order to have enough supplies so that they would not perish.

Since such a catastrophe as I have attempted to picture has never existed and we have no idea as to the size or number of bombs that would be dropped it is an understatement to say that it is impossible to foresee or plan management of the situation as it would happen. It has not been my attempt in this thesis to forecast the catastrophe as it may occur but rather to give some idea of the amount and extent of damage that would

result with a certain sized attack taking place at a certain place; namely one 20 megaton bomb dropped on Offutt Air Force Base.

V. SUMMARY

An assumed attack of one 20 megaon bomb on Offutt Air Force Base is discussed in this thesis. A 20 megaton blast would create a crater 250 to 300 feet deep and 0.5 mile in diameter. An air burst would not produce a crater but would destroy approximately twice that destroyed by a ground blast. At four miles from a ground blast there would be total destruction of reinforced concrete buildings and deep blast shelters. In a six mile radius all frome or brick buildings and basement shelters would be destroyed. At a ten mile radius reinforced concrete buildings would be p partially repairable. At fifteen miles from the blast, frame buildings would be beyond repair.

There are estimated to be 5 to 25 ignition points per acre in an average American city. The huge positive pressure at the time of the blast and the large negative pressure after the blast would result in winds up to 1000 miles per hour thus spreading fire after being started.

Deaths inside blast shelters results mainly from heat stroke, dehydration and carbon monoxide poisoning.

It has been estimated that at least 40 per cent of Omaha's population would be killed outright if a 20 megaton bomb was dropped on Offutt Air Force Base.

50 per cent injured of which 75 per cent would die thus leaving only 10 per cent uninjured. Assuming 500 physicians in Omaha this would be one physician for every 900 that would still be alive approximately two days postattack. If all available physicians worked 20 hours each day and saw 6 persons each hour, it would take 8 to 10 days to see them all once. This is assuming that all physicians will be willing to expose themselves to the radiation hazards and also that the injured can be gotten to the physicians and that the physician only deals with those who are injured from blast and radiation and not the common everyday illnesses.

Since none of the Omaha hospitals are beyond 15 miles from Offutt, it can probably be assumed that they will not be useable. Twelve 200 bed improvised hospitals have been placed in Nebraska. This would provide care for approximately 5 per cent of the estimated number that would be alive and need care approximately 2 to 3 days postattack.

Many persons will suffer infection because of the amount that human resistance is lowered in comparison to infectious organisms. There are also undoubtedly going to be many psychologic breakdowns due to fear, grief and pain.

Triage will be of ultimate importance in order

to benefit the greatest number that can be benefited.

Disposal of the dead will be a great problem in order to reduce the number of infections and also for psychologic reasons concerning the persons yet alive.

Fallout shelters will be of value to those persons who have one equipped sufficiently, providing they restrict its use only to the number of persons it was built and equipped to house.

VI. CONCLUSIONS

It can readily be concluded that an atomic attack on Offutt Air Force Base would be very disasterous to the people of Omaha. Not only would a large per cent of its population perish from blast and fire but many more would undoubtedly die from radiation exposure because they would not be prepared to combat against radiation. Probably the largest single reason for not being prepared would be the lack of knowledge about radiation.

Physicians to a large extent would also not have sufficient knowledge of what to do in protecting themselves as well as other against the obstacles in the post-attack period. Such specific medical problems as lacerations, fractures, and burns would be of such a large number that the physician would lack the training to cope with the vast numbers even though he could handle them very competently if the number were many times smaller. Infectious outbreaks due to lowered resistance of the human population and psychological problems would also confront the physician in vast numbers.

Physicians as well as supplies will be grossly inadequate at the present time. Transportation facilities will also be inadequate so that all the injured

will not get to a physician and receive medical care.

Triage of the persons that do get to a physician will be of utmost importance to that the medications are used on persons that can receive benefit from them and not be "wasted" on the terminal persons that will not be saved anyway.

Much reliance will have to be placed on nurses and other trained laymen in the postattack period so that the physicians will be able to see more of the severily injured. It is easy to see that many who could survive with the help of a physician will perish because of the shortage of medical trained personnal.

The dead within 10 miles of Offutt Air Force Base will be incinerated by the heat and will not have to be buried; at least not immediately. Those killed beyond the 10 mile range will have to be buried in order to eliminate these as hosts for epidemic organisms as well as to rid the area of the psychological effects caused by the sight and smell of decomposing corpses that this would have on the remaining population. It is very doubtful if this task can be done effectually because of the danger of radiation exposure to say nothing of the time and manpower it will require to achieve this task.

It can easily be seen that the only solution to

this vast problem is prevention.

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