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THE ORGANIZATION OF THE MEDICAL SERVICES IN AIR RAID PRECAUTIONS.

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INTRODUCTION.

THE suggestions I have to offer on medical organization are put forward after three and a half years' experience in a Casualty Clearing Station in France and nearly four years' work as a Red Cross Organizing Officer in

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the County of Surrey, working in connexion with Air Raid Precautions Schemes.

It is hoped that the details to be described will be of interest and value not only to the medical services of the forces, but also to those responsible for civilian medical organizations in connexion with Air Raid Precaution Schemes.

AIR RAID PRECAUTIONS ABROAD.

(A.R.P. Home Office—Passive Air Defence, P.A.D. Military.)

Practically every "civilized" country in the world is preparing, or has already prepared, to defend its civil population against air warfare, including gas.

In Europe the preparations are advanced and in most countries complete.

In Paris, a large number of underground shelters have already been erected, including first-aid posts. These are protected by ceilings sufficiently strong to withstand the weight of the collapsed superstructure.

These first-aid posts are hospitals of a considerable size, with operating theatres, beds, etc., and are staffed by five to ten doctors, with nurses and Red Cross volunteers.

In Germany, a new pattern civilian anti-gas respirator is now being produced at the rate of 35,000 a week.

In Berlin (4,500,000) a first-aid post is organized at each police sub-station, of which there are 200. A medical officer will be in attendance and the casualties are kept on double-decked stretcher frames. Oxygen can be administered here.

These small first-aid posts are arranged in groups with an Area Command Post as headquarters.

In addition there are at present between 700 and 800 public refuges, some of large size.

Large buildings, tenements, etc., will collect wounded and evacuate direct to hospital.

The cleansing stations can put through 50 cases per hour.

AIR ATTACK ON CIVIL POPULATION.

Recent Casualty Figures.

In Spain, incendiary bombs have produced little effect in the big towns, probably because so little wood is used in construction of buildings. (20-pound thermite bombs have been used.)

Gas has not yet been used.

High Explosive Bombs.—In 18 raids reported in Barcelona during the period November 20, 1937, to January 26, 1938, 100-pound bombs were chiefly used. The total casualties were said to be 700 killed and 700 wounded.

In one raid three or four 500-pound bombs, i.e. rather less than 1 ton, killed 220 and wounded 400.

The public appears to become quickly accustomed to raids, only showing signs of panic on the first raid.

In China some information is available :—

One 500 kilo bomb killed 145 and wounded 200. On another occasion in Shanghai in a short raid there were 173 killed and 549 wounded.

A press account of a Japanese raid on Chengchow in February, 1938, describes how a succession of bombers attacked the city for two hours : 80 to 100 bombs were dropped and from 500 to 1,200 people were killed or wounded. With the 100-pound bombs used 4 to 5 tons were dropped, i.e. 125 to 250 killed or wounded per ton. Three bombs fell on hospital quarters and the population became panic stricken.¹

AIR RAID CASUALTIES IN LONDON. September, 1917 to May, 1918.

(Quoted from "*War Over England*," Air Commodore, L.E.O., Charlton, 1936.)

In this period there were 20 night raids by large aeroplanes. Altogether 249 left German aerodromes and 225 arrived over London.

Fifty tons, representing nearly 2,000 bombs were dropped. £1,000,000 worth of material damage was done, 435 were killed and 980 injured, a total of 1,415, i.e. 29 casualties per ton.

Daylight raids were more productive of casualties. Twenty tons thus dropped produced about the same number of casualties, i.e. 75 per ton.

In these raids 20 to 27 per cent of the casualties were produced by our own anti-aircraft gun fire.

EXPECTATION OF CASUALTIES IN THIS COUNTRY IN ANY FUTURE AIR ATTACK.

All European countries except perhaps Turkey can attack this island from the air.

The modern high speed bomber can fly at a height of 20,000 feet, and at a speed of 200 or more miles per hour, carrying one ton of either H.E. incendiary or gas bombs.

This performance allows hostile aircraft to attack any large town in England, Wales and Scotland, south of Edinburgh, with very little warning.

A lone bomber may be sent to a given locality to create a diversion, but the main attack would probably be carried out by formations made up of from 25 to 36 machines, operating in relays.

This type of formation (of three or four squadrons) would cover an area of about a quarter of a square mile. An interval of a mile or more may be expected between formations (see fig. 1).

Each machine will carry approximately one ton of bombs, the load being made up of four or five 500-pound bombs. This means that 25 to 36 tons of bombs can be dropped in a quarter of a square mile. The bombs may be released simultaneously or in a pattern over a considerable area.

¹ Recently a doctor serving with the Chinese Red Cross told the author the ratio of killed to wounded was often 3 to 1.

FIG. 1.

By permission of "R.A.F. Journal."

Working on the London figures already mentioned the expectation of casualties per ton will be :—

Time			25 Machines			36 Machines.
Night	..	..	725	..	..	1,044
Day ..	..	..	1,875	..	..	2,700

In London the population varies from 30,000 to 50,000 per square mile. The casualty figures will be less than the above table gives, because possibly 30 per cent of the attacking machines will themselves become casualties before reaching their objective.

Successive relays of machines may attack the same locality, at periodic intervals.

In air raids the ratio of killed to wounded will vary from 1:1 to 1:2. Of the casualties caused by H.E. the proportion of walking to lying may be taken roughly as 2:1. Half the walking cases may require sitting transport. The women and children will require more help than men. Unwounded parents will want to accompany their children to hospital.

Taking 2,700 as a possible number of casualties caused by one attack by a formation of thirty-six machines, the following details may be expected:—

Killed	1,000
Lying cases	700
Walking cases	1,000
	<hr/>
	2,700

ESTIMATE OF GAS CASUALTIES.

The estimate will be based on the consideration: of (1) Tonnage of bombs dropped; (2) whether the gas is persistent or non-persistent; (3) weather conditions; (4) time of day; (5) protection available; (6) previous propaganda to allay panic; and (7) presence of an efficient Air Raid Warden Service.

In the *R.A.F. Journal* of April, 1936, this subject is discussed in an article on "Air Strategy," written by Lieut.-General N. N. Golovine.

Estimates to "gas" the population of a big city vary from 10 to 40 grammes per square metre.

Taking an average of 25 grammes 75 tons will therefore be required per square mile.

The following table shows the requirements necessary to gas the three capital cities of London, Berlin, and Paris.

Towns	Area in sq. miles	Tons of Gas	No. of Aircraft	Engines	Crews
London	76	5,750	5,750	11,500	23,000
Berlin	37	2,750	2,750	5,500	11,000
Paris	27	2,000	2,000	4,000	8,000

Of the machines required to produce the above figures 30 per cent may be estimated as failing to reach their objective. To "gas" London, therefore, 8,200 are required, and allowing for reserve engines, 33,000 would be needed, excluding fighters.

An Air Force of such magnitude is difficult to visualize; therefore the total and simultaneous gassing of a capital city is practically impossible.

CASUALTIES FROM INCENDIARY BOMBS.

A single aircraft may carry 1,000 kilo electron bombs. These can be dropped in batches of 10 to 20 every second, and the operation will be over in less than one minute. At 200 miles per hour this gives a spread of 50 yards, and all the bombs may be discharged over a depth of three miles.

In a built-up area 50 per cent are effective and fires will be started.

The bomb is designed to penetrate the roof only, and sets fire to the woodwork on the attic floors.

GENERAL REMARKS ON AIR RAIDS ON THE CIVIL POPULATION.

The first raids will be the worst, the uncertainty of the locality to be attacked and the absence of warning make it imperative that Medical Units must be mobilized everywhere. Some of the units not actually engaged should be mobile to allow of a rapid system of reinforcement for the less fortunate neighbouring localities.

AIR RAID PRECAUTIONS IN GREAT BRITAIN.

Preliminary plans for the protection of the civil population were initiated by the Chemical Warfare Committee about 1920, and later taken over by the Defence Against Chemical Warfare Committee.

In 1934 a brief public reference to this subject was made in the House of Commons by the Prime Minister.

In July, 1935, a circular letter was sent to all local authorities asking for the voluntary preparation of schemes and recruiting of personnel.

In 1936 many Committees were formed and A.R.P. Officers appointed.

In 1937 the movement grew slowly, and in January, 1938, the Air Raid Precautions Act became Law.

The local authority is asked to prepare a scheme, submit it to a County Officer for co-ordination with neighbouring schemes and to the Home Office for approval.

Under the Scheme an A.R.P. Headquarters with an appropriate staff will be formed and the following Services organized :—

- (1) Police.
- (2) Fire.
- (3) Engineering, including rescue and demolition, water, gas, and electricity repairs, sewage disposal, and repair and decontamination of roads.
- (4) Air Raid Wardens.
- (5) Medical.
- (6) Transport.
- (7) Communications and intelligence (Detection of gas) and warning.¹

MEDICAL ORGANIZATION.

The medical services are organized on Service lines, including first-aid parties, first-aid and cleansing posts, ambulance services, casualty clearing hospitals, special surgical centres, base hospitals, gas hospitals, records departments and headquarters, etc.

Cemeteries and central mortuaries for casualties who die from wounds and those killed outright come under the Registrar-General's department.

HEADQUARTERS AND STAFF OFFICERS.

Under the local authorities scheme the medical officer of health is the Officer in charge of medical arrangements. His deputy will share the duties and relieve him as required.

¹In view of the recent Home Office publication of a "Partial Evacuation Policy," an Evacuation Service (S) will probably be added to the list.

Medical headquarters will be in touch with L.A. headquarters and be notified of all events.

Reports should be received hourly or oftener from all medical units of the local authority and *all evacuation arranged centrally*.

At local headquarters relays of telephone clerks will be required and a sufficient number of runners available (cars, cycles, senior boy scouts), in case the telephone services are interrupted. Short wave two-way wireless telephony sets will be useful.¹

A records office is essential. Nominal rolls of all casualties will be required for: (1) The Ministry of Pensions; (2) Home Office; (3) L.A. Records; (4) Press and notification of relatives.

In some towns it will be necessary to decentralize and establish District or Zone Headquarters.

CONSULTANTS.

Surgical and medical consultants should be appointed in time to assist in the training of volunteer surgeons and physicians, anæsthetists and general duty practitioners.

The present position of technique in war surgery should be made known and administrative problems discussed.

The Home Office has already given courses of lectures on defence against chemical warfare to large numbers of doctors and nurses.

REINFORCEMENTS AND MEDICAL STAFF ORGANIZATION.

It is obvious that the scale of medical personnel suggested may not be sufficient to cope with all eventualities in any given locality. Arrangements must be made to bring in additional personnel, and also to transfer casualties and their friends to neighbouring medical units.

This entails the establishment of a Central Medical Staff. The County Medical Officer of Health may act as Chief Medical Controller, with Deputy or Assistant Controller in the various areas into which the county may be divided.

MEDICAL RECORDS.

Suggestions.—(1) An universal issue of identity cards or discs should be made to the entire population. (2) Casualty medical cards prepared on lines of the Field Medical Card (A.F.W. 3118) should be prepared for issue to first-aid posts, casualty clearing hospitals and private doctors.

This card should be used even in minor casualties. It is suggested that the card should have a notice advising the patient who does not go at once to a medical unit, to see a doctor as soon as convenient. (3) Admission and Discharge books will be kept at first-aid posts, casualty clearing hospitals and base hospitals. (4) At *District Headquarters*. Returns to be sent hourly to Main Headquarters. Numbers in first-aid posts, numbers evacuated, etc.

¹ I have interviewed Lieutenant-Colonel E. H. Richardson on the use of dogs. The training is too laborious and expensive, although the animals have been known to operate through gassed areas.

MEDICAL PERSONNEL REQUIRED.

The A.R.P. Organization is the greatest task ever imposed on this country; it has been, and is up to the present time, practically a voluntary one.

In densely populated areas for all A.R.P. Services, a personnel of 1:30 of the population must be trained. For medical services only, 1:50. This allows of three eight-hour shifts. Of this medical personnel approximately 1:25 will be doctors for two twelve-hour shifts.

As regards a knowledge of air raids, the use of respirators, etc., the entire population, or 1:1 must be trained.

The following tables give details of the medical personnel required per 100,000 of the population in large towns.

Dental surgeons will be useful in A.R.P. organization. Some may act as assistants to operating surgeons, others with a little extra training as anaesthetists.

Medical students.—Those students who are undergoing their final studies will be useful in the same way as dentists.

TABLE I.—MEDICAL PERSONNEL PER 100,000.

Table of Details of Personnel by Units (One Shift).

Name of unit	No. of units required	Sex	Trained	Untrained	Total per unit
F.A. Parties—					
4 Men	20	M.	2	2	4
Motor Ambulances	20	M.	1	1	2
1 Driver					
1 Orderly					
F.A. Posts	4				
1 M.O.		M.*	17	8	50
4 Nurses		W.	18	7	
50 O. Ranks					
C.C. Hospitals	1				
10 M.O.s					
20 Nurses		M.†	17	25	80
80 O. Ranks		W.	19	19	
Base Hospitals	2				
10 M.O.s		M.‡	30	20	140
40 Nurses		W.	50	40	
140 O. Ranks					
Headquarters	1				
2 M.O.s		M.	3	3	12
1 Matron		W.	3	3	
Reserves			10	10	35
		W.	10	5	

* 12 men should also be trained in nursing duties.

† 13 men should also be trained in nursing duties.

‡ 26 men should also be trained in nursing duties.

TABLE II.—MEDICAL PERSONNEL PER 100,000.

Unit	Number required	Composition	Total	Total	Total
			First shift	Two shifts	Three shifts
F.A. Party	20	4 Men	80	160	240
Motor Ambulances	20	1 Driver 1 Orderly	40	80	120
F.A. Post	4	1 M.O. 4 Nurses 50 O. Ranks	200	400	600
100 lying 200 sitting					
C.C. Hospital	1	10 M.O.s 20 Nurses 80 O. Ranks	80	160	240
200 beds					
Base Hospitals	2	10 M.O.s 40 Nurses 140 O. Ranks	280	560	700*
1,000 beds					
Headquarters	1	2 M.O.s 1 Matron	12	24	36
Reserves			35		1,936 35 1,971
M.O.s			40	80	100
Nurses			117	234	290

* Night shift half strength only.

TABLE III.—TOTAL MEDICAL PERSONNEL PER 100,000.

Trained, Untrained, Men and Women.

	ONE SHIFT		TWO SHIFTS		THREE SHIFTS	
	Trained	Untrained	Trained	Untrained	Trained	Untrained
Men	193	169 = 362	386	338 = 724	549	487 = 1,036
Women	179	139 = 318	358	278 = 636	487	377 = 864
Headquarters	6	6 = 12	12	12 = 24	18	18 = 36
Reserves	378	314 = 692	756	628 = 1,384	1,054	882 = 1,936
	20	15 = 35	20	15 = 35	20	15 = 35
	398	329 = 727	776	643 = 1,419	1,074	897 = 1,971

Trained men	i.e. passed in first aid, anti-gas	..	..	..	236	} = 549
Trained men	i.e. passed in home nursing also	..	..	..	313	
Trained women	i.e. passed in first-aid, anti-gas and home nursing	..	..	..	487	

In the early days of war the services of Territorial troops may be called on by the local authority. Steps should be taken now to familiarize these men in the use of protective clothing and the handling of stretchers.

In some localities there may be a shortage of able-bodied men for stretcher bearing and work in first-aid parties.

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Since many of the civilian casualties may be women and children and more easily handled than men, a certain number of women should be trained in these duties.

The onus of obtaining recruits lies on the Local Authority. The Order of St. John and the British Red Cross Society have undertaken to organize, train and maintain this large new medical personnel.

FINDING AND FIRST-AID TREATMENT OF CASUALTIES.

In war, in the case of troops in the field, casualties are expected, and the necessary arrangements made. Each soldier has a field or shell dressing and bearers are at hand.

In A.R.P. work the attack may be sudden, with practically no warning and the target almost anywhere.

The general public must, therefore, be informed of the risks and danger of air attack. This is being done by the issue of the *Householders Handbook*, and the provision of the civilian anti-gas respirator. When the time comes it is strongly recommended that a shell dressing also be carried by all.

In order that killed, unconscious and badly wounded persons may be readily identified, it will be necessary to issue an identity disc or card. It will be the duty of air raid wardens to see that these details are in order before air raids begin.

The casualties will be found by their friends, police, firemen and air raid wardens. The last three classes of men should definitely be able to apply first-aid and make the casualties ready for collection.

Experience of several mobilization exercises in 1937 showed that casualties, although found and recognized, were not treated till the medical personnel arrived thirty to forty minutes later. Hæmorrhage cases and carbon monoxide poisoning were left alone.

The difficulties of working under air raid conditions on a very dark night, of applying splints and dressings when the operator is hampered by a respirator, gauntlets and protective clothing will be thoroughly appreciated.

COLLECTION OF CASUALTIES.

This will probably have to be done in the dark, with perhaps the assistance of dim electric torches.

Rescue parties are being trained to get casualties out of damaged buildings. These men with police and air-raid wardens will locate the casualties, render immediate first-aid, and notify the first-aid parties for collection and evacuation.

This part of the casualty organization corresponds to that of the regimental stretcher bearers and is non-medical.

EVACUATION.

Here the duties of the medical personnel begin. First-aid parties of four volunteer bearers (St. John or Red Cross), will either carry the stretchers by hand to the first-aid posts, or load them into motor ambulances. One trained bearer will be in charge of each party.

The provision of 20 parties is suggested for each 100,000 population, i.e. 4 parties attached to each first-aid post and 4 in reserve.

The A.R.P. memorandum, No. 1, second edition Appendix B, lays down that each member should be equipped with a G.S. respirator, protective clothing (helmet) and first-aid pouch. The party carries a stretcher in an oil-skin cover, a blanket, surgical haversack and spare respirators. The blanket may be conveniently carried in the stretcher as described in R.A.M.C. training.

The ideal pouch and haversack has not yet been found. I suggest that for convenience in working in the dark the case should be opened by a zip-fastener, and the contents should be as simple as possible. The case should contain triangular bandages, shell dressings, splints, tourniquets, scissors and safety pins, labels for priority cases, dimmed electric torches, and a notebook for messages.

The present lists are too long, roller bandages are impracticable, and other items are unnecessary.

Efficient first-aid consists in stopping bleeding, covering wounds, splinting, preventing shock, and then rapid evacuation. Time is wasted and damage done by attempting disinfection of wounds and doing too much.

Walking cases will be grouped and sent off in charge of a guide to the first-aid post.

Before evacuation begins the initial dressing may require re-adjusting and possibly tourniquets applied. Serious cases must be labelled and given priority. The leaders of first-aid parties must be told how to dispose of the casualties.

In towns where great numbers of casualties may occur, it will be advisable to send (1) all the walking and lying cases to a first-aid post; (2) certain cases to the casualty clearing hospital direct; (3) dead to the central mortuary.

METHOD OF CARRYING CASUALTIES.

The devices shown in figs. 2 and 3 have recently been tested and found helpful in the type of work A.R.P. emergencies will demand.

(1) *The Universal Stretcher Sheet*.—This provides extra protection for the patient, and enables the stretcher to be carried in any position. It is described in the R.A.M.C. Training 1935.

(2) *The Hip Sling*.—This provides the ideal method for two bearers to carry a heavy stretcher at the maximum speed, with the minimum fatigue. Bearers' hands are free to hold a torch or adjust a respirator.

(3) *The Anti-Gas Stretcher*.—It is possible that a new pattern stretcher will shortly be introduced. The sheet or canvas will be detachable for easy decontamination, with the canvas packed in an air-tight container.

FIG. 2 (left).—Showing security of patient regardless of position.

FIG. 3 (below).—Tor hip sling. Normal carry—hands free.

AMBULANCE TRANSPORT.

Motor Ambulances required.

For the transport of casualties a fleet of some 20 motor ambulances will be necessary. The existing regular ambulances will be insufficient in number and auxiliary improvised ambulances must be available. Most regular ambulances do not at present carry more than one or two stretchers, and fittings for four stretchers should now be arranged.

The Tor Stretcher Frame (see figs. 4 and 4A) provides a simple and economical method of converting a light van into a four-stretcher ambulance.

The motor ambulance should be stationed as follows :—

Station					Total vehicles.
At each F.-A. Post	2	i.e.	8		
At each C.C.H.	2	„	2		
Headquarter Reserve	4	„	4		
			14		
For evacuation—At each Base Hospital ..	3	„	6		
			20		

Arrangements must be made to replace vehicles which have become casualties, and for repair and maintenance service organized to keep vehicles on the road.

Drivers will be relieved every eight hours. Orderlies trained in first-aid are essential. They will act as spare drivers, look after the patients, help load and unload and at night guide the vehicles in the dark.

Motor Ambulance Convoys.

In the event of larger numbers of motor ambulances being required a pooling arrangement can be made. In addition it will be advisable to organize definite 'convoys' in cities and in each area of the County or at County Headquarters. These convoys will be in charge of a Special Officer.

Temporary Ambulance Trains (T.A.T.'s).

Under certain circumstances it may be useful to transport casualties by train. Certain of the base hospitals may require to be cleared to other parts of the country, and road transport may be inadequate or the distance too great.

With the use of the stretcher sheet, the short St. John's stretcher can be loaded through the door of the ordinary third-class railway carriage. A simple bracket can be fitted in a few hours, and each compartment therefore will carry four lying cases.

FIG. 4.

The Tor Stretcher
Frame

FIG. 4A.

FIRST-AID POSTS.

A certain number of slightly wounded and gassed cases will make their way home, and call in their own doctor.

With this fact in mind, appeals have been made by the Home Office and British Medical Association for doctors to study the treatment of gas casualties.

Private practice, however, will be uneconomical of man power. Large numbers of doctors (80 per 100,000, two shifts), will be required to serve with medical units, and it is to be hoped that the profession will collaborate with Local Authorities, and volunteer their services for this organized effort.

Most of the casualties of all categories will tend to find their way to the nearest medical unit. Wardens and others concerned should be told to send, as far as possible, all cases to the nearest first-aid post, unless there is a special reason to the contrary.

SELECTION OF BUILDINGS.

Appendix C of the A.R.P. mem., No. 1, gives full details of the first-aid posts.

Schools afford the most convenient sites, and for gas cases the necessary alterations, including provision of bathing rooms, should be taken in hand now. The cost is approximately £500 to £1,000 per first-aid post according to its size.

The lay-out must be arranged for wounded and gas cases and duplicated for the sexes (H.O. circular, December 10, 1937).

Careful organization is required to ensure a constant stream in handling the casualties. Details are clearly laid down in the appendix referred to above.

The principles of this lay-out, together with protection and location of the buildings used, are the same as those described in this paper under the heading of Casualty Clearing Hospitals.

PROTECTION OF PATIENTS DURING AN AIR ATTACK.

It will not be possible to render the existing buildings which may be used by medical units entirely bomb-proof, splinter-proof, fire-proof and gas-proof. Attempts, however, should be made to do the best possible under the circumstances.

Where possible, sufficient six foot deep trenches may be dug in the immediate vicinity. These, if roofed and covered with a layer of sandbags, will afford some protection for those patients who can walk.

Where new hospital buildings are being erected, or new schools designed, certain details of construction may be attended to in order to render the buildings safer in the event of air attack. The ceilings of the ground floor should be strong enough to carry the weight of the structure above, and include a layer of concrete nine to twelve inches thick.

The roof, if tiled or slated, can easily be pierced by electron bombs. To prevent fires, the attic floors should be covered by a layer of fireproof

material and ready access should be planned.¹ A squad of auxiliary firemen should be ready to deal with this form of attack. Where additional accommodation is required, recreation grounds make good camp sites, and the tents can easily be camouflaged.

FIRST-AID POSTS.

These should be large enough to accommodate 300 patients, 100 lying and 200 walking. In some localities smaller ones may be prepared.

The following departments should be organized, and the lay-out consist of :—

- (1) Entrance for motor ambulances, stretcher dump (blankets, etc.) (12 stretchers, 36 blankets).
- (2) Office and room for C.O. (a doctor).
- (3) Reception room (canteen): (a) Wounds, 40 lying, 100 walking ; (b) gas, 20 walking.
- (4) Treatment room. (To hold 20 at a time.) A.T.S. for all wounded.
- (5) Evacuation department : Walking 100, lying 60.
- (6) Detention room for moribund cases. ? Transfusion (8 beds).
- (7) Special dressing-room (operating theatre) for : (i) Ligature of main vessels ; (ii) closing open pneumothorax ; (iii) amputation of shattered limbs.
- (8) Quarters for personnel. Kitchen, ablutions, rest rooms, etc., latrines.
- (9) Quartermaster's Department : Store of clothes, dispensary, office, etc.
- (10) Mortuary.

Remarks.—It is not necessary to have separate departments for men and women. A line of screens will be sufficient to separate the sexes. These can easily be moved according to relative numbers.

The organization must be elastic : for example, arrangements should be made to increase the gas treatment department if required.

The possibility of the building becoming a casualty must not be forgotten, and an alternative site should be planned.

Reserve personnel should be in readiness, and the possibility of the first-aid post having to hold cases for some hours in a large raid until the casualty clearing hospital is cleared must not be overlooked.

In addition to the dump of 12 stretchers, and the 4 of the bearer parties, a supply of at least 50 stretchers should be available for each first-aid post that is open.

EVACUATION ROOM.

The evacuation room should be arranged to minimise carrying, and enable outgoing ambulances to be loaded without interfering with incoming ones.

The reception block is duplicated for gas, and the other departments are duplicated for the sexes by the moveable screen method.

¹ By the use of a fine hand spray, 2 gallons of water will keep the bomb from setting fire to the surrounds.

Extra Latrine Accommodation.

In the case of all medical units, whether in improvised buildings or in existing hospital buildings, extra latrine accommodation may be necessary.

The details of personnel employed in each department is given in the accompanying Table.

TABLE IV.—DETAILS OF FIRST-AID POST,
Large.

	M.O.s	Nurses	D.O.s	Clerks	Dis- pensers	Nursing orderlies		Auxiliaries		Cooks	Total Vol. Per- sonnel
						M.	W.	M.	W.		
1. Stretcher dump								1			1
2. Office	1	1	1	2				1	2		6
3. Reception (wounded) ..		1		1		1	1	4	2		9
4. Reception (gas)				2		6	6				14
5. Treatment						2	3				5
6. Evacuation							1	1	1		3
7. Detention		1				1	1		1		3
8. Theatre		1				1	1		1		3
9. Q.M. Department			1	1				1			3
Kitchen										2	2
10. Mortuary						1					1
11. Quarters for personnel											
Totals	1	4	2	6		12	13	8	7	2	50

Remarks.—This table contains a M.O. at present omitted by the H.O., otherwise it practically agrees with details laid down for a large Aid Post. Small or medium posts are staffed in proportion to their size.

The Home Office recommends the organization of three types of first-aid posts—large, medium or small. Large firms, factories, etc., will organize their own small first-aid post.

The organization of the first-aid post outlined above does not agree entirely with the official Home Office description. That authority does not recommend a medical officer, and no provision is made for life-saving operations or detention.

In my opinion, the presence of a doctor is essential. He will control the morale of the patients, diagnose doubtful cases, give priority to urgent cases, perform the immediate operations required to save life and exercise general supervision over the medical work.

He is as valuable as the Regimental Medical Officer, if not more so.

Each large first-aid post should provide accommodation for 300 patients.

CASUALTY CLEARING HOSPITALS.

Selection of Buildings.

The ideal casualty clearing hospital is undoubtedly provided by the use of tents or huts. It is difficult to render these gas-proof, and existing buildings will in most cases be chosen. In A.R.P. work it will not be possible to select sites in perfectly safe localities in all cases. If tents are

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used, large structures of the "Bessonneau" type are infinitely preferable to laced marquees.

Protection by Signs.

Probably in future wars forward medical units will best protect themselves by camouflage and adopting the usual precautions for concealment. Hospitals, however, should be marked, and it is suggested that the letter "H," laid out in the grounds by 3-foot strips of linen or ordinary sheets folded lengthwise, is more visible than the Geneva Cross at present employed. A Geneva Cross can be improvised by using red blankets surrounded by white sheets. The red of the cross does not show above 10,000 feet, and at greater heights the "H" is more readily seen. Above 15,000 feet it is not easy to distinguish any sign, and the amount of protection to be expected is doubtful.

These remarks apply to sites of first-aid posts, base hospitals, etc.

THE LAY-OUT.

Reference to plans of casualty clearing stations in action in France will show the general lay-out (see fig. 5).

Efforts should be made to save labour, maintain a constant stream and allow of reception and evacuation simultaneously.

In civil work the arrangements must be duplicated for the sexes.

Doctors who have not worked in casualty clearing stations do not grasp the idea that the casualty clearing hospital must be kept cleared, and only a small per cent of cases should be retained. Experience of one or two mobilization exercises shows a lamentable ignorance of the organization of a casualty clearing hospital.

ACCOMMODATION.

Arrangements should be made for the accommodation of 200 cases.

Casualty clearing hospitals should work in groups of 2, 3, or 4. A convoy of 150 casualties is admitted to the first casualty clearing hospital, after which all cases are sent on to the next casualty clearing hospital and so on. By the time the last one is full the first should be cleared and ready to take in again.

Of the 200 "beds" 75 only need actually be *beds*, the rest are stretchers.

NOTICE BOARDS.

All blocks, departments and wards should be clearly marked with the name of each, and signs indicating the direction of the stream of casualties.

In each department a small blackboard should be available to show the names of Sister and wardmaster on duty. This is on account of a large, oft-changing personnel, unused to the work.

The Office should be situated near the entrance to the casualty clearing hospital.

The Officer in Charge should be a doctor, with an assistant or deputy for night duty.

FIG. 5.—Lay-out of No. 1 C.C.S. at Escadœuvres B.E.F., Nov. 1918.

The move was completed in 27 lorry loads in forty-eight hours. The C.C.S. was planned in four blocks, advantage being taken of the main road and a good side road.

A. *Q.M. Block* comprised: (1) Cook house; (2) Patients' dining tent; (3) Personnel's dining tent; (4) Water tank; (5) Stewards' store; (6) Serjeants' mess; (7) Pack store; (8) Q.M.S.'s tent; (9) Office; (10) C.O.'s office; (11) R.S.M.'s tent; (12) Dispensary.

B. *Walking Wounded Block*.—Personnel: (1), (2), (3) Wards of 5 laced marquees—stretchers; (4) Ablution bench; (5) Latrine; (6) Incinerator; (7) Personnel—bell tents; (8) Convalescent G.D.O.'s tents.

C. *Reception and Evacuation*.— R_1 , E_1 , E_2 , E_3 —placed to allow of evacuation at the same time as reception; $S.S._1$, $S.S._2$ —serious surgical; (3) Mortuary; (5) Church tent.

D. *Theatre Block, Officers' Ward*.— R , Reception; D , Dressing; Re , Resuscitation; $P.O.$ Pre-operation; T_1 , T_2 , Theatres—3 twin tables each; X -ray; Trailer and wash-up; O , Officers' ward; $O.D.$, Officers' dining tent; M , Matron's office.

Sisters' and Officers' Quarters.—On the opposite side of the road.

This officer keeps an eye on reception, treatment in the dressing-room and theatre, and is in constant touch with headquarters.

The rest of the C.C.H. Staff consists of (1) a surgical specialist, responsible for supervising the surgical technique; (2) matron with an assistant for each shift; (3) St. John or Red Cross Commandant, acting as duty officer for discipline. One is required for each shift.

PERFORMANCE FIGURES.

The surgical work that is done depends on the number of casualties, both actually admitted and expected.

Experience showed in France that convoys of 150 lying cases can be dealt with by 6 to 8 teams in about eight hours.

Of 150 stretcher cases probably not more than a maximum of 65 per cent require operation, that is to say 90 cases.

Six teams will therefore have 15 cases each which will take eight to ten hours.

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To save life 10 to 15 per cent of the cases must be operated upon. To save limb 16 to 25 per cent. To preserve manpower, the remainder.

In August, 1918, a casualty clearing station (No. 1 C.C.S.) was in action for ten days. Six teams were available. 1,876 lying cases were admitted and 40·8 per cent operated upon.

Here it was found that a resuscitation ward of less than 30 beds would have been adequate.

The Lay-out.—The entrance of the hospital should be clearly marked by day and by night, and situated so that motor ambulances can off-load and pull away without turning and congesting the road.

Direction signs should be erected in the neighbourhood to guide walking cases and drivers. These signs should be about two feet off the ground and capable of dull illumination at night.¹

Stretcher Dump.—A dump of twenty-five stretchers, seventy-five blankets, splints, hot-water bottles, etc., in charge of a capable attendant should be available for rapid exchange of items brought in with the patients. This store should be gas-proof with an air-lock entry. Each casualty clearing hospital will require at least 200 stretchers, with a reserve of twenty-five.

Reception Rooms.—These are duplicated for wounded and gassed patients. A central line of screens will separate the sexes. A medical officer should be available for diagnosis and to supervise the sorting of cases by a nurse or experienced orderly. Sufficient accommodation should be allowed for forty stretchers and twenty sitting cases. Priority cases will be looked for and suitably dealt with.

Clerking.—Patients arriving from first-aid posts will have casualty medical cards already attached and made out. From these particulars will be taken for the admission and discharge book. A useful check on numbers is made by the issue of a serial number, which is pinned on to the card and collected on evacuation. Cards must be made out for patients admitted direct.

CLERICAL PERSONNEL EMPLOYED IN A LARGE WALKING WOUNDED CASUALTY CLEARING STATION (ORGANIZED FOR WALKING WOUNDED).

At an active casualty clearing station in France, organized for walking wounded during the second battle of Cambrai in September, 1918, the following clerical staff was employed. In seven days 7,579 casualties were dealt with, rather over 1,000 a day (*see Appendix II*).

(1) Engaged in each of three large reception wards, three pairs of clerks (total 18)	18
(2) In the Records Office which send out hourly returns to Corps and Divisional Headquarters and nominal rolls to units, 1 N.C.O. in charge	1
8 clerks working in pairs, and	8
3 runners	3
(3) C.C.S. Office, compiling figures for evacuation, lists for ward orderlies, etc.	
1 chief clerk and 4 others	5
2 runners	2
Total	37

¹ These remarks also apply to first-aid posts.

Patients' valuables must be looked after in the reception room. Small bags are issued and, in the case of unconscious patients, taken to the pack store for safe keeping.

In the gas department an elaborate system of marking clothes must be employed.

A.T.S. TABLE.

All wounded should be given A.T.S. before leaving the reception block, adrenalin being available in case of anaphylaxis.

CANTEEN.

While patients are waiting they should be given hot drinks, chocolate or cigarettes.

STRETCHER BEARERS.

Four to six bearers in charge of an N.C.O. should always be on duty for off-loading ambulances and carrying stretchers away.

From the reception block the cases pass on as follows: (a) Walking cases and slightly wounded stretcher cases to the *treatment block*; (b) cases requiring operation to the *pre-operation block*; (c) all wound-shock cases to the *resuscitation ward* for blood transfusion, etc.

GAS CASUALTIES.

It will be impossible to refuse treatment to cases gassed in the neighbourhood of the casualty clearing station.

Arrangements must be made as in the cleansing block of a first-aid post.

Reception, undressing, cleansing, clothing, should be duplicated for the sexes.

Accommodation for 10 cases of each sex will probably be sufficient.

Phosgene cases will be admitted to a special ward. Mustard cases are sent home, or, where the eyes are affected, to a special base hospital.

THE TREATMENT ROOM.

This room should be large enough for 8 stretcher and 40 sitting cases.

Screens should suffice to separate the sexes. Here trivial wounds are cleaned up and dressings applied, also simple fractures are splinted.

They are then sent on to the evacuation block.

Experience in the casualty clearing station already mentioned, which was dealing with walking cases only, showed the following staff to be necessary for a large treatment department. This staff dealt with an average of 1,000 walking wounded a day for five days.

Medical Officers, 3.—1 Surgeon: 1 M.O. examining and signing medical cards; 1 M.O. relief for night work.

Sisters, 8.—4 by day, 4 by night (1 at each table).

N.C.O.s i/c, 2.—1 by day, 1 by night.

Dressers, 32.—16 by day, 16 by night (4 at each table).

G.D. Orderlies, 4.—2 by day, 2 by night.

Stretcher Bearers, 8.—4 by day, 4 by night.

Police, 2.—1 by day, 1 by night to direct to evacuation ward, etc.

The treatment room of a casualty clearing hospital will not require a large staff. The following should be detailed for duty. 1 sister or nurse; 2 men dressers, 2 women dressers (St. John or Red Cross); 1 G.D. man or woman.

A doctor should be available (the orderly M.O.).

X-RAY DEPARTMENT.

This should be available for the examination of simple fractures sent from the treatment room and selected cases from the pre-operation ward. In rush times it is impossible to X-ray all wounded.

The staff will consist of a radiologist, sister-radiographer and attendants. Arrangements should be made to work day and night shifts.

PRE-OPERATION WARD.

20 stretchers for each sex, separated by central screens.¹

The streams of wounded and cleansed gas cases now meet. In this ward the patients are put into pyjamas, their clothes must be preserved in bundles, labelled and sent to store, or better, accompany them on the stretcher through the theatre to the wards.

They are given pre-operative medication injections of morphia, etc., and kept quiet. Priority cases are kept apart and the theatre is notified hourly of all numbers waiting operation.

RESUSCITATION WARD.

15 beds for each sex. Experience in France shows the value of this ward. An experienced M.O. will be in charge, with a supply of transfusion apparatus, stored blood or donors, and nurses able to give intravenous injections, rectal saline, etc.

RESUSCITATION WARD.

Warming Apparatus.—Electric cradles or oil stoves; if the electric supply is cut off hot-water bottles, etc., will be required. An alternative lighting system is necessary for night work. No operations should be carried out until severe wound-shock has been successfully treated.

THE OPERATION BLOCK.

Adequate accommodation must be set aside for sterilizing dressings, preparation of instruments, washing waterproof sheets, repair of gloves, etc. A hut of the Nissen type 40 by 20 feet will suffice.

The theatre should be splinter-proof and gas-proof, and at the same time well ventilated. It should be large enough to allow of three "Teams" working at the same time. Alternative lighting systems should be arranged. For six teams two large theatres are necessary.

The speed at which large numbers of wounded can be operated depends on adequate accommodation, efficient organization with a sufficient number of stretcher bearers and orderlies.

Where the existing theatre accommodation is limited and there is only

¹ Six beds should be provided for each sex for severe cases.

room for one or two Teams to work, it is suggested that two theatre huts sixty by twenty feet should be put up in the hospital grounds as near as possible to the pre-operation and resuscitation wards.

These huts can be used in peace time as depôts for all the extra stores and equipment needed.

SURGICAL TEAMS.

Experience in France showed the best results could be obtained with teams of eight persons made up as follows:—

- 1 surgeon and assistant.
- 1 anæsthetist.
- 1 Sister (responsible for instruments).
- 2 Orderlies (nurses).
- 2 Stretcher-bearers.

The use of the "Twin-Table-System," i.e. two tables per team, allows the second case to be prepared for operation while the first operation is being completed. Screens separate all tables, and as the patient is drowsy he is not frightened.

It should not be necessary to have separate theatres for the two sexes.

- PLAN -

FIG. 6.—Operating Theatre No. 23 C.C.S. Plan showing arrangement of twin tables, movable screens, and trailer furniture. (A = Fixed cupboards and shelves which can be dispensed with and trailer furniture used. B = trailer furniture (containing shelves for dressings, lotions, etc., and washup for surgeons). C = Operating tables 1 to 6. D = Stoves. E = Anæsthetic table and stool. F = Form for bearers. G = Autoclave. H = Sterilizing rack. I = Splint rack. J = Mackintosh washup. L = Instrument table.)

For three teams a room with a floor space, 60 by 20 feet, is needed. Twelve feet are partitioned off for sterilizing and washing mackintoshes, etc., and keeping the patients' stretchers. The remaining 48 feet is divided equally between the three teams. Screens on castors separate the tables.

For work in a C.C. Hospital Theatre accommodation for six teams is advised. One duty officer is allotted to three teams.

A clerk is available for all surgeons to dictate notes for the medical cards, and to complete a theatre book. The number of casualties waiting operation is entered hourly on a small blackboard.

Experienced teams should be able to deal with an average of 1·8 cases per hour. In dealing with heavy casualties six teams will certainly be required.

OPERATING TABLES.

It is not necessary to use an expensive and elaborate operating table. A simple type, as issued to casualty clearing stations, is satisfactory. The table must not be too low and should be capable of being put into the Trendelenberg position.

OPERATING THEATRE VEHICLES.

Expensive mobile operating theatres have been designed and advocated from time to time. The public imagination is fired by the dash of such a unit, rushing up to a casualty in the field and operating on the spot, perhaps under fire. This practice is bad and to be heartily condemned. It is easy for the surgeon and his team to take the risk, but it is very bad for the patient. Very few serious operation cases can stand evacuation immediately after operation, and it is harmful for the patient's morale to be left in the danger zone.

The surgical maxim must remain: "Efficient first-aid in the Field and rapid evacuation to hospital."

Another type of mobile theatre, however, exists, designed to carry a large operating tent and all surgical equipment sufficient for a large number of operations. This is the Wallace-Cowell theatre, lorry and trailer, described in the *R.A.M.C. Journal*, 1917. The provision of this equipment is worth considering in A.R.P. medical organization.

EVACUATION BLOCK.

Arrange accommodation for 10 sitting and 40 lying (duplicated for sexes). (33 stretchers, 7 beds, i.e. total accommodation for 100 cases.)

The bulk of the cases operated can be evacuated quite soon after operation. They are made comfortable on their stretchers and given drinks. Numbers are notified to the office periodically.

1 sister, 2 orderlies or Red Cross nurses and 1 G.D. orderly should be available for each 40 patients.

SERIOUS SURGICAL BLOCK. (15 Beds, duplicated for Sexes.)

Some 10 per cent of operated cases will not be fit for immediate removal. These include head, chest and abdominal cases and fractured femurs.

A larger nursing staff will be required in each of these wards. (2 sisters, 2 nursing orderlies, 1 auxiliary.)

Gas Wards.

These may be required for mustard and phosgene cases. Arrangements must be made for the administration of oxygen. The illustration (Fig. 7) shows a simple open-top oxygen tent, of the "Tor" pattern—which is fire-proof.

FIG. 7.—Open top oxygen Tent of the Tor pattern.

KITCHEN ARRANGEMENTS.

The patients must be given suitable food and drinks and the personnel will require feeding.

QUARTERMASTERS DEPARTMENT.

In addition to the feeding problem, a dispensary must be organized capable of providing large quantities of dressings, with stores of oxygen, bleach paste and other special items.

A lock-up store with a responsible staff is required to deal with the patients' valuables.

QUARTERS FOR PERSONNEL.

Most of the additional and auxiliary personnel will live in their own homes, and only require feeding during their tour of duty. Rest and changing rooms and washing arrangements will be required and, perhaps, extra lavatory accommodation.

MORTUARY.

This is generally forgotten in mobilization exercises.

The details of employment of the personnel of a casualty clearing hospital per shift are given in Table V.

MOBILITY OF A CASUALTY CLEARING STATION.

During the period of stationary warfare in France, some of the casualty clearing stations accumulated equipment and tended to become cumbersome units incapable of rapid movement. No. 1 Casualty Clearing Station, for instance, having been in the same Chateau grounds at Choques for about three and a half years, occupied eighty lorries in its first move.

Its final move at the end of the War carried all requisites for a 500-bedded casualty clearing station in 27 loads.

The casualty clearing station should be prepared to move as a heavy and light section.

In August, 1918, a light section moved 20 kilometres from Pernes to Ligny St. Flochel. The stores and equipment were in readiness for loading and a canvas site that had been a main dressing station, was ready for occupation. The lorries were loaded and left at 06.00 hours. The new Camp was reached at 08.00 hours. Two large theatres were erected and at 12.00 hours a convoy of 150 lying wounded arrived.

TABLE V.—DETAILS OF CASUALTY CLEARING HOSPITAL.

	M.O.s	Nurses	D.O.s	Clerks	Dis- pensers	Nursing Orderlies		Auxili- aries		Cooks	Total Vol. Per- sonnel
						M.	W.	M.	W.		
1. Stretcher dump ..								1			1
2. Office ..	1	1	1	2				2	2		7
3. Reception (wounded) ..	1	1		2		1	2	4	1		10
4. " (gas) ..	1	1				3	3				6
5. Treatment ..		1				1	1		1		3
6. Pre-op. ..		2				1	1	1	1		4
7. Resuscitation ..	1	4				2	2	1	1		6
8. Theatre (teams 3) ..	6	3	1	1		3		8	1		14
9. Evacuation S. ..									1		1
10. " L. (M.) ..		1				2		1			3
11. " L. (F.) ..		1					2		1		3
12. Serious surgical (M.) ..		2				1		1			2
13. " " (F.) ..		2					1		1		2
14. Gas wards ..		1				1	2		1		4
15. Q.M. ..			1	1	1			1	2		6
16. Kitchen ..									2	2	4
17. Personnel quarters ..								1	1		2
18. Mortuary ..						1		1			2
19. Laundry (normal staff)											
Totals ..	10	20	3	6	1	13	17	22	16	2	80

Remarks.—This table is practically the same as that laid down in War Establishments for a casualty clearing station. It will probably be necessary to reinforce the stretcher-bearers and nursing sisters. Three or more extra surgical teams may be required.

SPECIAL SURGICAL CENTRES.

As the result of experience in France "Bowlby's" rule was evolved. This gives an expectation in a given number of casualties of 2 per cent for each class of serious wounds, i.e. abdominals, head and compound femurs, etc.

If possible such cases should be selected at the first-aid posts or casualty clearing hospitals and sent direct to the S.S.C.

Here the most expert surgeons, anæsthetists and an adequate nursing staff will be ready.

Evacuation will not be so rapid as in a casualty clearing hospital.

Accommodation on a scale of 30 beds per 100,000 should be arranged.

BASE HOSPITALS.

It has already been stated that a town of 100,000 may expect a maximum of 2,700 casualties from a simple daylight attack by one squadron. This attack might be repeated at least once in the twenty-four hours, producing a total casualty list of 5,400 cases made up as follows:—

Killed	..	..	..	..	2,000
Seriously wounded	..	..	..	..	1,400
Slightly wounded	..	..	..	..	2,000
					<hr/> 5,400

Of the seriously wounded 10 per cent will be retained in the casualty clearing hospitals, and of the slightly wounded perhaps 10 per cent would be unable to go to their homes. The death rate of the seriously wounded will be 10 to 15 per cent in the first few days.

Accommodation must therefore be available for 1,500 to 2,000 casualties in the first double raid. The raids may be repeated perhaps in the next ten days. Hospital accommodation may therefore be required for 3,000 beds in a population of 100,000. This is an enormous figure, but raids will be localized, and base hospitals of neighbouring localities should be organized to meet the situation.

Mental hospitals, which exist in many instances on the outskirts of large towns, are admirably suited for base hospitals.

Failing the presence of suitable buildings, hospital marquees or tents of the Bessonneau type must be used.

Situation.

The site should be as far removed as possible from any definite target, on a good road, accessible to a railway line for ambulance trains, and be provided with a water and electric light supply and if possible on a drainage system.

Organization and Lay-out.

The general arrangement is much simpler than that of a casualty clearing hospital and approximates more closely to those of an ordinary civil hospital.

Personnel.

The war establishment of a general hospital of 600 beds is given as:—
Medical Officers 22, Quartermasters 1, N.C.O.s 15, Other Ranks 127, Sisters, 50.

Observations.

It is extremely unlikely that more than a few base hospitals will be in action at a time.

It will be possible therefore to make up the large staff of nurses required by moving them from the hospitals which are closed to those open.

As regards doctors, their work in first-aid posts and casualty clearing hospitals will only be of short duration. Raids will not last continuously day after day. This will enable them to attend at the base hospitals.

Base hospital personnel also may be spared for duty at the first-aid posts and casualty clearing hospitals during rush periods.

The nursing orderlies and auxiliaries should be found locally.

SPECIAL HOSPITALS.

It will probably be found necessary to organize special base hospitals, where there are suitable staffs of surgeons and nurses. These will include orthopædic, nerve, plastic and eye centres, etc.

EVACUATION FROM BASE HOSPITALS.

Three motor ambulances will be stationed at each base hospital. These will be pooled for evacuation purposes and also use made of the other vehicles available.

The employment of temporary ambulance trains has already been mentioned.

OTHER METHODS OF TRANSPORT.

Water.—In some localities evacuation by barges on river or canal may be practicable.

Air.—Air ambulances will be available. A D.H. Dragon will carry four lying cases cruising at 140 miles per hour.

This method will only be useful for certain selected cases and will depend on the proximity of aerodromes for taking off and landing.

PATHOLOGICAL LABORATORIES.

Some extra laboratory accommodation will be required. One for each group of three casualty clearing hospitals, and one for each group of two base hospitals should suffice.

This will mean the formation of panels of doctors possessing the requisite special knowledge and willing to act as pathologists.

DEPOTS OF MEDICAL STORES.

A central depot should be organized early. One depot will suffice for several small Local Authorities where the population is under 50,000.

The Officer-in-Charge should be an experienced Quartermaster, ex-R.A.M.C. if possible. He should be appointed as soon as stores begin to accumulate, at a part-time salary.

SUMMARY AND CONCLUSIONS.

(1) The organization required under the A.R.P. schemes is colossal. For all purposes including medical, a personnel of 1 : 30 of the population is required at the lowest estimate.

The medical personnel figure alone works out at approximately 1 : 50.

(2) A large newly organized personnel is being recruited by the local authority and trained by the Order of St. John and the British Red Cross Society.

This personnel has to be maintained and their interest kept alive until "the millennium comes or Air Forces are disbanded" (Wing-Commander Hodson).

(3) The civilian medical organization is founded on and closely corresponds to that of a force in the field.

(4) Since public apathy is so great, and the conscience of many local authorities so dull, all efforts should be made to proceed with A.R.P. preparations with the greatest enthusiasm, energy and speed.

(5) Education of the medical profession in medical organization, gas and military surgery is essential.

APPENDIX I.

TIME TABLE OF PERFORMANCE OF MEDICAL UNITS IN AN AIR RAID ON A CONCENTRATED POPULATION.

Number of casualties to be dealt with (maximum expectation). Daylight raid by 36 machines :—

Killed	..	1,000
Walking	..	1,000
Lying	..	700

Medical units required to deal with these numbers :—

First-aid parties	..	20	May require to be increased if the journeys are long.
Motor Ambulances	..	20	
First-aid Posts	..	4	
Casualty Clearing Hospitals	..	3	
Base Hospitals	..	2	

Capacity of Medical Establishments :—

Motor Ambulances, each	..	4 lying or 6 sitting.
First-aid posts, each	..	100 lying, 200 walking.
Casualty Clearing Hospitals, each	..	200 "beds" admitting convoys at 150 at a time.
Base Hospitals	..	500 beds.

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TIME TABLE.

Air Raid	00.00 hours		
F.A. Parties arrive ..	00.15 hours		
Motor Ambulances arrive ..	00.15 hours		
F.A. Posts open	00.30 hours	should be clear by 25.00	
C.C. Hospitals		? open for treatment of minor cases	
No. 1 opens .. 00.45	No. 2 opens .. 02.30	No. 3 opens .. 05.00	
closes .. 02.00	closes .. 04.00	closes .. 06.15	
Evacuation begins 08.00	Evacuation begins 10.00	Evacuation begins 12.15	
Evacuation ends 10.00	Evacuation ends 12.45	Evacuation ends 14.15	
<i>No. 1 2nd Convoy</i>			
Opens 10.00	Opens 13.00	Opens 15.00	
Closes 12.00	Closes 14.15	Closes 16.00	
Evacuation begins 18.00	Evacuation begins 20.00	Evacuation begins 23.00	
Evacuation ends 20.00	Evacuation ends 22.00	Evacuation ends 25.00	
<i>No. 2 2nd Convoy</i>			
<i>No. 3 2nd Convoy</i>			

If the distances from first-aid posts to casualty clearing hospitals are increased the times for transport will also be increased.

Base Hospitals.

No. 1 opens	08.00	No. 2 opens	18.00
Received from 1 C.C.H.	10.30	Received from 1 C.C.H.	20.30
Received from 2 C.C.H.	13.15	Received from 2 C.C.H.	22.30
Received from 3 C.C.H.	14.45	Received from 3 C.C.H.	25.30
Closes	15.00	Closes	26.00

NOTES.

A casualty clearing hospital completes taking-in in one and a quarter hours, allowing ten four-stretcher motor ambulances with a round journey of twenty minutes.

Deciding that 40 per cent of the lying cases will be operated on at the casualty clearing hospital, sixty operations will be performed.

Ten per cent of the convoy will remain, therefore 135 or thirty-four car loads require removal to the base hospital.

The base hospital will be some miles away and forty minutes may be allowed for the round journey. Twelve cars will be required to do these journeys each, and the evacuation will be complete in two hours.

There are 700 lying cases to be dealt with ; it is strongly recommended that, if three casualty clearing hospitals are available, convoys of 150 are sent to each in turn. 250 lying cases will therefore be held at the first-aid posts until No. 1 Casualty Clearing Hospital is ready to take in again, about ten hours from zero. Five convoys will deal with the lying cases.

Of the 1,000 walking cases, 5 per cent will become lying and 10 per cent will require operation. These cases make up a sixth convoy to go to No. 3 Casualty Clearing Hospital.

These figures are optimistic. The personnel engaged will be new to the work, unused to working together, and staff arrangements may not be perfect. In the first raids, it will probably be necessary to add several hours to the performance time-table given above.

(No. 1 C.C.S. WALKING WOUNDED BOISCEAUX-AU-MONT, SEPTEMBER, 1918).

APPENDIX III.

PLAN OF CROYDON GENERAL HOSPITAL LAID OUT AS A C.C.H. OF 200 PATIENTS.

Accommodation of each department is indicated in figures. Names of departments are indicated thus (19). The direction of the stream of patients is indicated by arrows.

(1) Admission ambulances. (2) Stretcher dump. (3) Off-loading point. (4) Reception. (5) Treatment. (6) Resuscitation. (7) Pre-operation. (8) Route to theatres. (9) Theatres. (10) Sterilizing. (11) Route to evacuation and serious surgical. (12) Evacuation sitting. (13) Evacuation lying. (14) Evacuation ambulances. (15) Serious surgical. (16) X-ray. (17) Quartermaster. (18) C.O. (19) Personnel.

The C.C.H. is confined to the ground floor with the exception of two serious surgical wards on the first floor (male and female, 20 beds each).

(By kind permission of Sir Henry Berney—Architect)