ordinarily go beyond one crop, but new crops may appear up to five or six weeks, though this is unusual. By Cory's law the time taken in the maturation of pocks should be inversely proportional to the degree of immunity, and rapid maturation of new pocks will indicate that immunity is being developed. In diagnosis the following considerations will be helpful:

1. Auto-inoculation should be excluded.
2. The eruption does not appear earlier than the fourth, and seldom earlier than the ninth, day after vaccination.
3. The eruption must be elsewhere than in the neighbourhood of the vaccination site.
4. There must be a vesicular stage.

The eruption may arise on any part of the skin—limitation to one sole has been reported—and within the mouth. The distribution is not specific, and any resemblance to that of small-pox is accidental. When profuse the elements may show much diversity in size, up to that of a sixpence or even larger, as contrasted with the almost uniform size seen in discrete small-pox.

Treatment

In some quarters it is the practice to seek to prevent severe reactions in adult primary vaccinations by puncturing and evacuating the vesicle on the seventh or eighth day after vaccination and applying a dressing of permanganate of potash. This is not free from the risk of impairment of protection, as immunity against small-pox is not satisfactorily established before the ninth day and it would not be justifiable as an attempt to prevent the unusual complication of generalized vaccinia. Mervyn Gordon (1941) has suggested, however, that permanganate of potash, to which the viruses of both vaccinia and small-pox are extremely susceptible, might be effectively used in treatment by the application of a wet compress of the permanganate solution to the vesicles of the eruption. Even in a dilution of 1 in 100,000, he states, permanganate can inactivate the vaccinia virus, but glycerin should not be added, for it inhibits the virucidal action. He advises also that in a severe case trial should be made of serum from a recently vaccinated person—a treatment which, in fact, he was the first to suggest in post-vaccinal encephalitis. The most potent serum, in his opinion, would be that taken from young healthy adults 14 days after vaccination.

REFERENCES

- Allbutt's *System of Medicine* (1912), 2, 683.
 Anders (1919). *Z. Hyg. InfektKr.*, 88, 116.
 Blaxall, F. R. (1930). *Smallpox: in A System of Bacteriology in Relation to Medicine*, 7, 106.
 Bloch, E. (1942). *Lancet*, 2, 504.
 Chalke, H. D. (1931). *Ibid.*, 1, 578.
 Chaudhuri, K. C. (1940). Quoted by van Rooyen, C. E., and Rhodes, A. J., in *Virus Diseases of Man*, 376, Oxf. Univ. Press, London.
 Committee on Vaccination, 1928 Report, H.M. Stationery Office, London.
 Cory, R. (1898). *Lectures on Theory and Practice of Vaccination*, Baillière, London.
 Danziger, F. (1907). *Münch. med. Wschr.*, 54, 1583.
 Dible, J. H., and Gleave, H. H. (1934). *J. Path. Bact.*, 38, 29.
 Douglas, S. R., Smith, W., and Price, L. R. W. (1929). *Ibid.*, 32, 99.
 Gordon, M. H. (1941). *British Medical Journal*, 2, 822.
 Heaton, T. G. (1940). *Canad. med. Ass. J.*, 43, 593.
 Henderson, R. G., and McClean, D. (1939). *J. Hyg., Camb.*, 39, 680.
 Jorge, R. (1927). *Bull. Off. int. Hyg. publ.*, 19, 37.
 Lynch, F. W. (1932). *Arch. Derm. Syph.*, Chicago, 26, 997.
 Nimpfer, T. (1936). *Arch. Derm. Syph.*, Berlin, 174, 518.
 Paiseau, M. G., and Scherrer, E. (1929). *Bull. Soc. Pédiat. Paris*, 27, 500.
 Rolleston, J. D. (1937). *Brit. J. Child. Dis.*, 34, 187.
 Royal Commission on Vaccination (1896). Final Report, Appendix IX, Case CLXII.
 Shaw, W. V., and Stevenson, W. D. H. (1939). *Brit. Ency. med. Pract.*, 12, 515, London.
 Stelwagon, H. W. (1902). *J. Amer. med. Ass.*, 39, 21.
 Stewart, R. W. G. (1902). *British Medical Journal*, 1, 1602.
 Tedder, J. W. (1936). *Arch. Derm. Syph.*, Chicago, 34, 1008.
 Turnbull, J. N. (1941). *British Medical Journal*, 2, 751.
 Weichsel, M. (1931). *Mscr. Kinderheilk.*, 49, 28.

An account of a case of mycotic endocarditis has been given by A. Wikler and his colleagues (*J. Amer. med. Ass.*, 1942, 119, 333). The patient was addicted to heroin and had a mitral lesion. On two occasions during his life blood counts yielded a yeast-like growth subsequently demonstrated to be *Candida (Monilia) paracrusei*. The authors believe that careful laboratory work ruled out the possibility of contamination of the culture medium, and point out that during the past two years 5 cases of mycotic endocarditis have been recorded in cases of drug addiction; in 4 of these the infecting organism was *Candida paracrusei*, and in the fifth *C. guilliermondi*. The authors were unable to isolate *Candida* from samples of heroin, and point out that this fungus is frequently found on the surface of the skin.

THE PROGNOSIS IN CIVILIAN HEAD INJURIES

BY

ERIC GUTTMANN, M.D., L.R.C.P.Ed.

(From the Nuffield Department of Surgery and the Accident Service, Radcliffe Infirmary, Oxford)

The prognosis of accidents depends on many non-medical factors. Besides the results of organic damage there are social and psychological factors which profoundly influence the patient's health, happiness, and working capacity after an accident. Prognostic studies in the past have taken little account of these factors, though many discrepancies in recorded numerical results probably depended on such influences as the condition of the labour market at the time, the system of social insurance, and their consequent social and psychological effects.

The Accident and Rehabilitation Services which have recently been developed owe their existence largely to such considerations. In the publications on their organization, methods, and result very little reference has been made to the problem of head injuries, though the importance of these is far from negligible. Not only is their proportion among the accident admissions considerable—at this hospital about 30%—but their after-effects are generally regarded as serious in character and difficult to assess. It seemed of interest, therefore, to study the prognosis of head injuries, particularly at a time of comparatively standardized and favourable social conditions, when everybody has the choice of well-paid jobs and most employers are ready to facilitate gradual return to work.

All cases were treated by an active method of early rehabilitation. No patient was told to keep quiet; if he did so on account of unpleasant sensations he was early encouraged to move his head and body freely, to sit up, and, after a few days, to get out of bed. Lumbar puncture was carried out only where desirable for diagnostic purposes, and no dehydration was employed. Elsewhere I have described how, with this form of treatment, these patients suffered but little from headache (Guttmann, 1943). The same paper gives details of the severity and type of the accidents. The present paper deals with the results of the treatment on the loss of working time. Some references to earlier publications on the prognosis of head injury are appended. The figures reported are not easily comparable on account of the differences of time of follow-up, the proportion of cases re-examined, and the social conditions. Only Ritchie Russell (1932) has given a detailed analysis of similar material, and his figures are quoted on p. 95. But his patients were kept in hospital for at least three weeks.

Material

This paper is based on 300 consecutive admissions of head injury; among these were 255 civilians available for study. These cases, it must be emphasized, were the unselected accidents, mainly road accidents, of a mixed urban and rural area. Ten patients out of the 255 (4%) died; of the remainder 2 were permanently incapacitated owing to cerebral damage. The duration of the in-patient treatment is given in Table I.

TABLE I.—Duration of In-patient Treatment (245 Cases)

Up to 1 week ..	..	..	..	..	..	..	..	125
" 2 weeks ..	..	..	..	..	..	..	..	76
" 3 " ..	..	..	..	..	..	..	..	22
" 4 " ..	..	..	..	..	..	..	..	12
Longer ..	..	..	..	..	..	..	..	10

Table I shows that just over 80% of all cases were discharged from hospital within two weeks of admission. Among the 245 incapacitated patients are included all cases with injuries elsewhere: 73 had major injuries, such as fractures of bones. All cases of mild head injury (i.e., with a post-traumatic amnesia of one hour or less) were treated in hospital fourteen days or less; three-quarters of the cases of moderate severity (post-traumatic amnesia up to 24 hours) and one-half of the severe cases (post-traumatic amnesia over 24 hours) were discharged within the same period. All cases which stayed in hospital four weeks or longer did

so on account of complications, such as fractures of the spine, pelvis, or extremities. After discharge from hospital the patients returned for further treatment to their own doctors, to whom a letter was sent. They came back to hospital for re-examination at a date when they were expected to be fit for work, and again three months and six months after the accident. Patients who failed to keep these appointments were followed up by the department's social worker. Table II gives the social classification of the patients.

TABLE II.—*Social Classification*

	Number
Children under school age	12
School children	29
Housewives, excluding married women going out to work	25
Wage-earners, including aforementioned	158
Owners of businesses	12
Not working, including chronic invalids	9

Results

All housewives returned to their work; but as their duties varied very much from case to case, as did the amount of help they received during convalescence, it did not seem possible to express their time off work in precise figures. The school children will be discussed in another paper.

Of the 158 wage-earners, 19 could not be traced after the first follow-up appointment, and no information about their taking up work was forthcoming. Six patients returned to work during the follow-up period, but no exact information was available as regards the total working time lost by them. Three patients expected their call-up and did not return to their previous work for that reason; they all joined the Services during the follow-up period.

The working time lost in 130 cases is given in Table III. It should be noted that all cases are included, whether they

TABLE III.—*Loss of Working Time*

Weeks lost ..	1	2	3	4	5	6	7	8	9	10	11	12	13
No. of patients ..	4	18	10	18	18	7	9	10	3	4	2	4	5

Weeks lost ..	14	15	16	17	18	19	20	21	22	23	24	25	26 and over
No. of patients ..	—	1	1	1	—	—	3	1	1	1	1	—	8

had injuries to other parts of the body or not. To compare the figures with those given by Ritchie Russell the respective tables have to be condensed, as under (Ritchie Russell's figures in brackets).

Returned to work within 13 weeks	112
Returned to work within 26 weeks or joined up	131 (110)
Not returned to work within 26 weeks	8 (29)

The crude average of the figures in Table III is 6.6 weeks, exclusive of those still off work at the end of the six-months period. Owing to the large scatter this average does not give a true picture, and it is fairer to say that 25% of the patients lost three weeks or less, 50% between three and nine weeks, and 25% more than nine weeks.

The low incidence of headache in these patients has been described in another paper (Guttmann, 1943). None of the patients relapsed during the first six months after the accident. Only those patients who had symptoms or signs at that date were given further follow-up appointments; apart from one case of post-traumatic epilepsy no patient reported any further loss of working time. Some of those off work after 26 weeks subsequently returned to their occupations.

Of the eight patients who did not return to work within 26 weeks only two were incapacitated by cerebral damage. Four were definitely neurotic, and a fifth very likely so. The last case showed neurotic symptoms superimposed on residual symptoms due to a fractured pelvis. Though other psychological factors could be found to account for the neurotic reactions, the compensation problem played a part in three out of the five non-organic cases. In order to see the importance of this factor in the correct light one has to compare these cases with the other occupational accidents. There were altogether 11 cases in this series with a claim under the

Workmen's Compensation Act—the three cases mentioned and eight others. Of the latter eight cases six returned to work in 2, 3, 4, 5, 5, and 6 weeks respectively. Another case, off work for 10 weeks, was a serious injury with a post-traumatic amnesia of six hours. The last case was off for 16 weeks on account of a compression fracture of the spine. Claims against drivers and insurance companies arising out of road accidents were not here considered.

There was a higher proportion of compensation cases in Ritchie Russell's material; the mildly injured among them showed a tendency to stay off work comparatively longer. The lesser influence of the compensation in the present series may be due to the conditions of employment in wartime. But the number of cases is too small for any definite conclusions. The impression gained is that the compensation claim does not act as an incentive—conscious or unconscious—to produce a neurosis, but that in patients with latent difficulties the monetary compensation may enable them to stay off work when otherwise they might have put up with their symptoms. Delays and frictions in the compensation machinery increase and lengthen the neurotic symptoms. The psychological mechanisms have recently been described by B. Hart (1942), and the following case record illustrates some of them.

A carpenter aged 58 with a steady work record. While at work he fell down a 6-ft. hole. He was unconscious for a few minutes; his post-traumatic amnesia was 15 minutes. He had a fissure in his left temporal bone and a fracture of the right clavicle. Apart from slight nystagmus bilaterally, he had no neurological signs. He complained continually of some headache and giddiness, but was mostly handicapped by limitation of movement and pain in his right shoulder. This, he said, affected his head. The lack of power in his right arm was increasingly worse at subsequent examinations, though neither surgical nor neurological examination showed any objective signs to account for it.

On the day after the accident he was to have started in a new job for his firm. In order to see what this new job amounted to, he had opened the door to the stokehole where he was to work. No one had told him of the 6-ft. drop and iron stairs leading to the stokehole. This he still resented many months after the accident. At some medical examination he was told that there was nothing that medical treatment could do for him, and that he should find himself a lighter job. His comment was that he was a trade union man, and that so long as his compensation money was coming through he would sooner wait to be fit to resume his own job than take a light job meanwhile. He also had a grievance against the hospital because he was not seen by a particular doctor.

Of his previous history it is worth mentioning that he had not been fit for service in the last war on account of effort syndrome, and he had continued to suffer from this long after the war. He also mentioned spontaneously, in the course of the interview, that he never had much money to spend on himself, as all his three daughters had gained scholarships and he had to maintain them for the extra years, to pay for their training and so forth. The feeling that he deserved some rest and pay and consideration influenced his attitude very much.

Severity of Injury

The duration of unconsciousness is generally regarded as an indicator of the severity of a concussion. Ritchie Russell suggested using the duration of post-traumatic amnesia instead, as it is easier to assess. To test the prognostic value of this measure, the cases (excluding those patients kept off work by injuries to other parts of the body) were divided into four groups and the average off-work times calculated for each. Table IV shows clearly that the time off work increases with

TABLE IV.—*Duration of Post-traumatic Amnesia and Loss of Working Time not affected by Injuries Elsewhere (105 Cases)*

Post-traumatic Amnesia	No. of Cases	Weeks	Difference	St. E.
Up to 1 hour	67	4.5 ± 2.08	1.10	0.539
1 day	27	5.6 ± 2.46		
1 week	7	8.85 ± 5.34		
Longer	7	13.75 ± 4.65	4.90	3.084

the length of post-traumatic amnesia (though only the difference between the first and the second group is statistically significant). Considering that the cases are entirely unselected, the figures may well be used as a prognostic guide: in other words, one may expect a patient with a post-traumatic amnesia of an hour or less

to be fit for work in about four weeks; with an amnesia up to about 24 hours, within about six weeks; and with an amnesia up to one week, within eight or nine weeks. This, however, does not refer to penetrating injuries; about these and other pitfalls of the prognosis, in the light of the post-traumatic amnesia, the reader must be referred to Cairns (1941).

In all those with mild concussion who stayed off work for seven weeks or more, psychological factors could be found to account for the fact. A few short examples may illustrate the point.

A boy with a momentary amnesia stayed off work for eight weeks. The reason he gave was a trivial scar, which, he said, prevented him from cycling to his work. In fact, he was badly shaken by the terrifying experience of being squeezed between a van and a wall while cycling.

A woman with a head injury incurred in an attempt at suicide during the third attack of a recurrent depression stayed away from work on account of her depression.

A nervous woman given to bilious headaches all her life stayed off work on account of post-concussional headache; she was employed on strenuous war work in a factory, and had the obvious attitude that she deserved a good rest.

A man with a trivial concussion and a haematoma round his eye, with transient restriction of eye movement, developed psychogenic symptoms referring to his eye first and general depression and anxiety later.

A short survey of the small number of independent shopkeepers and business men (12 in all) confirms the view that late effects of head injury are more often due to social and psychological factors than to the physical effect of the accident. All but one had had accidents of moderate severity. Five returned to work within two weeks, four within two months. The latter were inclined to take it easy—one among them on account of a mild endogenous depression, another for the duration of the settlement of an insurance claim. The psychological factors operative in the three remaining cases were more complicated. The following is the history of one of them.

A man aged 34 had a concussion with a post-traumatic amnesia of about six hours. Apart from a few lacerations of the scalp he had a fracture of the right zygoma which caused no disability. He was discharged from hospital 16 days after the accident, complaining only of slight giddiness. When seen again three months after the accident he showed generalized tremor of the shell-shock kind and a hysterical astasia abasia. The patient was a man of moderate intelligence. Until a short time before the accident happened he had been a general labourer employed on construction of an aerodrome near the village where he lived. He had earned an unusual amount of money, and, on the advice of his clever brother-in-law, he bought a lorry and undertook work for the contractor on his own account. A fortnight after he had started the venture the accident occurred: an Army lorry ran into him and his lorry was badly damaged. The Army authorities assumed responsibility for the repair, but he had not succeeded in getting the repair work done and had not received any monetary compensation so far. Everything was in the hands of his brother-in-law and the solicitors. There were probably additional reasons for the hysterical reaction. The patient had previously had an accident which had been followed by a considerable time off work and continuous headache.

This case, which mostly resembles the picture of compensation neurosis, is probably more correctly interpreted as the patient's reaction to his life situation, with which he was not able to cope. His position as an entrepreneur was already beyond him, and the complications created by the accident made him break down. It is very unlikely that he could, or actually did, expect any financial gain, beyond compensation for his loss.

Comment

The analysis of all the cases—it must be emphasized again that they are the unselected total of cases of head injury admitted to this hospital—gives some idea in how short a time the average patient can be discharged from hospital and become fit to return to work under the social conditions characterized in the beginning of this paper. The figures of off-work time given for the groups of different severity are somewhat below those suggested for similar cases by Cairns, and this is not surprising in view of the different social setting (civilian as against Service cases). This does not mean that all patients were free from symptoms when they returned to work: the social prognosis is not identical with the medical prognosis. Some patients complained of headache and a few

of postural giddiness for a varying length of time (Guttman, 1943); but they were able to adjust themselves to their symptoms, just as they had adjusted themselves to headaches and other symptoms before the accident. Several showed, when examined psychologically, some impairment of their mnemonic functions; but this did not prevent them from returning to their previous work and doing it efficiently and willingly. (Such patients may find themselves handicapped when they have to change their occupation and to adjust themselves to new conditions; but this did not arise in the present series: it is generally of greater importance in intellectual workers, who are in the minority among hospital admissions.) A few cases showed emotional changes (slight euphoria or emotional indifference) which did not interfere with their working capacity, and may, indeed, have helped in adjusting them to their symptoms. Where return to work was delayed beyond the average periods it could be shown that social and psychological factors, rather than physical after-effects, of the injury were predominantly responsible.

This points to the need for psychological management in the early stages and for facilities for psychological treatment and social after-care in the convalescence and afterwards. It is impossible to estimate to what extent the outcome in this series was influenced by the interviewing and follow-up arrangements; but one may assume that the procedure had some effect, since such psychiatric investigations inevitably lead to increased contact through discussion of some of the patient's problems and arrangements for his convalescent period, etc. One would anticipate that more systematic and intensive work along these lines would improve the social results not only in head injuries but in all branches of accident work.

Summary

A series of 300 consecutive admissions of head injuries to an Accident Service in a mixed urban and rural district was investigated in regard to the social effects of the accidents. 4% of the patients died, and two became invalids through cerebral damage. Of the cases 80% were treated in hospital for 14 days or less. The average working time lost by wage-earners was roughly eight weeks. In mild cases (i.e., those with a post-traumatic amnesia of one hour or less) the average loss of working time was 4 to 5 weeks; in moderate cases (post-traumatic amnesia 1 to 24 hours) it was 5 to 6 weeks; in severe cases (post-traumatic amnesia 1 to 7 days) about 9 weeks; and in the severest cases 14 weeks. Eight patients were off work for 26 weeks—two on account of cerebral damage. In patients who stayed off work for an unusually long time, with the exception of the cases of cerebral damage, it could be shown that social and psychological factors were responsible rather than the physical effects of the accidents.

These results emphasize the need for prophylactic management and after-care until the patient has successfully returned to work.

My thanks are due to Prof. H. Cairns and Mr. J. C. Scott for permission to use their case material and for much helpful criticism; to Miss Horder, social worker, for her assistance in the follow-up; and to the Rockefeller Foundation for a grant to support this investigation.

BIBLIOGRAPHY

- Akerman. Quoted by Knoefach and Scholl (loc. cit.).
Benon, R. (1926). *Gaz. Hôp.*, **99**, 1667.
Borchardt, M., and Ball, E. (1935). *Arch. orthop. Clin.*, **35**, 227.
Cairns, H. (1941). *Proc. roy. Soc. Med.*, **35**, 299.
Dandy, W. E. (1933). *J. Amer. med. Ass.*, **101**, 772.
Guttman, E. (1943). *Lancet*, **1**, 10.
Hart, B. (1942). *Proc. roy. Soc. Med.*, **35**, 995.
Knoefach, J. G., and Scholl, R. (1937). *Arch. klin. Chir.*, **190**, 452.
Ranzi, E., and Huber, P. (1932). *Wien. klin. Wschr.*, **45**, 481.
Rowbotham, G. F. (1942). *Acute Injuries of the Head*, Edinburgh.
Russell, W. Ritchie (1932). *Brain*, **55**, 549.
— (1934). *Trans. med. chir. Soc., Edinburgh*, **41**, 129.
Scherwitz, K. (1936). *Ther. Gegenw.*, **77**, 501.
Symonds, C. P. (1940). *S. Brock's Injuries to the Skull, Brain and Spinal Cord*, Baltimore.

E. H. Trowbridge and L. Secunda (*New Engl. J. Med.*, 1942, **226**, 195) examined the cerebrospinal fluid in 641 cases of chronic alcoholism admitted to the Boston Psychopathic Hospital between 1929 and 1939, and found that 20% had more than 45 mg. of protein per 100 c.cm. of cerebrospinal fluid. Abnormal protein in the cerebrospinal fluid was more than twice as frequent in chronic alcoholics as in controls. The presence, duration, and number of previous attacks of alcoholic psychosis had no influence on the protein of the c.s.f., and in this connexion, too, the presence of polyneuritis seemed to have no significance.