BURNS AND THEIR TREATMENT

Burns and Their Treatment

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FOREWORD

Almost invariably burns are incurred through carelessness and are paid as the price of civilisation. It is unfortunate that children and the elderly should bear the brunt of our apparent unwillingness to screen our fires, to protect our cookers and to elaborate methods of rendering clothing less inflammable. Whatever the causes more than 14,000 sufferers are treated in hospital every year, but this figure represents only a tithe of the problem, since the numbers dealt with by general practitioners or by "self help" remain a matter of conjecture.

The more extensive injuries present an immediate threat to life. Subsequent treatment will be prolonged and may well fail to result in the restoration of anything like full function. All but the most minor lesions will cause disfiguring scars which must to a large extent be permanent.

From time immemorial there have been a multiplicity of treatments suggested for burns and it is suggested that this can be regarded as an index of our ignorance of the subject. On the other hand it could be an admission of the vast differences existing between one burn and another and between their effects, both immediate and remote, on different individuals. Area, depth and site are important, whilst the age of the sufferer may well be a determining factor.

It will be evident that much knowledge has been acquired and it may be that our greatest lack is not of knowledge but of the clinical skill and of the amenities requisite to ensure its correct and timely application.

The book reflects the experiences of experts working in a Centre specially adapted and equipped to deal first with the illness created by burns, then with the re-creation of an intact skin surface and finally, wherever this is possible, with the restoration of lost function. As the result of such work here and elsewhere, recovery can be expected to be more rapid and more complete and to be achieved at the expense of less pain and suffering than hitherto. There has, however, been but little if any alteration in mortality rates.

There is no question but that the treatment of all phases of an extensive burn injury taxes the skill and the knowledge of the surgeon to the utmost. The difference between success and failure may depend as much on an evaluation of the individual patient as it does on technical procedures. In essence this is true of all reparative medicine and surgery—care expended on the evaluation of these factors influences both immediate survival and ultimate function. The writers are not afraid to point out that there can be occasions when enthusiastic resuscitation may

well result not in the remote possibility of recovery, but only in the prolongation of the agony of dying.

It is certain that anyone from the most recent graduate to the most senior consultant will find in these pages explicit guidance without didacticism. He will be left with a clear appreciation both of the enormity of the problem posed by any extensive burn and of the means presently at our disposal to ensure that the end result in functional and cosmetic restoration is as nearly perfect as may be and that such a state shall be achieved in the least possible time and with minimal suffering.

RAINSFORD MOWLEM

PREFACE TO THE SECOND EDITION

In the foreword to the first edition Mr. Rainsford Mowlem wrote that improvements in treatment had achieved more rapid recovery and improved the end results in survivors of burning accidents but that there had been "little if any alteration in mortality rates".

In the eleven years which have elapsed since the writing of the first edition, improvements in the control of infection and other advances have at last made an impression on the mortality figures and many children and young adults who would previously have died can now be saved. Our statistics for burning accidents have therefore been brought up to date and are discussed with reference to the individual patient and to the community as a whole.

In the field of burns shock, schemes of management which rely on electrolyte solutions alone have received support in some centres. The advantages and disadvantages of electrolyte and colloid solutions are discussed and reasons are given for our continued preference for colloid solutions.

The advent of new and powerful antiseptics has raised new hopes in the prevention and treatment of infections, particularly those due to Gram-negative organisms. This has made it necessary to re-examine the techniques of local wound care so that these new drugs can be used selectively and with proper regard to their drawbacks.

In the new edition of *Burns and Their Treatment* we have set out to include these new developments without losing sight of the original aim of the book which was to guide surgeons in the course of their training in the day-to-day care of patients with burns.

We hope that we have again given an up-to-date account of clinical practice in Great Britain. It is a pleasure to pay tribute to our medical and nursing colleagues both in our own hospitals and also in other units in the United Kingdom of whose knowledge and experience we have freely availed ourselves. We particularly thank John Settle of the Pinderfield Burns Centre, Wakefield whose work has made valuable contributions to this present edition. We have also been able to draw on the experience of our friends in Australasia and wish to thank Hugh Dudley, John Masterton and A. Murray Clark of Melbourne and D. Annear of Perth, Western Australia.

October, 1973 I.F.K.M. and T.L.B.

PREFACE TO THE FIRST EDITION

In *A System of Surgery* by Holmes and Walker published in 1883 are to be found the following words:

> "The local treatment of burns is a subject on which many books have been written and perhaps more numerous remedies recommended than in any branch of surgery. The success which is said to have attended very different, and even opposite modes of treatment, shows that the authors must either be misrepresenting the facts or speaking about different matters. I prefer the latter explanation, more especially as I find authors who have written to recommend certain methods have almost invariably spoken of burns as if they were all alike, forgetful, apparently, that the essential question in the treatment of a burn is the depth or degree, the consequent probability of sloughing, ulceration, or mere inflammation resembling erysipelas. It is only by keeping this point steadily in view that we can hope to arrive at any rational plan for the treatment of these injuries."

These words remain a pertinent comment on the treatment of burns at the present day. Since they were written, the treatment of burns has changed in many ways, and publications on the subject have appeared and continue to appear with great frequency. The very number and variety of recommendations for treatment make it clear that there is still no single "best treatment" for burns, and in order to make the best use of modern materials and techniques, the doctor must be able to choose the method of treatment which is most suitable for the individual patient under the particular circumstances of the moment.

Registrars, casualty officers and house surgeons are most likely to have the responsibility of initiating treatment and supervising the day-to-day care of patients, yet they are unlikely to have had sufficient experience to be able to evaluate the many and apparently contradictory recommendations.

In this book we have attempted to go into the rationale behind various methods of treatment and to give the reasons for our own choice of methods. We make no apology for discussing certain simple but important subjects at some length, for, as in other branches of medicine and surgery, it is only by a constant awareness of the basic principles involved that intelligent use can be made of the methods available.

A mass of information from the laboratory workers' standpoint has been collected and analysed by Sevitt in his book *Burns—Pathology and Therapeutic Applications* (Butterworth, 1957); and Artz and Reiss in

The Treatment of Burns (W. B. Saunders, 1957) have given an account of clinical practice in the U.S.A. The present book is based on current practice in Great Britain, and more particularly on that in the wards of the Mount Vernon Centre for Plastic Surgery.

Both of us have been fortunate enough to serve as senior registrars under Mr. Rainsford Mowlem, surgeon-in-charge of the Mount Vernon Centre for Plastic Surgery, and we are fully conscious of the debt which we owe to him for our understanding of the problems of the care of burned patients. We hope that we have been able to pass on some of the clarity of his thought and teaching. We are also grateful to our colleagues at Mount Vernon, R. L. G. Dawson and S. H. Harrison for their co-operation and help.

It is a pleasure also to acknowledge our indebtedness to workers in other units, and in particular to D. McG. Jackson and his colleagues of Birmingham, A. B. Wallace and A. D. R. Batchelor of Edinburgh, T. Gibson of Glasgow and A. J. Evans of Roehampton.

The photographic illustrations are the work of the photographers at our various hospitals and we acknowledge our gratitude for their help; Miss Susan Robinson kindly prepared the line diagrams.

We are grateful to Parke-Davis and Co. of Hounslow, and Smith and Nephew of Welwyn Garden City who have made generous contributions towards the cost of the coloured illustrations.

June, 1962

I. F. K. M. and T. L. B.

Chapter I

THE SCOPE OF THE BURNS PROBLEM

In the last decade the number of people dying from burns and scalds in England and Wales has declined by about one-tenth in actual numbers, and by a slightly greater margin when calculated as deaths per million living. Over 600 people die each year however, and there are more than ten times that number who sustain serious injuries from burns and scalds and who require prolonged hospital treatment, surviving with varying degrees of disfigurement and disability.

Patients with burns and scalds fall into various categories of age and sex: under the age of 3 scalds predominate, from ages 3 to 14 most injuries are due to clothes catching fire, from ages 15 to 60 industrial accidents result in a substantial number of burns, and after the age of 60 momentary black-outs and inco-ordinated movements in the kitchen cause many heat injuries. It is instructive to consider the incidence in some detail, as this gives an idea of the variety of injuries and the proportion of children to adults which may be seen by the casualty surgeon, and also indicates which preventive measures might have most effect.

Total Incidence

The exact incidence of burns and scalds in the United Kingdom is not known, since accidents due to burning are not notifiable to the authorities. An informed guess can be made, however, by analysing the figures for admissions and deaths from departments specialising in the care of burns, and projecting these figures to the population as a whole, while making allowance for the fact that more serious burns will tend to be referred to special departments, and larger numbers of the less severe injuries retained in general hospitals.

Thus in the period 1954–59 the average annual number of deaths in England and Wales was 724; during this period 142 patients with burns and scalds were admitted to the burns ward of Mount Vernon Hospital at Northwood each year, and 18 of these died. If the figures from Mount Vernon Hospital are projected, the national incidence would be $\frac{724 \times 142}{18} = 5{,}712$.

In 1951 Colebrook calculated as follows: the total incidence of patients with burns and scalds requiring admission to hospital in Birmingham in one year was 500: the population of Birmingham was

1·2 million: the population of England and Wales was 42 million: therefore the national incidence might be $\frac{500 \times 42}{1{\cdot}2} = 17{,}500$. It seems probable that this figure is too high, since the same technique applied to the Birmingham mortality gives a figure in excess of the 1951 *national* mortality from burns and scalds, and the death rate in the efficient special unit at Birmingham would undoubtedly have been well below that in other hospitals.

There is good reason to suppose therefore that between 5,712 and 17,500 patients with burns and scalds required admission to hospital each year in the 1950's, and probably 10,000 is a reasonably accurate figure. Although the number of deaths from burns in the country as a whole has now declined by about one-tenth, the population has increased by nearly as great a proportion, indicating a substantial fall in deaths per million living.

	1958	1968
Total Population	45,109,000	48,669,000
Deaths from Burns and Scalds	715	652

It seems probable that such factors as advances in treatment which have improved the prognosis for a patient with an extensive burn, and also more widely-practised preventive measures which have limited the size of some of the injuries, have all played a part in this welcome decline in the death rate; the actual number of accidents resulting in burns in 1968 was probably very much the same as ten years previously. A more exact knowledge of the incidence must await the better collection of data from all hospitals, both for in-patient and out-patient services.

Age Incidence

Burns patients requiring hospital admission comprise approximately equal numbers of children and adults. The exact proportion has not varied much during the past 15 years, as evidenced by figures collected in Mount Vernon Hospital Northwood in the period 1954–59, and in Pinderfields Hospital, Wakefield in the years 1966–69:

	1954–59	1966–69
	862 *patients*	264 *patients*
Children 0–14	46·3 per cent	51·1 per cent
Adult 15–64	46·5 per cent	40·1 per cent
Elderly 65+	7·2 per cent	8·8 per cent

Children (Fig. 1)

The pattern of injury varies with the age of the child. Children of less than 9 months are not mobile, and therefore not capable of reaching the

fire to burn themselves, or of climbing on to the kitchen table to upset the teapot; accidents do however occur owing to mistakes or carelessness on the part of parents or others. Between the ages of 1 and 3 the numbers increase sharply, and patients in their third year of life account

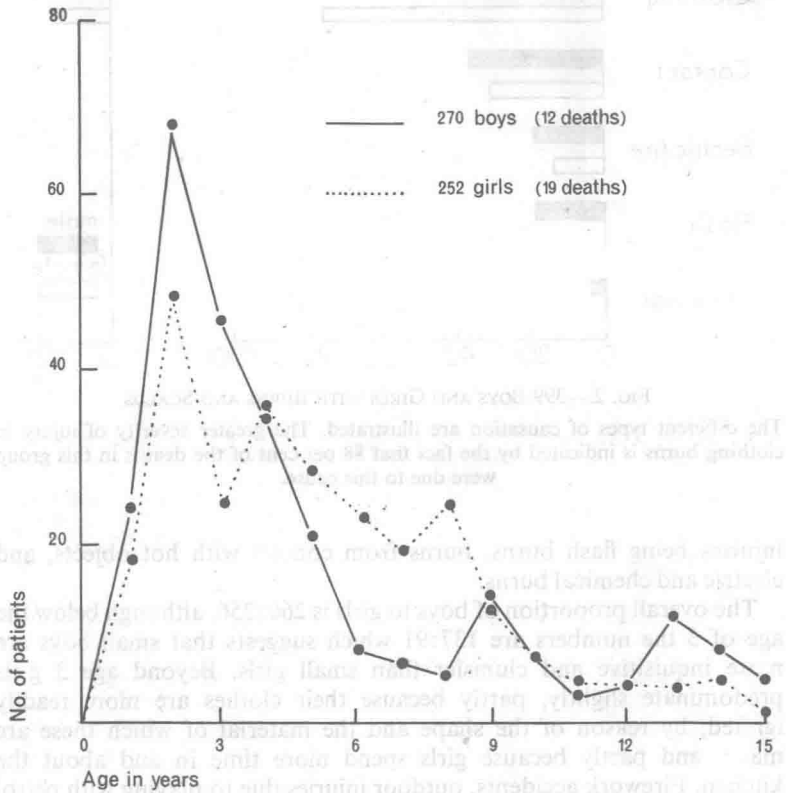

FIG. 1.—522 CHILDREN WITH BURNS AND SCALDS

This graph shows that 44 per cent of the cases in this age group occur in children of less than 3 years of age, and indicates the special hazards to young children in the home.

for one quarter of the total child admissions. The high peak at this age is due in the main to scalds from hot water, tea or coffee. Of the 522 children under review 227 (42 per cent) had scalds, and of these 158 were aged less than three years. This means that 65 per cent of children scalded were babies or toddlers.

Beyond the age of 3 the proportion of scalds rapidly declines, and most of the injuries are due to clothes catching fire, other less common

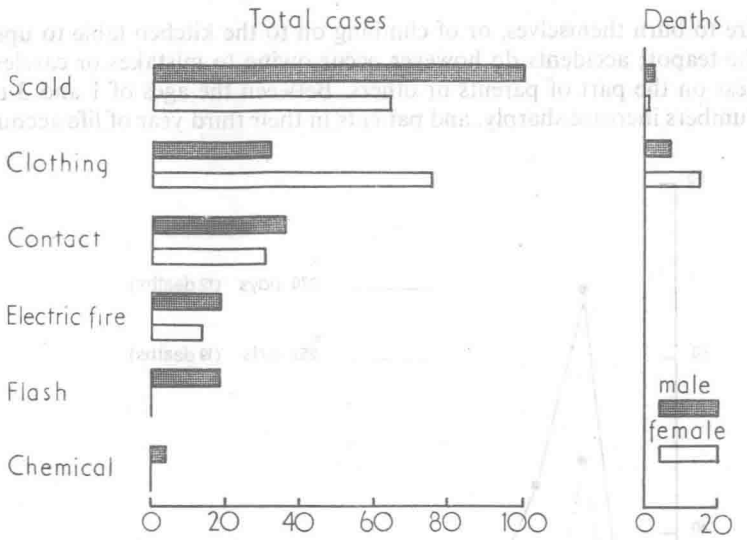

FIG. 2.—399 BOYS AND GIRLS WITH BURNS AND SCALDS

The different types of causation are illustrated. The greater severity of injury in clothing burns is indicated by the fact that 88 per cent of the deaths in this group were due to this cause.

injuries being flash burns, burns from contact with hot objects, and electric and chemical burns.

The overall proportion of boys to girls is 266:256, although below the age of 3 the numbers are 137:91 which suggests that small boys are more inquisitive and clumsier than small girls. Beyond age 3 girls predominate slightly, partly because their clothes are more readily ignited, by reason of the shape and the material of which these are made, and partly because girls spend more time in and about the kitchen. Firework accidents, outdoor injuries due to playing with petrol or birds-nesting in electricity substations, and accidents involving bonfires, are more common in boys.

Adults (Fig. 3)

By contrast with children, there is no particular peak between the ages of 15 and 65. In burn cases, men outnumber women by 271:220, and this is a reflection of the additional hazards of industrial injuries, which affect men more than women because of the nature of the actual work involved. 66 per cent of the injuries in men were due to accidents at work, whereas only 8 per cent of women were injured in industrial premises. Nevertheless, domestic injuries outnumber industrial injuries of the group as a whole by 2:1. Scalds account for only 8 per cent of

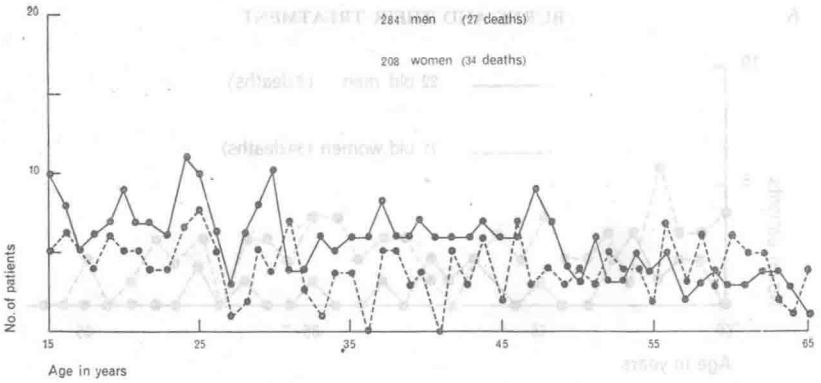

FIG. 3.—491 ADULTS WITH BURNS AND SCALDS

The incidence of burns and scalds in the wage-earning groups. Although the male to female ratio is 3:2, the death rate of male to female is approximately 2:3, a reflection again of the greater severity of injury in clothing burns in women.

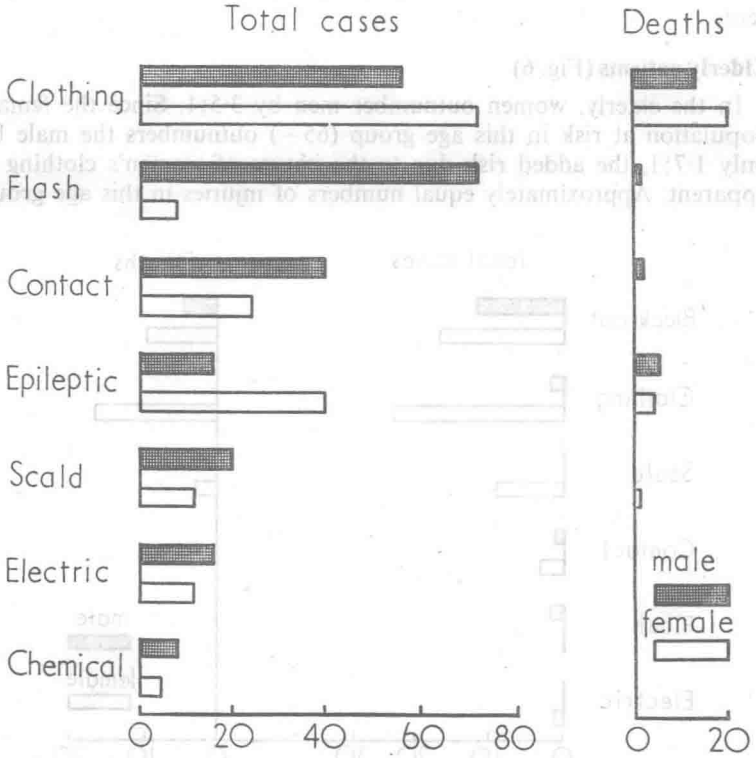

FIG. 4.—402 MEN AND WOMEN WITH BURNS AND SCALDS

This shows the frequency of causation, and indicates the continued danger of clothing burns which were responsible for 68 per cent of the deaths in this group.

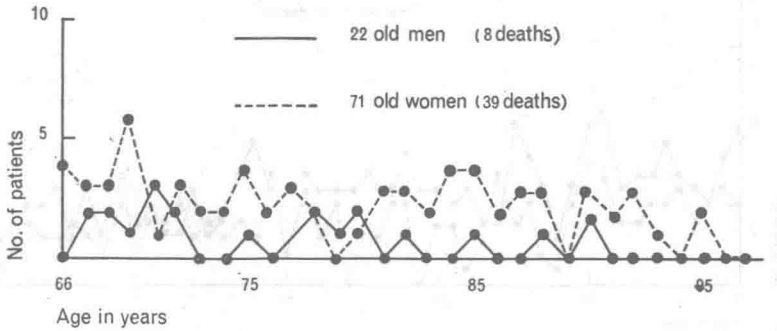

FIG. 5.—93 OLD PEOPLE WITH BURNS AND SCALDS
Age incidence of burns and scalds in elderly people.

the total and burns sustained by epileptic patients account for 11 per cent.

Elderly patients (Fig. 6)

In the elderly, women outnumber men by 3·5:1. Since the female population at risk in this age group (65+) outnumbers the male by only 1·7:1, the added risk due to the nature of women's clothing is apparent. Approximately equal numbers of injuries in this age group

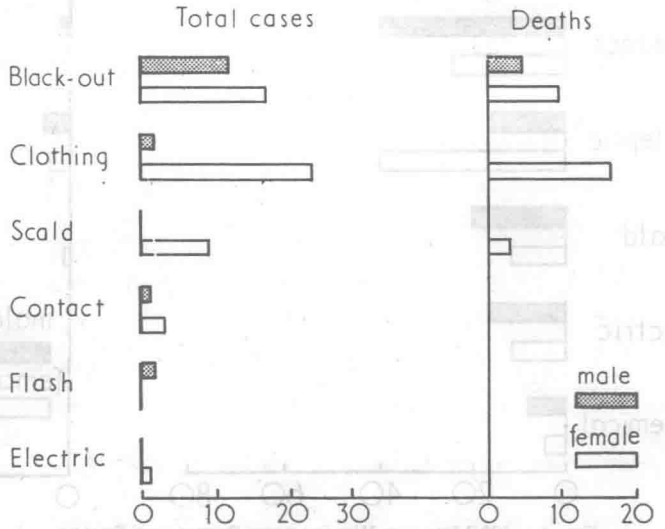

FIG. 6.—72 ELDERLY PEOPLE WITH BURNS AND SCALDS
Shows that in elderly people clothing burns still predominate as the cause of death.

result from fainting attacks near a heat source, and from clothes accidentally catching fire. Scalds, mainly from leaking hot-water bottles, are in third place.

The main differences of causation in the age groups of our series of 1,105 patients is summarised as follows:

Type of Accident	*Children* 0–14 *per cent*	*Adult* 15–64 *per cent*	*Elderly* 65+ *per cent*
Scald	42	8	13
Flame burn	28	30	43
Epileptic attack or blackout	1	13	42
Other (chemical, electrical, flash, contact)	29	49	2

Seasonal Incidence (Fig. 7)

In our series, the curves for total cases and for clothing burns were virtually parallel from month to month, being highest from December

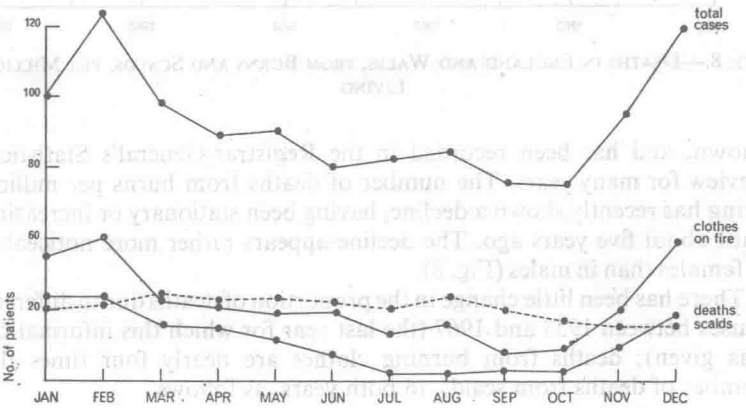

Fig. 7.—Seasonal Incidence

A chart of the seasonal incidence of burns and scalds for 1,105 patients.

to March, with the peak in February, and lowest from September to November, with the lowest total in October. The incidence of scalds, however, did not bear any apparent relation to the severity of the weather, being slightly higher in summer than in winter.

Mortality

By contrast with *incidence* of burns in the country as a whole, which can only be guessed at, the *mortality* from burns and scalds is accurately

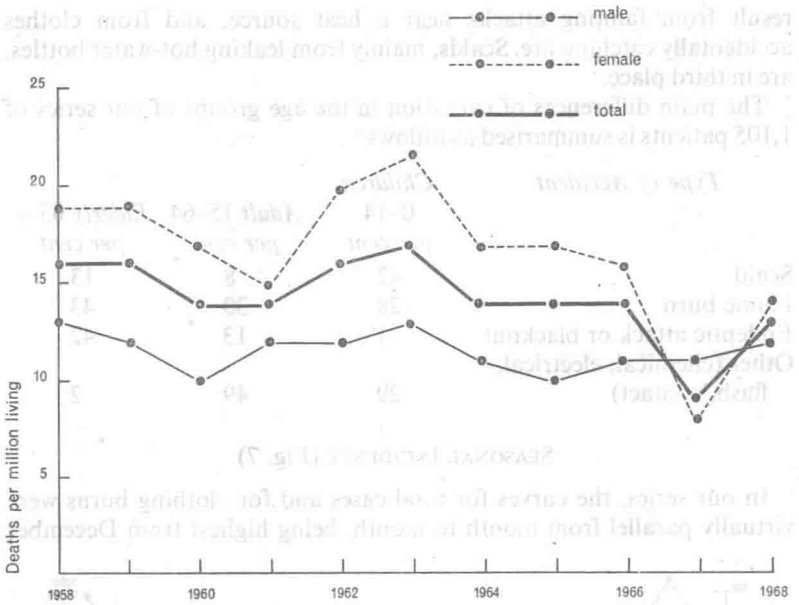

FIG. 8.—DEATHS IN ENGLAND AND WALES, FROM BURNS AND SCALDS, PER MILLION LIVING

known, and has been recorded in the Registrar-General's Statistical Review for many years. The number of deaths from burns per million living has recently shown a decline, having been stationary or increasing until about five years ago. The decline appears rather more noticeable in females than in males (Fig. 8).

There has been little change in the proportion of deaths due to different causes between 1958 and 1967 (the last year for which this information was given); deaths from burning clothes are nearly four times the number of deaths from scalds, in both years, as follows

	1958			1967		
	Male per cent	*Female per cent*	*Total per cent*	*Male per cent*	*Female per cent*	*Total per cent*
Clothes on fire	9	38	47	6	23	29
Falling into fire	5	5	10	3	4	7
Conflagration	6	5	11	11	8	19
Scalds	6	6	12	4	4	8
Unspecified	11	9	20	20	17	37

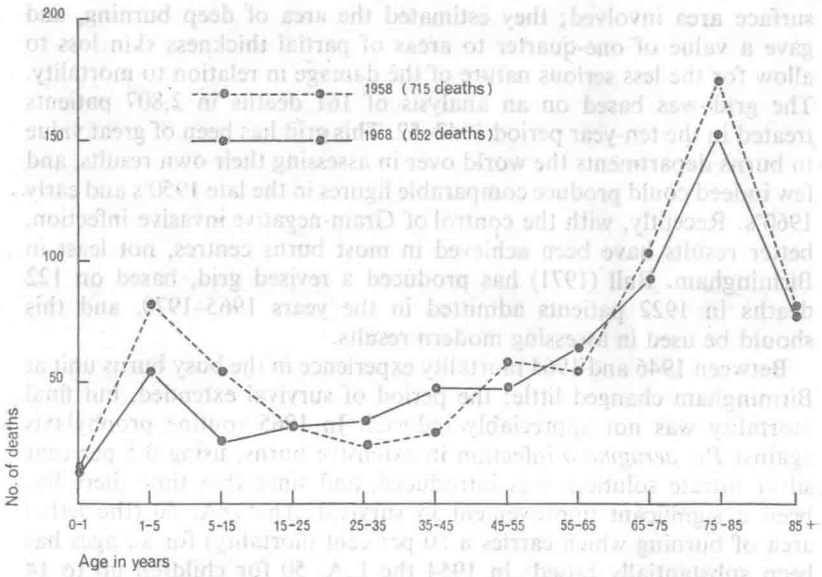

FIG. 9.—AGE INCIDENCE OF ALL DEATHS FROM BURNS AND SCALDS IN ENGLAND AND WALES, 1958 AND 1968

A considerable saving of children's lives is evident in the latter year.

There has been a change, however, in the relationship between age and mortality (Fig. 9). Beyond the age of 25, the curves for 1958 and 1967 follow each other closely, but the divergence of the curves below the age of 25 shows that there has been a decline in the deaths of children and young adults. This reflects the fact that Gram-negative septicaemia is now largely controllable with modern antibiotics, and thus children who sustain large burns are less likely to die from infection; also it may well be that the campaign for better guarding of fires and for flame-proof clothing has had the effect of reducing the number of injuries in this age group. Advances in treatment have had proportionately less effect on the death rate in the elderly, and it appears that factors such as pre-existing disease, intercurrent illness, or merely confinement to bed are of prime importance for them.

The mortality from burns depends on the extent and depth of the burn, the age of the patient, the previous health of the patient, and the efficiency of treatment in both early and late stages of the illness. The most important factor in prognosis is the extent of the burn which has resulted in whole-thickness skin destruction; and the commonest causes of death are uncontrolled shock and uncontrolled septicaemia.

J. P. Bull and A. J. Fisher, in 1954, constructed a grid of approximate mortality probabilities for various combinations of age of patient and