STUDIES ON ILLNESSES

ASSOCIATED WITH TRAVEL.

(IN TWO VOLUMES)

VOLUME 1

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ABBREVIATIONS USED IN THE THESIS

A.I.D.S.	=	acquired immune defiency syndrome
anti-HAV	=	antibody to hepatitis A virus
B.A.A.	=	British Airport Authority
B.B.C.	=	British Broadcasting Corporation
B.M.A.	=	British Medical Association
C.D.C. (Atlanta)	=	Center for Disease Control, Atlanta
C.D.S.U.	=	Communicable Diseases (Scotland) Unit
C.S.A.	=	Common Services Agency
dbase II	=	data base II
D.H.S.S.	=	Department of Health and Social Security
G.P.	=	general practitioner
H. influenzae	=	Haemophilus influenzae
H.M.S.O.	=	Her Majesty's Stationery Office
I.C.L.	=	International Computers Limited
I.T.L.	=	Information Technology Limited
L. pneumophila	=	Legionella pneumophila
P.H.L.S.	=	Public Health Laboratory Services
S.H.E.G.	=	Scottish Health Education Group
S.H.H.D.	=	Scottish Home and Health Department
SPSSx	=	statistical package for the social sciences
S.T.B.	=	Scottish Tourist Board
S. typhi	=	Salmonella typhi
U.K.	=	United Kingdom
U.S.A.	=	United States of America
U.S.S.R.	=	Union of Soviet Socialists Republic
V.M.E.	=	virtual machine environment
V.S.O.	=	Voluntary Service Overseas
W.H.O.	=	World Health Organisation

SUMMARY

These studies have concentrated on the health experience of travellers whilst abroad, predominantly Scottish "package holidaymakers". In the introductory part of the thesis, the growth of travel over the past 35 years is detailed, historical aspects of the movement of Scots abroad are discussed, and comparison made with the characteristics of contemporary travel. Sources of health advice for travellers are mentioned and reference made to the development of my research interest in the subject. The evolution of my study from a special interest in Legionnaires' disease and serological studies on returning travellers, to enquiry about the health of larger and more general groups of returning travellers, study of travel associated hospital admissions, and of pre-travel health advice in travel brochures is discussed, and the general aims of the studies are defined.

In view of the comparatively recent development of the "package holiday" type of marketing within the travel trade, a strict historical analogy encompassing large groups of short-stay Scottish travellers is difficult to find. As an alternative I was most fortunate to be permitted access to the information which Dr Derek Dow had compiled about Scottish Presbyterian missionaries when he wrote his PhD thesis entitled "Domestic Response and Reaction to the Foreign Missionary Enterprises of the Principal Scottish Presbyterian Churches 1873-1929". From this source I was able to make a study of the inter-relationships between date of appointment, place of appointment (continent, country and mission station), gender, and social background, and, the length of service, the reason for retiral (such as personal or family ill health), death in service, and the cause and age at death of missionaries. This provided a fascinating historical "window" on the health experiences of 1427 Scots living abroad at the turn of the century, and provided a backdrop against which the experiences of the mass of contemporary Scottish short-stay travellers could be set.

The findings from the studies of the missionaries show that on the basis of comparative analysis within the group those with less medical knowledge

experienced higher morbidity and mortality rates. On a similar basis mortality was found to be influenced by geographic location, the more rigorous the climate (e.g. tropical Africa) the higher the proportion affected. Infections, malaria in particular, accounted for the majority of documented causes of death. This trend was accentuated pre-1900 but seemed to improve in parallel with advancing medical knowledge in later years.

In the main study a standard questionnaire was used to compile personal, travel and health details from 13,816 returning Scottish travellers. The majority were contacted at Glasgow Airport, but others were contacted at Edinburgh Airport, via travel agents, or made personal contact through local environmental health departments either spontaneously, or occasionally following media publicity about illness in travellers. Many local and national agencies gave generous assistance in providing facilities to conduct, or help with, the different surveys. This enabled comparative studies to be carried out in different years, seasons, and on different groups of travellers from a range of varied holiday destinations. From these comparative analyses study was made of the incidence and type of illness experienced, and the influence of age , socio-economic background, smoking habits, and season and country visited on such illness. Specific study was made of travellers' immunity to Legionella pneumophila, poliomyelitis, typhoid, and hepatitis A on the basis of serological tests.

In order to gain details of the impact of travel related illness as it affects the hospital service, further information was gathered on admissions to the infectious diseases wards at Ruchill Hospital during 1985 such as age, gender, ethnic origin, diagnosis and country visited. Thereby comparison was possible between the patterns of illness in travellers as elucidated by questionnaire enquiry, and those of travellers ill enough to require admission to hospital.

Finally study was made of the advice taken by travellers prior to travel, where the advice was sought, and the presence and quality of advice contained in a representative sample of 1985 travel brochures. This enabled an assessment of the effectiveness of that advice to be made when viewed against illness in travellers, and for informed comment to be made

regarding how such advice could be improved and best delivered to travellers, the travel trade and health care personnel.

Contemporary travellers experienced an overall attack rate of 36 per cent with alimentary illnesses either alone or with other symptoms accounting for the majority of problems experienced. Younger travellers - those aged 20 to 29 years in particular, those travelling further south, notably to north Africa, and smokers, featured the highest attack rates.

From the serological studies it emerged that travellers were not at particular risk from Legionnaires' disease, most were immune to poliomyelitis although 20 per cent had incomplete immunity, immunity to hepatitis A rose from 30 per cent to 89 per cent with increasing age (<20 and >60 years respectively); the typhoid antibody studies showed that few travellers availed themselves of typhoid immunisation.

Travel associated admissions accounted for 6 per cent of all infectious disease admissions to Ruchill Hospital during 1985 with Asian males accounting for greater than one in three of the total, the 20-29 year age group most represented, travel to the Indian subcontinent accounting for 60 per cent of the admissions, gastro-enteric symptoms the most frequently recorded, and malaria the commonest single diagnosis.

It is suggested that in view of the continuing growth of travel and in the numbers likely to be affected by travel related illnesses, some of a contagious and life-threatening nature, there is a need for continued surveillance of this problem and for improved provision of advice for the traveller, the travel trade and the medical profession.

Based on the figures detailed in this thesis it is suggested that measures to reduce illness in travellers would be cost-effective. It is proposed that effectively "packaged" advice, which is already in existence, be made readily available to travellers by travel agents, preferably at the time of holiday booking, and that this responsibility for improving the current situation be shared with the medical profession and health educators. The use of modern technology to give doctors ready access to accurate, detailed, up to date health information for travellers, such as malaria prophylaxis, held on a computer data-bank, is already operational

and could be quickly brought into widespread use.

This can only be of benefit to all concerned, with more travellers able to enjoy their time abroad unaffected by illness, less demand and expense on the medical services in the United Kingdom occasioned by travel related illnesses, and improved business for a responsible travel trade showing an interest in promoting good health in their clients.

CHAPTER 1

BACKGROUND AND GENERAL AIMS OF THE STUDY.

1.1 Introduction

"For my part, I travel not to go anywhere, but to go. I travel for travel's sake. The great affair is to move"[1].

Robert Louis Stevenson wrote these words in 1879. Observing the continuing increase in the numbers of travellers to-day his statement continues to be pertinent. Travel is an integral part of everyday life. The development of travel to facilitate international trade and political exchanges has become an economic necessity for most countries. Businessmen and politicians often have to go abroad and the television and news media portray travel such that it has become accepted as an essential contemporary "modus operandi".

In 1612 Francis Bacon observed

"Travel in the younger sort, is a part of education: in the older, a part of experience."[2]

International tourism affords the opportunity for education and widening of experience and is currently the world's fastest growing industry continuing to expand even in times of world economic recession. Increased personal affluence, the refinement of the package holiday industry, and the desire to experience adventure, a different climate, culture, topography or to pursue a specific sport or hobby have all contributed to the increase in the numbers of tourists throughout the world. These factors taken in association with the trend towards greater leisure time suggest that the numbers will continue to increase.

1.2 Statistics on the growth of international travel

The exchange of technical expertise around the world has resulted in more Europeans working in tropical countries now than during the peak "colonial" days[3]. There continues to be an annual net migration of workers across international boundaries, in particular from the lesser to the more highly industrialised countries - 7 million from southern and south-western parts of the Mediterranean and Asia have been more or less permanently absorbed into many northern countries[4].

Annual pilgrimages to places like Lourdes, Mecca and to religious shrines throughout India account for the international movement of several million people. Refugees, obliged to migrate in their millions to seek safety and food form a significantly large and "at risk" group. Military exercises or intervention in a geographically distant country necessitate foreign travel for another group of people. Olympic games and other major global sporting events cause further episodes of foreign travel for participants, support personnel and spectators. To meet the demand for travel, service industries such as catering, hotel chains, travel agencies and transport systems have had to expand internationally so that further groups of workers become part of the "world on the move".

The trend and scale of international travel both globally and from a United Kingdom perspective is shown in Table 1.01. In the 35 years 1949-1984 the number of international tourists increased twelve-fold from 26 to 312 million[5]. During the same period the number of scheduled air travellers increased twenty-seven fold[6] and visits abroad by U.K. residents increased thirteen-fold[7,8]. Also during this time there was a shift in the proportion of U.K. residents travelling beyond Europe from 8 per cent of 1.7 million to 12 per cent of 22.1 million[7,8] (a twenty fold increase), the ratio of sea to air travellers reversed from 3:2 to 2:3 and the package holiday proportion of travellers rose from 30 to 59 per cent[8].

One of the most important technological influences on the growth in number of international travellers is improved aircraft design. In 1948 a passenger aircraft carried forty, the fastest aircraft cruising speed was

340 miles per hour, and Hong Kong to London was a five and a half day journey with compulsory stopovers[9]. This compares with a modern "jumbo jet" carrying four-hundred passengers, the cruising speed of the fastest passenger aircraft at 1,356 miles per hour, and Hong Kong to London now takes fourteen hours[10].

In summary these statistics show ever increasing numbers of travellers to ever more widespread destinations using predominantly air transport. Additionally due to the speed and frequency of modern travel it is now more possible than before for the traveller to return apparently well but within the incubation period of many infections.

1.3 Historical aspects of illness associated with travel abroad

Recognition of the importation of infection by travellers is not new. It was in response to outbreaks of plague during the Middle Ages following the arrival of ships from the East that measures were taken to protect communities from these epidemics; Venice and Rhodes introducing the first regulations in the twelfth century[11]. Ships arriving into these European ports were kept at a distance and travellers detained in isolation for 40 days (quaranta giorni) before they were allowed to proceed to their final destination[12]. This law first imposed in 1377 by the Venetian Republic was the origin of the concept of quarantine, other cities and countries following her example until some form of sanitary regulation became general in many countries during the next five centuries.

The Scot has a historical tradition of travel abroad born of necessity due to difficult geography (75 per cent uninhabitable hill/mountainous terrain[13]), inhospitable climate, impoverished domestic economy, agricultural insufficiency and political oppression allied with natural enterprise in the fields of exploration, commerce, and the acquision and dissemination of knowledge. Many examples of this Scottish translocation can be found during different episodes of colonisation, in military records and in educated Scottish pioneers whose global exploits earned them

international recognition.

Historical examples of the movement of substantial numbers of Scots to other countries include, the "plantation" of Ulster in 1609 (for political, strategic, financial and religious reasons), France, Holland, and Poland early 17th century (for study, trade and combat), Darien 1699 (the financial and political dream of a Scottish Empire), North America 1749-1775 (following the 1745 rebellion and due to domestic famine and high rents), North America early 19th century (forced evictions and highland clearances by landlords to maximise commercial return from the land), and North America, New Zealand and Australia from mid-19th century onwards (due to famine - potato blight, and to seek employment opportunities) - it has been stated that between 1871-1901 alone, 483,000 Scots emigrated, the country's biggest world export[14]. This is shown in summary in Figure 1.01.

Scottish mercenary regiments were popular on the continent from the 15th century onwards and were to be found in France, Sweden, Bohemia and Denmark. Later from the 18th century onwards increasing numbers of regiments were raised from Scotland, the highlands in particular, to help defend and expand the colonial empire.

Examples of educated Scots with entrepreneurial spirit who either travelled abroad themselves, or disseminated their technical/professional expertise via their fellow-countrymen, include, the missionaries (Dr. David Livingstone, Mary Slessor), civil engineers (William M^{ac}Adam, Thomas Telford), mechanical engineers (James Watt), physicians (Dr. William Hunter, Sir James Simpson) explorers (Dr. Mungo Park, Alexander M^{ac}Kenzie), traders (Sir Thomas Lipton), diplomats (Lord Elgin), and adventurers (Alexander Selkirk). There were also world famous emigrant Scots (James M^{c}Gill, Alexander Bell, Andrew Carnegie) who in association with the former group promoted an expansive world-wide exchange of culture, knowledge and ideas through the travelling Scots people.

Although there was not the problem of imported infections associated with modern rapid air travel, the more prolonged nature of the travel was not without health hazard. Some 2,000 Scots died at Darien due to appalling local conditions where malaria and yellow fever were rife[15]. David

Livingstone, Mary Slessor, and Mungo Park all died in Africa due to dysentery with internal haemorrhage, "exhaustion", and trauma (drowned while under attack by hostile natives) respectively.

In view of these facts and on account of Scotland's unique role in supplying more Protestant missionaries than any other European country - as stated by Tom Steel[16], I decided to attempt a quantitative study of the health hazards experienced by this latter group setting a comparative historical background to the main thesis study on the health hazards to contemporary Scottish travellers.

1.4 Medical problems associated with contemporary travel abroad

The modern travel phenomenon not only has economic, cultural and social repercussions but also medical, epidemiological and medico-legal consequences, for example, the 1,471 cases of malaria with 12 deaths confirmed in Britain in 1982[17] (the highest number of such deaths for ten years). Figure 1.02 shows the threefold increase in malaria notifications in Scotland over the past fifteen years, compared with almost a ten-fold increase for England and Wales during the same period.

The problem continues to evolve with the eradication of some diseases in different parts of the world and a change of emphasis in relation to others such as hepatitis, the viral haemorrhagic fevers and legionellosis, compounded by the scale and speed of modern travel.

Examples of this changing pattern are the report in 1950 of 18 cases of smallpox with six deaths in Glasgow[18] (but the World Health Organisation [W.H.O.] Smallpox Eradication Programme later achieved its objective in 1977[19]), in 1982 the report on the effect of time zone changes on psychiatric morbidity[20] and the report in 1984 of brucellosis in American student travellers to Spain[21]. Perhaps the most current example is the concern about the transmission of acquired immune defiency syndrome (A.I.D.S.) by blood transfusion in Africa viz. 3 per cent of A.I.D.S. cases in Africa are associated with transfusions which is 50 per cent higher than

for all other areas[22]. Due to technical and economic difficulties in introducing effective screening in this part of the world there is a greater risk to transfusion recipients, with obvious implications for travellers who experience trauma such as road traffic accident victims.

Recent examples of more serious illnesses acquired and imported from abroad include, typhoid[23], hepatitis[24,25,26], polio[27,28,29], leptospirosis[30], schistosomiasis[31,32], amoebiasis[33], cholera[34,35], rabies[36], giardiasis[37], dysentery[38], salmonellosis[38,39], shigellosis[40], leishmaniasis[41,42], lassa fever[43,44], trypanosomiasis[45], legionnaires' disease[46,47,48], diptheria[49,50], cytomegalovirus infection[51], A.I.D.S.[52], and sexually transmitted diseases[53,54]. A summary of infections imported from abroad is shown in Table 1.02. The problem was also highlighted by a Royal Society/Royal College of Edinburgh Symposium[55], editorials in the British Medical Journal[56] and the Journal of the American Medical Association[57], and the publication in 1983 of a new joint U.S./U.K. medical journal (Travel Medicine International) devoted to the subject.

1.5 Sources of travel health advice

Immunisations are recommended for most holiday countries in Southern and Eastern Europe, Africa and Asia, and the majority of visits (19 million; 88 per cent) carried out by United Kingdom residents in 1984 were to these destinations[8]. These recommendations change frequently on the basis of eradication of disease and outbreaks of infection which vary from area to area in a temporally random manner. It follows that specific prophylactic immunisation advice for travellers is only as valid as the most recent updating on and accuracy of that advice. Many people do not follow Department of Health and Social Security (D.H.S.S.) recommendations. There are several reasons for this including indifference, lack of information, incorrect information, fear of injection and insufficient time prior to travel.

There are several sources of information (figures 1.03-04) for the

intending traveller and this can cause confusion, in particular when the advice differs according to the source consulted. The following list illustrates the multiple nature of the sources of information for travellers,

"Official" sources: e.g. D.H.S.S. - Notice to Travellers (SA. 35); the family doctor.

Specialist sources: e.g. The Communicable Diseases (Scotland) Unit (C.D.S.U.); Liverpool School of Tropical Medicine.

Specialist associations: e.g. British Diabetic Association - Holidays and Travel for diabetics.

General literature sources: e.g. The Traveller's Handbook Holiday Which? Foreign embassies

Travel agent sources: e.g. travel brochures.

With so many direct access sources of information whose research, resources and motivations are quite variable, it is not surprising that the intending traveller can be easily misinformed and confused. The family doctor himself has a wide choice of information sources which frequently offer differing advice (Figure 1.05).

In view of the fact that the majority of U.K. travellers going abroad travel on "inclusive" package holidays[8] marketed by travel agents, the pre-travel health information available for such holidaymakers is of prime importance. An assessment of this information can be readily undertaken by study of the travel brochures made available to clients at any major travel agency. For the reasons given above I decided to carry out such a study in 1985 (**2.8**) in an attempt to set this source of pre-travel health advice in perspective.

1.6 Background to my research interest

In 1973 the first case of legionnaires' disease recognised outside North America was recorded by Dr.J.H.Lawson and colleagues at Ruchill Hospital[58]. This case occurred in a member of an organised tour returning from a holiday

in Benidorm, Spain in July 1973. Out of this group one person was found to be dead on arrival at Glasgow Airport, another died two days later and the third died one week later in Ruchill Hospital. In the third case a retrospective serological diagnosis of legionnaires' disease was made. All three tourists had stayed in the same hotel in Benidorm and had suffered from an unexplained respiratory illness of which the main feature was pneumonia.

In June 1977 a 51 year old houswife returned from holiday in Benidorm, Spain, having stayed at the same hotel as the aforementioned group. She was admitted to hospital with a severe pneumonia and died within three days from legionnaires' disease[46]. These examples of travellers returning with a then - unknown disease which presented diagnostic difficulties and delay in the home country motivated a collaborative study of illnesses associated with travel which began in 1977. The study was conducted by C.D.S.U., the University of Glasgow Department of Infectious Diseases, the Department of Laboratory Medicine and the Regional Virus Laboratory all at Ruchill Hospital, Glasgow.

First of all a standard questionnaire (Appendix I, pages 119-28; [**2.2**]) was compiled and distributed to returning package holidaymakers at Glasgow Airport during the period May to November 1977 as well as to several other groups who had recently travelled or were about to travel abroad. Additional publicity was generated by the media. In particular, an article appeared in a Sunday newspaper (Appendix II, page 175) on September 11th, 1977, entitled 'The Benidorm Bug', and a television current affairs programme on December 13th, 1977, dealt with legionnaires' disease. This publicity stimulated considerable public interest and travellers telephoned and wrote to the newspaper, the television company and the C.D.S.U. These travellers were also issued with a questionnaire.

The resulting volume of data collected encouraged Professor Grist to apply to the Scottish Home and Health Department (S.H.H.D.) in November 1977 for a grant to fund a research assistant. The application was approved and accepted (grant K/OPR/2/2/C424) by December 20th, 1977, and I was appointed to and commenced that post on March 13th, 1978, under the administrative

supervision of the University of Glasgow and the C.D.S.U.

1.7 The development of the research

Initial research concentrated on data already collected. It revealed surprisingly high reports of illness (43 per cent) amongst the tourists who returned the questionaires, predominantly of an alimentary type[59]. Furthermore, amongst the self-selected group who responded to the media publicity, 78 per cent reported illness, and 9 per cent showed serological evidence of previous infection with Legionella pneumophila[47]. In view of these initial findings it was decided to institute a programme of monitoring illness in travellers over the ensuing decade along with the facility to deploy rapid response surveillance on receiving an alert about illness in travellers, and to collect sera for antibody testing to L. pneumophila.

1.8 Serological studies for antibodies to Legionella pneumophila

Legionnaires' disease was named after the outbreak which caused many severe and fatal pneumonic illnesses among veterans of the American Legion attending a convention in a Philadelphia hotel (Figure 1.06) in 1976[60]. Long and intensive investigations eventually unmasked as the cause a previously unknown bacterium which was very difficult to culture and detect by standard methods - L. pneumophila (Figures 1.07-10). Tests on materials saved from earlier outbreaks, for which no cause had been identified, showed serological reactions with the newly discovered organism and incriminated it as the cause of these as well. Thus the outbreak of pneumonia with three fatalities affecting a group of package holidaymakers returning from Benidorm to Glasgow in 1973 (**1.6**) was subsequently shown to be caused by legionnaires' disease. Since then this infection has been found in many countries of the world[61,62], causing a wide range of clinical responses from asymptomatic to lethal.

1.9 Epidemiology of Legionnaires' disease

Although legionnaires' disease came to light as the result of spectacular outbreaks, mainly involving people staying in hotels, sporadic, unpredictable cases are also common. The epidemiological pattern is usually of an explosive onset with the number of cases rapidly increasing, typical of a common-source type of infection (Figure 1.11). It is likely that about a third of the cases of legionnaires' disease are associated with outbreaks[63]. Person to person spread is extremely uncommon.

There is a preponderance of cases during the late summer and autumn, with about twice as many males affected as females. Susceptibility is general but the disease is rare in those under 30 years of age[64]. Illness is reported more commonly in older people, and the average age of patients is 50 to 60 years. Increasing age , being immunocompromised, smoking and possibly alcohol are predisposing factors. Legionnaires' disease has been linked with overseas travel[47,65], and about a third of seropositive subjects in one study[66] had a history of being abroad within the incubation period of the illness.

L. pneumophila has been isolated from many environmental sources - mud[67], water from air-conditioning units[68], creeks[69], cooling towers[67], shower heads[70], piped supplies and taps in hospitals and hotels[71]. The organism may survive for at least a year in tap water[72].

Spread of legionnaires' disease within a hospital can occur[73,74], and the complexity of hospital water supply systems and the presence of immuno-compromised patients may be important factors. This occurred at Glasgow Royal Infirmary in 1985 affecting 16 in-patients[75].

Legionnaires' disease is a common cause of community-acquired pneumonia. In a study in Nottingham M^{ac}Farlane and his colleagues[76] found that it was the second commonest cause of pneumonia (the pneumococcus being the commonest) in patients admitted to hospital - 19(15 per cent) of 127 adult patients. By contrast, serological screening of 2,023 healthy subjects in the Nottingham population showed that only 1.5 per cent had antibody to L. pneumophila[77]. A recent example of a Glasgow outbreak of community acquired

illness due to the organism occurred in the Dennistoun district in 1984 with 33 cases and 1 death[78].

1.10 Clinical features of Legionnaires' disease

The concept of Legionnaires' disease as epidemic, commonly fatal (between 10-25 per cent mortality during outbreaks), predominantly pneumonic and diagnostically perplexing has evolved[79] following the initial outbreaks, with the recognition of sporadic cases[80] and asymptomatic seropositive individuals. Infection would seem to be by inhalation of the organisms in an aerosol of infected water, the organism usually infecting the lungs by processes which are, as yet, ill understood.

The cases which present are likely to become unwell fairly rapidly and, in the elderly, those severely affected or with compromised immunity continue to deteroriate quickly in the absence of effective diagnosis and treatment. The hypothesis that an endotoxin-like agent causing multi-organ damage is produced during the course of the illness[81], is helpful in rationalising the varied clinical presentation.

The overall clinical spectrum (Figure 1.12) is usually of an initial 'viral'-type illness with malaise, myalgia, headache, a rapidly rising fever with rigors and a dry, unproductive cough[79,82,83]. Progressively severe symptoms occurring within a few days include chest pain - often pleuritic in type, vomiting, diarrhoea, abdominal pain and distension. Central nervous system findings include confusion, delirium, dysarthria and clouding of consciousness inappropriate to the height of the fever. Further prognostically unfavourable complications are disseminated intravascular coagulation, gastrointestinal bleeding, rhabdomyolysis, respiratory failure, encephalopathy, shock and renal failure.

Initial clinical examination reveals an acutely ill, febrile (>39^{0}C) patient with rales and a relative bradycardia. With progression of the disease the chest X-ray shows changes (Figure 1.13) from patchy localised consolidation to multilobular involvement with massive bilateral

consolidation[80,82]. Pleural effusion is minimal or absent. Other findings recorded include a moderate leukocytosis, haematuria, hyponatraemia, hypophosphataemia, abnormal liver function tests[79,80,82,83] and elevated kinase of skeletal muscle origin[81].

Returning travellers developing an illness with these aforementioned features were more likely to come to the attention of a clinician rather than be identified by serological surveillance, but it was considered to be of value to look at the antibody status of the group as a whole to gauge their exposure to legionella.

1.11 Studies on the poliomyelitis and typhoid antibody status of travellers

Poliomyelitis continues to be a serious health problem in the developing countries and to non-immune persons in others, the latter group at risk in particular when travelling abroad or exposed to wild virus at home.

Poliovirus may be carried by infected persons from one continent to another and from one country to another. For example virus was carried from Holland to Canada in 1978, from Canada to the United States in early 1979, and from the United States back to Canada, causing 110 cases in Holland and 22 cases in North America[84,85]. Also of the 13 cases of poliomyelitis known to have occurred in the German Federal Republic in 1972, 9 were due to imported virus - mostly in the families of Turkish immigrant workers, and all those affected had been in the Near East or North Africa shortly before being taken ill[86]. Although there are many people without full immunity and fewer children are receiving vaccine, there are very few cases of poliomyelitis in the United Kingdom each year[87]. However, those most at risk from virulent strains of poliovirus are very young children who have not yet received vaccine and those, probably less than 10 per cent in each age group, who have never acquired immunity intentionally or unintentionally.

For those travelling to areas where poliomyelitis is known to be endemic

it is current D.H.S.S. policy to encourage one poliovaccine booster if they have not had one within the last ten years[88]. In view of the increased risk of poliomyelitis to travellers going abroad, in particular those incompletely or non-immune, from 1977 onwards I decided to study the polio antibody status of travellers.

The first travellers studied were from a group of package holidaymakers who stayed at a Maltese hotel during June 1981 at the same time as a 61 year old Scottish tourist who developed typhoid fever shortly after his return to Scotland[89]. He was admitted to hospital but died despite appropriate treatment. It was decided to extend the questionnaire survey (**1.6**) to this group and to ascertain their susceptibility both to typhoid and polio; thereafter these serological studies were extended retrospectively to include samples previously collected for L. pneumophila (**1.7**) antibody studies, and prospectively to include serum collected in subsequent studies.

1.12 Prevalence of viral hepatitis markers in travellers

The traveller is unlikely to share an identical immunity to enteroviruses and other bowel pathogens with the indigenous population in the country he visits and this is taken as a contributory factor in the common problem of diarrhoea in travellers. This situation is exacerbated by an inadequate sanitation infrastructure which can be secondary to a lack of expertise, funding, or a gross overloading of the system due to adverse environmental conditions or frank commercial exploitation. These aforementioned circumstances are also of epidemiological significance in the transmission of viral hepatitis.

Viral hepatitis A occurs endemically in all parts of the world, and is spread by the faecal-oral route, more readily in conditions of poor sanitation and overcrowding[90]. Studies on the prevalence of viral hepatitis markers have shown higher levels in the populations of Mediterranean and Middle Eastern as opposed to northern European countries for hepatitis A virus (anti-HAV)[90,91,92,93,94,95].

The faecal-oral method of transmission occurs in travellers' diarrhoea, polio and typhoid, and it was therefore a logical extension of the serum screening programme to study the prevalence of viral hepatitis markers (anti-HAV) in travellers, and to attempt to set a perspective for the risk of infection.

1.13 Travel related hospital admissions

In 1985 I decided to look at the problem of illness associated with travel from a different viewpoint; being in a priveleged location at Ruchill Hospital I was able to liaise with the infectious diseases consultants and it proved possible to study the proportion and types of admissions to the infectious diseases wards which were related to recent travel abroad. This was most useful in making comparison with the features associated with less serious illnesses experienced by travellers and also enabled some health costings to be calculated for travel associated illnesses.

1.14 General aims of the study

The development of this research programme is an example of the continuing evolution of communicable disease surveillance. As the scourge of one disease retreats another diagnostically perplexing infection emerges offering the challenge of medical detection and scientific exploration in our own time[96]. By the systematic collection of data on the incidence of infection or illness in different population groups and monitoring factors which determine illness distribution, the analysis, interpretation and dissemination of this information can be effected.

In view of the predicted rise in the numbers of international tourists to 480 million by 1990 with travel to the developing regions expected to show the highest growth rate (about 10 per cent - almost double the world average)[97], and the consequent increased responsibility of different groups within the medical profession towards dealing with the hazards produced by these changes, study in this thesis was conducted with the following aims:

(1) To study historical aspects of illness associated with travel abroad with particular reference to Scottish Presbyterian missionaries (1867-1929).

(2) To study the incidence and type of illness experienced by contemporary travellers abroad.

(3) To determine the influence of age and socio-economic grouping on the incidence of illness.

(4) To study the illness rates experienced by travellers to different countries and in different seasons.

(5) To compare the experience of illness in smokers and non-smokers.

(6) To study the serological evidence in travellers of infection with L. pneumophila.

(7) To study the immunity of travellers to poliomyelitis.

(8) To study the immunity of travellers to typhoid.

(9) To study the immunity of travellers to hepatitis A (anti-HAV).

(10) To study the prevalence of travel related illness recorded in in-patients over a year at Ruchill Hospital.

(11) To assess the effectiveness of the current communication system within the United Kingdom in relation to illnesses associated with travel abroad.

CHAPTER 2.

SUBJECTS AND METHODS.

2.1 Introduction

To fulfill the general aims of the study as detailed in CHAPTER 1 (**1.14**) several elements are desirable:

1. A sufficient sample number of travellers returning from different countries/regions.
2. A spectrum of age and social class in the samples.
3. Samples from different seasons and years.
4. Adequate gathering of initial information to permit study of the lifestyle of travellers (e.g. smoking) and follow-up studies such as serology.

In considering the strategy that will allow for the inclusion of the above elements, the following aspects have to be taken into account:

Sampling of travellers (**2.1.1**)
Location of survey(s) (**2.1.1**)
Traveller contact methodology (**2.1.2**)
Alternative contact strategies (**2.1.3**)
Questionnaire design (**2.2**)
Use of resources and manpower (**2.2.1**)
Time frame (**2.2.2**)
Data analysis (**2.3**)
Illness classification (**2.3.1**)
Possible bias and remedy (**2.3.2**)
Serum sample collection (**2.4-2.5**)

In further setting the principal study findings in perspective it is

useful to view illness in travellers who required hospital admission (**2.6**), and in assessing the adequacy of pre-travel health advice it is important to evaluate the available advice from the prime source contact for travellers - travel agents (**2.7**).

For the purposes of a thesis submission it is also desirable to include a comparable study group which is of historical interest (**1.3**), and the relevant study methodology for this group is included later in the chapter (**2.8**).

Finally some simple statistics were used, where appropriate, to validate the results from the studies (**2.9**), and the thesis compiled at home on a home computer (**2.10**).

2.1.1 Travellers studied

Glasgow Airport (figure 2.01) is a large regional airport currently handling 1.8 million (0.9 million charter)[98] passengers per annum, with all year round flights direct to Europe for both business and holiday travellers. On account of the relative ease of access to this sufficiently large and representative body of Scottish travellers returning from abroad it was a logical starting point for carrying out studies. Due to its geographical location the airport comes under the jurisdiction of the Renfrew District Council and the environmental health department serving this district is particularly involved with any health hazards connected with the airport and its passengers. Contact was established both with this department and the British Airports Authority (B.A.A.) and a close liaison ensued. Flight schedules were consulted enabling groups returning from foreign destinations to be identified and met at the airport by environmental health officers from Renfrew District. Also, when returning travellers were to be questioned the Airport Authority permitted a desk and notice to be displayed in front of Passport Control (figure 2.02) where all arrivals from abroad are obliged to congregate. This arrangement had the dual benefit of publicising the studies and augmenting their authenticity due to the

prominent location within the offical confines of the airport. The excellent co-operative relationship between these groups meant that it was possible to conduct repeat studies in different seasons, years and also if an alert was received of a health problem affecting returning travellers. Using the same contact system for repeat studies a standard procedure was introduced enabling valid comparative analyses to be carried out.

A similar arrangement was made with Edinburgh Airport Authority and Edinburgh City Environmental Health Department enabling comparable studies to be made on travellers using that airport.

Annual statistics[98,99] are produced by these airports detailing the total numbers of passengers handled and those travelling on non-scheduled (charter) flights, the latter virtually equating to package holiday travellers. In addition the Department of Trade produce annual statistics[8] on the number of visits abroad by U.K. citizens with a subdivision for "inclusive" (i.e. package) holidays. These statistics help to set the numbers studied in perspective not only in absolute terms but also in relative terms by extrapolation of the findings for total numbers of U.K. travellers. A definition can thereby be made of both the scale and significance of the findings.

Other groups were contacted regarding their health experience whilst abroad via their employers, travel agents and tour operators, as detailed in the next section **(2.1.2)**. Invariably our attention was drawn to these groups on account of a particular health problem experienced by members of the group which was highlighted by the travellers themselves or by the media. Whilst such study groups were not randomly selected the interventionist role which they offered for further epidemiological study was too useful to be ignored. Thus "incident" epidemiology was married to more "academically pure" epidemiological research in much the same way that medical research in general practice often relies on facets from both "incident" and preventative medicine.

Initially travellers were selected for investigation of their specific health experience whilst abroad. Subsequent studies considered the experience of illness amongst various groups such as package

holidaymakers[59], different occupational groups and travellers to different countries[59], a highly self-selected group of tourists at risk of contact with L. pneumophila[47], summer visitors to Scotland[100], winter package holidaymakers[101], tourists to Malta at risk of typhoid infection[89], package holidaymakers to Romania[102], Portugal, and other general groups of package holidaymakers.

The surveillance methods described in this chapter were used with the objective of revealing epidemiological patterns of the type and incidence of illness experienced by travellers and of discerning possible risk factors. A standard questionnaire (2.2) and a similar methodology were used throughout enabling valid comparative analyses to be drawn up for the groups studied.

Altogether eleven discrete groups were studied (Table 3.13), selected both randomly and by design: the number of travellers studied in each group is shown below in parenthesis e.g. (no. x),

1) Package holidaymakers and other travellers[59]. A study of the experience and type of illness amongst different socio-economic groups travelling both for recreation and /or business to various countries returning through Glasgow Airport in the summer of 1977 (no. 2,211).

2) Legionnaires' Disease (L. pneumophila study[47]). This study looked at the experience of travellers to Spain who had experienced a high morbidity mainly from respiratory illness during 1977. They made contact with the C.D.S.U. following media publicity highlighting Legionnaires' disease in holidaymakers to Benidorm (no. 375).

3) Visitors to Scotland[100]. A group of multi-national visitors to Scotland who booked accommodation at tourist information offices in the West of Scotland during the summer of 1980 were studied and their experience of illness compared with Scottish travellers abroad (no. 355).

4) Winter package holidaymakers[101]. Tourists returning through Glasgow Airport from winter holidays abroad in January 1980 and 1983 were investigated and the frequency and type of illness compared with those travelling in the summer (no. 342).

5) Typhoid "at risk" holidaymakers[89]. A study was carried out on the

health of a party of Scottish tourists who stayed at a hotel in Malta during June 1981 at the same time as other guests at the hotel developed typhoid (no. 141).

6) Illness associated with a package holiday in Romania[102]. Tourists returning from Romania through Edinburgh Airport during August and September 1981 who volunteered numerous reports of ill health associated with their holiday, were the subject of further observation (no. 370).

7) To set a perspective for earlier, smaller, more selective studies [1)-6)], a large group of package holidaymakers returning through Glasgow Airport during July and August 1981 were studied (no. 3,906).

8) Continuing the study principle as above [7)], a further group of summer package holidaymakers returning through Edinburgh Airport in 1982 were studied (no. 1,978).

9) An identical investigation as above [8)] conducted at Glasgow Airport (no. 3,024).

10) Observation of package holidaymakers returning through Glasgow Airport from southern Portugal during September 1984 initiated on account of a high incidence of reports of gastro-intestinal illness[103,104] amongst holidaymakers returning from that area (no. 388).

11) A further study of package holidaymakers returning though Glasgow Airport during August 1985 to compare with earlier study groups and assess the impact of pre-travel health advice (no. 726).

2.1.2 Traveller contact methodology

I was most fortunate to receive the inter-disciplinary co-operation of other professional groups who assisted in contacting travellers and in distributing questionnaires, as well as directly referring travellers to C.D.S.U. and alerting the unit to travellers "at risk" from a possible health problem. Assistance was also given in follow-up studies on travellers in certain instances; the details are as listed over (the group numbers included refer to the groups detailed in **2.1.1**),

Renfrew District Environmental Health Department,
The British Airport Authority (B.A.A.).
(a) "Infection and Travel; the experience of package tourists and other travellers"[59] - group 1),
(b) "Travel and Health. Illness asssociated with winter package holidays"[101] - group 4),
(c) "Illness Associated with a Package Holiday in Romania"[102] - group 6), and groups 7), 9), 10), 11).
The Common Services Agency (C.S.A.) - (a).
Edinburgh City environmental health department - (c) and group 8).
Glasgow City Public Relations Department,
Argyll and Bute Leisure,Recreation and Tourism Department,
Cunninghame District Leisure, Recreation and Tourism Department,
Strathclyde Region Leisure, Recreation and Tourism Department,
The Scottish Tourist Board (S.T.B.).
(d) "Illness amongst travellers to Scotland: a pilot study"[100] - group 3).
Various Glasgow companies and travel agents - (a) and (e) "Rapid response health surveillance of Scottish tourists[89] - group 5).
The British Broadcasting Corporation (B.B.C.),
A Scottish Sunday newspaper.
(f) "Legionella pneumophila in tourists"[47] - group 2).
The family doctors of affected travellers - (a), (b), (c), (e), (f), and groups 7), 8), 9).

2.1.3 Alternative traveller contact methodologies

From a theoretical viewpoint two other contact approaches are possible viz.

1. Prior to embarkation
2. On the return journey

In 1982 I contacted three sympathetic local travel agents who agreed to distribute questionnaires along with tickets to their clients prior to

departure for completion and return on disembarkation to the U.K. Several thousand forms were personally delivered to these travel agents but none were returned to the C.D.S.U. In retrospect it was assumed that the forms were accepted by the agents out of a sense of loyalty/duty but that in the event the fear of an adverse commercial impact/consumer reaction inhibited further distribution.

Enquiry was also made of the airline passenger carriers regarding a supply of questionnaires for distribution to travellers on their return journey. It became apparent that this was more complicated than was initially thought as relatively few flight schedules involve a simple, Glasgow - foreign airport - Glasgow, shuttle-type service, but instead relay between several other airports and countries before making the return flight to Glasgow. Passing appropriate instruction to the crew on these return flights sometimes staffed by foreign nationals seemed insurmountable, particularly as the carriers appeared unenthusiastic towards the idea - no doubt sensitive about a possible negative marketing influence.

I also corresponded with travel health insurers, the Consumers' Association and the Scottish Tourist Board with a view to conducting collaborative studies on the subject of illnesses associated with travel. All these overtures failed in their objective of producing a study on the subject from a different perspective.

2.2 The standard questionnaire

Since the commencement of the studies analysis has been made of the information provided by travellers on a 20 item standard questionnaire recording personal and travel details including age, sex, occupation, country, town and hotel visited, dates of travel, reasons for travel, type of accommodation, pre-travel health status, symptomatic complaints with date of onset and duration, any factors to which illness might be attributed, and whether the help of a doctor or hospital was required (Appendix I - page 119). Questionnaires were returned to C.D.S.U. in a prepaid reply envelope.

From time to time questionnaire revision was carried out e.g. to enquire about smoking habit (1980), to record data from visitors to Scotland (1980), to make the form easier to complete, to facilitate computer storage of data (1981), and to enquire about pre-travel health advice (1985) (Appendix I). Thus the time frame (**2.2.2**) was turned to advantage by allowing evolution of the survey instrument and modification of the direction of the surveys in the light of initial findings, consumer response, data handling and travel trade developments. The basic information collected remained otherwise essentially unchanged enabling valid comparative analyses to be carried out. Each group of travellers contacted received a letter with the questionnaire explaining the reason for the information request and confirming that it would be kept strictly confidential. This was not only ethically appropriate but also good public relations which it was hoped would increase the response rates. Examples of the questionnaires and accompanying letters are included in Appendix I (Q1-7; standard letters GA1, GA1b, P.1., IC1, SA/P1, P.H.1, P.H.1A., T.A.1, P.H.1A.81, GA/P1 - pages 119-133 and 136-155 respectively).

2.2.1 Realities of resources and manpower

The sampling of travellers (**2.1.1**), the location of the surveys (**2.1.1**), and the traveller contact methodology (**2.1.2**) were all tempered by the available resources and manpower. I was appointed to the post of part-time research assistant at the C.D.S.U in March 1978 funded by the S.H.H.D. (**1.6**). This post was thereafter continued with funding from the C.S.A. from November 1982, then expanded (from 2 to 4 sessions per week) and jointly funded with the Scottish Health Education Group (S.H.E.G.) from September 1984. My location within the C.D.S.U provided several advantages viz.,

1. Invaluable administrative and secretarial assistance
2. Access to professional expertise and epidemiological information of the highest calibre
3. An established national epidemiological contact network

4. Access to modern technology and information handling/retrieval systems

I was able to call upon secretarial help for filing, typing, information and communications handling. Additional help was readily available from an experienced administrative officer who co-ordinated secretarial and other technical assistance as well as liaising with outside organisations **(2.1.1-2)** involved in the different studies. Other colleagues within the C.D.S.U., the University Department of Infectious Diseases, and the departments of laboratory medicine at Ruchill Hospital gave freely of their time, knowledge and expertise to assist me in my research **(2.2-2.3).** Information exchange between C.D.S.U and other individuals/groups with epidemiological interests both nationally and internationally provided opportunities for intelligence gathering on illnesses associated with travel. This helped me to establish contacts who guided and furthered the research. I was given free access to library, computing, audio-visual, photocopying and other technology which made for efficient use of my time and personal resources.

Sponsorship from the award of the Miller Travelling Fellowship in 1983 enabled me to visit W.H.O. (Geneva) in October 1984, The Centers for Communicable Diseases (Atlanta, U.S.A.) and Johns Hopkins University (Baltimore) in June 1985, to exchange information with other contemporary workers in the field of illness associated with travel.

Also in 1984 I was fortunate to be awarded the B.M.A. Brackenbury Award. This was used to fund a part-time data handling operator who prepared over 6,000 questionnaires for entry, and entered 3,000, on to computer.

There were two main constraints in relation to the management of these resources:

1. The weekly time available to me to devote to research
2. Considerations of economy

Throughout the period of this research I have continued as a full-time principal in urban general practice practising in a group of three which provides a comprehensive range of primary care services including all "out-of-hours" services. This makes a heavy demand on time and of necessity

my first priority was to discharge this commitment responsibly and thereafter my sessional and research commitment at C.D.S.U. The research was therefore spread over a number of years (**2.2.2**), but in retrospect I feel that this has been advantageous in encouraging evolution of the research rather than the converse.

In my privileged part-time position at C.D.S.U. there was a responsibility not to abuse the generous facilities available to me. In particular with the volume of routine work to which the staff were committed it seemed reasonable to give precedence to that activity and to be as sparing in the use of their time and in expenditure wherever possible.

2.2.2 Time frame

The time frame of the research stretched over several years. The reasons for this are detailed above (**2.2.1**). This permitted evolution of the survey instrument (**2.2**) in the light of the initial findings and changes in the data analysis (**2.3-2.5**) as well as allowing studies to be carried out in travellers from different countries/continents, in different years, seasons, and in response to a travel health alert or for monitoring purposes.

2.3 Data analysis

Initially the data collected was analysed manually. Use was then made of the departmental computer (an International Computers Limited [ICL] 1500) from 1984 until the installation of a new computing facility in 1985 - an Information Technology Limited (ITL) word processing system. The use of new technology was not without its penalties. A lot of time, effort, and patience was taken up in the learning of new methods and techniques which were often untried and did not always meet with success. For example the first computer required to be addressed in the language extended business basic which is not an industry standard, is known and used by few operators,

is slow and ponderous in use, and was virtually obsolete from its inception. The second computer system used was primarily an office based word processing system but did have the facility to run a standard data processing package - data base II (dbase II). However considerable teething difficulties were experienced in effecting this function.

To begin with I wrote programmes to analyse the data on the ICL 1500 with assistance from a statisitician experienced in computer programming at Strathclyde University. Thereafter I also received help from the C.S.A. computer support unit based in Edinburgh in using dbase II on the ITL.

Data (mixed numerical and string characters) was entered directly on to a screen display which shared a common layout to the questionnaire on both computer systems, in addition for certain of the items of information a pre-defined code value was entered for ease of further analysis. Examples of such items include the occupation, type of accommodation used, reason for travel, illness classification **(2.3.1)**, and all the information in the historical analysis **(2.8)**.

For the analysis of some of the later batches of questionnaires [groups 7), 8), 9), 11); **(2.1.1)**] the coded information was punched in at the University of Glasgow Department of Computing Science and thereafter analyses were carried out using the Statistical Package for the Social Sciences (SPSSx version 2.1). This is a comprehensive information analysis system of sub-routines for sorting, describing and analysing data, and various combinations of these sub-routines may be selected as appropriate for a particular study. It was then run on the ICL 2988 mainframe computer using the ICL Virtual Machine Environment (VME) Operating System at the above-named department. By using this powerful combination of software and hardware it was possible to make a detailed study of all the information collected on these later batches of questionnaires (total no. 8,633) to complement the earlier data.

2.3.1 Illness classification

An affirmative response given for any of the symptoms listed on the questionnaire (**2.2**; Appendix I) was accepted in all the studies as identifying a traveller who experienced illness as opposed to a "well" traveller.

The classification of illness according to the system(s) involved was determined by the symptoms experienced. A common classification was used throughout all the studies for both manual and computer analyses enabling valid comparisons to be made. The symptom or symptoms, and combinations of symptoms which affected the type classification of a particular illness are as detailed below:

VOMITING assignation code 1
DIARRHOEA assignation code 2
FEVER assignation code 3
HEADACHE assignation code 4
DIZZINESS assignation code 5
CHEST PAIN assignation code 6
BREATHLESSNESS assignation code 7
OTHER assignation code 8

If 1 & or 2, illness classification "Alimentary".

If 3 & or 4 & or 5 & or 8, illness classification "Other".

If 6 & or 7, illness classification "Respiratory".

If 1 & or 2 together with 3 & or 4 & or 5 & or 8, illness classification "Alimentary and Other".

If 1 & or 2 together with 6 & or 7, illness classification "Alimentary and Respiratory".

If 6 & or 7 together with 3 & or 4 & or 5 & or 8, illness classification " Respiratory and Other".

If 1 & or 2 together with 6 & or 7 together with 3 & or 4 & or 5 & or 8, illness classification "Alimentary, Respiratory and Other". In the subsequent analyses it was found that very few illnesses came within this latter category (less than 1 per cent) and for this reason this group was

equally divided between "Alimentary and Other" and "Respiratory and Other".

Taken in a strictly clinical context this classification system has obvious anomalies e.g. breathlessness or chest pain could be secondary to a cardiovascular problem, but used predominantly for the purposes of comparative analyses these anomalies are less relevant. This methodology enabled an illness reference framework to be structured from the questionnaire responses and was the practical alternative to collecting detailed personal medical case histories from over 13,000 travellers distributed throughout the U.K.

2.3.2 Possible bias and remedy

The limitations of surveys based on the methodologies detailed above are best recognised from the outset so that the findings from these and subsequent conclusions can take such factors into account to try and minimise error and bias.

Firstly in any survey it is virtually impossible to achieve a 100 per cent response rate. In addition the lower the response rate the higher the likelihood of bias. The "available health manpower" - as recommended by Getzandamer[105], was utilised on the grounds of economy, practicality and consistency **(2.2.1)**. The self-administered questionnaire **(2.2)** was the logical means to obtain information from large numbers of travellers without the need to employ interviewers. This methodology increases the possibility of introducing bias as a result of non-response[106], as compared to personal interview surveys. It is always possible that travellers troubled by health problems and those with a greater awareness of health preservation are more likely to respond. These limitations have been recognised and taken into account in three ways.

First of all when considering the results of the findings emphasis has been put on comparative attack rates in different groups of travellers in different years, seasons etc.., rather than on absolute rates. The studies have been conducted using the same methodology throughout and it has

therefore been assumed that the non-responders have been consistent in their non-response and reasons for this throughout. The converse has also been taken to be true.

Secondly comparison has been made with the results from other contemporary workers in the field.

Finally in the ultimate analysis even if all the non-responders (non-returners of questionnaires) were assumed to be 100 per cent well and were included in the denominator to those reporting illness, the overall attack rate based on this presumption still produces a significantly high rate. Applying this rate to the total number of U.K. package holidaymakers in 1984 and also assuming that only 10 per cent of those affected have a problem of medical importance, still produces a figure of over 140,000 affected travellers for 1984. This is best illustrated by the actual figures detailed below,

Overall "attack rate" experienced by travellers studied - 36 per cent.

Averaged "response rate" (percentage return out of total number of forms distributed) - 32 per cent.

"Real attack rate", assuming all non-questionnaire respondents to be "well" - 11 per cent.

Applying this "real attack rate" to the total number of U.K. package holidaymakers in 1984 (11 per cent of 13.04 million), the number affected - 1.43 million.

Assuming only 10 per cent have a problem of medical significance, the number affected - 143,000.

If criteria specified by Sir Austin Bradford Hill[107] in his presidential address to the Royal Society of Medicine in 1965 are applied to the findings, viz:

strength, consistency, temporality, plausibility, coherence,

then the problems ennumerated above have to a large extent been recognised and dealt with.

2.4 Serum sample collection: methodology

Over 750 of the travellers from several of the studies[47,59,89,101,102] volunteered a 5ml. sample of venous blood in response to my request (standard letters LDS2/P1, SA/P2, 80B/P2, 80B/P2/1, along with enclosure P2 - Appendix I, and prepaid reply envelope). I collected samples at Ruchill Hospital, at travellers' homes and places of work, and with the help of their family doctors, particularly for those distant from Glasgow. To assist the family doctor, after it was established that his patient was willing to donate a blood sample, I contacted the doctor (standard letters G.P.1, G.P.1A, GA/G.P.1, G.P.80B, G.P.81B, LDS2/GP1, G.P.2/81/C, along with enclosure G.P.2 and prepaid reply envelope - Appendix I, pages 156-70), and, after he had agreed to collect the sample, despatched a "test-kit" (figure 2.03) comprising sterile needle and syringe, collection bottle, medi-swab, cotton wool ball, and laboratory request card in a prepaid return carton. At the same time, the traveller was asked to make a mutually convenient appointment to attend his family doctor for venepuncture (P3). This system worked well with no apparent problems, and I received superb co-operation from family doctors.

The use of standard letters minimised the volume of repetitive secretarial work and enabled it to be transferred on to the departmental computer (ICL 1500) so that a "letter cascade" (figure 2.04) could be set up to cope with positive responses, negative responses, and non-responses.

2.5 Laboratory analyses[108,109,110,111] (2.5.1-4)

The serum samples thus collected were divided into portions at the laboratory for various antibody titres to be measured such as poliomyelitis[89,102], typhoid[89,102], Legionnaires' disease[47,59,89,101,102] (L. pneumophila), and to hepatitis A[108] (anti-HAV).

2.5.1 Legionella pneumophila antibodies.

Initially (March 1978 to March 1979) the samples obtained were divided: one portion was examined at the Department of Laboratory Medicine, Ruchill Hospital, as described by Fallon and Abraham[109], the remaining portion at the Center for Disease Control, Atlanta, U.S.A. In the event of discrepancy between the two results, the samples at Ruchill Hospital were re-examined; if the discrepancy remained, the lower of the two laboratory results was accepted. After approximately a year good correlation of results between the two laboratories obviated the need to continue this duplication "control" proceedure.

2.5.2 Poliomyelitis antibodies

The modified micro-metabolic inhibition test[110] was used to estimate neutralizing antibodies to each of the three types of poliovirus. This was carried out at the Regional Virus Laboratory, Ruchill Hospital. All serum titrations were started at a dilution of 4 (i.e. 8 in final serum virus mixtures) which were incubated for three hours at room temperature followed by overnight incubation at 4^0C. All tests were carried out in parallel with British Standard poliovirus antisera types 1, 2 and 3. As these results became available they were passed to the subjects' general practitioners (G.P.14 Appendix I); poliomyelitis vaccination was recommended where titres of <8 (negative) or 8 (borderline negative) were recorded.

2.5.3 Salmonella typhi antibodies

A standard agglutination technique was used[111] except that the incubation temperature used was 50^0C. The test was carried out at the Department of Laboratory Medicine, Ruchill Hospital.

2.5.4 Antibodies to hepatitis A

Total antibody (IgG and IgM) to hepatitis A virus was measured by a competitive radioimmunoassay (HAVAB, Abbott Laboratories, Chicago)[108]. This test was carried out at the Regional Virus Laboratory, Ruchill Hospital.

Thereafter these results were sent to the family doctor (G.P.14) along with suggestions for any further appropriate action e.g. polio vaccination to boost an incomplete immunity.

2.6 Methodology for in-patient studies

During the period 1st January to 31st December 1985 I was priviledged to be allowed access by the consultants in infectious diseases at Ruchill Hospital to the Infectious Diseases Unit Record Sheet completed on patients discharged from their wards. This sheet records the in-patient details of age, sex, ethnic origin, diagnosis, length of stay in hospital, whether the illness was considered to be associated with travel abroad, the country visited, and number of days since returning to the U.K. (Appendix I - page 134). From this information source I was able to compile a profile of the in-patient statistics related to patients admitted to Ruchill Hospital during 1985 with an illness associated with travel.

2.7 Methodology for study on pre-travel health advice in travel brochures

Travel brochures were collected from the public display of an established independent travel agency in the city centre of Glasgow. The brochures represented all the main tour operators and carriers covering destinations throughout the world, including cruises, and were readily available to prospective holidaymakers from the west of Scotland. Brochures were categorised according to the season of the advertised vacation and the

destination. Health information was classified as "specific" when it included details of specific immunisation recommendations or of particular environmental or climatic conditions in the holiday destination relevant to maintaining good health. "General" health information recommended seeking further advice from the family doctor, local health department, or embassy of the country to be visited.

2.8 Subjects and methods used for the studies on missionaries

Over a ten year period (1973-1983) Dr. Derek Dow (currently archivist to the Greater Glasgow Health Board) conducted a search of Scottish Presbyterian missionary records contained in General Assembly Reports of the Foreign Mission Committees of the Church of Scotland, the Free Church of Scotland and the United Free Church of Scotland, Synod Reports of the United Presbyterian Church, Life and Work, Free Church Monthly Record, Home and Foreign Missionary Record and other similar missionary magazines, University Matriculation and Graduation Records, Medical Directories, newspaper and British Medical Journal obituaries. From these sources (over the period up to 1977) he completed his Ph.D. thesis entitled "Domestic Response and Reaction to the Foreign Missionary Enterprises of the Principal Scottish Presbyterian Churches 1873-1929 (Edin. Ph.D., 1977). As part of his methodology he compiled a summary card index on all the missionaries he was able to identify. I was priviledged to be permitted access to this cumulative card index and I recompiled it with a view to conducting a comparative analysis of the experiences of different missionary sub-groups, and inter-relating these with regard to retiring from missionary service due to personal or family ill health, to death in service, the cause and age at death, and to length of service at different mission stations, areas, countries and continents during different years of appointment.

There was sufficient information on 1,427 missionaries from the original group to carry out these analyses. The information was re-carded and code numbers allocated for each of the following items of information, serial

number, sex and occupational groupings, mission fields, year of birth, age at death, year of appointment, years of service, reason for retirement, and specific cause of death. The coding key for all these values is detailed in Appendix I (page 171). The coded information was punched in at the University of Glasgow Department of Computing Science and thereafter analyses were carried out using SPSSx version 2.1 in the same way as for the later batches of questionnaires from the package holidaymakers (**2.3**).

From study of the information on the original cards there were obvious limitations on the impartiality of the final analyses. For example the missionaries were pre-selected by denomination - Presbyterian, country of origin - predominantly Scotland, the study period limited to 1867-1929, and also depending upon the availability and completeness of the original missionary records. It is theoretically possible to conduct a study where this sampling inconsistency is minimised, but detailed research of this kind would probably justify a thesis submission in its own right as opposed to a historical review within a different thesis context. However by assuming that all the sub-groups were similarly pre-selected and biased I felt that a comparative analysis between sub-groups at different mission locations and during different periods of appointment would be useful and more valid than stressing the absolute figures on the missionary group as a whole, thereby providing a meaningful insight on the missionaries' health experiences. Indeed this methodology is virtually identical to that used in the main thesis study on contemporary Scottish travellers and seems appropriate in this context.

2.9 Statistical analyses

In an attempt to validate the results from the studies with appropriate, accurate statistics, I consulted with Dr. Christopher Robertson of the Department of Mathematics at Strathclyde University. From these discussions it was confirmed that the major problem to surmount was the self-selection bias of the sample i.e. if those who responded were motivated to respond on

account of illness, then overestimation of the rate of illness in holidaymakers is likely to occur. However if it is assumed that all the subgroups have the same response bias then comparisons of the subgroups are permissable (**2.3.2**). This is the same as assuming that those travellers who do not respond do so at random. Whilst this assumption may not be valid for the "Romania" and "Typhoid at risk" subgroups, these groups are both very small and are not likely to be very influential when combined with the much larger groups of package holidaymakers.

In most cases the method of statistical analysis is a Chi-Squared (x^2) test of Independence in a two-way table. This test is equivalent to the Chi-Squared test of Equality of Proportions and is to be found in almost all elementary statistics textbooks. Occasionally when dealing with tests for trend or three-way tables it was necesary to use more complicated statistical methods, namely log-linear models and logistic models. These models are more efficient than the Chi-Squared tests and are equivalent to the Chi-Squared test in the case of two-way tables.

The missionary group is an extremely non-random sample of all Britons working abroad at the specified time due to the motivation of the missionaries, the selection procedures which they underwent, and the selectivity of the data collected on them. However this was common to the group as a whole and therefore comparisons within this population are valid. The methods of analysis were exactly the same as in the case of the holidaymakers.

2.10 Thesis compilation

From the outset of the study I have compiled this thesis submission at home on a Sinclair QL computer with a Microvitec colour monitor, a twin floppy disc drive, and a Juki daisy wheel printer. This gave me total independence from secretarial services and permitted greater freedom in the time of day for working which was complementary to my commitment in general practice. I was also able to use and photograph some computer graphics for use as

figures and to produce the final thesis ready for binding.

CHAPTER 3.

RESULTS

3.1 Introduction

The results from the studies described in CHAPTER 2 are detailed in Tables 3.01 - 3.62 in Volume II, the Tables 3.01 - 3.12 detail the results from the studies on missionaries; Tables 3.13, 3.27, and 3.28 display the overall results from the contemporary groups of travellers studied; Tables 3.14 - 3.24 the results from individual groups of contemporary travellers; Tables 3.25, 3.26, 3.29 - 3.39 the cumulative results from studies on the whole group; and Tables 3.40 - 3.62 the results from the smaller related studies i.e. pre-travel health advice, serology, in-patient details, and travel brochure health information.

For ease of data assimilation a similar table format is adopted throughout. On account of the effects of rounding percentages up (if 0.5 or greater), or down (if less than 0.5), the percentages do not necessarily add up to 100 per cent in all instances. Due to the nature of retrospective collection of information from questionnaires and study of historical records, the information collected on individuals was incomplete in some instances thereby precluding identical totals in all of the analyses for the different groups. This numerical discrepancy is small and largely irrelevant due to the study numbers (usually of the order thousands) and the comparative nature of the analyses.

3.2 Studies on missionaries (Tables 3.01-12)

The mission fields of 1,409 Presbyterian missionaries serving abroad between 1867 and 1930, divided into sub-groups, were identified (Table 3.01 and Figures 3.01-4). Similar numbers served in India and Africa (594 and 612 respectively) accounting for the major proportion (85 per cent) of the total. One hundred and forty-two (10 per cent) served in China and the remaining 61 (4 per cent) were equally divided between Jamaica and other areas (Arabia; New Hebrides; Japan).

Male missionaries (739: 52 per cent) and female missionaries (639: 45 per cent) were the largest sub-totals, only 3 per cent could not be classified by sex (Figure 3.05). Females who were neither trained in health care nor ordained comprised the largest sub-group (441: 31 per cent), followed by ordained males (384: 27 per cent) and those trained in health care (343: 24 per cent). The remaining five sub-groups (3, 5, 7, 9 and 15 per cent of the total) range from 47 ordained male doctors to 210 non-ordained males.

Taking the distribution within sub-totals and sub-groups by area served, 51 per cent of all female missionaries served in India accounting for 55 per cent of all the missionaries who served there. The largest proportion of female doctors (67 per cent) and also of those trained in health care (40 per cent) served in India.

Fifty per cent of all male missionaries served in Africa accounting for 60 per cent of all who served there. Seventy-five per cent of the non-ordained males comprised 26 per cent of all missionaries to Africa. The largest proportion of ordained male doctors, male doctors and nurses all served in Africa (45, 43, and 43 per cent respectively).

Seventy (51 per cent) of those who served in China were female, 16 of whom were doctors (22 per cent of all female medical missionaries). In the remaining mission fields 19 had training in health care (including 7 ordained male doctors - 15 per cent of this sub-group), and the majority, 51, were male missionaries (31 and 84 per cent respectively of the total for these fields).

The length of service amongst the missionary sub-groups is shown in Table 3.02 and Figure 3.06. The mean number of years served by the 1427 missionaries studied was 21.1 with the largest group (522: 37 per cent) serving between 5 and 19 years and equal proportions (25 per cent) serving either less than 5 years or from 20-39 years. Seventy-four (5 per cent) served more than forty years and the length of service was not determined for 108 (8 per cent) of the missionaries.

Amongst those serving less than 5 years non-ordained males and female nurses had equally high proportions (38 per cent) of their groups represented - 81 and 48 respectively. Only 4 (9 per cent) of ordained male doctors served less than 5 years but this group had the highest proportion of their numbers (7: 15 per cent) serve over 40 years compared with the other sub-groups.

Of those serving between 20 and 39 years the range was from 13 per cent (17) female nurses to 36 per cent (17) ordained male doctors with ordained males accounting for the largest proportion of the total (128: 35 per cent) followed by females (114: 31 per cent).

Comparing the experience amongst the major sub-totals viz. all male missionaries, all female missionaries, and all missionaries with training in health care serving less than 5 years (23, 27 and 29 per cent respectively), 5 to 19 years (35, 38 and 42 per cent), 20 to 39 years (27, 23 and 21 per cent) and over 40 years (8, 2 and 2 per cent), the range of difference is 7 per cent or less. The difference between the proportion of females serving for more than 40 years compared with males (2 and 8 per cent respectively) is statistically significant ($P < 0.001$).

The mean number of years served ranged from 25.1 for ordained male doctors, 24.9 for ordained males and 24 for females down to 13.8 for non-ordained males (overall mean 21.1 years).

Table 3.03 and Figures 3.07-9 detail the length of service by selected mission stations, all mission stations and continents. Those serving less than 5 years ranged from 7 per cent of those in Jamaica to 36 per cent of those in West Africa. The range for those serving 5 to 19 years was from 27 per cent - China to 43 per cent - Livingstonia. Amongst the sub-totals and

sub-groups serving between 20 and 39 years there was a low of 17 per cent for missionaries to West Africa and Calabar and a high of 42 per cent for missionaries to China. Of those serving more than 40 years there were none in other areas (Arabia, New Hebrides, Japan), 1 per cent of those in West Africa ranging up to 23 per cent of those in Jamaica. The differences between the regions, India, Central Africa, West Africa, South Africa and the rest in the proportions serving for each of the four selected lengths of service (less than 5 years, 5-19 years, 20-39 years, and over 40 years) are statistically significant ($P < 0.0001$).

Comparing the experience of missionaries to the Indian sub-continent (594) with those to Africa (612), fewer served less than 5 years in India - 23 per cent compared with 29 per cent, similar proportions served 5 to 19 years (38 and 37 per cent), disparate proportions 20 to 39 years (28 and 20 per cent) and similar proportions over 40 years (5 and 6 per cent respectively). A similar contrast exists within Africa between missionaries serving in South Africa compared with those in Central and West Africa, less than 5 years - 16, 29, and 36 per cent respectively, 5 to 19 years - 37, 39 and 36 per cent, 20 to 39 years - 23, 20 and 17 per cent and over 40 years - 17, 4 and 1 per cent.

The mean number of years served ranged from 15.1 for missionaries to West Africa to 30.4 for missionaries to Jamaica.

The length of missionary service related to the year of appointment - the first period of 12 years (1867-1879), then the five ensuing decades (1880-89, 1890-99, 1900-9, 1910-19, 1920-29) is shown in Table 3.04 and Figure 3.10. Out of 1,416 missionaries studied 560 (40 per cent) were appointed pre-1900 (284: 20 per cent betwen 1890-1899) and 856 (60 per cent) were appointed post-1900 (324: 23 per cent between 1920-1929). Those serving less than 5 years prior to 1900 range from 16 per cent during 1880 and 1889 to 30 per cent between 1890 and 1899. After 1900 there is greater similarity between decades - 25, 25 and 28 per cent respectively. In missionaries serving from 5 to 19 years the smallest proportion (28 per cent) was amongst those appointed between 1890 and 1899 and the highest proportion (42 per cent) amongst those appointed between 1920 and 1929.

Missionaries serving between 20 and 39 years ranged from 18 per cent of those appointed between 1867 and 1879 to 29 per cent of those appointed between 1900 and 1909. The comparative proportions for those serving over 40 years are 2 per cent (1910 to 1929) and 13 per cent (1867 to 1879).

Comparing the length of service pre-1900 with post-1900 the proportions serving less than 5 years and between 20 to 39 years are very similar (24 and 26 per cent, and 25 and 26 per cent), whilst the proportions serving between 5 and 19 years and over 40 years are more different (32 and 40 per cent, and 10 and 2 per cent).

Table 3.05 shows the numbers of missionaries retiring early on account of personal ill health, ill health in the family, marriage or premature death, and also amongst sub-totals and sub-groups of the missionaries. Overall 287 (20 per cent) returned prematurely due to ill health, 70 (5 per cent) due to family ill health, 76 (5 per cent) on marriage and 151 (11 per cent) died in service. The majority 837 (59 per cent) completed their appointed period of service.

Amongst the sub-totals, all male missionaries, all female missionaries and missionaries trained in health care, similar proportions returned due to personal ill health (19, 21 and 20 per cent respectively) and due to family ill health (6, 4 and 5 per cent); there was greater disparity in the proportions who died in service (12, 9 and 11 per cent) and in the proportions retiring to marry (less than 1, 11 and 7 per cent).

Amongst those who died in service ordained males had the highest number (50: 33 per cent of this total), proportionately the range was from 6 (8 per cent) female doctors to 7 (15 per cent) ordained male doctors. Amongst those retiring on account of personal ill health the proportions ranged between 15 per cent (15 male doctors) and 24 per cent (11 ordained male doctors). Those returning due to illness in the family ranged from 3 female nurses (2 per cent) to 10 male doctors (10 per cent). Taking the same range extremes amongst those leaving to be married there were no non-ordained males or ordained male doctors compared with 9 female doctors (12 per cent).

The reason for leaving missionary service according to the missionary location by continent, sub-continent, smaller areas and some mission

stations is shown in Table 3.06 and Figures 3.11-13. Between the proportions retiring due to ill health within continental and sub-continental divisions there is a range of from 14 per cent (China) to 27 per cent (Jamaica), the other proportions within this sub-division being 21, 21 and 19 per cent (India; Africa; and other areas respectively). Sub-dividing further within these areas the proportions range from 17 per cent (South India) to 27 per cent (Calcutta). Within the number affected by ill health in the family the lowest proportion affected of any of the subdivisions was 2 per cent (Blantyre, South India, South Africa) and the highest 10 per cent (other areas). Making a similar comparison for those who died in service the range is from 7 per cent (Calcutta) to 20 per cent (Jamaica) with missionaries to Africa contributing the largest number within this total 73 (48 per cent), the mission stations of Livingstonia (20: 16 per cent) and Calabar (26: 25 per cent) accounting for 63 per cent of this number.

Amongst those leaving to marry the percentage ranged from nil in Jamaica to 11 per cent in South India.

Table 3.07 shows the reason for leaving service during the six appointment periods studied (five decades and one 13 year period - page 58). Comparing those retiring due to ill health pre-1900 and post-1900 (Figure 3.14) the proportions are 24 and 18 per cent respectively with a range of from 15 per cent (1920-1929) to 25 per cent (1890-1899). Using a logistic regression model the decreasing trend in the percentages leaving due to ill health over all six appointment periods is statistically significant (P 0.0001).

Making a similar comparison amongst those who died in service the proportions are 17 per cent and 7 per cent (pre-1900 and post-1900) and 4 to 19 per cent (1920-1929 and 1890-1899); these two decades (in parenthesis) accounting for the highest numbers of missionaries (324: 23 per cent and 284: 20 per cent respectively).

Amongst the 70 missionaries who returned prematurely on account of family ill health there was little difference during the appointment periods studied (range 4 to 6 per cent), and of the 76 who left to be married the

percentages were lower pre-1900 compared with post 1900 (range 2 per cent 1890-99 to 7 per cent 1910-29).

The comparison between pre-1900 and post-1900 missionary appointments in India, Africa, all other areas, three mission stations in Africa and one in India and the reason for leaving service is shown in Table 3.08.

Amongst those retiring prematurely due to ill health the lowest proportion - 11 per cent was in missionaries to Livingstonia between 1900 and 1929 and the highest - 32 per cent in missionaries to Calabar between 1867 and 1899. The proportion range of those who died in service is from 4 per cent (Livingstonia 1900-1929) to 29 per cent (Livingstonia 1867-1899). Adding the proportions for those retiring due to ill health to the proportions of those who died in service the comparable proportions are 15 per cent (Livingstonia 1900-1929) and 54 per cent (Calabar 1867-1899).

There is a proportion range from 2 per cent (Livingstonia, Blantyre, and Africa pre-1900; Blantyre post-1900) to 8 per cent (Calabar post-1900) amongst those returning due to family ill health, and from nil to 8 per cent in those retiring on marriage.

The age at death was recorded for 537 (38 per cent) of the missionaries studied and was noted by decade for those aged between 20 and 59 years and over 60 years, shown within sub-totals and sub-groups in Table 3.09. The representation of sub-group totals within these subsets ranged from 11 per cent (14 female nurses) to 83 per cent (39 ordained male doctors). Overall 392 (73 per cent) died over the age of 60 years, the next largest number 55 (10 per cent) died between 30 and 39 years, and the mean age at death was 67.4 years.

Amongst the 42 non-ordained males (20 per cent of sub-group) were found the highest proportions of deaths between 20 and 29 years (21 per cent) and 40 to 49 years (29 per cent), the lowest proportion of deaths over 60 years (40 per cent) and the lowest mean age at death, 52.1 years.

There were 40 male doctors in whom the age at death was determined (40 per cent of sub-group) and they had the highest proportion (25 per cent) of deaths between 30 and 39 years; female doctors (27 total, 36 per cent of sub-group) had the highest proportion (85 per cent) over the age of 60

years.

In the 17 per cent (total 78) of the female sub-group the highest mean age at death (72.7 years) was recorded. Within the sub-totals all male missionaries, all female missionaries and all missionaries with training in health care, the proportion range within age groups was 7 per cent or less, and the range of the mean age at death less than 6 years.

The recorded age at death within four decades (20-29; 30-39; 40-49; 50-59) and those aged over 60 years for missionaries appointed to different stations, areas, countries, sub-continents and continents is shown in Table 3.10 and Figures 3.15-17.

Amongst the 63 (36 per cent of sub-group) appointed to Calabar the highest relative proportion of deaths were recorded between 20 and 29 years (10 per cent) and for 30-39 years (21 per cent); the lowest mean age at death (60.2) was also recorded. Similarly the highest relative proportions for the 40-49 year (14 per cent) and 50-59 (86 per cent) age groups occurred in 21 (26 per cent of sub-group total) missionaries to Calcutta and also the highest mean age at death (73.5). Ten (91 per cent) of the 11 missionaries (37 per cent of sub-group total) in other areas (Arabia, New Hebrides, Japan) comprised the highest relative proportion for any of the sub-divisions within the over 60 year age group.

The differences between the proportions within age groups for India, Africa and China ranged from a low of 2 per cent (between 20-29 years) to a high of 14 per cent (over 60 years of age).

The recorded age at death (five age groups) related to six appointment periods is shown in Table 3.11 and Figure 3.18. The age at death was recorded for 313 (56 per cent of the total group) missionaries appointed between 1867 and 1899 and for 224 (25 per cent of the total group) of those appointed from 1900 to 1929.

Comparing the proportions dying during the six appointment periods within each age group there is little difference (4 per cent) within the 20-29 age group, a 10 per cent difference (low 5 per cent, 1900-1909; high 15 per cent, 1880-1889) in the 30-39 year group, and a 7 per cent difference (low 3 per cent, 1910-1929; high 10 per cent, 1880-1889) in the 40-49 year

and 50-59 year groups (low 1 per cent, 1920-1929; high 8 per cent, 1867-1889, 1900-1909). The largest difference (16 per cent) occurred within the over 60 year group with the lowest proportion - 65 per cent in those appointed between 1880-1889 and the highest - 81 per cent in appointees between 1900-1909.

Of the 151 missionaries who died in service, a cause of death was determined for 72 (48 per cent) and is shown in Table 3.12 and Figure 3.19 sub-divided into pre- and post- 1900. Death due to infection accounted for 35 (41 per cent) of the missionary deaths pre-1900 (21: 23 per cent due to malaria), and for 19 (32 per cent) post-1900 (6: 10 per cent due to malaria). Overall these 54 deaths comprise 75 per cent of those cases with a recorded cause and 36 per cent of the total number. Seven (5 per cent of the overall total) died accidentally, the majority (6) during the post-1900 period.

3.3 Overall results from contemporary travellers (Table 3.13)

The overall results from the eleven discrete study groups (**2.1.1**) are shown in Table 3.13. The numbers in the different groups varied; there were 7 smaller groups ranging from 1-5 per cent of the total number studied, two groups of intermediate size (14 and 16 per cent respectively), and 2 larger groups - representing 22 and 28 per cent of the total. Of 13,816 respondents, 4,962 (36 per cent) gave a history of illness with group response rates ranging from 20 to 77 per cent (mean 32 per cent).

The attack rates ranged from 19 per cent in 355 summer visitors to Scotland in 1980 and 20 per cent in 342 winter package holidaymakers in 1980 and 1983, to 75 per cent in 370 summer package holidaymakers to Romania in 1981 and 78 per cent in 375 tourists who selected themselves for study by writing or telephoning to the CDSU after media publicity on Legionellosis and travel in 1977 (**1.6**).

Amongst the unselected general groups of summer travellers abroad, attack rates were lower in later as opposed to earlier studies - 43 and 35

per cent (1977 and 1981 respectively) and 25, 32 and 28 per cent (1982 - two groups, and 1985 respectively).

3.4 Results from individual groups of contemporary travellers (Tables 3.14-24)

Questionnaires were returned from 2,211 package holidaymakers and other travellers in 1977 (Table 3.14). Most (89 per cent) were completed by returning package holidaymakers who had received them at Glasgow Airport on their return from holiday (**2.1.2**). Nine hundred and fifty (43 per cent) stated that they had been ill either during their holiday or shortly after their return. Those in the 21-30 year age group were most affected by illness - 55 per cent reporting symptoms. The least affected group was that aged between 51 and 60 years, 26 per cent being affected.

Alimentary symptoms (usually vomiting and diarrhoea) were the most frequently encountered - 32 per cent (occurring in 87 per cent of all illnesses) and respiratory symptoms accounted for 3 per cent; 10 per cent of ill travellers had both alimentary and respiratory symptoms.

Three hundred and seventy-five tourists who contacted C.D.S.U. following media publicity on Legionnaires' disease in holidaymakers completed and returned questionnaires (Table 3.15). Most had visited Spain (364: 97 per cent) and illness was reported by 78 per cent of the tourists. Excluding the very few under 10 years of age, the reporting of symptoms ranged from 69 per cent in the 30-39 age group to 87 per cent in those aged over 60.

Respiratory symptoms alone or in combination with alimentary or other symptoms were the most frequently reported (168: 46 per cent). The next most frequently reported were alimentary, alone or combined with other conditions (124: 34 per cent). Vague symptoms such as fever, headache, dizziness accounted for 69 illnesses (18 per cent).

Of the multi-national visitors to Scotland there were 355 completed forms returned from the study period of June-September 1980 (Table 3.16). One hundred and seventy-four of the respondents were male, of whom 27 (16

per cent) reported illness; 172 of whom 40 (23 per cent) reported illness were female (Table 3.27). The remaining nine of unknown sex were well, giving an overall attack rate of 19 per cent.

The age group 20-29 years was the largest accounting for 30 per cent of the travellers; 29 per cent were over 50 and only 3 per cent were under 20 years of age. Reports of illness were most prevalent in those under 40 years of age.

Of the 67 who reported illness, respiratory illness alone accounted for 27 per cent and alimentary illness alone for 25 per cent of the illness. Alimentary upset alone or with other symptoms featured in 42 per cent of the illnesses, respiratory symptoms in 37 per cent; 25 per cent of the illnesses featured neither alimentary nor respiratory symptoms.

Questionnaires were returned by 342 winter package holidaymakers - 263 in 1980 and 79 in 1983 (Table 3.17). One hundred and fifty were males (44 per cent) of whom 24 per cent reported illness and 192 (56 per cent) were females of whom 16 per cent reported illness (Table 3.27); the overall attack rate was 20 per cent.

The distribution of tourists by age group indicated that 33 (10 per cent) were less than 20 years old, with other age groups more evenly represented. Reports of illness ranged from 8 per cent in the over 60 years age group to 33 per cent in the 21-30 age group and 30 per cent in the 31-40 age group. These latter two groups accounted for 49 per cent (33/67) of the total reports of illness.

Alimentary illness alone accounted for 42 per cent of the reports from those unwell (54 per cent when totalled along with other symptoms), and altogether respiratory symptoms were reported by 20 (30 per cent of those unwell) - 5 per cent of the travellers.

Completed questionnaires were returned by 141 (77 per cent) of the 182 Scottish tourists who stayed at a hotel in Malta at the same time as other guests at the hotel of different nationality developed typhoid (Table 3.18). There were 64 male and 77 female tourists of whom 32 per cent were aged 50-59 years; 24 (38 per cent) of the males and 32 (42 per cent) of the females reported illness (Table 3.27).

Reports of illness were highest in the 20-29 age group (72 per cent). Altogether 50 (35 per cent) tourists reported alimentary symptoms either alone or combined with others. These accounted for 88 per cent of the total reports of illness. Those reporting alimentary symptoms ranged from 2 (15 per cent) of the 40-49 age group to 14 (56 per cent) of the 20-29 age group. There were 5 reports of ill health which included respiratory symptoms.

Six hundred and fifty-five questionnaires were sent out to holidaymakers returning from Romania during August and September 1981, and 370 (56 per cent) were completed and returned; overall 279 (75 per cent) reported illness (Table 3.19). One hundred and fifty seven (42 per cent) of the respondents were male of whom 121 (77 per cent) reported illness; 213 (58 per cent) were female, 158 (74 per cent) reporting illness (Table 3.27).

Except for the over 60 years age group which recorded a comparatively low 38 per cent, illness by age group varied within a narrow range. Eighty-three per cent were affected in age groups 0-9 and 10-19 years.

Alimentary upset alone predominated accounting for 58 per cent of reported illness and 44 per cent of the tourists. Two hundred and sixty-one (94 per cent) of all the reports of illness included alimentary symptoms, involving 73 per cent of the tourists. Alimentary symptoms alone were most common in the 0-9 years age group (53 per cent) and least common (28 per cent) in those aged over 60 years. Alimentary combined with other symptoms ranged from 1 (3 per cent) in the over 60 age group to 14 (35 per cent) in the 10-19 age group. Altogether illness with alimentary symptoms accounts for 100 per cent of the reports of illness in the 50-59 years age group affecting from 71 to 78 per cent of age groups up to 59 but only 37 per cent of older persons. Respiratory symptoms affected only 20 (2-10 per cent) of these travellers.

In July and August 1981 10,773 questionnaires were distributed to returning holidaymakers at Glasgow Airport and 3,906 (37 per cent) were completed and returned of whom 1,382 (35 per cent) reported illness (Table 3.20). Thirty-four per cent of the 1,682 males (43 per cent of total) and 36 per cent of the 2,196 females (56 per cent of total) reported illness (Table 3.27).

Alimentary symptoms predominated and were recorded in 1,127 (29 per cent) of the illnesses. Respiratory symptoms occurred in under 3 per cent of the reports. The under 10 year and over 60 year age groups were the least and the 20-29 year age group the most represented (3,7 and 23 per cent respectively). The 20-29 year age group was the most affected by alimentary illness alone (22 per cent), by alimentary illness combined with other symptoms (19 per cent), and overall illness (47 per cent). The mean attack rate for those aged under 40 years (1,617 total) was 54 per cent compared with 28 per cent for those aged over 40 years (1,611 total).

During the summer of 1982, 1,978 completed questionnaires (35 per cent of total distributed) were returned by package holidaymakers disembarking at Edinburgh Airport (Table 3.21). Of the total of 494 (25 per cent) who reported illness 208 were male (24 per cent of males) and 234 were female (22 per cent of females) - the sex was not specified for the other 52 (Table 3.27).

The distribution of travellers by age group varied within a narrow range (13-16 per cent) with the exceptions of the under 10 (9 per cent) and over 60 (11 per cent) age groups. The 20-29 year age group reported the highest illness rate (35 per cent) along with the highest rate for illnesses with an alimentary component (25 per cent) and shared the highest rate for alimentary illness alone (12 per cent) with the 30-39 age group. Those aged under 40 years (1,087: 55 per cent) recorded a 29 per cent attack rate compared with 19 per cent for those aged over 40 years (787: 40 per cent). The over 60 age group was the least affected by illness (12 per cent).

At the same time as the above-mentioned group were under study 3,024 (30 per cent response) completed questionnaires were collected in a parallel comparative study conducted at Glasgow Airport (Table 3.22).

Age distribution within decades over the range 10-59 years varied from 15 to 19 per cent; there were 1,260 males (42 per cent) of whom 36 per cent reported illness and 1,534 females (51 per cent) of whom 37 per cent reported illness with an overall attack rate of 32 per cent (including 17: 7 per cent unwell - sex not stated, group total 230). Excluding the 2 per cent of unknown age with the atypically high attack rate of 77 per cent, the

highest attack rate was in the 20-29 year age group (39 per cent) and the lowest (17 per cent) in the over 60 age group. The former age group also shared the highest attack rates from alimentary illness alone with the 0-9 age group (18 per cent) and alimentary and other illness with the 30-39 age group (12 per cent).

Taking all the symptom complexes which include alimentary symptoms the 20-29 year age group is the most affected with 38 per cent followed by the 30-39 and 10-19 age groups (37 and 36 per cent respectively). Comparing the mean attack rate in those below (1,576: 52 per cent) and above (1,379: 46 per cent) 40 years of age, shows a rise of over two-fold - 27 compared with 56 per cent.

Of the 1,021 questionnaires distributed to package holidaymakers returning through Glasgow Airport from Southern Portugal during September 1984, 388 (38 per cent) were completed and returned (Table 3.23). One hundred and sixty-eight (43 per cent) of the respondents were male of whom 56 per cent were unwell and 220 (57 per cent) female of whom 55 per cent reported illness (Table 3.27).

Alimentary illness alone accounted for 50 per cent of the illness in the 216 (56 per cent) affected travellers and was associated with other symptoms in 43 per cent of the rest (i.e. 93 per cent of all reported illness). The 20-29 year age group was the most represented (38 per cent of the total); the 30-39 year age group the most affected by illness (71 per cent) and the over 60 group the least (25 per cent). Sixty-eight per cent of the 30-39 year age group reported illness which included alimentary symptoms. The mean attack rate for those aged under 40 years (55 per cent) was 67 per cent compared with 39 per cent for those aged over that age (39 per cent).

In the last group of package holidaymakers studied who returned to Glasgow Airport during August 1985 there were 726 (20 per cent) respondents (Table 3.24). There were 324 males (45 per cent of total: 25 per cent unwell) and 401 females (55 per cent of total: 29 per cent unwell) - Table 3.27.

The distribution within age groups ranged from 2i per cent (0-9 years) to 21 per cent (20-29 years). Overall 200 (28 per cent) reported illness with

higher proportions affected in the three age groups between 0-30 years (43-44 per cent) and lower proportions in the other age groups (15-21 per cent). The 20-29 year age group shared the second highest attack rate (43 per cent) with the 0-9 year group and also had the highest number affected by alimentary illness alone (16 per cent). The age group with the highest attack rate (10-19 years) had the highest proportion of illness with alimentary symptoms (32 per cent). Those aged less than 40 years (50 per cent) had a mean attack rate of 35 per cent compared with 10 per cent for those aged over 40 (44 per cent). Comparable rates using 30 years of age as the dividing point are 44 and 13 per cent respectively.

3.5 Overall results from groups of contemporary travellers (Tables 3.27, 3.28)

The sex of the travellers was documented in 10,910 (79 per cent) out of the total number (13,816) who returned questionnaires (Table 3.27). It was revealed that 6,064 (56 per cent) were female of whom 32 per cent reported illness and 4,846 were male (44 per cent) with a 31 per cent attack rate. Of all those reporting illness females comprised 39 per cent (14 per cent of all travellers), males 30 per cent (11 per cent of all travellers) and those unwell of unspecified sex 31 per cent (11 per cent of all travellers).

The overall pattern of illness experienced by the groups of travellers studied is shown in Table 3.28. Apart from the first group of package holidaymakers studied in 1977 the highest attack rates occur in those groups to which attention was drawn on account of a particular health problem experienced by the group or in the area of their vacation. Specifically these groups were, those concerned about illness due to L. pneumophila (78 per cent attack rate), travellers "at risk" of typhoid (40 per cent attack rate - but not from typhoid!), tourists returning from Romania complaining of health problems (75 per cent attack rate), and travellers from southern Portugal when there was a health problem local to that area (56 per cent attack rate).

These aforementioned groups all had the highest rates of illness which included alimentary symptoms (34-73 per cent) and with the exception of the L. pneumophila study the highest rates of alimentary illness alone affecting from 28-44 per cent. Altogether 18 per cent of all travellers were affected by alimentary symptoms alone and a further 10 per cent by illness which included alimentary symptoms; the comparable figures for respiratory symptoms were 1 and 3 per cent. Other illness alone accounted for 6 per cent of travellers and for 9 per cent in combination with respiratory or alimentary symptoms.

3.6 Cumulative results from studies on the group as a whole (Tables 3.25, 3.26, 3.29-39)

Table 3.25 shows the distribution of travellers by age group and illness type and Table 3.26 and Figure 3.20 the distribution by age group and reports of illness. The least numbers of travellers were in the 0-9 and over 60 age groups (4 and 9 per cent respectively), the highest in the 20-29 group (22 per cent) and the other groups were closely ranged between 14 and 17 per cent. Only 5 per cent did not detail their age. The 20-29 year age group had the highest attack rate (48 per cent), thereafter attack rates show a progressive diminution with increasing age; those aged over 60 years being least affected by illness (20 per cent). Illness was reported by 42 per cent of those aged under 40 years (7,381: 53 per cent of total travellers) and by 28 per cent above that age (5,764: 42 per cent).

The reports of alimentary illness alone or with other symptoms had a similar pattern with higher rates in those less than 40 years, the highest rates in the 20-29 year age group (25 and 15 per cent respectively) and the lowest in the over 60 group (9 and 2 per cent respectively). Of those affected by other illness alone, those aged less than 10 years had the highest proportion (9 per cent) and thereafter the proportions affected decreased with increasing age. Those reporting respiratory symptoms either alone or with others varied little between age groups (range <1 to 4 per

cent). The higher illness rate and proportion of alimentary illness in the 20-29 year age group is statistically significant (P <0.001).

Reports of illness by travellers shown by season of travel and country visited are displayed in Table 3.29. The most visited countries were Spain (7,182 travellers: 52 per cent) followed by Greece (1,194: 9 per cent) and Yugoslavia (843: 6 per cent); other countries shared between less than 1 and 6 per cent of the total.

There is a trend to higher attack rates with travel further south and to some extent further east, and this remains generally true both in summer and in winter. Examples in support of this trend are the 77 per cent summer attack rate reported by tourists to Tunisia and Morocco and the 74 per cent for Romania, and the rate of 32 per cent reported by winter tourists to Tunisia and Morocco. Attack rates in general are substantially lower in winter (mean 20 per cent) than in summer (mean 37 per cent).

The relationship between the country visited and the percentage unwell is statistically significant (P <0.0001). In the countries with both summer and winter travellers, with the exception of Malta, the higher percentage of summer travellers unwell is statistically significant for all locations (P <0.001).

Travellers were subdivided into socio-economic groups using the criteria defined in "Classification of Occupations 1980" (Office of Population Censuses and Surveys - H.M.S.O.), as used in the 1981 General Census, and their reporting of illness is shown in Table 3.30. Altogether 48 per cent could be classified in this way the two largest groups were in the professional (17 per cent) and intermediate and junior non-manual (13 per cent) categories; other groups ranged between 1 and 6 per cent. The group of employers and managers had the lowest attack rate (26 per cent) and the unskilled manual the most affected (39 per cent); the size of these two groups was comparable (589 and 127, 4 and 1 per cent of the total respectively).

A more selective study on 18 per cent of the travellers similar to the above, but specifying three of the subdivisions included under "others" (infants and schoolchildren, housewives, and retired - Table 3.30), is

detailed in Table 3.31.

Infants and schoolchildren (7 per cent of total) shared a relatively high attack rate of 30 per cent with medical, veterinary, dental and related workers (2 per cent of total), the retired group (3 per cent of total) was least affected - 17 per cent, and the unskilled and unemployed (1 per cent of total) the most affected - 39 per cent.

The smoking habits of travellers were determined for 10,078 (73 per cent) of the total number (Table 3.32 and Figure 3.21). Two thousand seven hundred and eighty-four (28 per cent) were smokers of whom 37 per cent reported illness and their attack rates within group subdivisions ranged from 17 to 80 per cent. Non-smokers accounted for the remaining 7,294 travellers (72 per cent) with an overall 32 per cent attack rate and a range of from 19 to 75 per cent amongst subdivisions. Four of the smaller groups of travellers studied had higher attack rates in non-smokers compared with smokers. Overall the greater percentage of smokers unwell compared with non-smokers is statistically significant ($P < 0.0001$).

The majority stayed in hotel accommodation (44 per cent) and other types were selected by from 2 to 7 per cent of travellers (Table 3.33). The lowest reports of illness (26 per cent) were submitted from those in self-catering accommodation - 7 per cent, and the highest (41 per cent) from those staying at a caravan, campsite, hostel or with friends - 6 per cent.

Very few of the travellers (1 per cent) were abroad for reasons other than a holiday (69 per cent) as shown in Table 3.34. Bearing this discrepancy in mind only 10 per cent of those combining business with a holiday reported illness compared with 31 per cent of those simply on holiday, and 36 per cent of those travelling for other reasons. The reason for travel was not documented by 4,210 (30 per cent) travellers.

Most travellers (57 per cent) spent between 11 and 15 days abroad, 5 per cent spent less than this time and 3 per cent stayed for over 30 days; the length of stay was not recorded for 4,580 (33 per cent) of the travellers (Table 3.35). Those staying abroad the longest recorded the lowest attack rate (23 per cent) and those staying from 16 to 30 days the highest (31 per cent).

Only 4 per cent of travellers were abroad other than during the summer and the same percentage could not be ascribed a season of travel (Table 3.36). Thirty-six per cent of summer travellers reported illness compared with 22 per cent who travelled during other seasons.

As would be expected most travellers reported their pre-travel health as good (68 per cent) of whom 31 per cent recorded illness compared with 46 per cent of those who set off with a pre-existing health problem (2 per cent) - Table 3.37. This detail could not be documented for 4,072 of the travellers (29 per cent).

A single causal factor for illness was given by unwell travellers on 3,908 occasions (74 per cent) out of a total of 5,287 reports (Table 3.38). Of the visitors to Scotland most (34 per cent) blamed the weather for their ill health and the majority (44 per cent) of winter holidaymakers who went abroad blamed drink; in all the other subgroups food was most frequently incriminated. Overall food (48 per cent), followed by drink (20 per cent), emerged as the most frequently reported cause for illness; surprisingly the weather ranked next equal (14 per cent) along with other factors.

Details on the medical management of travellers were collected from 3,049 (61 per cent) of those who were unwell (Table 3.39). The bulk of these reports (93 per cent) were submitted by package holidaymakers studied in 1981 and 1982. Almost a quarter (24 per cent) were confined to bed, 14 per cent required the services of a doctor (9 per cent abroad, 5 per cent after returning), and 61 (2 per cent) were admitted to hospital - almost equally divided between at home and abroad. More unwell travellers were confined to bed and were seen by a doctor in the 1982 group compared with the 1981 group (28: 18 per cent and 18: 8 per cent respectively).

3.7 Studies on the effect of pre-travel health advice (Tables 3.40-42)

In the 1985 study group almost 90 per cent provided details on the use of pre-travel health advice and of precautions taken to minimise illness whilst abroad. Two hundred and nine (32 per cent) sought advice prior to

travelling of whom 77 (37 per cent) reported illness compared to 115 (26 per cent) of those who did not (68 per cent) - Table 3.40.

The travel agent was most frequently consulted for advice and these 133 travellers (22 per cent) reported the least illness (31 per cent); the family doctor was least consulted; paradoxically the 66 travellers (11 per cent) who consulted the family doctor had the highest attack rate (42 per cent) - Table 3.41.

Only 26 per cent of the 401 (62 per cent) who took no precautions reported illness but 34 per cent of those who took precautions (246: 38 per cent) were affected (Table 3.42). However it was apparent from the completed questionnaires that many travellers confused taking precautions with taking medication for illness, rendering these latter results unreliable.

3.8 Legionellosis: antibody status to Legionella pneumophila of travellers, a self-selected group of tourists (Tables 3.43-46)

From 375 travellers who completed the questionnaire 174 (46 per cent) serum samples were examined for antibodies to L. pneumophila. Fifteen (9 per cent) of the samples gave a positive result, i.e., a titre of ≥256 (Table 3.43). Of those tested who stayed in Benidorm, 6 (8 per cent) had a positive result compared with 9 (9 per cent) of those staying elsewhere in Spain. There was no significant difference between sexes in the seropositivity rate.

Of those tested who reported respiratory symptoms either alone or in association with other symptoms 7 (7 per cent) were seropositive (Table 3.44), a lower proportion than the 13 per cent seropositivity of travellers with alimentary illnesses alone or in combination.

Table 3.45 shows a diminishing proportion of seropositivity with increasing age (13 per cent in the 10-29 year age group, 8 per cent in those 30-49 and 3 per cent in those over 50 years old). Smokers accounted for 6 of the 11 positive tests for legionellosis (10 per cent compared with 6 per

cent amongst the non-smokers; Table 3.46).

Of travellers who stayed in hotels, 14 (4 per cent) had a positive test compared with 1 (3 per cent) in self-catering accommodation.

These results require to be interpreted with caution as the group studied were self-selected and not a random sample. As such the percentages quoted could not be regarded as valid for travellers in general but rather as directing attention to areas for further study.

3.8.1 Other groups of travellers (Table 3.47)

A further four random studies were carried out between 1977 and 1980 (**2.1.1**) during which questionnaires were distributed to returning travellers at Glasgow Airport, Edinburgh Airport, and to travellers contacted via travel agents and tour operators. The timing of these studies was related mainly to the logistics of the numbers and distribution network of personnel involved, and other factors such as time of year, rather than in response to 'media' generated publicity.

These groups comprised,

a) Package holidaymakers and other travellers(1977 - 2,211)

b) Winter package holidaymakers (1980 - 263)

c) Package holidaymakers to Romania (1981 - 370)

d) Tourists to Malta at risk from typhoid (1981 - 141)

Out of this total of 2,985 travellers 20 per cent (587) were tested for antibodies to L. pneumophila and no positive results were recorded (titre $\bar{>}256$) - Table 3.47.

Totalling all the samples tested 15 (1.9 per cent) of 761 travellers were seropositive which is similar to the study carried out by Macrae[75] on a general population in Nottingham (none had a titre of $\bar{>}128$).

3.9 Poliomyelitis antibody status of travellers (Tables 3.48-50)

Sera from 40 tourists (20 male and 20 female travellers to Malta) were tested for the presence of poliomyelitis antibodies. Their ages ranged from 18 to 76 years, 33 (83 per cent) aged over 40 years (Table 3.48); 75 per cent of all those studied had antibodies to all three poliovirus types. Of the 40 tourists, 20 per cent had no detectable antibody to poliovirus type 1, 10 per cent none to type 2 and 7.5 per cent none to type 3. Two travellers were triply negative; both were females, one aged 19 and the other 56 years.

From a second group of tourists who experienced a high illness rate (75 per cent) whilst holidaying in Romania in August/September 1981, a further 107 serum samples were tested (Table 3.49). Their ages ranged from 18-83 years, with 54 per cent in the age group over 40. Eighty-five per cent of them had antibodies to all three poliovirus types. Of the 107 tourists 4 per cent had no detectable antibody to poliovirus type 1, 5 per cent had none to type 2 and 8 per cent none to type 3.

In total during the period 1979-1982, 470 serum samples were collected from travellers and tested for poliovirus neutralising antibody (Table 3.50). The ages ranged from 15 to 83 years: 55 per cent were aged 30-60. Eighty per cent were considered immune to poliovirus infection but some in each age group were susceptible to at least one serotype: 2 completely lacked antibody. Antibodies to poliovirus types 1 and 3 were those most frequently absent; 8 per cent and 11 per cent of the travellers had no detectable antibody to these types, while 45 had no antibody to poliovirus type 2.

3.10 Salmonella typhi antibody status of travellers

In the first group studied (travellers to Malta 1981) 40 tourists were screened for typhoid serology (Table 3.51). Twenty-three showed no evidence of immunisation; of those with antibodies to somatic (O) antigens, only one

had not got antibodies to flagella (H) antigens. Only two tourists showed an antibody pattern which might suggest possible infection rather than immunisation. Both had 'O' antibodies at a titre of 80 and 'H' antibodies at a titre of 320.

From a second group of package holidaymakers who visited Romania in 1981 and experienced high rates of illness (75 per cent) a further 121 samples were tested (Table 3.52). Thirty-three of the sera were positive for antibodies to S.typhi although the levels were low, none of the antibodies to somatic antigen being of a significant level.

In total during the period 1979-1982, 79 (25 per cent) of the 312 sera tested for antibodies to S.typhi were positive although the levels were low except in 22 travellers with 'H' antibodies at a titre of 160 or greater (Table 3.53). No serum had an 'O' titre >160. Three sera showed antibody levels which could be diagnostically confusing, two having 'O' titres at 320, and the other an 'O' titre of 40 and an 'H' titre of 640.

3.11 Hepatitis type A: Anti-HAV prevalence in travellers (Tables 3.54, 3.55)

Five hundred and eleven samples were tested (Table 3.54); 64 per cent were anti-HAV positive with a range of from 30 per cent (age group 10-19 years) to 89 per cent (age group over 60 years). There was a rise in seropositivity with increasing age apart from a slight dip in the 50-59 year age group; the averaged seropositivity by cumulative age grouping (both increasing and decreasing) is shown in Table 3.55. The prevalence of anti-HAV in those under 40 years compared with those over 40 years ranges from 40 to 83 per cent. No difference of note was recorded in average seropositivity between earlier (1979) and later (1983) samples.

3.12 Studies on travel associated admissions to Ruchill Hospital during 1985 (Tables 3.56-60)

Out of a total of 1,265 admissions to the infectious diseases wards at Ruchill Hospital from 1st January to 31st December 1985, 71 (6 per cent) were associated with travel abroad (44: 62 per cent male; 27: 38 per cent female) - Table 3.56 and Figure 3.22. Amongst both males and females the most represented ethnic group was Asian (57 and 52 per cent respectively) then Caucasian accounting for 38 per cent of the total of these admissions; Africans were least numerous (7 per cent of the total).

The age range of those admitted was from 4 months to 76 years (range 8 to 25 per cent within age groups), the median age 27 years and the mean 29 years (Table 3.57). The most numerous age group was that aged from 20-29 years (25 per cent) closely followed by the 0-9 age group (23 per cent); 11 per cent of those affected were aged over 60 years. Altogether those aged less than 40 years accounted for 71 per cent of the total number.

Patients were admitted between 1 and 365 days after their return from abroad (median 14 days), the mean length of stay in hospital was 6 days (range 1-41 days), and the total number of hospital "bed-days" accounted for by these admissions was 432 (Table 3.58).

Most of those admitted - 50 per cent, had visited the Indian subcontinent (37 per cent Pakistan: 23 per cent India), of the remainder Spain accounted for 14 per cent, Nigeria 11 per cent, and 16 per cent had visited other countries (Table 3.59).

The two commonest diagnoses were malaria and gastro-intestinal illnesses (27 cases each: 38 per cent), and a range of other diagnoses accounted for the remaining 24 per cent of admissions (Table 3.60). These diagnoses included "viral" infection, pneumonia, pyrexia of unknown origin, hepatitis A and B, typhus, brucellosis, bacteraemia, urinary tract infection, bullous urticaria, influenza, infected bites and sarcoid.

3.13 Study of the pre-travel health advice carried by travel brochures (Tables 3.61, 3.62)

Twenty-two (34 per cent) of the 64 travel brochures (1985 season) studied carried no health information for travellers (Table 3.61). Brochures covering all year round travel (23: 36 per cent) included the highest proportion (83 per cent) with health information. The smallest group of brochures (19: 30 per cent) covered winter travel and had the least health information (53 per cent).

The largest number of brochures (29: 45 per cent) related to European travel and included the lowest proportion with health information for travellers (38 per cent), none of which was specific for the travel destination (Table 3.62). Worldwide travel was covered by 15 brochures (23 per cent), all of which carried health information but only four with specific advice. Altogether 36 brochures (56 per cent) carried general and 7 (11 per cent) specific health information.

Ten of the brochures covered cruise ships, nine sailing all year round and five to worldwide destinations. There was no health information in three of these brochures but all stated that qualified medical and paramedical personnel accompanied the cruise.

CHAPTER 4

DISCUSSION

4.1 Introduction

In this discussion of the results from the studies detailed in CHAPTER 3 a similar order of presentation is used viz. the findings on the missionaries are considered first (**4.2**), then the overall findings from the contemporary groups of travellers (**4.3**), findings from individual groups of contemporary travellers (**4.4**), and finally the conclusions drawn from cumulative studies on the whole group (**4.5**) and also from the smaller related studies (**4.6-12**).

In the final sections the discussion focuses on how the thesis has addressed the general aims of the study (**4.13**), the conclusions and recommendations based on the study findings (**4.14**), and a final summary (**4.15**).

4.2 Studies on Scottish Presbyterian missionaries (1867-1930)

Certain observations affecting missionary service are worth noting prior to detailed discussion of the study findings. It is of interest that almost equal numbers of the missionaries studied served in Africa (612) and India (594), only 15 per cent serving outside these areas. The majority of males (50 per cent) served in Africa, only 34 per cent in India, the converse occuring for females (36 per cent Africa; 51 per cent India). This unequal geographic distribution of the sexes is likely to affect comparative studies amongst the missionary sub-groups on length of service, reason for leaving,

age at death and cause, due to the contrasting climatic hardship between e.g. tropical Africa and sub-tropical India. In addition it seems likely that missionaries with medical knowledge would be in a better position to protect and organise their own health care compared with other groups. Balanced against this is "dedication beyond the call of duty" rendering the doctors and nurses vulnerable to the very problems they are treating in others such as infectious diseases. However it is likely that all the sub-groups would have a proportion with an over-dedicated approach. This may have changed with the passage of time, as reflected in the fewer numbers serving over 40 years post-1900 and the increased percentage of those on short-term contracts.

The majority of females (69 per cent) did not fall within any other subgrouping which compares with 28 per cent of the males - this largely reflects the fact that women could not be ordained in the church at this time.

A further note is that "retiring due to ill health" effected a premature passage to the home country without financial penalty[112]. From insight on the dedication and self-sacrifice of the group as a whole consequent on my research, I am satisfied that any who contrived this situation were more than balanced by those who continued working despite being eligible to return on account of ill health. A final comment is that advances in medical, para-medical and technical knowledge would tend to favour the experience of better health in missionaries appointed at later dates.

The non-ordained male missionary group stands out for several reasons, viz. the largest relative proportion of their number served in Africa (75 per cent), the lowest relative proportions in India (19 per cent) and China (5 per cent), and very few elsewhere (1 per cent). This group had the highest relative proportion of missionaries retiring for reasons other than ill health (66 per cent), of deaths occurring in the 20-29 year (21 per cent) and 40-49 year (29 per cent) age groups, and shared the highest relative proportion for service under 5 years (38 per cent). The group also had the lowest mean number of years of service (13.8) and mean age at death (52.1 in a 20 per cent sample) amongst all the sub-groups.

The findings support the hypothesis that service in Africa was more hazardous to health than service in India, and that less knowledge of health matters adversely influenced the length of service, the age at death and premature death.

In contrast the experience of the smallest subgroup, ordained male doctors, supports the hypothetical converse. Their mission field distribution was more even, Africa - 45 per cent, India - 26 per cent, China - 15 per cent, all other areas 14 per cent. They had the smallest relative proportion serve under 5 years (9 per cent) and the highest over 40 years (15 per cent), of any of the subgroups. This group recorded the highest mean number of years of service (25.1) and paralleling this finding the highest relative proportion of those who died in service (15 per cent) and of those retiring due to ill health (24 per cent) - probably reflecting advancing age and length of time spent in hostile climates. Evidence for this is a relatively high mean age at death - 68.5 (79 per cent in the over 60 age group) - recorded in an 83 per cent sample of the group.

It is of note that ordination for medical men usually followed prolonged service in the mission field which perhaps makes this group a self-fulfilling prophecy.

However, there are marked differences between the two groups, the former being much larger (210) than the latter (47) and being recruited more from an artisan as opposed to an academic background. These differences would affect missionary selection, choice and designation of mission location, Christian motivation and philosophy, and physical, immunological (i.e. the acquisition of differing antibodies from previous exposure to infection) and mental resilience to illness.

Male doctors had the lowest relative proportion (15 per cent) of their group retiring due to ill health and female doctors the lowest (8 per cent) for missionaries who died in service. This further suggests that doctors were less subject to illness and death during missionary service than their non-medical colleagues. Also the lower proportion of deaths amongst female doctors compared with male doctors probably reflects the differing distribution of these subgroups between Africa (11 and 43 per cent) and

India (67 and 33 per cent - former and latter respectively).

Seventy-eight per cent of the male doctors spent less than twenty years in service perhaps reflecting a return to pursue professional careers in the home country or the effect of being the sub-group with the highest relative proportion with family ill health (10 per cent), necessitating return home.

In contrast only 2 per cent of the nurse missionaries returned on account of family ill health, probably as this subgroup was least likely to be accompanied by family. A further contrast is that 69 per cent of female doctors spent between 5 and 39 years in service despite manifesting the highest relative proportion (12 per cent) of any of the sub-groups retiring to marry.

Looking at the influence of mission location on the experience of missionaries, West Africa, Calabar in particular, fits the descriptive historical cliche of "white man's grave". Calabar had the lowest relative proportion of missionaries serving between 20 and 39 years (17 per cent) and for over 40 years (1 per cent), shared the lowest for missionaries retiring for reasons other than ill health (50 per cent; only 38 per cent pre-1900), and was amongst the highest for service under 5 years (34 per cent), for death in service (15 per cent: 22 per cent pre-1900), and for retirals due to ill health (24 per cent: 32 per cent pre-1900). In keeping with this pattern missionaries to Calabar had the lowest mean number of years in service (15.1), the lowest mean age at death (60.2 - 36 per cent of subgroup) and the highest relative proportion of deaths in the 20-29 year (10 per cent) and 30-39 year (21 per cent) age groups.

Livingstonia in Central Africa shared a similar reputation with a 16 per cent mortality rate (29 per cent pre-1900; only 4 per cent post-1900), and 72 per cent serving less than 20 years.

Jamaica has the two highest relative proportions of missionaries returning due to ill health (27 per cent) and for death in service (20 per cent). The main explanation of these findings is that many less robust missionaries were selected for service there as opposed to more climatically rigorous areas, or were semi-retired to Jamaica following ill-health elsewhere[112]. This is further supported by the comparative figures showing

the highest mean number of years of service (30.4), a relatively high mean age at death (69.4 in an 80 per cent sub-group sample), and the lowest relative proportion (7 per cent) serving less than 5 years.

Overall 25 per cent of the missionary total returned on account of personal or family ill health and a further 11 per cent died in service.

As anticipated the average proportions for those appointed pre-1900 are higher for those retiring due to ill health (24 per cent) and dying in service (17 per cent), and lower for those retiring for reasons other than ill health (51 per cent) compared with post-1900 appointees (18, 7 and 63 per cent respectively). This contrast is particularly highlighted during the two decades with the two largest groups of missionaries viz. 1810-1899 (284 missionaries - 15, 19 and 48 per cent respectively) and 1920-1929 (324 missionaries - 15, 4 and 69 per cent respectively) perhaps emphasising the advances in knowledge of health hazards in serving abroad during the 39 year period (1890 to 1929).

The pattern is repeated within the study time periods for the ages at death with the highest relative proportions occurring in younger age groups pre-1900 (15 per cent, 30-39 years and 10 per cent, 40-49 years in appointees between 1880 and 1889) and lower average relative proportions in all age groups post-1900 except one (50-59 years). The lowest relative proportion surviving more than 60 years were appointed between 1880 and 1889 (65 per cent) and the highest between 1900 and 1909 (81 per cent).

These findings show that later appointment coupled with advances in medical knowledge are associated with fewer retirements due to ill health, lower mortality rates in service and longevity in missionaries. Statistically there were no significant differences in the distribution of these findings between Africa, India or the other areas during the pre- and post- 1900 periods, which suggests that all locations benefited equally from medical advances in the later years.

Surprisingly amongst those appointed pre-1900, 10 per cent served more than 40 years compared with just 2 per cent post-1900, the smallest sub-group (103; 1867-1879) having the highest relative proportion - 13 per cent. Apart from identifying these early pioneers as a breed apart in terms

of determination and physical survival, this difference between the two study eras probably also reflects an altered social approach to the time served abroad by missionaries pre-1900 compared with post-1900. In the later appointees missionary service was less likely to be regarded as "for life", and Christian martyrdom became less socially acceptable.

Considering the study period it is not surprising that infections accounted for the majority of deaths in service amongst those in whom a cause was specified and that this was more pronounced pre-1900. Malaria was the single most mentioned cause and was a major influence on the high mortality figures for Central and West Africa. The improvement in knowledge of this disease is shown in the reduction of deaths from 21 to 6 persons after 1900. The higher proportion of accidental deaths (6 persons: 10 per cent) in the post-1900 era is evidence of a war-troubled world as the majority of this group died as a result of civil unrest and vessels sunk by enemy action during the war years. These details were recorded on the card index compiled by Dr. Derek Dow.

In conclusion this comparative analysis on the experience of Scottish Presbyterian Missionaries serving overseas between 1867 and 1929 shows that the year of appointment, the mission station and continent location, and medical knowledge were all influencing factors on the length of missionary service, early retirement on account of ill health, death in service and age at death - the salient study findings are summarised in Table 4.01.

4.3 Conclusions from overall study of contemporary travellers

Bearing in mind the disparity between group numbers - seven of smaller size (20 per cent of the total), two of intermediate size (30 per cent of the total) and two larger groups (50 per cent of the total), and that some groups were self-selected (L. pneumophila study 1977; holidaymakers to Romania 1981) higher response rates (mean 32 per cent) show some correlation with higher attack rates (mean 36 per cent). Comparatively the best examples of this are the Typhoid "at risk" holidaymakers-1981 (77 per cent

response - 40 per cent attack rate) and Package holidaymakers-1985 (20 per cent response - 28 per cent attack rate) as both these groups travelled during the summer and were not self-selected, however group numbers were dissimilar (141 and 726 respectively) and attack rates in general were lower in later studies (**3.2**).

It is interesting to speculate that perhaps some of the media publicity generated by episodes of illness in travellers during the study period heightened the awareness of the problem in travellers and travel agencies, thereby effecting a change of attitude towards the subject with consequent lower attack rates (**1.6**; Appendix II, pages 175-9).

In considering the overall attack rate of 36 per cent there are two comparable studies on illness in travellers, the one was conducted by Steffen and his colleagues on travellers' diarrhoea in 16,568 randomly selected Swiss travellers[113] in whom an attack rate of 28 per cent was recorded; the other by Peltola and colleagues on travellers' illnesses in 2,665 randomly selected Finnish travellers[114] in whom an overall attack rate of 48 per cent was recorded. Whilst these attack rates differ by eight and 12 per cent respectively from my figure the dissimilarities between the studies will account for some of these differences. For example different times of year/years of study and countries visited, ethnically distinct base populations (Scottish, Swiss and Finnish) with different immunity to pathogens[113,114], and cultural differences in attitudes to illness and its prevention.

Nevertheless when other profiles of these groups of unwell travellers are compared e.g. alimentary problems alone (page 91), the age group with the highest attack rate (page 96) and the highest attack rate by country visited (page 97) there is remarkable correlation (Table 4.02).

4.4 Discussion on individual groups of travellers

The earliest group of package holidaymakers (2,211) studied in 1977 set the pattern seen in most of the subsequent studies viz. alimentary symptoms

predominated, the 21-30 year age group was most affected and the older age groups least affected. This may be due not only to infective agents but also to dietary indiscretion and altered intestinal flora. From later studies (page 91) it is apparent that many tourists perhaps took too much advantage of comparatively inexpensive alcoholic drinks or of the availability of food to which they were unused. These factors are likely to be accentuated in younger, more adventurous, and less experienced travellers, and in countries with the greatest contrast in climate and culture to the home country and later studies (pages 88, 98) again tend to confirm these hypotheses.

The occurrence of respiratory symptoms in 1 per cent of the travellers is harder to understand but the congregation of travellers into aeroplanes and hotels may be contributary factors. Whilst there seems to be no special proneness to such infections in those who travel - in contrast to diarrhoeal infections, respiratory viruses affect travellers. The main significance of this is probably that it is in this way that the viruses reach new hosts and thus survive as infectious agents[115]. There is an interesting report in 1979 of an outbreak of influenza aboard a commercial airliner[116]; one passenger, the apparent index case, was ill on the aeroplane, and within 72 hours of the flight, 72 per cent of the 54 passengers became ill with symptoms of cough, fever, fatigue, headache, sore throat and myalgia. Whilst this supports the hypothesis that crowding of travellers contributes to the spread of respiratory infection, it is of importance that in this case the flight was delayed for three hours on the ground during which time most passengers stayed on the plane and the ventilation system was inoperative.

In contrast the next group studied - 375 self-selected tourists responding to media publicity on legionellosis in travellers had a preponderance of respiratory symptoms (reported by 46 per cent altogether) and the age group over 60 years was most affected. Not only did this study and its results demonstrate the power of the media in increasing public awareness of the subject but also how effective these volunteers were in selecting themselves for study according to specific criteria - viz. travel

to Spain (mainly Benidorm) and respiratory problems. This relevance is further reinforced by the results of the serological studies carried out on the group (**3.7**) which showed a relatively high seropositivity to L. pneumophila.

As would be expected in the group with the highest incidence of respiratory symptoms smoking emerged as a risk factor. It is of interest to note that a study in 1979 postulated that a regular supplement of nicotine in the bronchial secretions of a heavy smoker may be sufficient to encourage an excessive multiplication of Haemophilus influenzae[117]. Taken with the evidence that cigarette smoke can reduce the antibacterial capacity of alveolar macrophages[117], increased infection with L. pneumophila could occur in heavy smokers through a combination of susceptibility to bacterial growth and reduced macrophage activity.

In the study on 355 multi-national visitors to Scotland carried out in 1980 the main difficulty, as encountered to a greater or lesser extent in all the studies, was the response rate and the numbers studied. The sample number is relatively limited and is representative only of the travellers who made bookings whilst visiting the tourist information offices in the West of Scotland, and represent only a small proportion of the number of persons receiving questionnaires (1,565) and of the estimated total of 12.9 million visitors to Scotland in 1980[118]. Contacting the traveller presented a particular challenge as the subject of illness on holiday is an unlikely promotional feature for any tourist organisation, nevertheless it was hoped that the information supplied by these travellers would be of help in outlining the pattern of illness in travellers to Scotland.

Compared with the other groups studied this group had the lowest attack rate of 19 per cent. This is not surprising as the majority of visitors (27 per cent) originated from other parts of the United Kingdom and a further 66 per cent from countries with ethnically and culturally similar populations - the U.S.A., non-tropical Commonwealth countries, and Western European countries (Table 4.03). These factors have to be borne in mind when comparing attack rates in visitors to Scotland with those in package holidaymakers to the Mediterranean, along with the influences of differing

sanitation infrastructure, public health controls, food hygiene standards, perhaps a more extreme climate and the tendency to consume a higher proportion of hot cooked foodstuffs in a cooler country.

These same factors probably also account for the much lower rates of alimentary illness and the similar proportions of respiratory and other symptoms recorded by this group compared with the other study groups.

The enquiry into illness associated with winter travel represented 3 per cent of the non-scheduled passenger arrivals at Glasgow Airport during the study period[119]. The conclusions reached were that a package holiday taken abroad in the winter months seems to carry less risk of holiday illness than a comparable summer package holiday but slightly more risk than a summer holiday in Scotland. This may be due to a number of variants, among which are perhaps the differing lifestyles of those undertaking a winter holiday for example more orientated towards active sports, the climate or other factors. In common with summer package holidays abroad, the risk of illness appeared greater the further south the travel, with alimentary illness the predominant hazard and the 21-30 years age group at most risk. This may reflect a more adventurous outlook adopted by the latter group, especially in relation to eating and drinking habits while abroad, or perhaps a relative inexperience of holidays abroad. This information could be of help in formulating medical advice given by the general practitioner as to where and when a patient should travel abroad, particularly if there is a pre-existing health problem.

The next group of travellers was selected for study as they had been at risk of typhoid, a case having been confirmed in a fellow tourist. All stayed at the same relatively isolated beach hotel in Malta at the same time. The proportion (40 per cent) reporting illness out of the 141 who returned the questionnaire is similar to the 43 per cent who reported illness in the group of 2,211 Scottish travellers returning from abroad in 1977. The excess of illness recorded amongst females was not statistically significant. Those reporting alimentary symptoms alone accounted for 30 per cent of the tourists compared with 32 per cent of summer package tourists studied in 1977, 10 per cent of winter tourists in 1980, and 5 per cent of

summer visitors to Scotland in 1980.

Most illness (72 per cent) was reported by the 20-29 year age group, a finding similar to that in the previous surveys of both winter (33 per cent) and summer (55 per cent) package tourists. Although the numbers were small (14) it was notable that 45 per cent of those aged under 20 years reported illness.

In this investigation smoking did not emerge as a risk factor in relation to holiday illness. This corroborates the experience recorded by the winter package tourists and the summer tourists to Scotland. It is of interest that 76 per cent of the 20-40 age group were non-smokers as compared with 58 per cent in the 40-60 year age group. This suggests that the anti-smoking campaign may be making a greater impact on younger age groups.

Problems associated with food emerged as the main reason given by the travellers for their illness. This was also the experience reported by the previous study of summer package tourists.

Eighteen (45 per cent) of the 40 tourists from this group screened for typhoid serology (**3.9**) showed evidence of immunisation. In addition it was disturbing to find that 20 per cent of them appeared to be poorly protected against infection with poliovirus serotype 1 (**3.8**), the serotype most frequently encountered in outbreaks of paralytic disease. Indeed one in four of those tested had no detectable antibody to one or more poliovirus type and were therefore at risk. Looking at the age distribution of those studied it is possible that the older tourists had never received polio vaccination after its routine introduction in 1962, and may never have encountered poliovirus in the wild state. Hopefully this problem may now be resolved with the routine immunisation of younger age groups.

The group of tourists returning from Romania in 1981 attracted attention because of numerous reports of ill health to environmental health authorities. The response rate of 56 per cent compared favourably with most of the earlier studies - summer tourists to Malta (77 per cent), returning winter tourists (28 per cent), and summer tourists to Scotland (21 per cent). Illness affected a notably high proportion of the group and their

concern was emphasised by their contacting the environmental health authorities. Their illness rate (75 per cent) was well above the mean recorded in the previous studies.

Two hundred and eleven (57 per cent) of the travellers were aged under 39 years and recorded the highest illness rate of 82 per cent; the 29 (8 per cent) aged over 60 years escaped relatively unscathed with an illness rate of 38 per cent. This compares with the 21 to 30 years age group who recorded the highest illness rate in both winter (33 per cent) and summer (55 per cent) package tourists previously studied, and the 30-39 years age group in summer visitors to Scotland (24 per cent), confirming that younger age groups appear to be more at risk. Similarly an investigation by Steffen et al[113] of traveller's diarrhoea in 16,568 returning air travellers reported a higher diarrhoea rate in those aged under 30 years (36 per cent) compared with those aged over 39 years (27 per cent). As previously mentioned perhaps younger age groups represent less experienced travellers more likely to be self-indulgent in relation to unusual food and drink or excesive intake. This is supported by the preponderance of reports blaming food and drink as the source of the illness (238: 85 per cent). From the copious subjective information volunteered under the "other comments" section of the questionnaire, there was no doubt amongst the travellers that their problems originated in the area of food and drink supply, handling and preparation.

In keeping with a food or drink related problem there, the 261 reports of ill health which included alimentary symptoms accounted for 94 per cent of illness reports. These compare with alimentary symptoms in 32 per cent of the summer package tourists studied in 1977, 19 per cent of winter tourists, 5 per cent of summer visitors to Scotland, and 30 per cent of summer tourists to Malta in the earlier investigations. Although the numbers were small (39) it was again of concern that 53 per cent of those aged under ten years suffered an alimentary complaint.

Package holiday brochures reveal definite economic advantages in direct holiday flights to certain eastern European countries. This along with the advantage of a convenient local airport is likely to attract those with

larger families including young children, as well as bringing a foreign holiday within the means of more people including less experienced travellers. This investigation suggests that these are the very groups who are more vulnerable to illness, alimentary in particular.

The remarkably high number of reports of alimentary illness may in part be attributable to the tourists visiting a relatively new holiday resort which was less well equipped to cater for groups of tourists than well established resorts. Also to some extent the tourist visiting a recently promoted resort is pioneering contact with an unfamiliar and perhaps wider range of environmental infectious agents. Whilst the hazards of such contact may be the subject of wider publicity in relation to the more familiar holiday destinations the relative lack of information about less well known resorts may lull the tourist into a false sense of security.

In this investigation smoking did not emerge as a risk factor in relation to holiday illness corroborationg the experience of three of the earlier studies.

Although most of the tourists were satisfactorily immune to poliomyelitis, the presence of a proportion (19 per cent) without antibody to one or more poliovirus types indicates that a few are at risk, especially when visiting countries where bowel infections are so obviously actively circulating.

The group of travellers studied in 1981 was the largest single study group (3,906) accounting for 28 per cent of the total study numbers. The response rate was 37 per cent - 5 per cent above the mean for all the travellers, the attack rate 35 per cent (overall mean 36 per cent), and the attack rate was similar for both males and females (34 and 36 per cent respectively). As in the majority of the previous studies alimentary illness predominated either alone (17 per cent) or with other symptoms (12 per cent) and the 20-29 year age group was most affected both in total (47 per cent) and in the first two circumstances mentioned. It was of particular interest that the mean attack rate for those aged under 40 years was almost double that for those aged over 40 years (54 and 28 per cent respectively) with almost identical group numbers - 1,617 and 1,611

respectively. This starkly illustrates the differing experience of illness between these groups which had previously been noted.

The 1,978 travellers returning at Edinburgh Airport in 1982 who completed questionnaires had the lowest attack rate of all the groups of summer holidaymakers from abroad - 25 per cent. There was little difference in attack rates between the sexes (2 per cent), alimentary illness was most frequently reported occurring in 25 per cent of all reports, the 20-29 year age group was most affected (35 per cent) and the over 60 year group the least (12 per cent). The illness "watershed" below and above 40 years of age was less pronounced than in the previous group - 29 per cent compared with a 19 per cent attack rate.

The tour operators produce brochures which are specific to the perceived market in different geographic areas of the country. This is determined by market research analysis and relates to the socio-economic breakdown of the population under study. Thus some different resorts are offered to holidaymakers from the Edinburgh area compared with the Glasgow area. It is interesting to speculate what relationship this may have to the differing attack rates seen in travellers from these respective areas who are also representative of geographically discrete populations in their home country perhaps with differing immune experience.

This difference is highlighted by comparing the experience of the 3,024 travellers who returned questionnaires following arrival at Glasgow Airport over the same study period as the above group. Thirty per cent returned questionnaires, 32 per cent reported illness (24 per cent with an alimentary component), the 20-29 year age group was most affected (39 per cent), those aged over 60 years least affected (17 per cent), and the attack rate was 56 per cent for those aged under 40 years and 29 per cent for those above that age. The proportions of those affected by illness are increased in all categories compared with those studied from Edinburgh and the contrast between those below and above 40 years of age is increased.

The 388 package holidaymakers who completed questionnaires following their return from holiday in Portugal in 1984 were the subject of further study on account of the large number of reports of diarrhoeal illness in

travellers received from travellers, general practitioners, community medicine specialists, and alerts from the Communicable Disease Surveillance Centre of the Public Health Laboratory Services (P.H.L.S.)[103], London, and W.H.O.[104] during August/September of that year.

In view of these investigative circumstances it is not surprising that this group had the third highest mean attack rate - 56 per cent, exceeded only by the group at risk from legionnaires' disease (78 per cent) and summer holidaymakers returning from Romania in 1981 (75 per cent). The group had the second highest attack rate for all illness with an alimentary component - 52 per cent (Romania group - 73 per cent); those aged from 30-39 years were most affected (71 per cent) and those aged over 60 years the least (25 per cent). Again those aged over 40 years (attack rate 39 per cent) fared better than those aged less than 40 years (attack rate 55 per cent).

It is of particular note that the above group and the "Romania" group virtually "demanded" further attention, those returning from Portugal due to the illness reports received from many different sources, and those from Romania due to the attention sought by the travellers themselves. Both groups showed above average response rates and had amongst the highest attack rates both overall and from illness which included alimentary symptomatology. This seems to more than justify mounting this type of investigation both on epidemiological grounds and those of public interest; indeed it is reassuring to find the channels of epidemiological intelligence and the travellers themselves to be such accurate barometers of health problems which are affecting travellers.

The last group to be studied (726 travellers - 1985) had the lowest response rate (20 per cent) of all the groups in which the rate was known. This perhaps represents under-reaction from the travelling public due to over-publicity of the subject of illness in travellers since the studies first began with publication of some of the findings in scientific papers[47,55,59,89,96,100,101,102,108,120,121,122,123,124,125] and comment in the popular press and news media (Appendix II); hopefully it also reflects a better public awareness of the problem with a lowering of the attack rate

and this group recorded the second lowest attack rate for summer travellers - 28 per cent. The converse of the finding of a low attack rate with a low response rate is also seen in the three groups with the highest attack rates viz. 75, 56 and 40 per cent and response rates 56, 38 and 77 per cent respectively, although there are two groups with higher attack rates but an unknown response rate.

Despite the low response and illness rates similar patterns of illness were recorded with alimentary illness being most frequently reported both alone (10 per cent) and combined with other symptoms (8 per cent). The over 60 year age group was least affected by illness (15 per cent) and the 10-19 year age group was most affected (44 per cent). Those aged over 40 years had lower attack rates (mean 10 per cent) compared to those under 40 years (mean 35 per cent) and a more striking comparison in attack rates is seen between those aged above and below 30 years of age (13 and 44 per cent respectively - mean attack rates).

4.5 Conclusions from the cumulative studies on travellers

Overall in the 79 per cent of travellers (10,910) in whom the sex was recorded there was no real difference in attack rates between the sexes (males 31 per cent, females 32 per cent), and in individual study groups the difference between the sexes ranged from 1 to 8 per cent with the larger differences occurring in the smaller studies with 3 per cent or less of the total study numbers. It was therefore concluded that the incidence of illness in travellers was not affected by the sex of the traveller.

Comparing the attack rates for the different study groups higher rates are seen in the more selected groups, this is particularly highlighted in the group concerned about illness due to L. pneumophila (78 per cent attack rate) and is also seen in the other groups who seemed to be particularly at risk from a holiday health hazard (typhoid - Malta 1981, and diarrhoeal illness - Romania 1981, Portugal 1984). It is not altogether unexpected that the more one looks for a health problem in a group of travellers who

appear to be "at risk" either on the basis of subjective or of objective reports, the higher the incidence of illness found compared with other more randomly selected groups of travellers.

With regard to the pattern of illness seen in the different groups by far the major problem encountered by travellers is an alimentary upset, predominantly diarrhoea either alone or with other symptoms. The attack rate borne by any particular group specifically from this type of illness correlates mainly with the overall attack rate i.e. a high overall attack rate is associated with a high incidence of alimentary illness both alone and in combination with other symptoms, and vice-versa. The only exception to this pattern is the L. pneumophila study which was highly self-selected and represents just 3 per cent of the total numbers.

The least represented groups of travellers (those aged less than 10 years and those aged over 60 years; 4 and 9 per cent of the total respectively) had lower than average attack rates (lowest attack rate 20 per cent - those aged over 60 years) and the largest group (those aged 20-29 years) had the highest attack rate (48 per cent). Even in study groups with more evenly distributed numbers the 20-29 year age group is the most affected by illness both in general and by alimentary illness in particular. This age group also emerged as having the highest attack rate in Steffen's study on travellers' diarrhoea[113].

It gives cause for concern that such high attack rates are reported in those aged under 40 years (mean 42 per cent) compared with those over 40 years of age (mean 28 per cent) and that 33 per cent of those aged below 10 years were reported as being unwell. As would be expected the pattern for alimentary illness mirrors the overall illness pattern.

Comparing attack rates in summer and winter travellers there is a substantial difference with just 20 per cent of 342 winter travellers reporting illness as against 36 per cent of 13,474 summer travellers. Even taking only those countries with less disparate numbers of winter and summer travellers there is still a marked difference (U.S.S.R. - 12 per cent and 37 per cent; Malta - 21 per cent and 32 per cent; and Tunisia and Morocco - 32 per cent and 77 per cent, winter and summer rates respectively). The

respective totals for the countries referred to in parenthesis are winter travellers 151 with a 21 per cent attack rate and summer travellers 938 with a 42 per cent attack rate. Based on these more comparable figures as opposed to the overall figures which include the results for many quite different countries some with no winter travellers included for study, the attack rate for summer travellers appears to be double that for winter travellers.

These findings suggest that a package holiday taken abroad in the winter months seems to carry less risk of holiday illness than a comparable summer package holiday but slightly more risk than a summer holiday in Scotland. This may be due to a number of variants, among which are perhaps the differing lifestyles of those undertaking a winter holiday, for example more active sports participants, the warmer climates promoting the multiplication of infective agents, lesser numbers to Mediterranean coastal resorts making less demand on the sanitation infrastructure, or other factors.

Taking the attack rates and the countries visited there is a general trend to higher rates with travel further south and to some extent further east, and this remains generally the same both in summer and in winter. Supporting this trend are the summer attack rates reported by travellers to Romania (74 per cent) and Tunisia and Morocco (77 per cent), and also the winter attack rate reported by travellers to Tunisia and Morocco (32 per cent). Whilst without comparing equal study numbers of travellers matched for age, sex, social class, lifestyle and period of holiday in each country a completely accurate picture cannot be given, it does not seem illogical that the greater the climatic and cultural contrast between the host country and that of the visiting traveller, the greater the risk of holiday illness. In both of the other studies by Steffen[113] and Peltola[114] mentioned earlier, travellers to North Africa emerged with the highest attack rates (57 and 54 per cent respectively) which is in agreement with these findings.

Almost 50 per cent of the total number of travellers studied could be classified into socio-economic groups as defined by the general household survey. The unskilled manual workers had the highest attack rate amongst these defined groups, perhaps due to less knowledge about avoidance of

illness whilst abroad, or the effect of more basic holiday facilities consequent on economic constraints. The converse is not entirely borne out as the professional subgroup had a higher attack rate than the next two groups down the table - perhaps reflecting a higher stress factor or a less restrained holiday lifestyle? It is interesting to recall that amongst the missionaries studied the non-ordinated male missionaries (those with fewer academic qualifications) experienced the highest incidence of premature death and lowest mean number of years of service (page 81).

Taking a more selective subgrouping which accounted for 18 per cent of all the travellers, it was reassuring to note that retired people on holiday were least at risk of illness (17 per cent attack rate) followed by housewives (24 per cent), but of concern that the more vulnerable groups included infants and schoolchildren (30 per cent), and the unskilled and unemployed (39 per cent). It was surprising that the group expected to be most knowledgeable about holiday illness and its avoidance (medical, veterinary, dental and related workers) had an attack rate of 30 per cent.

Comparing attack rates between smokers and non-smokers only those travellers aged over the legal age for smoking (16 years) were considered. Whilst in some of the smaller and more selective groups studied there was a higher attack rate in non-smokers, overall smokers had a higher attack rate than non-smokers - 37 per cent compared with 32 per cent. This would be in keeping with the hypothesis mentioned earlier suggesting that smokers may be more vulnerable due to impaired macrophage activity[117] causing increased susceptibility to infection. Alternatively smoking may be an indirect marker for a group of travellers with a different lifestyle which places them more at risk of illness whilst abroad.

The type of accommodation used by travellers was determined for the majority (64 per cent) and in keeping with the style of promotional literature for package holidays most stayed in hotels - 44 per cent. Whilst the disparity in numbers between the subgroups makes accurate comparison difficult it is of interest that lower attack rates seem to be enjoyed by those not staying at hotels with the exception of the 6 per cent who stayed at a caravan, campsite, hostel or with friends. This again suggests that

economic constraints may prejudice the health of those on holiday.

A reason for travel abroad was given by 70 per cent, and as the studies were confined almost exclusively to non-scheduled (package) flights, less than 1 per cent travelled other than for the purposes of a holiday alone. Comparison is therefore relatively meaningless, suffice to say that of the 77 persons who travelled for other than holiday alone 32 per cent reported illness (holidaymakers - 31 per cent attack rate).

As would be expected from holiday trends, of the 67 per cent with a determined duration for their stay abroad, the majority were away for between 11 and 15 days (57 per cent). Although the disparate numbers within the different groups makes accurate comparison difficult the group with the longest stay abroad (over 30 days) reported least illness (23 per cent attack rate). This may be a group with more experience of travel abroad and hence greater experience in avoiding illness, or perhaps better immunity due to previous exposure to infection.

Of the 96 per cent of travellers for whom the season of travel was known, only 4 per cent were abroad other than during the summer. Accurate comparison is again difficult but attack rates seem to be substantially less during seasons other than the summer and this correlates with the earlier findings comparing summer and winter attack rates for the same countries. Possible reasons for this finding have already been discussed (page 97).

Not surprisingly most travellers set off in good health on holiday (68 per cent) and fared better than the 2 per cent who stated they were unwell prior to travelling (attack rates 31 and 46 per cent respectively; 30 per cent did not give details of their pre-travel health status). Clearly this is a risk that 2 per cent of the travellers were prepared to take or perhaps it was hoped that a holiday would aid recovery. The study findings for this type of holiday suggest that such a philosophy has just over a 50 per cent rate of success.

To ask travellers to state possible reasons for becoming unwell is a highly subjective exercise but this more personal part of the questionnaire showed that an interest was being taken in the traveller as an individual. It was also useful as an insight on the travellers' own opinions about

travel illnesses. It was reassuring to note that the majority of reports implicated either food or drink as the source of trouble (68 per cent of total reports), which is probably a fairly accurate causal assumption, and that this proportion increased in the group with the highest incidence of alimentary problems (Romania 1981, 86 per cent). Clearly the weather is subjectively considered to be of importance in causing illness whilst abroad, but whether this is a direct (e.g. sunburn, heat exhaustion) or an indirect (e.g. dehydration - increased ingestion of fluids) factor, is less easy to establish. However awareness that such factors may be relevant to falling ill whilst abroad is a good starting point for pre-travel health education.

The majority of those who were unwell (61 per cent) provided details on their medical management. Almost a quarter (24 per cent) stated they were confined to bed, a further 14 per cent were attended by a doctor, and 2 per cent required to be hospitalised either abroad or on their return. If these findings are generalised in the manner described in Paragraph **(2.3.2)**, and applied to the total numbers of package holidaymakers for 1984 (Table 4.04) then the following statistics are produced, possible numbers confined to bed as a result of illness whilst abroad - 343,200, attended by a doctor - 200,200, and admitted to hospital - 28,600. This produces some interesting statistics for perusal both with regard to doctors' time and in healthcare economics, especially as the method of calculation is very likely to produce an underestimate of the figures rather than the opposite.

In summarising the findings from these comparative analyses on illness experienced by travellers it is possible to define an 'at risk' profile and this is shown in Table 4.05, the features on the left side being associated with higher attack rates. This can then be used as a basis for formulating relevant pre-travel health advice and also for selective 'targeting' of those groups most vulnerable to illness whilst abroad.

4.6 Findings from smaller studies relevant to travel associated illness

Almost 90 per cent of the 726 travellers who returned questionnaires in 1985 completed the enquiry section on pre-travel health advice taken. Only 32 per cent of these respondents had sought advice of whom 37 per cent reported illness compared with 26 per cent of the rest. This suggests that there is scope for improvement in the quality of advice provided, or that those not seeking advice were more experienced travellers knowledgeable about avoiding illness whilst abroad.

It is of note in this sample that the family doctor was least consulted for advice compared with travel agents or other sources and this has obvious implications in terms of choosing a distribution outlet to provide advice for travellers. It is surprising that the minority who consulted their family doctor for advice reported the highest attack rate, but perhaps this group were the least fit of the travellers and therefore the most at risk of illness. This hypothesis correlates with the earlier finding that those travellers setting off in other than good health had higher attack rates (page 99).

4.7 Findings on L. pneumophila antibody status of travellers

The conclusion reached from these results is that legionnellosis is not a major hazard for travellers who seem to have a similar seropositivity to the general population; sporadic cases and outbreaks of Legionnaires' disease have been shown to occur in travellers[46,62] and in view of the observed predilection for the organism to survive and multiply in warm water (kept below 55^0C and untreated with chlorine or other biocides[126,127].) hotel operators would be well advised to consider introducing measures to minimise this problem (i.e. continuous chlorination and raising the temperature of the water supply to 55-60^0C).

It is of interest to note that in the highly self-selected group with the 9 per cent seropositivity rate a higher proportion of smokers (6persons,

10 per cent), and those aged <40 years (7 persons, 10 per cent), were represented, although the numbers are too small to be statistically significant. This representation correlates with the groups found to be at greatest risk from travel associated illness as described earlier in this chapter, but is at variance with the commonest ages noted in patients with Legionnaires' disease as previously mentioned (**9.2**).

4.8 Findings on Poliomyelitis antibody status of travellers

United Kingdom poliovirus immunisation schemes are approaching their objective of eradication, however serological studies have shown a pool of susceptible individuals who have not received a full course of poliovaccine and/or been exposed to poliovirus[128,129,130]. These individuals are vulnerable when travelling abroad to areas where poliomyelitis is still endemic and constitute a potential source of future infection by importation of the virus. For example during 1984, 24,275 cases of poliomyelitis were recorded by 152 countries in the 6 W.H.O. regions. The annual incidence was lowest in the European Region, increasing through the Region of the Americas, the African, Western Pacific and Eastern Mediterranean Regions to a peak in the S.E. Asia Region, approximately 50 fold higher than in the European Region[131]. The poliovirus immune status of the travellers studied may be an underestimate since current methods equate the presence of detectable antibody with protection of the individual; where no antibody is detectable immunological memory alone may be a sufficient defence[132]. Nevertheless, it was disturbing to find that 20 per cent of the international travellers tested lacked one or more poliovirus antibody, most often those to the serotypes (types 1 and 3) frequently associated with paralytic disease. Looking at the age distribution of those studied it is possible that the older travellers had never received polio vaccination after its routine introduction in 1962, and may never have encountered polioviruses in the wild state. This problem may be resolved with the routine immunisation of younger age groups.

4.9 Findings on Salmonella typhi antibody status of travellers

In the first group of travellers studied who were 'at risk' from typhoid infection, a case having been confirmed in a fellow tourist, 18(45 per cent) of the 40 tourists screened for typhoid serology showed evidence of immunisation, four with 'H' antibodies >320. Although 2 of these had 'O' antibodies at a titre of 80 no clinical evidence of infection was reported to me.

Overall 233 travellers (75 per cent of those tested) had no evidence of successful immunisation against S. typhi despite the fact that at that time immunisation was recommended for most countries in Southern and Eastern Europe, Africa and Asia, and that the majority of visits (13 million; 63 per cent) carried out by British travellers in 1982 were to these destinations[8].

In only 3 travellers could the agglutination reaction be interpreted as indicating possible current infection - 2 with an 'O' titre of 80 and an 'H' titre of 320 (mentioned above in an 'at risk' group) and, less likely the other with an 'O' titre of 40 and an 'H' titre of 640. The latter would be more suggestive of recent immunisation.

There is well documented controversy regarding current D.H.S.S. recommendations on immunisation against typhoid fever[133]. This is based on low attack rates - less than 1 case per 100,000 visitors in Spain and most Mediterranean countries in recent years; on the practicality in terms of healthcare economics and manpower resources in immunising up to 13 million travellers per year, and on the basis that it is not a highly effective vaccine - the best protection being scrupulous personal hygiene in relation to food and drink. The low immunisation levels recorded in this study amongst travellers to countries where immunisation is recommended may reflect a lack of enthusiasm on the part of the profession or of travellers in the light of these facts, or simply the indifference of either of these groups to the recommendations.

These findings suggest that a review of the immunisation recommendations may be a realistic approach to the current situation, as although the 1987 D.H.S.S. leaflet S.A.35 does not now recommend typhoid immunisation for

European and Mediterranean destinations, the U.K. policy making body (The Joint Committee on Vaccination and Immunisation) has yet to make public pronouncement on this subject.

4.10 Findings on the anti-HAV status of travellers

Hepatitis A is recognised as being an infection often associated with travel - in West Germany and Switzerland over 60 per cent of acute cases have a history of recent travel abroad[134] and a similar pattern is seen in West Scotland, although the percentage is smaller (20 per cent)[135]. On account of this it is commonly recommended that travellers have an injection of human immunoglobulin[136] particularly if travel is to a Third World country, the Far East, involves an adventurous lifestyle or exposure to inadequate environmental sanitation. The current cost in the U.K. of a single injection of normal immunoglubulin ranges from £3.00 to £9.00 depending upon the manufacturer and dose (250mg to 750mg i.m. for 6 weeks' to 6 months' protection respectively)[137], and in certain circumstances a fee of £3.45 may be claimed from the Health Board by practitioners[138]. In 1986 the West of Scotland Blood Transfusion Service distributed 1249 vials, the vast majority for the purpose of immunising prospective travellers[139].

The results from the random serum survey of travellers predominantly from the West of Scotland between 1979 and 1983 show the prevalence of anti-HAV in those under 40 years compared to those over 40 years ranges from 40 to 83 per cent and is similar to the results for random testing in blood donors (age range 18-65 years) from the same area and in comparable age groupings (57 and 83 per cent respectively)[140]. These figures suggest that immunity to hepatitis A amongst travellers from the West of Scotland will range between 3 out of 10 for those aged below 20 years rising progressively to almost 9 out of 10 for those aged over 60 years. This also correlates with the efficacy of using immunoglobulin in young persons working abroad (V.S.O. recruits)[141].

The cost of anti-HAV testing ranges from £8.00 down to £4.00 dependimg

on laboratory throughput[142]. Based on the costings shown here the economic benefit of screening before immunising as opposed to immunising the putative traveller at risk rises with increasing age in the traveller, length of stay abroad and frequency of visits abroad. Using such information, Larouze et al. have devised a formula that enables the cost benefit to be calculated[143]. Implementing a selective screening policy also minimises the undesirability of giving travellers unneccesary immunoglobulin, which can be a painful proceedure (due to the volume - 5mls.), on repeated occasions, and makes for effective use of a limited resource.

4.11 Findings from studies on travel associated hospital admissions

The most recently available in-patient data for admissions to the infectious diseases wards at Ruchill Hospital (1985) is a further information source of the pattern of illness in travellers. During the year of study 6 per cent of all admissions to these wards were travel associated; almost twice as many males as females were admitted, and Asian males accounted for greater than one in three of the total. Travel to the Indian subcontinent was associated with 60 per cent of the admissions correlating with the higher attack rate in holidaymakers travelling further south and east. The 14 per cent proportion associated with travel to Spain probably reflects the sheer volume of visitors to that country (36 million from U.K. in 1984)[144] which is by far the most popular destination abroad for British holidaymakers.

The 20-29 year age group had the highest proportion of admissions - the same group most vulnerable to illness amongst the holiday travellers studied, and it gives cause for concern that 23 per cent of the total admissions were aged less than 10 years.

Illnesses with alimentary symptomology accounted for 38 per cent of the admissions, the biggest single group with common symptomatology as occurred in the travellers' study findings. However it is of note that the largest single diagnosis was malaria accounting for 37 per cent.

These findings also correlate with the isolates of pathogens in

travellers received from laboratories, community medicine specialists and environmental health officers and collated at C.D.S.U. by Dr. C Sharp (Table 4.06). Infections associated with inadequate food handling and poor water supply or sanitation account for 86 per cent of the reports. It is also of interest that between 1981 and 1984 there was a 33 per cent increase in the annual total of reports and an increase both absolute and proportionate in the infection reports in holidaymakers (Table 4.07). In each of the four years and cumulatively holidaymakers account for the highest proportion of imported infections followed by business travellers.

The findings from the in-patient study show that there is a real problem associated with travel to the Indian subcontinent which predominantly affects members of the local Glasgow Asian community. This has clear implications for appropriate pre-travel health education to this ethnic group if an impact is to be made in reducing the incidence of travel associated hospital admission particularly in relation to malaria.

In health economic terms the cost for the number of bed days occupied in Ruchill Hospital due to travel associated illness is given as £38,000 for the year of study[145]. As there was a total of 71 such admissions the average cost is £535. If this figure is applied to the total number hospitalised in the U.K. following illness whilst on holiday, calculated earlier (page 100, Table 4.05), then a possible national costing of £15.3 million is reached for 1984. This helps to set the cost effectiveness of competent pre-travel health education in perspective.

4.12 The findings from study of travel brochures for health advice

Most people going abroad from the U.K. travel on inclusive package holidays[8]. Hence the attitude of package tour operators towards the health of their clients while abroad is of prime importance.

In view of the amount of illness associated with travel as evidenced in the earlier findings it gives cause for concern that a third of the 1985 brochures analysed carried no health advice for travellers. Winter

travellers and travellers to Europe were likely to have even less guidance (47 and 62 per cent of brochures, respectively, without health advice). "Specific" health advice was inconsistent. Some brochures carried general recommendations on immunisations, dietary caution, and the use of anti-malarial tablets; others were both more and less specific for the same destination country. Reciprocal health arrangements with the National Health Service were mentioned occasionally.

That all the brochures carried promotional information to help travellers insure against medical misfortune while abroad shows that tour operators are aware of health needs. Given this discrepancy when viewed against the inadequacies and inconsistences in the health information in the brochures studied, there seems to be common ground where health educators and the medical profession could collaborate with the travel trade for the benefit of all concerned.

4.13 The study findings viewed against the aims of the study

The historical aspects of travel with particular reference to Scottish Presbyterian missionaries (1867-1930) show that taking ill on foreign soil is not a new problem, and that less medical knowledge was associated with higher morbidity and mortality as evidenced by comparative analyses between different subgroups and earlier and later appointees. Mortality was influenced by geographic location, and as with the studies on contemporary travellers location also affected morbidity - areas with a more rigorous climate (e.g. tropical Africa compared with sub-tropical areas) being associated with higher proportions affected.

Infections, malaria in particular, accounted for the majority of documented causes of death, and this was accentuated pre-1900 as were the proportions of those dying in service and retirals due to ill health.

Contemporary travellers were affected by illness with an overall attack rate of 36 per cent, alimentary illnesses either alone or in association with other symptoms accounting for the majority of problems experienced.

Younger travellers (aged under as opposed to over 40 years of age), those aged 20-29 years in particular, were more affected and those aged under 10 years shared this experience; both these findings were noted in returning travellers and the in-patient studies. Those aged over 60 years of age were least affected. Although a small sub-group, the unskilled manual and unemployed emerged as the most affected socio-economic group.

In general travel further south and to some extent further east was associated with higher attack rates, travellers to north Africa in particular seemed to fare less well. The same findings were noted in winter travellers but attack rates were substantially lower compared with summer travellers.

Smokers experienced higher attack rates than non-smokers for all types of illness.

Travellers did not seem to be particularly at risk from L. pneumophila based on the serological studies, although a highly self-selected "at risk" group had a 9 per cent seropositivity.

Most travellers were immune to poliomyelitis, but 20 per cent of those studied had incomplete immunity based on the presence of detectable antibodies.

The majority of travellers did not avail themselves of typhoid immunisation as evidenced by the serological findings of those studied.

Travellers' immunity to hepatitis A rose from 3 (those aged less than 20 years), to almost 9 (those aged over 60 years), out of 10 in those undergoing serological testing.

Travel related illness accounted for 6 per cent of all infectious disease admissions to Ruchill Hospital during 1985. Asian males comprised more than one in three of the total, the 20-29 year age group was most represented, travel to the Indian subcontinent accounted for 60 per cent of the admissions, gastro-enteric symptoms were most frequently recorded and malaria the most frequently recorded diagnosis.

The travel agent was the most consulted source for pre-travel health advice and was more effective in terms of attack rate recorded by travellers than other sources amongst those studied. Those who took no advice reported

the lowest attack rate.

More than one in three of the 1985 travel brochures selected for study carried no health information for travellers, those covering winter and European travel had the lowest proportions with health information most of which was non-specific.

4.14 Conclusions and recommendations based on the study findings

The literature study shows that travel is a major growth sector for the populations of the developed countries with important implications for the transmission of infections between different parts of the world. Whilst the majority of illness associated with travel usually comprises a mild diarrhoeal upset which rarely results in more than a mild self-limiting inconvenience, more serious illnesses acquired from abroad continue to be recorded. In view of the almost exponential growth in numbers of international travellers and the emergence of threatening new transmissible diseases capable of a world-wide distribution - the most notable recent example being acquired immune deficiency syndrome, it is essential that there is appreciation of the problem and understanding on prevention amongst travellers, the travel trade and the medical profession.

The historical study of death, illness and patterns of illness amongst Scottish Presbyterian missionaries shows that these consequences of travel are not new, indeed the patterns of illness are not dissimilar to those seen in contemporary travellers, and the benefit from advances in medical knowledge and understanding of disease is clearly reflected in the lowering of morbidity and mortality rates amongst later appointees and those with greater medical knowledge. It is reasonable to expect a similar benefit from effective dissemination of preventative pre-travel health advice to the contemporary traveller.

There seem to be clear deficiencies in the availability, quality, effectiveness, and awareness of current advice for the traveller. Indeed a market research survey conducted by the University of Strathclyde Business

School on behalf of the Scottish Health Education Group in 1985[146] showed an almost total lack of awareness amongst travellers of information on this subject and none of those questioned had knowledge of leaflet SA 35 - the official DHSS publication for travellers. As a result of this survey the following criteria emerged as being of prime importance in the design of literature to address the subject of travel related illness and its prevention,

- readily available and easy to refer to,
- convenient for personal use,
- capable of providing comprehensive information,
- easily portable,
- capable of achieving both individual and widespread distribution.

All travellers should be exposed to pre-travel health advice and as the vast majority make their arrangements with a travel agent this seems to be the key in deciding the optimal location for the distribution of health educational literature. Travel operators could be obliged to provide within their promotional brochures a page/half-page of pre-travel health advice of a general nature which is relevant, uniform, and succinct with direction to sources of specialist expertise for specific or more critical information such as malaria prophylaxis, without being inhibitory to holiday enjoyment or the commercial interests of the trade. In addition the obligatory distribution of a pre-travel health advice booklet based on the criteria detailed above along with leaflet SA 35 at the time of booking a visit abroad would leave no aspect of prevention uncovered. This presents an opportunity for health educators, the medical profession and the travel trade to collaborate for the benefit of all concerned. The costs of such an exercise should be more than recouped when viewed against the conservative costings detailed earlier for some of the components of travel related illness shown below,

- GP consultations,
- laboratory investigations,
- specialist consultations,
- hospital admission,

- drug prescriptions,
- loss of working days,
- loss of vacation days.

In addition there is scope for specifically targeting those groups seen to be at particular risk such as the under 40 year olds but particularly those aged 20-29 years, and the ethnic minorities such as Asians who seem to be particularly at risk from malaria. This presents a challenge to the health educators in terms of design orientation of literature for the younger traveller and provision of information in relevant cultural terms and language.

By way of example I have collaborated with the Scottish Health Education Group in the design of a pre-travel health advice booklet (Figures 4.01-4) which was designed to meet the market research criteria detailed earlier. It is a general pre-travel health advice booklet which directs the traveller to sources of expertise on such subjects as immunisations and anti-malaria tablets; it is airline ticket sized such that it can be carried in existing ticket wallets and is attractively designed to match with the existing "glossy" travel trade literature. There are advice sections directed towards pre-travel, whilst in transit, whilst abroad, and on return, as well as sections for personal use about health and other subjects thereby encouraging the traveller to use and carry the booklet. Initial reaction from travellers and representatives of the travel trade has been very positive.

Turning to the findings which are relevant specifically to the medical profession there is a need to keep doctors aware and up to date on the problems and prevention of illness in travellers. This also has medico-legal importance as evidenced by the now annual examples which are included in the reports from the Medical and Dental Defence Unions of failure to diagnose malaria competently[147], necessitating financial compensation. Information of this type consequent on the study findings are that attention should be directed to ensuring that travellers' immunity to poliomyelitis is fully reviewed and updated if required, and that immunoglobulin for the prevention of hepatitis A should be considered for

those who are likely to be at risk but that pre-injection screening becomes increasingly cost effective for the frequent and the older traveller.

These principles are equally applicable to ensuring travellers are immune to tetanus, diptheria and in those at risk, hepatitis B. Immunisation against typhoid now seems to be of less importance in terms of efficacy and general usage.

As a start towards this goal since 1980, in association with colleagues at Ruchill Hospital, I have contributed to several publications in professional journals on various facets of travel associated illness (detailed on page 94). The publications have been in a range of different journals to try and reach as wide a representation of the profession as possible. In addition for several years now annual symposia held for medical and related workers by the C.D.S.U. and meetings held by the West of Scotland Committee for Postgraduate Medical Education for general practitioners have included the subject of travel related illnesses (Appendix II, pages 187-93). Clearly this programme is fully justified, should continue, and perhaps even be expanded.

A further development is the provision of a computer based information system currently in operation at the CDSU under the supervision of Dr Eric Walker[125] (Figures 4.05-8). This allows approved users access to accurate information on specific immunisations required or advised and malaria prophylaxis on a country by country basis. The information is updated in line with the latest reports collated at WHO, CDC, and CDSU on malarial resistance and other relevant information such as immunisations. The system can be readily accessed using a standard modem linked to a computer. It is an example of the use of modern technology to address the problem of dissemination of accurate, up to date information to the profession on the prevention of illness in travellers. With suitable adaption (removal of medically specific advice) the same system could be made available to the travel trade who already make wide use of computers and modems. Such systems can only expand the availability of the appropriate information for travellers and it is up to the profession and the travel trade to fully avail themselves of this opportunity. This again points to the overlap

between the travel trade, health educators and the medical profession in this field which suggests that a regular dialogue, perhaps in the form of a joint symposium, should be set up.

4.15 Final summary

The growth of travel and the numbers affected by travel related illnesses, some of a serious nature, means that this subject will increasingly demand recognition by the medical profession, the travel trade and travellers.

Provision of appropriate advice for the traveller, which is already available, is a shared responsibility and is best channelled, in the main, through travel agencies and can be shown to be cost effective.

Continued monitoring of illness in travellers and provision of information systems about this problem and its prevention, utilising traditional channels of communication and modern technology currently under development, with ready access for medical and related workers, is fully justified.

Increased collaboration on travel illness between medical workers, health educators and those involved in the travel trade, would be a very positive and efficacious contribution to reducing illness in, and discomfort for, travellers, and the associated expense that this brings to the health services.

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