24 Social Aspects of Diabetes

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Keypoints

Driving

- Potential hazards facing the driver with diabetes include hypoglycemia, visual impairment, and disability from severe neuropathy or leg amputation.
- Hypoglycemia can severely disrupt driving skills by causing cognitive dysfunction and mood changes. Motor skills and judgment can become impaired when blood glucose falls below 3.8 mmol/L, often without inducing hypoglycemic symptoms. Impaired awareness of hypoglycemia is a relative contraindication to driving. Drivers with diabetes must take precautions to avoid hypoglycemia and know how to treat it if it occurs while driving.
- Corrected visual acuity that is worse than 6/12 in the better eye precludes driving in the general population. People with diabetes may fulfill this criterion, but still have significant visual impairment (e.g. field loss, poor night vision and perception of movement) secondary to retinopathy, laser treatment or cataracts.
- In many countries, drivers with diabetes are legally required to declare the diagnosis for their driving license and motor insurance. Failure to do this will invalidate insurance claims.
- Driving licenses are often issued for fixed terms and only renewed following satisfactory medical review. In many countries, insulin-treated drivers are barred from driving passenger-carrying vehicles and large goods vehicles.

Employment

- Diabetes is not a bar to most occupations, and people with diabetes are protected in many countries by legislation against discrimination on the grounds of disability.
- People with insulin-treated diabetes are barred from certain occupations because of the risk of hypoglycemia. These include the armed forces, emergency services, commercial pilots, prison and security services, and jobs in potentially dangerous areas (e.g. at heights, underwater and offshore).
- Severe hypoglycemia in the workplace is uncommon and shift work seldom compromises glycemic control. Depressive illness and poor glycemic control are associated with higher unemployment and sickness absence in people with diabetes.

Prison and custody

- Glycemic control may be suboptimal in prison because of restrictions in diet, exercise and blood glucose monitoring. Intercurrent illness and metabolic abnormalities may not be recognized or treated promptly.
- Input from a diabetes specialist may improve the quality of care. Knowledge of diabetes among prison officers and staff of short-term custodial units is often limited and may be improved by liaising with local diabetes specialist services.

Insurance

- Diabetes should be declared to insurers, who may impose higher premiums or limited coverage. Many insurers' decisions are based on outdated actuarial data or misconceptions about the current prognosis of diabetes. National diabetes organizations can provide details of insurance brokers who do not weight policies against people with diabetes.
- Life expectancy in type 1 diabetes can be modeled from age, sex and the presence of proliferative retinopathy and nephropathy. As the latter is a major determinant of survival, life insurance premiums should be reduced for all those who reach the age of 50 years without renal impairment.

Alcohol

- The association between excessive alcohol consumption, chronic pancreatitis and secondary diabetes is well established. Alcohol excess is also associated with central obesity and poor compliance with medication; both could increase the risk of type 2 diabetes and compromise control of established diabetes. Most epidemiologic studies, however, have demonstrated a U-shaped relationship between alcohol consumption and diabetes, with moderate intake being associated with a lower risk of diabetes.
- In type 2 diabetes, moderate alcohol consumption is associated with a 35% reduction in total mortality and lower risk of cardiovascular disease compared to abstinence. Excessive alcohol consumption is associated with hypertriglyceridemia and resistant hypertension; affected individuals have an increased vascular risk.

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- Ethanol inhibits hepatic gluconeogenesis and increases the risk, severity and duration of hypoglycemia. Alcohol obscures the ability, both of the individual and of observers, to recognize and treat hypoglycemia, and intoxication can simulate hypoglycemia.

Recreational drugs

- Approximately one-third of young people with diabetes use recreational drugs at some time. The most common class of drug taken is cannabis, but amfetamine-type stimulants (including 'ecstasy'), cocaine and opiates are also used.
- Recreational drug use is associated with a sixfold higher risk of death from acute metabolic complications of diabetes. Intravenous drug use is uncommon but is dangerous and is associated with omission of insulin therapy, frequent hospital admissions (usually with diabetic ketoacidosis) and high mortality.
- Cocaine and amfetamine-type stimulants can have profound hemodynamic effects through sympatho-adrenal activation. In addition to an increased risk of cardiac arrhythmias and myocardial ischemia, the sympathetic activation antagonizes the action of insulin and can precipitate diabetic ketoacidosis.

Travel

- Diabetes is not a bar to traveling, but changes in meals, physical activity and antidiabetic drug treatment *en route* and after arrival all need careful consideration. Important issues include travel insurance, medical identification, supplies and storage of medication and monitoring equipment and immunizations.
- During long flights, blood glucose should be monitored frequently and glycemic control relaxed to avoid hypoglycemia. Insulin injection schedules may require in-flight adjustment, especially if the time-shift exceeds 4 hours.

Leaving home

- In the Diabetes UK Cohort Study, "living alone" was associated with a more than fourfold increase in risk of death from acute metabolic complications of diabetes.
- Leaving home is potentially a period of high risk for young people with diabetes; particular concern has been expressed about the welfare of university students with type 1 diabetes.

Diabetes influences many aspects of daily life, principally through the effects of treatment and its potential side effects, particularly hypoglycemia. The development of diabetic complications, such as neuropathy and retinopathy, can also affect everyday activities, particularly when these are severe with clinical manifestations, or require time-consuming treatment such as dialysis for chronic renal failure.

Driving

Driving is an everyday activity that demands complex psychomotor skills, visuospatial coordination, vigilance and satisfactory judgment. Although motor accidents are common, medical disabilities are seldom responsible. Diabetes is designated a "prospective disability" for driving because of its potential to progress and cause complications, while side effects of treatment (principally hypoglycemia) can affect driving performance. In most countries, the duration of the license of a driver with diabetes is period-restricted by law, and its renewal is subject to review of medical fitness to drive. The problems associated with diabetes and driving and the limitations of relevant research data have been reviewed [1,2].

The main problems for the driver with diabetes are hypoglycemia and visual impairment resulting from cataract or retinopathy. Rarely, peripheral neuropathy, peripheral vascular disease and lower limb amputation can present mechanical difficulties with driving (Table 24.1), but these problems may be overcome by adapting the vehicle and using automatic transmission systems.

Despite these challenges, drivers with diabetes do not appear to be involved in more accidents than their non-diabetic counterparts [3]. Population studies have shown no excess in accident rates among drivers with diabetes in Northern Ireland [4], Scotland [5], England [6], Germany [7], Iceland [8] or Pittsburgh in the USA [9], while a large survey of over 30 000 drivers in Wisconsin, USA found only a modest increase [10]. In most surveys, however, incidents were self-reported and probably underestimated, while fatal accidents (in which a diabetes-related cause, such as hypoglycemia, could have had a role) were excluded. Accident rates may also have been lowered by regulatory authorities barring high-risk drivers and by drivers with advancing diabetic complications who voluntarily stop driving [4,5]. Practical advice for drivers with diabetes is given in Table 24.2.

Table 24.1 Reasons for drivers with diabetes to cease driving.

Newly diagnosed people with diabetes, especially insulin-treated, should not drive until glycemic control and vision are stable
Recurrent daytime hypoglycemia (particularly if severe)
Impaired awareness of hypoglycemia, if disabling
Reduced visual acuity in *both* eyes (worse than 6/12 on Snellen chart) – note use of mydriatics for eye examination will affect visual acuity
Severe sensorimotor peripheral neuropathy, especially with loss of proprioception
Severe peripheral vascular disease
Lower limb amputation

Hypoglycemia

Drivers with insulin-treated diabetes often experience hypoglycemia while driving [4,5,11] and this can interfere with driving

Table 24.2 Advice for drivers with diabetes.

Inform licensing authority* (statutory requirement) and motor insurer of diabetes and its treatment
Do not drive if eyesight deteriorates suddenly
Check blood glucose before driving (even on short journeys) and at intervals on longer journeys
Take frequent rests with snacks or meals; avoid alcohol
Keep a supply of fast-acting and longer-acting carbohydrate in the vehicle for emergency use
Carry personal identification to indicate that you have diabetes (and are prone to hypoglycemia)
If hypoglycemia develops, stop driving, switch off engine, leave the driver's seat and then treat
Do not resume driving for 45 minutes after blood glucose has returned to normal (delayed cognitive recovery)

* In the UK, the licensing authority is the Driver and Vehicle Licensing Agency (DVLA), Swansea, SA99 1TU, UK.

skills by causing cognitive dysfunction, even during relatively mild hypoglycemia that does not induce symptoms. Studies of subjects with type 1 diabetes (T1DM) using a driving simulator showed that driving performance often became impaired at blood glucose concentrations of 3.4–3.8 mmol/L, and deteriorated further at lower levels [12]. Problems included poor road positioning, driving too fast, inappropriate braking and causing "crashes" by stopping suddenly. Alarmingly, most did not experience hypoglycemic symptoms or doubt their competence to drive; only one-third treated the hypoglycemia, and only when blood glucose had fallen below 2.8 mmol/L [12]. In the UK, the Driver and Vehicle Licensing Agency (DVLA) does not distinguish between type of diabetes, and the restrictions are based on the use of insulin as therapy, as this can cause hypoglycemia in any person using this treatment. The risk of hypoglycemia in insulin-treated type 2 diabetes (T2DM) rises with duration of insulin therapy.

Judgement and insight become impaired during hypoglycemia, and some drivers with diabetes describe episodes of irrational and compulsive behavior while at the wheel [12]. Hypoglycemia also causes potentially dangerous mood changes, including irritability and anger [13]. In addition, asymptomatic hypoglycemia impairs visual information processing and contrast sensitivity, particularly in poor visibility [14,15], which may diminish driving performance.

Poor perception of hypoglycemia is also potentially dangerous. Many drivers with diabetes subjectively overestimate their current blood glucose level and feel competent to drive when they are actually hypoglycemic [16]. Impaired awareness of hypoglycemia, often associated with more frequent severe episodes, is particularly hazardous and is a common reason for revocation of the driving license. It is not an absolute contraindication to driving if it can be demonstrated, by frequent self-monitoring, that there is prolonged freedom from hypoglycemia [17].

Hypoglycemia is a recognized cause of road traffic accidents, but its true frequency and causal relationship to an accident are often difficult to ascertain. Blood glucose is seldom estimated immediately after a crash, and evidence for preceding hypoglycemia is often circumstantial. Hypoglycemia was the main cause of non-fatal motor accidents in the Diabetes Control and Complications Trial (DCCT); hypoglycemia was three times more common in the intensively treated patients, but the rate of major accidents was no higher, perhaps because of better precautionary advice [18]. Other studies found that the frequency of hypoglycemic episodes during driving correlates with the total number of accidents [4,5,19]. The frequency of hypoglycemia-related accidents is substantially lower than those caused by alcohol and drugs.

Avoiding and treating hypoglycemia while driving

General measures to avoid hypoglycemia are discussed in Chapter 33. All drivers with insulin-treated diabetes should keep some fast-acting carbohydrate in the vehicle: disturbingly, some do not [20,21]. Each car journey, no matter how short, should be planned in advance to anticipate possible risks for hypoglycemia, such as traffic delays. It is advisable to check blood glucose before and during long journeys, and to take frequent rest and meals. Unfortunately, this is seldom undertaken [22]. Driving expends energy and – as with other forms of exercise – prophylactic carbohydrate should be taken if the blood glucose is <5.0 mmol/L [23].

If hypoglycemia occurs during driving, the car should be stopped in a safe place, and the engine switched off before consuming some glucose. In the UK, the patient should vacate the driver's seat and remove the keys from the ignition, as a charge can be brought for driving while under the influence of a drug (insulin) even if the car is stationary. Driving should not be resumed for at least 45 minutes after blood glucose has returned to normal, because cognitive function is slow to recover after hypoglycemia [13].

Many features of hypoglycemia resemble alcohol intoxication, and semi-conscious hypoglycemic diabetic drivers are sometimes arrested on the assumption that they are drunk. Drivers with insulin-treated diabetes should therefore carry a card or identity bracelet stating the diagnosis. Individuals with newly diagnosed insulin-treated diabetes may have to stop driving temporarily until their glycemic control is stable.

Sulfonylureas is the only group of oral antidiabetic drugs that may cause hypoglycemia while driving, and people treated with these agents should be informed of this possibility. While GLP-1 agonists alone are not associated with a risk of hypoglycemia, this may be a problem when used in combination with a sulfonylurea. Blood glucose testing in relation to driving is not a requisite for drivers with group 1 licenses (see below), but may be required for holders of group 2 licenses who are taking this treatment combination.

Visual impairment

In the UK, monocular vision is accepted for driving, provided that the person meets the minimum legal requirement, i.e. is able

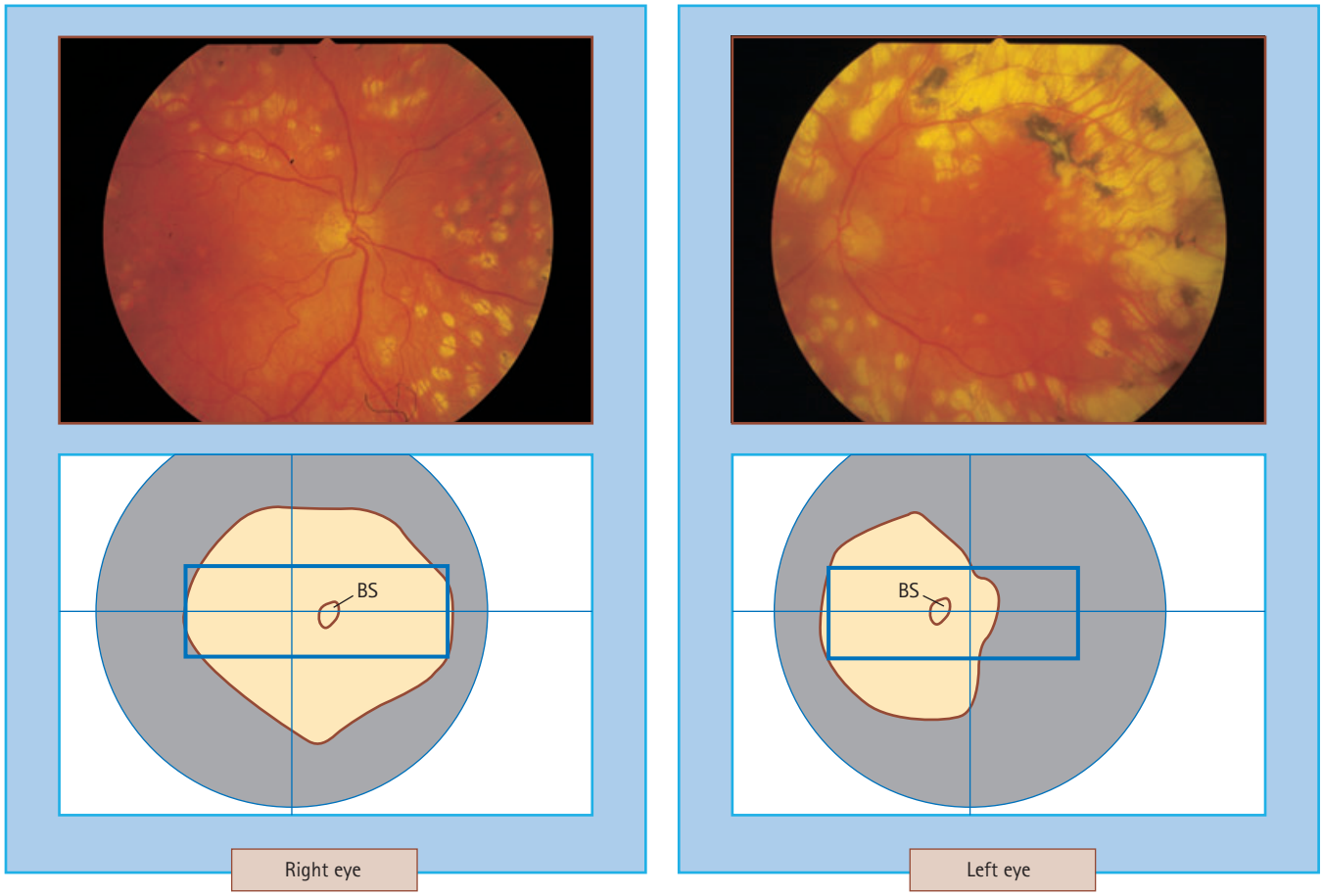

Figure 24.1 Visual field loss caused by photocoagulation. This 60-year-old man with diabetes needed heavy laser photocoagulation to the temporal retina of the left eye, causing nasal visual field loss which caused this eye to fail the standard test for driving. The right eye required less intensive laser treatment and the visual field was adequate for driving. BS, blind spot. Blue rectangle: minimum area recommended for safe driving. Courtesy of D. Flanagan, Addenbrooke's Hospital, Cambridge, UK.

to read a number plate with letters 8.9 cm (3.5 inches) high at a distance of 30 m (75 feet), wearing spectacles if necessary. This corresponds to a distance visual acuity of approximately 6/10 on the Snellen chart. The number plate test has deficiencies: it is poorly reproducible under clinical conditions and does not assess visual fields, night vision or the ability to see moving objects. All of these may be severely reduced by retinal ischemia in preproliferative retinopathy [24], while visual field loss can be caused by extensive laser photocoagulation for diabetic retinopathy [25,26] or macular edema (Figure 24.1) [27]; careful containment of laser burns may help to preserve vision [28]. Cataracts often accentuate glare from headlights, and in such cases driving in the dark should be avoided.

Previous surveys have identified very few drivers with diabetes who would fail the standard eyesight test. Impaired vision is an uncommon reason for the driving license to be refused or revoked [29], although many people stop driving voluntarily because their eyesight is deteriorating. Worsening vision from diabetic (or other) eye disease should be reported by the individual to the licensing authority.

Eye screening is a crucial part of assessing medical fitness to drive. Pupillary dilatation for fundoscopy or retinal photography temporarily reduces visual acuity, particularly if the usual binocular visual acuity is 6/9 or worse [30]. Patients should be told not to drive for at least 2 hours after the use of mydriatics. The driving regulatory authority may request perimetry to assess visual fields (Figure 24.1).

Statutory requirements for drivers with diabetes

In most developed countries, drivers with diabetes are required by law to declare their diabetes to the relevant regulatory authority (in the UK this is the DVLA). The statutory requirements for ordinary and vocational (professional) driving licenses vary considerably around the world; the national licensing authority should be contacted for details.

European driving licenses

Ordinary driving licenses (group 1)

The European Union (EU) States all use the same classification for driving licenses but this is not applicable to other areas. In the

UK, the DVLA must be informed when a person with diabetes applies for a driving license, or if diabetes develops subsequently. Failure to do this constitutes "concealment of a material fact," which can incur a fine [29], and can invalidate a claim to the motor insurers; professed ignorance of the law is not accepted as an excuse. The onus to declare rests with the individual driver, and doctors who provide diabetic care, including general practitioners, have a responsibility to inform patients of this legal requirement, and should offer practical advice (Table 24.2). Drivers with diabetes who are treated with diet alone or with antidiabetic medications do not have to notify the DVLA unless they have visual impairment or other diabetes-related problems that could affect medical fitness to drive. In the UK, a driving license is usually issued for a maximum of 3 years, and is renewed after completion of a medical questionnaire. The DVLA request further medical reports in a few cases, and always when an applicant reports a medical problem that may seriously affect driving (e.g. recurrent hypoglycemia). GLP-1 agonists (given by injection) can be used without restriction, other than when used in combination with a sulfonylurea for drivers with group 2 (vocational) licenses, when this must be notified to the DVLA and requires assessment of medical fitness to drive.

Although the member states of the EU have an agreed policy on restrictions on driving licenses for people with insulin-treated diabetes, considerable variations in policy and practical application exist between countries with respect to the implementation of the recommended regulations and how these are reviewed.

Vocational driving licenses (group 2)

It is extremely difficult to estimate the risk and likely outcome of a motor accident. In the absence of scientific evidence, risk and hazard are gauged by the size of vehicle being driven, which is perhaps not unreasonable, given the potential consequences of a hypoglycemic person losing control of a vehicle weighing several tons.

Most European countries restrict vocational (group 2) driving licenses for people with insulin-treated diabetes. These include category C licenses for large goods vehicles (LGV; previously called heavy goods vehicles) weighing over 7500 kg, and category D licenses for passenger-carrying vehicles (PCV; previously called public service vehicles), or those with more than 17 seats (including the driver's). In 1991, the then European Community (now the European Union) extended group 2 licenses to include small lorries and vans weighing 3500–7500 kg (category C1) and minibuses with 9–16 seats (category D1). Although all EU member states agreed to this policy (2nd European Council Directive on Driving Licences, 91/439/EEC), and presumably enacted appropriate legislation, considerable variations exist in the interpretation and imposition of these restrictions, and in some countries the EU Directive is openly disregarded. A few countries, such as the UK, Sweden and Spain, have robust systems in place to review medical fitness to drive at regular intervals. In the UK, C1 (but not D1) licenses are issued to drivers with insulin-treated diabetes as "exceptional cases" provided specific medical criteria are satisfied. A recent EU directive on driving has recommended individual assessment of all insulin-treated drivers with diabetes who apply for a Group 2 license, so medical fitness criteria will be modified in 2010.

Oral antidiabetic medication is not a bar to vocational driving licenses in the UK. In practice, however, many public transport companies restrict the employment of drivers with T2DM who take sulfonylureas; metformin or exenatide treatment is not a contraindication, but medical assessment is usually necessary. Progression to insulin therapy will terminate the employment of bus and train drivers. Taxi and ambulance drivers are not covered by the statutory regulations. In the UK, taxi licenses are issued by local authorities, which vary considerably in the assessment of medical fitness to drive [32,33], although many have now adopted group 2 licensing standards.

The European approach to vocational licensing has been criticized as being draconian and discriminatory against drivers with diabetes, showing how difficult it can be to balance the civil rights of the person with diabetes against the need to safeguard public safety.

Driving outside Europe

Outside Europe, the regulations in different countries range from a complete ban to no restriction other than a medical examination for prospective or current drivers who require insulin [31]. Differences in approach between countries are influenced by the level of economic development and the prevalence of insulin-treated diabetes; many low and middle income countries impose no restriction on vocational driving licenses for people with insulin-treated diabetes [31]. In the USA, the Federal Highways Administration (FHWA) prohibits drivers with insulin-treated diabetes from driving commercial motor vehicles across state borders [35]. Within most states, drivers with insulin-treated diabetes can drive commercial vehicles except for lorries transporting hazardous materials and passenger-carrying buses.

In most other countries, insulin treatment alone is targeted by legislation, even though hypoglycemia can occur with other diabetic drugs. Interestingly, a Canadian survey of crashes involving truck and commercial vehicle drivers with diabetes revealed an increased in risk for drivers with T2DM treated with sulfonylureas [34], the presumption being that unsuspected hypoglycemia is a causal factor.

Aircraft pilot licenses

The UK Civil Aviation Authority does not allow individuals with diabetes treated with insulin or sulfonylureas to fly commercial aircraft or to work as air traffic controllers. Private pilot licenses can be issued to individuals with diabetes taking sulfonylureas (provided that they have a safety license endorsement), but not insulin. The EU has discussed introducing common airworthiness regulations for pilots with medical disorders.

Employment

With a few provisos, people with diabetes can successfully undertake a wide range of employment. There remains some prejudice

against people with diabetes, but employment prospects in the UK and many other countries have improved with the introduction of legislation that makes it unlawful to treat a disabled person less favorably.

The main concern when considering people with diabetes for employment is the risk to safety associated with the condition or its treatment. Employers often fail to make the crucial distinction between a "hazard" (something with the potential to cause harm) and a "risk" (the likelihood that such harm will occur). The potential problems of diabetes relevant to employment are the hazards of acute hypoglycemia related to insulin and sulfonylureas, poor control of diabetes and the development of serious diabetic complications that may affect ability to work or interfere with performance at work.

Employment is generally restricted where hypoglycemia could be hazardous to the worker with diabetes, their colleagues or the general public. Employment-related issues, however, are not confined to people with T1DM. The rising prevalence of T2DM in the population of working age, along with the increasing use of insulin, has become an issue for occupational health assessment. Access to employment may be limited through discriminatory employment practices and restrictions posed by companies (rather than by legislation) because of perceived problems associated with diabetes or to job-sensitive issues related to the potential risks of hypoglycemia or to visual impairment. Diabetes can also affect employment through increased sick leave and absenteeism and by adversely influencing productivity. Diabetes in general has a negative long-term influence on the economic productivity of the individual; health-related disabilities can cause work limitations, especially in older employees in whom early retirement is more common on medical grounds.

A prospective survey in Edinburgh of 243 people with insulin-treated diabetes in full-time employment found that hypoglycemia occurred uncommonly at work (14% of all severe episodes) and had few adverse effects [36]. The study cohort, however, may have been subject to selection bias in terms of occupational diversity and many had suboptimal glycemic control; surprisingly few participants had impaired awareness of hypoglycemia. For some occupations (e.g. commercial airline pilots or train drivers) any risk of hypoglycemia is obviously unacceptable. Elsewhere, the case for employment restrictions may be less clear-cut.

Jobs that restrict the employment of workers with insulin-treated diabetes are listed in Table 24.3. People treated with insulin are not usually permitted to work alone in isolated or dangerous areas, or at unprotected heights. Shift-work is not necessarily a contraindication: one study in a car assembly plant found no difference in glycemic control between day and night-shift workers with diabetes, although control deteriorated if shift rotas were changed frequently [37].

In one British survey, the prevalence of diabetes in the workforce was 7.5 per 1000, including a lower-than-anticipated rate of 2.6 per 1000 for people treated with insulin [38]. Employment is generally disbarred in the armed forces, emergency work such as fire-fighting, civil aviation, jobs in the off-shore oil industry and in many forms of commercial driving [38]. Workers with diabetes seldom conceal their medical condition from their employers, and any blanket policy that disbars workers with diabetes from a specific occupation may be inappropriate or even discriminatory. Individual assessment is crucial, as employment regulations may not differentiate between different types and treatments of diabetes. Some bureaucratic regulations have been successfully challenged on medical grounds: for example, active fire fighters in the UK and a US air traffic controller were reinstated following appeals against dismissal.

In some cases, entering or persevering with a specific occupation may not always be in the individual's long-term interests (e.g. with the advance of disabling complications). This is clearly a difficult issue, which may require sympathetic medical counseling because of possible repercussions on the individual's income, self-esteem, future quality of life and the financial support of dependants.

Table 24.3 Forms of employment from which insulin-treated people with diabetes are generally excluded in the UK. Data from Waclawski [38] and Waclawski & Gill [56].

Vocational driving
Large goods vehicles (LGV)
Passenger-carrying vehicles (PCV)
Locomotives and underground trains
Professional drivers (chauffeurs)
Taxi drivers (variable; depends on local authority)
Civil aviation
Commercial pilots and flight engineers
Aircrew
Air-traffic controllers
National and emergency services
Armed forces (army, navy, air force)
Police force
Fire brigade or rescue services
Merchant navy
Prison and security services
Dangerous areas for work
Offshore: oil-rigs, gas platforms
Moving machinery
Incinerators and hot-metal areas
Work on railway tracks
Coal mining
Heights: overhead lines, cranes, scaffolding

Unemployment, sickness and diabetes

According to a British survey, employers do not generally believe that diabetes *per se* limits employment prospects, because most workers with diabetes have few medical problems and can tackle a wide range of occupations [39]. Discrimination by employers, however, may affect hiring practices; a US study reported that job applicants who told prospective employers of their diabetes were more likely to be refused than their non-diabetic siblings or individuals who did not declare that they had diabetes [40].

Some British and Dutch surveys reported no apparent excess of unemployment among people with diabetes as compared with the general population [41–44], but other studies in the UK [45,46] found that relatively more people with diabetes were not earning because of inability to work, intercurrent illness, early retirement or by being housewives. Although in many cases there was no apparent reason why an individual with diabetes could not obtain employment [46], depressive illness is strongly associated with unemployment and difficulties with work performance [47]. Adolescents with diabetes appear more likely than their non-diabetic peers to lose jobs, or to fail to follow their desired occupation or cope with shift-work [48]. Reduced employment and income in workers with diabetes in North American have been related to disability, which was seven times more common than among a sibling control group, was mainly related to diabetic complications [49,50] and was associated with lower employment income [51,52]. Sickness absence rates among employees with diabetes are reportedly either similar to, or 1.5- to twofold higher than in non-diabetic workers [40,53–55]. Workers with insulin-treated diabetes and good glycemic control had fewer sickness absences than those with poor control [56]; poor control itself (86 mmol/mol [HbA_{1c} >10%]) is associated with a high rate of sickness absence [57].

Prison and custody

Imprisonment and short-term custody are unusual but troublesome life situations that can interfere with the management of diabetes. Hypoglycemia can occur if food is withheld after arrest, and may be confused with intoxication by alcohol or drugs. Diabetes is generally managed badly in prison because of the unsuitability of prison diets, lack of exercise and the practical difficulty of using some insulin regimens (e.g. basal bolus); also, self-monitoring may be prohibited, and glucose to treat hypoglycemia may be unavailable during long "lock-up" periods. Most prison medical personnel have no specialist knowledge of diabetes and there may be no access to specialist supervision during custody.

Some prisoners with diabetes deliberately manipulate their treatment (e.g. by omitting insulin to induce ketoacidosis to have themselves removed to hospital which arguably offers a more amenable environment [59]). By contrast, treatment of intercurrent illness may be delayed by prison staff, who think that the prisoner is "misbehaving."

In some cases, withdrawal of alcohol, better dietary compliance and weight loss may actually improve glycemic control while in prison, and structured diabetic care can be provided effectively by an attending specialist physician [60,61]. Facilities for people with diabetes in police custody are generally limited, with an inability to measure blood glucose, treat diabetic emergencies or to provide insulin and appropriate meals [62]. A Scottish liaison initiative between a specialist diabetes department and the local police force identified and successfully addressed deficiencies in their custody facilities, including the provision of glucose monitoring equipment and the training of police staff [62]; this has been assisted by the development of a forensic nursing service.

Insurance

In many societies, insurance is viewed as essential to protect individuals and their families from the financial risk of unexpected events or illness, and insurance is often necessary to secure a financial loan, as for house purchase. People with diabetes are sometimes refused insurance or have to accept higher premiums and limited coverage, because the disorder is associated with reduced life expectancy, the risk of complications and greater use of health care services. Several factors are important for insurance underwriting, including the severity and duration of the diabetes, the extent of diabetic complications and other concurrent medical disorders. It is reasonable for an insurer to be cautious in dealing with applicants who have poorly controlled long-standing diabetes and established complications.

There is wide variation in insurance terms and premiums among different European countries [63], in the USA [64] and even within the UK [65], which suggests that insurers work from assumptions about diabetes rather than using scientific evidence from actuarial studies. The presence of T1DM may be the only factor considered by insurers [64], and many still base potentially discriminatory decisions on outdated information that reflects the poor outcome of diabetes diagnosed and treated decades ago. There are no standardized guidelines, nor is there any uniformity in the approach to diabetes and insurance [65], although risk classifications for life insurance have been published [66]. Some companies do not accept applicants with diabetes, while others do so without financial penalty. People with diabetes seeking insurance cover should therefore request quotations from several companies, and should be supported by a medical assessment from a physician who is competent in the specialty. Many national patient organizations have negotiated favorable terms with insurance brokers and will provide details on request.

The prognosis of people with diabetes (particularly T1DM) has improved considerably during the last 50 years, and the impact of this on life insurance for people with T1DM has been analyzed in Scandinavia [67]. In the last 30–40 years, median life expectancy has increased by over 15 years, largely because of substantial reductions in diabetic nephropathy. It has therefore been suggested that life insurance in T1DM should focus entirely on the risk of developing diabetic nephropathy [68], and a model to calculate insurance terms has been proposed, based on current age, age at diagnosis, sex, presence of nephropathy or proliferative retinopathy and other pre-existing disease [67]. As the risk of nephropathy falls after 25 years of diabetes, all people who reach the age of 50 without nephropathy should have their insurance premium reduced. This approach has been adopted by most insurance companies in the Nordic countries, and by some in other European countries. To avoid penalizing people with dia-

betes, there must be regular updating of mortality and life expectancy data, and this information must be transmitted to actuarial advisers and insurance underwriters.

People with diabetes also face higher premiums for accident insurance, which is unjustified because there is no evidence that they have more accidents or permanent disability than the general population [69]. Neither is there any rationale for higher motor insurance premiums [64,65,70], particularly for those not treated with insulin, because no excess in road traffic accidents has been demonstrated (see above). A US study of the insurance cost of employees with diabetes showed that while health care expenditure was three times higher than all health care consumers, it was not more expensive than other chronic illnesses such as heart disease, asthma and cancer [71].

Diabetes must always be disclosed to the insurer: concealing the diagnosis constitutes the withholding of a material fact, which nullifies the contract with the insurer and thus the insurer's liability in the event of a claim.

Alcohol

Many people enjoy drinking alcohol and diabetes should not be a barrier to social drinking. Accumulating data suggest that moderate alcohol consumption not only reduces the risks of developing T2DM but improves metabolic control and restricts diabetic complications. By contrast, alcohol can promote hypoglycemia and chronic excessive consumption may be deleterious both to long-term diabetes management and general health.

Alcohol consumption and risk of diabetes

Chronic high consumption of alcohol can predispose to the development of secondary diabetes. Alcohol has a direct toxic effect on the pancreas resulting in both acute and chronic pancreatitis. Diabetes complicates about 45% of cases of chronic pancreatitis (see Chapter 18). Insulin treatment is usually required to control hyperglycemia in patients with chronic pancreatitis, although diabetic ketoacidosis is rare. This may be because the pancreatic damage also destroys the α-cells that secrete glucagon, which is an essential factor in ketogenesis (see Chapters 13 and 34). A heavy alcoholic binge, with concomitant low food intake, can result in alcoholic ketoacidosis.

By contrast, modest alcohol consumption appears to protect against T2DM, reducing risk by up to 30% [72,73]. A U-shaped relationship has been observed between alcohol consumption and risk of diabetes, such that heavier drinkers and those who abstain from alcohol share a similar risk of developing T2DM (Figure 24.2). In epidemiologic and clamp studies, moderate alcohol consumption is associated with enhanced insulin sensitivity, which in part may be a consequence of reduced central adiposity [74]. Such epidemiologic data, however, may not provide an accurate assessment of risk for very heavy drinkers who tend to be underrepresented in such studies.

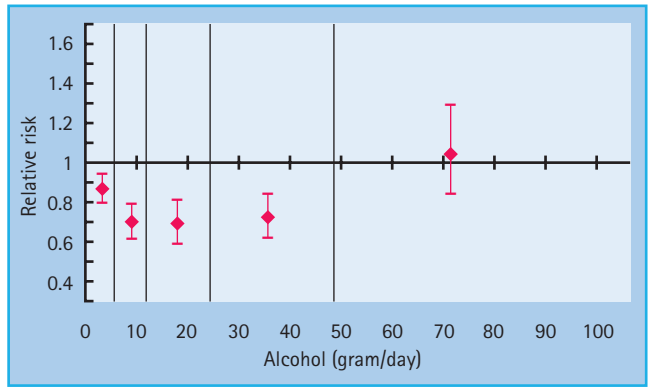

Figure 24.2 Pooled relative risk estimates for development of type 2 diabetes (with 95% confidence intervals) for five alcohol consumption categories (demarcated by the vertical lines) from 15 prospective studies. The categories are: ≤6 g/day; 6–12 g/day; 12–24 g/day; 24–48 g/day and ≥48 g/day. Reproduced from Koppes *et al.* [73], with permission from American Diabetes Association.

Alcohol and glycemic control

Hypoglycemia

Ethanol has marked metabolic effects on the liver, which metabolizes over 90% of an alcohol load. Gluconeogenesis is suppressed, even at blood alcohol levels that are not usually associated with intoxication [75–77], while the processes of recycling carbon as glucose and lactate between hepatic gluconeogenesis and muscle glycolysis [76] and fatty acid oxidation are also inhibited by alcohol. Thus, alcohol has the potential both to predispose to hypoglycemia and to inhibit glucose recovery. In non-diabetic individuals, total hepatic glucose production is not reduced by alcohol, despite the inhibition of gluconeogenesis [77], and alcohol-induced hypoglycemia only occurs if hepatic glycogen stores are already depleted; for example, by fasting for at least 36 hours [78].

In people with diabetes, alcohol consumption may impede recovery from insulin-induced hypoglycemia. This effect is often delayed, occurring up to 24 hours after alcohol ingestion and may occur during the night or the following day [79]. Those with a deficient glucagon response to hypoglycemia (see Chapter 33) may be at greater risk, because they are unable to increase hepatic gluconeogenesis. The signs of hypoglycemia may be missed or mistaken for those of alcohol intoxication by the individual or by observers and even moderate alcohol consumption increases the cognitive impairment that occurs during hypoglycemia [80]. People with insulin-treated diabetes should be advised not to drink *any* alcohol before driving.

Overall, alcohol is an important contributory factor to many episodes of hypoglycemia in people with diabetes – an estimated 20% in one study [81]. Hypoglycemia-induced brain damage is rare, but when it occurs, it is often preceded by excessive alcohol consumption, which presumably promotes protracted neuroglycopenia. Severe hypoglycemia caused permanent neurologic damage after binge drinking in five alcoholic patients with insulin-treated diabetes, two of whom died [82].

Hyperglycemia

Excessive alcohol consumption is associated with central obesity [83], which may be a consequence of the adverse lifestyle factors that tend to accompany high alcohol intake. It should also be noted that alcohol provides 7 kcal energy per gram (1 unit = 10 g alcohol) in an easily consumable form and can therefore provide a substantial caloric intake, particularly as beer and lager. This is a commonly overlooked source of calories in obese, middle-aged males with T2DM, who are having difficulty in achieving weight loss by dietary means. The caloric content of spirits is much lower but may be augmented by adding sugar-rich mixers to drinks. Low-carbohydrate beers and lagers (such as Pilsner) have been marketed as being suitable for patients with diabetes but should not be recommended because of their high alcohol content.

Heavy drinking has also been linked with poorer compliance with medications, outpatient follow-up and self blood glucose monitoring [84,85]. Despite this, and the association with increased central obesity, excessive alcohol consumption does not appear to be associated with poorer glycemic control. Indeed, in one large registry study, a linear inverse relationship was found between glycemic control and alcohol consumption [86]; however, the same caveat applies to these data with respect to very heavy consumption.

Alcohol and diabetic complications

Moderate alcohol consumption in people with T2DM is associated with a 35% reduction in total mortality compared with non-drinkers (i.e. a similar magnitude to the effect of moderate alcohol on the risk of developing T2DM) [87]. High alcohol consumption (more than 18 g/day) is not associated with any excess mortality, and indeed cardiovascular mortality and incident coronary heart disease are lower than in non-drinkers (Figure 24.3). These favorable effects of alcohol consumption

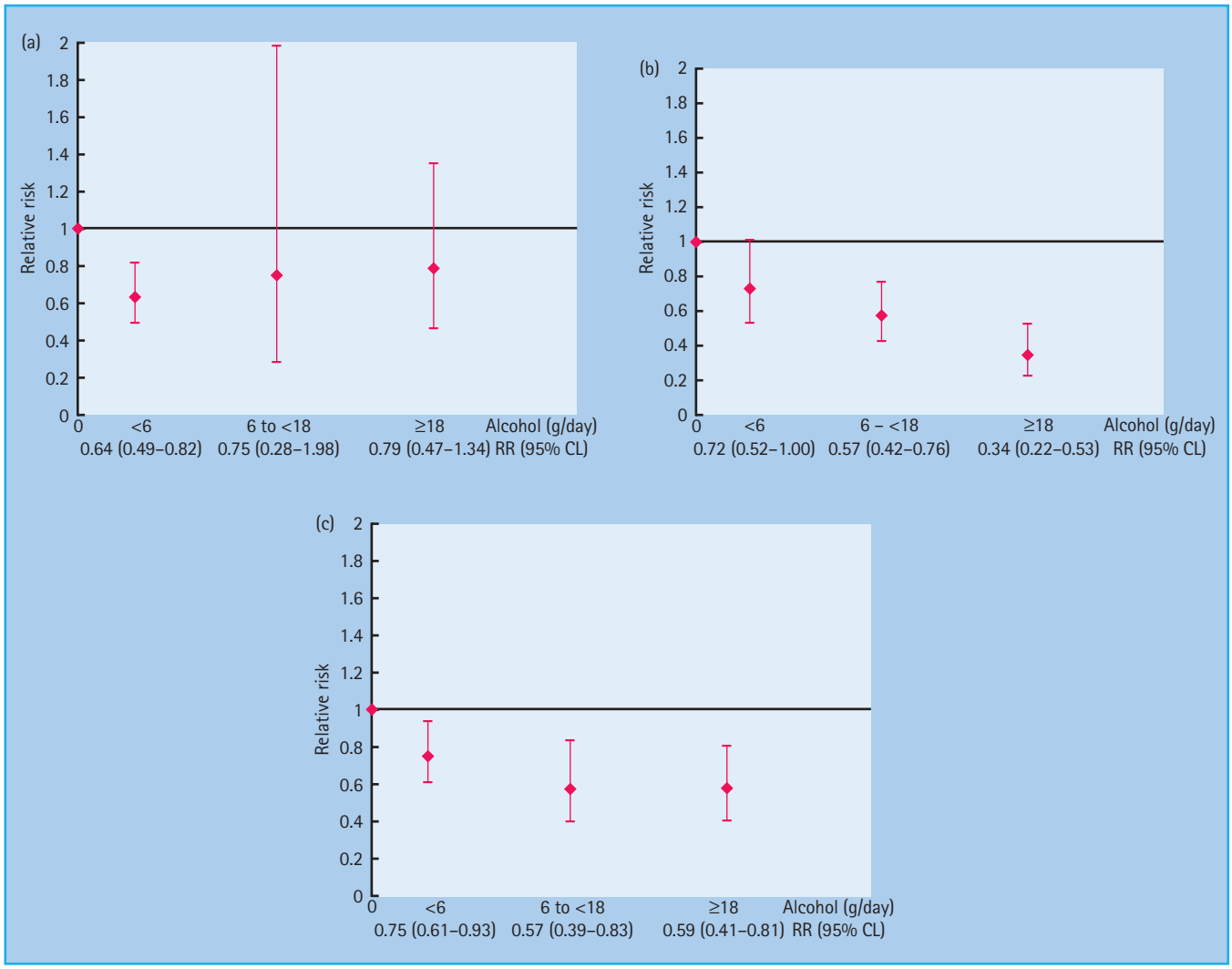

Figure 24.3 Pooled relative risk estimates (with 95% confidence intervals) of: (a) total mortality; (b) coronary heart disease mortality; and (c) coronary heart disease incidence for three alcohol consumption categories, with non-drinkers as the reference. Reproduced from Koppes *et al.* [87], with permission from Springer-Verlag.

may be a consequence of enhanced insulin sensitivity, lower blood pressure and favorable changes in lipids and hemostatic factors [74]. These observations do not include data on substantive numbers of very heavy drinkers and it is well established that excessive alcohol consumption increases serum triglyceride concentrations in susceptible individuals and raises blood pressure; excess alcohol consumption is an important cause of hypertension failing to respond to treatment (see Chapter 40). It might be anticipated in such individuals that cardiovascular risk would be higher [88].

With regard to microvascular complications, a U-shaped relationship is again observed between risk and alcohol consumption [89]. Moderate consumption (30–70 g/week) is associated with a 40% reduction in risk of proliferative retinopathy and neuropathy in T1DM, and over 60% reduction in risk for macroalbuminuria. Conversely, chronic excessive consumption of alcohol in people with diabetes is associated with peripheral neuropathy and exacerbation of neuropathic symptoms [90] and also with erectile dysfunction.

Recommended alcohol intake

Diabetes UK recommends that women with diabetes should drink no more than 2 units of alcohol per day and men no more than 3 units. Guidelines issued by comparable organizations in other countries are broadly similar. Although these limits have been chosen arbitrarily for the non-diabetic population, it seems reasonable to apply them to people with diabetes as well. The general advice given to people with diabetes regarding alcohol is summarized in Table 24.4.

Table 24.4 General advice on alcohol for people with diabetes. Reproduced with permission from Diabetes UK.

Moderate amounts of alcohol can be drunk shortly before, during or soon after a meal without affecting short-term blood glucose control and can be beneficial for the heart
Alcohol should never be drunk on an empty stomach as the alcohol will be absorbed too quickly
Alcoholic drinks should not be substituted for usual meals or snacks as this may cause hypoglycemia
Severe hypoglycemia can occur with larger quantities of alcohol, particularly when taken by people treated with insulin and especially if insufficient carbohydrate has been eaten
Hypoglycemia may occur up to 16 hours after heavy drinking
Observers may be less aware of hypoglycemic symptoms when a person with insulin-treated diabetes has been drinking; some form of diabetes identification should be worn. A hypoglycemic episode can be confused with drunkenness
Continuous heavy drinking can lead to raised blood pressure
All types of alcoholic drinks contain calories and may contribute to weight gain or failed dietary effort
Drinking alcohol can worsen neuropathy and aggravate associated symptoms
Drinking low carbohydrate beers and cider offer no benefit because of their higher alcohol content
Low alcohol wines are often higher in sugar than ordinary ones, so intake should be restricted
Mixer drinks should be "diet" or "sugar-free" such as diet tonic water and diet cola
Drinking and driving should be avoided.

Recreational drugs

Use of recreational (illicit) drugs is a serious problem in the general population, but can pose particular difficulties for people with diabetes [91]. The main classes of drugs involved are cannabis, amfetamine-type stimulants (including "ecstasy"), cocaine and opiates, with cannabis being the most commonly used drug by far.

Regulation

In the UK, drugs that are associated with dependence or misuse are regulated under the Misuse of Drugs Act, 1971. This Act grades drugs according to harm associated with misuse and specifies controls over manufacture, supply and possession (Table 24.5). The Misuse of Drugs Regulations, 2001 define the classes of individuals who are authorized to supply and possess controlled drugs and lay down the conditions under which these activities may be carried out. Drugs are classified under five schedules, which specify the requirements governing import, export, production, supply, possession, prescribing and record keeping. Cannabis and lysergide (LSD) classified as Schedule 1 as they have no medicinal use, while opiates, cocaine and amfetamine are

Table 24.5 Classification of controlled drugs. Data from UK Misuse of Drugs Act 1971.

Class A includes:*
Cocaine
Diamorphine (heroin)
Methadone
Methylenedioxymethamfetamine (MDMA, "ecstasy")
Morphine
Opium
Pethidine
Class B includes:
Oral amfetamines
Barbiturates
Codeine
Cannabis
Class C includes:
Most benzodiazepines
Ketamine
Zolpidem
Androgenic and anabolic steroids

* Includes Class B substances when prepared for injection.

classified as Schedule 2 and as such are subject to full controlled drug requirements.

Prevalence of recreational drug use

On a global scale, approximately 5% of adults aged 15–64 years (208 million people) use recreational drugs on at least an annual basis and 2.6% (112 million people) use such drugs on at least a monthly basis [92]. In the UK, drug abuse is more common in men and in people under 25 years of age [93]. Approximately one-third of adults have used recreational drugs at least once in their lifetime and approximately 10% over the previous year [93]. Trends in recreational drug use have changed in recent years with a decline in the use of LSD and solvents and an increase in the use of amfetamine-type drugs and ketamine, particularly associated with the night-club and "rave" culture.

Data specifically about the use of recreational drugs by people with diabetes are sparse. Two uncontrolled questionnaire surveys of young adults with T1DM, one from the USA and one from the UK, have reported a similar prevalence and pattern of recreational drug use to that observed in the general population [94,95]. In the UK survey, approximately 30% of respondents had used recreational drugs, with cannabis (28.2% of respondents), amfetamine-type stimulants (13%) and cocaine (12%) being used most commonly [95]. Many (15% of respondents) used more than one drug. A report from Chile has suggested that use of recreational drugs was lower in school-aged adolescents with T1DM than in the general population (9.6% vs 22.2%), although this difference disappeared during later years at school [96]. The prevalence of recreational drug use in people with T2DM is low, which reflects the pattern in adults of similar age in the general population [97].

Impact of recreational drug use on diabetes

In the Diabetes UK Cohort Study, acute metabolic complications (diabetic ketoacidosis and, to a lesser extent, severe hypoglycemia) were the most common causes of death in adults with T1DM under the age of 30 years, closely followed by accidents and violence [98]. In that study, a history of previous drug abuse was associated with a nearly sixfold increase risk of death from acute complications. Drug misuse has also been identified as a major cause of death in young people with T1DM [99]. Substance abuse co-occurring with mental illness is associated with a particularly high mortality [100].

Intravenous drug abuse

Recreational drug use often disrupts normal lifestyle and a person with diabetes may abandon the daily routine of regular meals and insulin injections. Recreational drug use may also be only one aspect of a chaotic lifestyle associated with other high-risk behaviors. This can result from the use of any recreational drug, but intravenous drug abuse (particularly of opiates, but also amfetamines) is particular damaging and is strongly associated with poor social support, criminality and mental illness. Intravenous drug use is uncommon in people with diabetes (as it is in the general population), but is associated with omission of insulin therapy, frequent admissions to hospital and high mortality, both from diabetic ketoacidosis and deliberate or accidental opiate overdose [101]. Unsurprisingly, intravenous drug abusers with diabetes may also present with complications related to the route of drug administration: deep venous thrombosis and abscesses at groin or limb injection sites. Intravenous drug abusers often default from outpatient clinic attendance (this may be associated with imprisonment) and maintaining contact with such individuals is usually difficult.

Cocaine and amfetamines

Cocaine and amfetamine-type stimulants can have dramatic effects on the cardiovascular system through activation of the sympathetic nervous system [102]. Cocaine is a sympathomimetic that inhibits reuptake of norepinephrine and dopamine at sympathetic nerve terminals. Amfetamine and ecstasy potentiate the release of norepinephrine, dopamine and serotonin from the central and autonomic nervous systems. Cocaine toxicity may be potentiated by cannabis, while amfetamine toxicity is enhanced by alcohol. Drug-induced sympathetic activation leads to tachycardia, vasoconstriction and hypertension. Myocardial ischemia and infarction, supraventricular and ventricular tachyarrhythmias, and severe hypotension can all occur. Prolonged use can result in a dilated cardiomyopathy. The sympathetic activation produced by these drugs antagonizes the action of insulin and cocaine use has been identified as an independent risk factor for diabetic ketoacidosis [103]. The risk of diabetic ketoacidosis may be increased by the omission of insulin before discos and parties to avoid the potential risk and embarrassment of hypoglycemia.

Ecstasy is also associated with severe hyponatremia, secondary to inappropriate secretion of antidiuretic hormone, which may complicate the management of diabetic ketoacidosis [95].

Cannabis

Cannabis is not known to affect glucose metabolism but its effects on the central nervous system may increase appetite and impair recognition of hypoglycemia. Use of cannabis in low doses is associated with sympathetic activation and tachycardia; at high doses, parasympathetic activation may predominate, resulting in bradycardia and hypotension. In the absence of any structural heart disease, these effects are usually well tolerated.

Hypoglycemia

While the association between recreational drug use and diabetic ketoacidosis is well established, there are few data suggesting any association with hypoglycemia. Such drugs, however, are often taken in conjunction with alcohol and may be associated with poor oral intake of carbohydrate both of which will increase the risk of hypoglycemia. Moreover, amfetamine-like stimulants can induce frenetic behavior at night clubs and raves which can induce hypoglycemia in people treated with insulin [104]. The

hallucinatory, or central nervous system, depressant effects of recreational drugs may impair an individual's ability to recognize and treat hypoglycemia. Furthermore, the sympathomimetic effects of cocaine and amfetamine-type stimulants may mimic the autonomic signs and symptoms of hypoglycemia.

Advice on recreational drug use in diabetes

Illicit drugs cause significant morbidity and are hazardous for people with diabetes. Their dangers must be emphasized to people with T1DM (particularly teenagers and young adults), but advice must be given in a sensitive and non-judgmental manner. When exposed to recreational drugs and alcohol, modest reductions in insulin dosage and regular consumption of carbohydrate-based snacks or non-alcoholic sugary drinks are required, particularly if strenuous dancing is to be undertaken. In such situations, dehydration occurs and water should be drunk regularly.

Travel

Diabetes must not be regarded as a bar to short or long-distance travel, although careful planning may be required to avoid metabolic disturbances and other problems of diabetes that could have particularly serious consequences away from home. Diet and an adequate fluid intake may be disrupted while traveling or staying abroad, and local differences in climate, food, endemic diseases and medical facilities may compromise diabetes control. Blood glucose levels should be monitored frequently during travel and holidays, and people with diabetes must be able to take a pragmatic approach to deal with contingencies (e.g. loss of insulin, delays during travel) that could perturb their diabetes. Occasionally, specific diabetic complications or other medical disorders such as uncontrolled hypertension or ischemic heart disease can jeopardize health and safety during travel and periods away from home.

Preparation for travel

Personal identification

Travelers with diabetes should carry a doctor's letter stating the diagnosis and treatment, and ideally some other form of identification such as the "Medic Alert" bracelets or necklaces or "Medi-Tag" labels (these contain personalized medical information and are recognized worldwide). These should also allay the suspicions of airline security, immigration and customs officials who discover syringes and drugs in luggage. Many national diabetes associations provide an identification card that shows the patient's photograph, doctor's name and contact telephone number. Diabetes UK issues a card with the statement "I have type 1 diabetes" in five different languages.

If a prolonged stay abroad is intended, it is useful to carry a prescription letter listing all medications (with generic names, as brand names often vary between countries), insulin-injection devices and blood-testing items.

Insurance and medical care abroad

Comprehensive medical insurance is essential to cover accidents and illness that require medical assistance, and loss of medical equipment and drugs. The insurance policy must cover diabetes and other pre-existing medical conditions, as claims relating to these may otherwise be rejected. Most travel policies contain exclusions, which frequently include diabetes; a person with diabetes may not be covered for conditions such as a stroke or myocardial infarction for which diabetes is a recognized risk factor. When appropriate, insurance must be adequate to cover any dangerous sporting activities (when hypoglycemia could be particularly hazardous), and the costs of emergency air transport home in the event of a serious accident or illness.

Most countries in the EU provide emergency medical attention free or at reduced rates to visitors from other member states, although immediate payment for treatment may be demanded in some countries, such as France. Travelers from the EU can obtain a form (E111) in their home country, which confirms their entitlement to this scheme, although full medical travel insurance is still recommended. Those planning to stay in an EU country for over 6 months will require an E112 form. Some non-EU countries (e.g. Australia and Russia) offer free or reduced-rate medical care for EU members. Details are given in leaflet SA30, obtainable from travel agents and government departments. In the USA, emergency medical treatment can be extremely expensive, and insurance premiums are correspondingly high. A list of insurers who do not load premiums against people with diabetes can be obtained from national diabetes associations.

Irrespective of medical insurance cover, it should be appreciated that emergency medical care available in some countries is suboptimal or even potentially dangerous for a diabetes-related emergency. In some parts of the world, insulin is not readily obtainable and intravenous fluids are in short supply. These considerations may influence the choice of holiday destination for people with diabetes.

Drugs and equipment

Essential items for the diabetic traveller are listed in Table 24.6.

- *Immunization.* Routine recommendations should always be followed for the relevant destination. Occasionally, a severe reaction to a vaccine may cause a temporary rise in insulin requirements.
- *Medication.* Air travelers treated with insulin should carry an ample supply in their hand luggage. Preferably, another supply of medication should be carried by a relative or friend in case of loss or theft. When traveling by air, medication and blood monitoring equipment should not be consigned to the hold, because of the risk of losing luggage. During travel, insulin can be carried in an insulated cool bag or a pre-cooled vacuum flask. People on CSII should carry insulin pens as a back-up in case of pump failure and the contact details of the pump manufacturer so that a replacement can be ordered.

Table 24.6 Checklist of essential items for travelers with insulin-treated diabetes.

Documents
Diabetes identity card/bracelet
Document stating diagnosis and treatment
Blood glucose monitoring diary

Equipment
Insulin vials or cartridges
Syringes and needles/pens and spare pen needles
Flask or cool bag for insulin storage
Blood glucose meter; spare meter and batteries
Finger pricker and spare lancets; container for used needles
Blood glucose strips (visual reading)

Fluids
Glucose free drinks (screw-top container)
Bottled water (plastic container)

Hypoglycemia treatment
Quick-acting carbohydrate:
- Glucose drinks (screw-top container)
- Glucose tablets/confectionery

Slow-acting carbohydrate:
- Biscuits or cereal bars

• *Blood glucose monitoring.* Extremes of temperature and high altitude can disable some blood glucose meters and affect the accuracy of blood glucose test strips, although the cabin pressure of passenger aircraft (equivalent to an altitude of up to 8000 feet) should not pose problems [105]. While on holiday, it is sensible to carry a spare meter and/or visually read glucose strips in case the meter fails.
• *Other considerations.* Those prone to motion sickness should take an anti-emetic to prevent nausea and vomiting from disrupting glycemic control. Antidiarrhoeal agents and a broad-spectrum antibiotic should be carried, particularly if traveling to regions with a high risk of acquiring gastroenteritis. People with peripheral sensory neuropathy should take comfortable and appropriate footwear for travel and for holiday use, as foot ulceration may be caused by wearing ill-fitting sandals or walking barefoot across rocks or even hot sand.

Long flights and crossing time zones

These pose several potential problems, ranging from the timing and composition of airline meals to ensuring that insulin dosages will cover the flight and adjust to local time on arrival.

Meals

Times of serving in-flight meals after take-off can usually be obtained from the airline. Meals can either be regarded as snacks or as main meals, depending on the travel schedule. Some airlines provide so-called "diabetic" meals but these are mainly intended for people with T2DM and are small and low in carbohydrate [106], thus increasing the risk of hypoglycemia. Vegetarian meals may be more suitable for people with T1DM, as they often contain pasta-based dishes or rice. In-flight meals can be supplemented with the patient's own supply of suitable carbohydrate, but it is impractical to carry large quantities, not least because of the limits of what foods may be imported into many countries. Allowance may have to be made for delayed flights or long intervals between meals, while fatigue or travel sickness may blunt appetite.

Alcohol

Drinking alcohol before and during air travel is best avoided because of the risk of hypoglycemia; also, the diuretic effects of alcohol favor dehydration, which has been implicated in deep venous thrombosis and pulmonary embolism during long-haul flights (although diabetes does not appear to confer greater risk) [107]. Water or non-alcoholic sugar-free drinks should be drunk liberally.

Blood glucose

Blood glucose levels should be monitored frequently while in transit and when changing time zones. It is often safer to allow in-flight blood glucose values to be slightly higher than usual to avoid the risk of hypoglycemia.

Insulin treatment

There is no evidence-based information on how to adjust insulin dosages during flights that cross several time zones, and this probably accounts for the variability in the advice that is given [108]. Each case should be discussed individually with the patient, taking into account the duration of the flight and the change in time zone, the usual insulin preparations and dosages, the size and timing of meals, and the results of glucose monitoring. Some general guidelines are suggested in Table 24.7 and Fig. 24.4.

Guiding principles are:
• Do not aim for strict blood glucose control while flying. A few hours of mild or moderate hyperglycemia (e.g. 10–13 mmol/L) will do no harm and, as long as glucose levels are monitored regularly, it is safer to reduce usual insulin dose and use small additional insulin dosages rather than risk hypoglycemia.
• Blood glucose levels should be checked every 2–3 hours.
• Time changes of less than 4 hours in either direction usually need no major adjustment of the usual insulin schedule: simply give the next dose of insulin at its usual clock time, using the destination's time zone.
• Westward flights lengthen the "day." Give the next dose of delayed-acting or premixed insulin at its usual clock time (using the destination's time zone) or adjust the insulin infusion rate using an insulin pump. If this injection is delayed by more than 12 hours, then additional insulin with food will be needed in the interim. The most convenient way to do this is with small doses (usually a few units) of soluble insulin or a rapid-acting analogue,

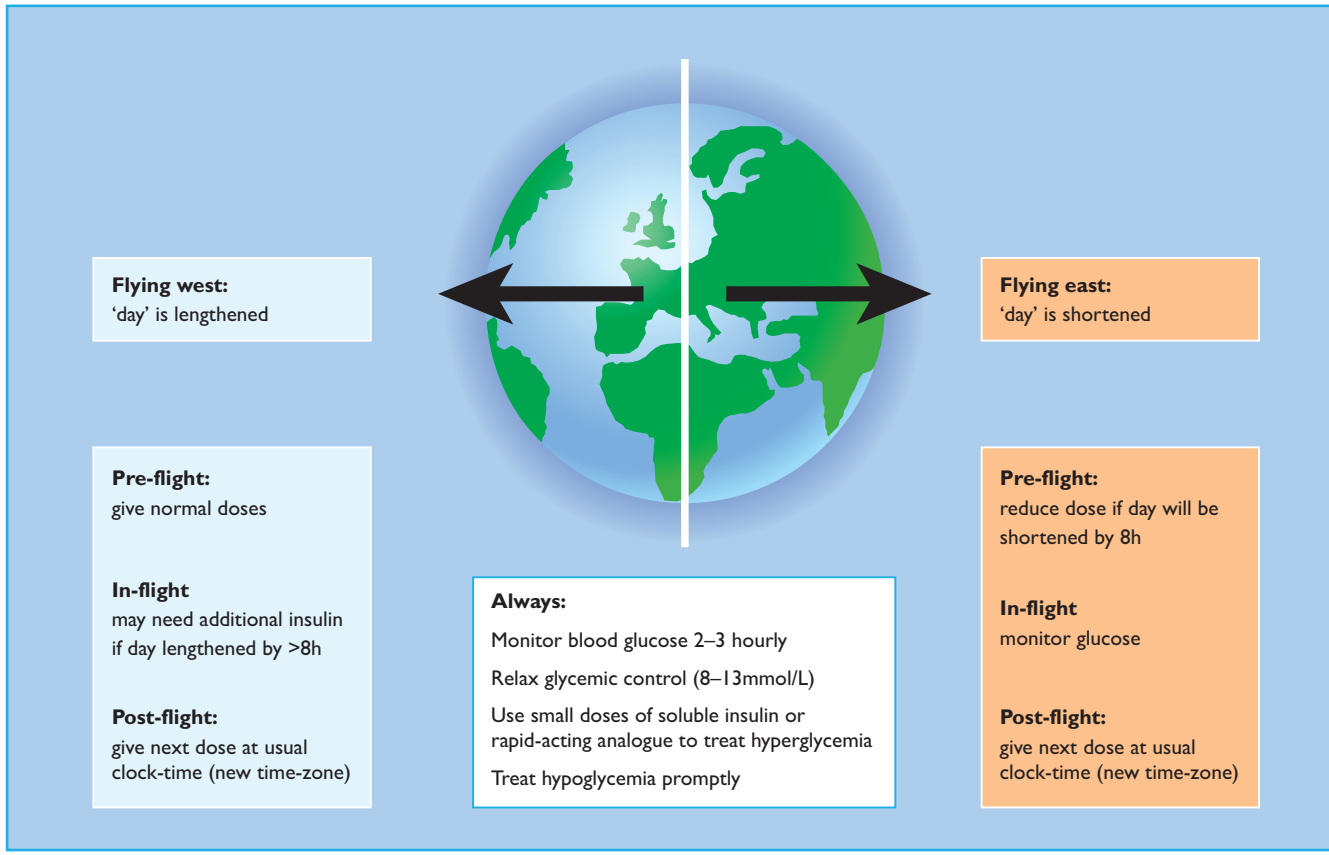

Figure 24.4 Scheme for adjusting insulin dosages during flights that cross time zones.

Table 24.7 Management of diabetes during long-distance air travel.

Obtain advice from the diabetes clinic before traveling
Obtain essential information, including the local time of departure, flight duration and local time of arrival
Inform the airline that you have diabetes, especially if treated with insulin
Carry extra supplies of carbohydrate
Anticipate that delays may occur
Time zone travel may necessitate two consecutive morning or evening insulin doses, before and after the flight
Ensure that you can monitor your blood glucose frequently during travel
Do not strive for meticulous control of blood glucose while traveling
Adjust insulin doses if necessary

injected every 4 hours or so on the basis of blood glucose measurements.

• Eastward flights shorten the "day." The next dose of delayed-acting or premixed insulin should again be given at its usual clock time (destination time zone), but because this injection will effectively be earlier than usual, the previous dose of delayed-action insulin should be reduced if the interval between the injections is less than 12 hours.

• Extremely long flights with a time shift of 12 hours or more may require two "morning" or two "evening" insulin dosages to be injected consecutively, before and after the flight.

• Any additional insulin needed to fill in long gaps between delayed-action injections or to correct hyperglycemia is best given as small doses of soluble or a rapid-acting analogue, ideally using a pen injection device.

Oral antidiabetic agents

Additional doses are not usually required to cover an extended day.

Insulin treatment in hot climates

A patient's insulin requirements may change markedly in different countries, the main factors being differences in diet and daily physical activity. Subcutaneous insulin absorption can be accelerated by high ambient temperatures, such as in a sauna (see Chapter 27), and this effect has variable clinical significance in very hot climates.

Modern formulations are quite stable, but sometimes denature if exposed to high temperatures and shaken; in this case, discolored particles or a granular appearance (distinct from the normal cloudiness of delayed-action preparations) may be seen

when the insulin is resuspended. Sometimes, there are no visible changes, but the insulin appears to lose its effect, with the usual dosages failing to lower blood glucose. Particularly in hot countries, insulin is best stored in a refrigerator; if one is not available, insulin can be protected by a damp flannel or a porous clay pot containing some water or wet sand, placed in a cool part of the room. Even these measures may be unnecessary, as most insulin preparations can survive being kept at 25°C or more for up to 6 months, and will retain most of their biologic activity [109].

Food and drink

When traveling abroad, it is essential to know the basic form of carbohydrate that is eaten locally, and useful to learn to judge quantities of foods such as pasta or rice. Items selected from local menus can be supplemented with bread, biscuits or fruit. Sugar-free drinks are difficult to obtain in many countries but bottled water is safe and usually available.

Quick-acting carbohydrate to treat hypoglycemia should always be carried and stored appropriately: dextrose tablets may disintegrate or set hard in hot and humid climates unless wrapped in silver foil or stored in a suitable container, while the temperature-dependence of chocolate is well known. Cartons of fruit juice cannot be reused once opened; a plastic bottle with a screw top is preferable. Sealed packets of powdered glucose may be the best option for hot damp climates.

Traveling companions should carry a supply of quick-acting carbohydrate (and glucagon) for emergency use, and should know how to test the patient's blood glucose and how to treat hypoglycemia.

Intercurrent illness

Any intercurrent infection should be treated promptly and appropriately, with adequate replacement of fluids and carbohydrate in the form of drinks if possible. Insulin therapy must never be discontinued and dosage may have to be increased, and blood glucose should be checked every 3–4 hours, with testing for urinary ketones is possible. The "sick-day" rules described in Chapter 27 should be followed.

Recreational activities

The impact of physical exercise and sport on diabetes is discussed in Chapter 23. Patients need advice about strenuous and unaccustomed exercise during holidays, such as beach sports or prolonged and vigorous dancing. Swimming alone should be avoided. The risks of alcohol and recreational drugs have been described above.

Leaving home

As a child with diabetes grows up, inevitably parental input to the day-to-day management of diabetes is reduced with increasing autonomy of the adolescent. In teenage years this is often manifest by a deterioration in glycemic control (Chapter 52). Even in adolescence, parents or guardians still have a very important role with the provision of regular meals and in the recognition and treatment of hypoglycemia, particularly at night. Therefore, the eventual move away from the parental home can pose problems, especially if the individual with T1DM is living alone and if they move to another town. Social isolation may exist until new friends are made and access to alcohol and recreational drugs may increase, with the attendant risks that have been highlighted. Sexual activity may commence or increase, introducing issues of sexual health and pregnancy, and novel forms of exercise may be more readily available. On leaving the parental home, individuals often become removed from the familiar support of the health care professionals in their local diabetes centre and initially do not have the similar contact and immediate access to advice from doctors and nurses about diabetes – precisely at a time it may be most needed. It is a disturbing fact that "living alone" was associated with a more than fourfold increase risk of mortality from acute metabolic complications of diabetes in the Diabetes UK Cohort Study [98].

Students with diabetes

Particular emphasis has been placed on the welfare of students with T1DM who have left home to attend university or college. In part, this has been because of high-profile instances where individuals with T1DM have died shortly after commencing university [110]. Several surveys have suggested that students do find diabetes more difficult to manage, although this does not necessarily translate into a rise in glycated hemoglobin concentrations [111–116]. Barriers to diabetes control include fear of hypoglycemia, diet, irregular schedules, lack of parental involvement, limited finances, recreational drugs and alcohol. There is a natural desire for students with diabetes not to appear different from their peers and this may lead them to assign a lower priority to diabetes management than they would normally and to undertake potentially high risk activities.

Diabetes services need to be responsive to the needs of adolescents and young adults who are leaving home. Such individuals are often poorly informed about the inherent risks associated with, for example, alcohol and drugs [95,116] and these and other needs may not be addressed in the context of a routine diabetes consultation [115]. Before the individual leaves home, a formal re-education program should be offered in which alcohol, drugs, exercise, sex and sick-day management are discussed [117]. Individuals leaving home need to think about their mealtimes; it can be difficult for someone living alone to motivate themselves to prepare substantial meals and many adolescents have limited cooking skills. Regular meals are provided in university halls of residence, but the nature and content of the food, particularly the carbohydrate content, may not be ideal. Students should be advised to monitor blood glucose levels frequently during examination periods. Many students report that studying and undertaking examinations can cause marked fluctuations in glucose levels – this may partly be associated with stress or varying carbohydrate intake. Both acute hypoglycemia and hyperglycemia

impair cognitive function and can cause mood changes and may affect examination performance adversely. Therefore, students should try to optimise glucose control during examinations and ensure that a supply of rapid-acting carbohydrate is available during an examination.

Many students may prefer to remain under the care of their "home" diabetes team, but it is important that they know how to contact local specialist diabetes services in the university town for advice or assistance. Medical practitioners in university health services have a duty to ensure that students with diabetes are offered regular diabetes follow-up. The student should be encouraged to confide at an early stage with a reliable friend or colleague about their diabetes and the potential problems that may arise [117]. This may cause embarrassment talking to recent acquaintances about having diabetes. University authorities have a pastoral responsibility for students with diabetes [111].

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