Cystic fibrosis-related diabetes (CFRD) differs from type 1 and type 2 diabetes, but has similar characteristics (Moran et al, 2010). As life expectancy has increased for people with cystic fibrosis (CF), CFRD and its inevitable complications are becoming more prevalent. The CF Trust (2004) guidelines suggest that all people with CFRD are screened annually for complications. This article reports on a screening programme for CFRD complications performed at a centre for adults with CF, where 38% of individuals have CFRD. The study demonstrates that annual screening for CFRD complications is important. A formal screening process should be adopted by all centres for adults with CF in an attempt to improve the care of this growing subgroup of people with CFRD.

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Background to study
Liverpool Heart and Chest Hospital is a regional centre in the North West of England with approximately 260 individuals with CF; ninety-nine of these individuals require insulin, either continuously or intermittently, and have been diagnosed with having CFRD. The CFRD service is led by a CF nurse specialist trained to degree level in the care and management of diabetes (BA [hons] in specialist practice) as well as having completed a training session relating to foot screening. The other CF nurse specialists as well as the specialist dietitians and pharmacists have also been trained to care for individuals with CFRD in an attempt to deliver specialist holistic care.

Methods
CF nurse specialists were trained to screen for complications of CFRD using a set protocol that included HbA1c, cholesterol level, liver function tests (LFTs), albumin:creatinine ratio (ACR), inspection of injection sites, foot screening and blood pressure. In addition, individuals were asked to attend local retinal screening. Participants who were drivers were asked whether the DVLA had been informed about their use of insulin. Individuals’ management of hypoglycaemia and hyperglycaemia were discussed, as was how they were coping with a second medical condition in addition to CF.

Results
A total of 68 individuals (69% of the available population) with CFRD were screened during 2009–10. Some of the other individuals had already had screening at their local GP practices or diabetes centres, but as the results were not available they could not be included in this audit. In addition to this, there were two individuals who had not attended the clinic for over a year.

The 68 individuals with CFRD were aged 17–42 years; 36% were male and 64% were female. Each diabetic complication was audited, and the results were as follows.

“The measurement of HbA1c in cystic fibrosis-related diabetes is viewed with caution, as it is not the most effective way to diagnose individuals and can be prone to false-negative results because of the increased red cell turnover in individuals with cystic fibrosis.”
Evaluating screening for long-term complications of cystic fibrosis-related diabetes

HbA1c
There are no specific targets for HbA1c in CFRD; therefore, the standard NICE guidance (NICE, 2002) is followed, with a target level of <58 mmol/mol (<7.5%). The audit found that 12 individuals (18%) had HbA1c levels ≥58 mmol/mol (≥7.5%; Figure 1).

Cholesterol
According to NICE (2008), the minimum acceptable standard for total cholesterol is ≤5 mmol/L, with the target for people with diabetes being <4 mmol/L (Joint British Society Guidelines, 2005). Three individuals were identified as having a cholesterol level >5 mmol/L (Figure 1), which is surprising as most individuals with CF have fat malabsorption. Figueroa et al (2002) reported that individuals with CF have lower cholesterol levels than normal. As individuals with CF are encouraged to have a high-calorie, high-protein diet and require 150% of the calories a person without CF would require, this complication may need to be addressed in the future, especially as individuals with CF have increasing longevity.

LFTs
It is already known that the liver plays an important role in the regulation of carbohydrate homeostasis, which can affect blood glucose control. In individuals with CF, the liver is an organ that can be affected by the condition, which can lead to cirrhosis. It has also been identified that liver disease can be a risk factor for the development of CFRD (Minicucci et al, 2007); therefore, LFTs have been added to the annual complication screening programme in order to identify individuals who may be predisposed to CFRD or who may prove difficult to control post-diagnosis. In our sample we had a total of 17 individuals (25%) with raised LFTs (Figure 1).

Microalbuminuria
It has been debated whether microalbuminuria is an appropriate screening marker for CFRD, as assessed by ACR. Considerations in individuals with CF include having a low muscle mass, resulting in reduced urinary creatinine and elevated urinary albumin, increased urine albumin excretion caused by infection or sepsis, and concurrent renal disease as a result of nephrotoxic use of intravenous antibiotics. CF-related factors, such as a low muscle mass, may result in the ACR being a less sensitive tool for the detection of microalbuminuria (Dobson et al, 2005).

Taking all of these factors into consideration for the audit, a spot urine sample was obtained from participants in the morning for ACR. Eleven individuals (16%) had significant microalbuminuria; five were not screened because of continuous intravenous antibiotic use, as the drugs used are often nephrotoxic and could make the results unreliable.

Lipohypertrophy
At screening, individuals’ injection sites were examined, and advice was given regarding rotation of sites and size of needle. Some individuals with CFRD use insulin only intermittently, such as when on steroids or unwell; others are managed effectively on once-daily basal insulin. It is surprising that even with a relatively small sample, six individuals (9%) had developed lipohypertrophy. As individuals with CF live longer, many more may develop this complication.

Foot checks
The CF nurse specialists were trained by a podiatrist to check foot pulses, colour, temperature and detection of any problems, including the use of a microfilament test to assess sensation. Microvascular complications, in particular peripheral neuropathy, have been reported in individuals with CFRD with similar prevalence rates to people with other types of diabetes (Swartztenberg et al, 2007). In this audit there was one individual with existing peripheral neuropathy, who had been diagnosed with CFRD 11 years ago (Figure 1).
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Retinopathy screening
Retinopathy screening could not be carried out during the screening visit as there is no ophthalmology department at the trust. Eye screening was discussed at the annual screen, and a letter was given to the individuals asking them to attend their local retinopathy screening centre. In addition to this, the GPs were sent a copy of the results and asked to check whether the individuals were involved in the retinopathy screening programme.

The results of eye screening were only known for 22 individuals (32%), as results had not been sent to the authors’ clinic. Retinopathy was never thought to be a significant problem for people with CF, because of some protection offered by endogenous insulin production and because these individuals have less hyperlipidemia and hypertension (Moran et al, 2010). Alarmingly, the authors identified five individuals who had developed proliferative retinopathy requiring treatment (Figure 1).

Driving
Out of a total of 52 drivers from the sample, 19 (37%) had not informed the DVLA that they required insulin injections (Figure 1). On further questioning, individuals who developed CFRD displayed confusion on diagnosis. This was partially because some individuals only require insulin during exacerbation of illness during infection or if prescribed oral steroids.

Psychological issues
CF and its treatment burden can be challenging, and having the extra diagnosis of CFRD can have a huge impact on individuals. Annual screening gives an opportunity to discuss how individuals are coping generally, regardless of the duration of their CFRD. In addition to this, involving a CF clinical psychologist at the diagnosis of CFRD is of paramount importance, providing guidance and support; often individuals have found the extra diagnosis of CFRD overwhelming. At annual screen, individuals are asked how they are coping both physically and mentally with their diabetes and are offered extra support by means of a home visit, psychology input and sometimes a joint appointment with a nurse specialist and psychologist combined. Consideration is given to each individual’s lifestyle when determining insulin regimens, thus minimising treatment burden and providing an individualised approach to care.

Conclusion
The prevalence of CFRD is increasing, and this audit has shown a significant number of complications associated with CFRD. These complications are likely to become more prevalent as life expectancy in CF increases. Annual screens for CFRD complications are important, and a formal process should be adopted by all adult CF units in an attempt to improve the care of this growing subgroup of individuals. A structured programme of screening would also give opportunity for individuals to identify difficulties and address issues relating to compliance.

Figure 1. Prevalence of cystic fibrosis-related complications in the audit sample (n=68). DVLA=not declaring insulin requirement to the Driver and Vehicle Licensing Agency; LFTs=liver function tests.
CFRD is sometimes viewed by individuals as unimportant; this could be partly because of the fact that they feel no different whether they administer insulin or not. Some individuals feel that they do not have “proper diabetes”, and getting the message across to individuals that they are at risk of diabetes-related complications continues to be challenging. Also, confusion surrounding an absolute diagnosis of CFRD, with some individuals only requiring intermittent use of insulin, can be problematic for both individuals and staff.

A limitation of this audit is that the sample size was small (n=68), and a multi-centred approach may prove more beneficial. However, this audit does demonstrate that CFRD and its related complications are common and may even be more prevalent than first thought.


