Healthcare Improvement Scotland | SHTG Advice on health technologies

Innovative Medical Technology Overview| May 2026

Intelligent liver function testing (iLFT) pathway for the management of chronic liver disease (CLD)

Key messages

- iLFT is an automated algorithm-driven diagnostic pathway designed to enhance the earlier diagnosis of liver disease in primary care settings and improve patient outcomes including reducing the need for specialist referrals.[1]
- iLFT has been implemented across NHS Tayside since 2018.[2] Evidence from NHS Tayside indicates that:
    - Following the introduction of iLFT, CLD detection increased by 43%, compared with usual care, as all abnormal LFTs were investigated automatically.[1]
    - In the first year of iLFT implementation, 75% of people with potential CLD were recommended by the algorithm to be safely managed in primary care.[3]
    - Adding the Enhanced Liver Fibrosis (ELF) test to the iLFT pathway can support a 34% reduction in referrals to secondary care by enabling the stratification of people with indeterminate fibrosis score estimates, although the calculation for this statistic is unclear.[4]
    - GPs reported that they felt that using the iLFT pathway was easy, reduced their workload and would recommend it to colleagues.[1, 5]
- Within trial economic evaluation from NHS Tayside found that while iLFT increased the cost per diagnosis at the outset, iLFT dominated current standard of care in the long term by delivering savings generated from the earlier identification of liver disease.
- Preliminary budget impact analysis estimates that an additional £22,879 would be spent for every 1,000 iLFT tests requested by primary care.
- The impact of the iLFT pathway (with or without ELF) on equality outcomes, as well as longer-term outcomes, such as mortality and morbidity, is not currently clear.

Definitions

Definitions and acronyms can be found in Appendix 1 and 2.

The technology and its use

LFTs are commonly used in primary care to assess the health and functioning of an individual's liver, but current practice is variable with follow-up and management following abnormal LFT results.[6, 7] In the current pathway, clinical history, alongside an evaluation of the pattern of abnormal LFTs will determine the choice of management pathway. Progression through the pathway following abnormal LFTs often requires multiple additional diagnostic tests (eg ultrasound) to determine next steps, including whether referral to secondary care is necessary (eg for invasive testing) for further investigation.[6, 7]

Abnormal LFTs caused by CLD are difficult to identify because the tests are not sensitive or specific enough in isolation to support a diagnosis, contributing to people remaining undiagnosed until the point at which they require an emergency admission to hospital.[2, 7, 8] Approaches to the management of abnormal LFTs can also be suboptimal as tests may not be followed up or investigated in primary care.[1, 9]

iLFT is an automated, algorithm-driven diagnostic non-invasive pathway designed to improve the detection and management of liver disease in primary care settings. The automated system used in NHS Tayside was deployed via Aptio® Automation technology by Siemens Healthcare Diagnostics Inc, but the algorithm can be used on other laboratory information management or middleware systems (Catriona Macdonald, Project Manager-National Innovation, NHS Golden Jubilee. Personal communication, 17 November 2025).

The purpose of iLFT is to enhance early diagnosis before presentation with end stage liver disease and improve patient outcomes by reducing the need for specialist referrals.[1] In this Innovative Medical Technology Overview (IMTO), iLFT will be referred to as a testing pathway as per the description of the intervention by NHS Tayside.[2] iLFT involves a series of LFTs (liver enzyme tests), as well as additional tests supported by an algorithm to generate a probable diagnosis and management plan and results are communicated back to the referring clinician.

In the iLFT pathway, clinicians in primary care request iLFTs using ordering software and are prompted to enter clinical details for the people with potential CLD. Details include body mass index (BMI), maximum weekly alcohol consumption in the past 6 months and whether the individual has a metabolic syndrome such as type 2 diabetes. The software prompts the clinician to take three vials of blood in a single session (venepuncture). Two serum samples are for biochemistry, immunology and virology testing to support an initial panel of standard LFTs.

One serum sample of potassium-ethylenediaminetetraacetic acid (K-EDTA) is taken to calculate non-invasive indirect fibrosis scores (the fibrosis-4 [FIB-4] and NAFLD fibrosis score [NFS]) if required.[1, 2]

The FIB-4 score and NFS are indirect fibrosis markers because the likelihood of fibrosis and cirrhosis is estimated from routine LFTs and individual characteristics such as age, rather than a direct test of the liver tissues.[10]

In the laboratory, the initial standard panel of LFTs are analysed and if abnormalities are detected, additional tests are cascaded automatically (known as a reflex system), with all of the recommended blood tests as per guidelines performed.[3] The iLFT pathway algorithms combine individual demographics and LFT results to produce one of 33 predefined 'outcomes' that describe the most likely diagnosis, presence and severity of liver fibrosis (if required) and recommendations for follow-up investigation (eg referral to secondary care).[2] After testing, if any doubt remains with diagnosis or staging, the output from the algorithm recommends that the individual with potential CLD is referred to secondary care.[11] A management plan is automatically generated from the iLFT pathway and is returned to the primary care clinician via the ordering system.

NHS Tayside introduced ELF testing as a second line test for fibrosis in the iLFT pathway to reduce the number of people being referred to secondary care with 'indeterminate' fibrosis scores from the FIB-4 and NFS tests.[2]

Implementation groups for the development of an iLFT pathway have been established in NHS Fife, NHS Lothian, NHS Lanarkshire and NHS Greater Glasgow & Clyde.[12] ELF testing is being used by NHS Fife alongside an iLFT pathway.[13] with the ELF tests analysed in NHS Tayside (Catriona Macdonald, Project Manager-National Innovation, NHS Golden Jubilee. Personal communication, 17 November 2025). iLFT, alongside ELF testing is also being tested in NHS Highland and NHS Western Isles, with ELF tests being analysed in NHS Tayside (Catriona Macdonald, Project Manager-National Innovation, NHS Golden Jubilee. Personal communication, 17 November 2025).

In England, the iLFT pathway is available for use in the County Durham and Darlington NHS Foundation Trust[14] and Cumbria.[15] Ongoing work on the implementation and delivery of an iLFT pathway is in progress in Birmingham, Wolverhampton, Coventry, Liverpool and north London.[16] NHS Cheshire and Merseyside have committed to supporting work by the Cheshire and Merseyside pathology network on a iLFT programme in a joint forward plan for 2023 to 2028.[17] It is unclear whether the ELF test is also available in the locations in England that use an iLFT pathway.

What is innovative about the technology?

The combination of an algorithm supported automated iLFT pathway and ELF testing for CLD in primary care in NHS Tayside represents a first use case in Scotland.[2, 4] At referral, GPs are able

to request that abnormal LFTs are screened for liver disease, thus there is potential to reduce burden on future clinical work.[1, 2] iLFT also provides GPs with an objective probable diagnosis, presence and severity of liver fibrosis (if required) and management recommendations for any necessary follow-up investigations.[2]

The Lancet standing commission on liver disease in the United Kingdom (UK) noted that encouraging the wider roll out of the iLFT pathway in NHS Tayside in the UK was a priority in 2018 to 2019.[18]

Regulatory information

The iLFT as a pathway does not have a class or Conformité Européenne (CE) marking at present. The ELF test is a CE marked medical device.[19]

To date, iLFT has been embedded in NHS workflows and has not been marketed as a standalone product. Medicines and Healthcare products Regulatory Agency guidance on the new medical device regulations suggests that clinical decision support tools like iLFT may fall under software as a medical device if they influence diagnosis or treatment decisions.[20, 21]

Population, setting and intended user

Population

People with CLD often do not have any symptoms, but if they do then symptoms may include:

- feeling unwell
- feeling tired despite resting
- feeling or being sick
- pain or soreness under the ribs (right hand side)
- small spider like veins on the skin above waist level
- blotchy red palms
- sleeping difficulties.[22]

People with established CLD experience a progressive reduction of liver functioning for 6 months or more which is characterised by inflammation and scarring of the liver tissue.[23] Early changes to cells in the liver (such as the build up of fat, known as fatty liver disease) can progress to inflammation (hepatitis), scarring (fibrosis), permanent scarring (cirrhosis) and if cirrhosis worsens, potential liver cancer (hepatocellular carcinoma).[24]

For some individuals, there can be a missed or delayed diagnosis of CLD until the disease has progressed to cirrhosis or hepatocellular carcinoma.[25] The odds of receiving a late CLD diagnosis are 12 times higher for people with alcohol-related liver disease (ARLD), compared with people with viral hepatitis (odds ratio [OR] 12.01, 95% confidence interval [CI] 6.32 to 22.83, $p<0.001$).[25]

The Scottish Burden of Disease study reported that from 2000 to 2019, the number of people diagnosed with CLD increased from 18,400 to 43,200 (135% increase). The prevalence of CLD is expected to increase by 54% to 66,300 by 2044.[26]

The most common preventable causes of CLD that account for 90% of people who are diagnosed in England include ARLD, viral hepatitis (B and C) and non-alcoholic fatty liver disease (NAFLD), also known as MASLD.[3, 27] The main non-preventable, but treatable causes (eg to manage symptoms) of CLD include genetics and autoimmune diseases.[23] Being diagnosed with CLD is also a major risk factor for development of hepatocellular carcinoma.[28]

The morbidity burden of CLD is projected to increase in Scotland from 2,100 years lived with disability (YLD) in 2019 to 4,000 YLD in 2044, representing a relative increase of 91% (absolute increase of 1,900 YLD).[26] Hospital stays for people with CLD in Scotland have decreased by 4.1% to 180.4 hospital stays per 100,000 in the financial year 2023 to 2024, compared with 188.2 per 100,000 in the financial year 2022 to 2023.[24] There were 18.4 deaths per 100,000 people with CLD in 2023 in Scotland.[24] More than a three quarters of deaths related to CLD (77.7%) were attributable to ARLD in Scotland in 2023, although the proportion has been decreasing over time.[24]

Setting and intended user

The iLFT pathway is intended for primary care clinicians for testing people with potential CLD. The addition of ELF testing to the iLFT pathway further characterises the risk of fibrosis in individuals with indeterminate or high direct fibrosis scores (FIB-4 and NFS).[4]

Equality considerations

The largest relative and absolute increases in prevalence of people living with CLD in Scotland are expected to be seen for females compared with males by 2044 (68% or 13,600 females compared with 41% or 9,500 males).[26]

The hospital stay rate in Scotland 2023/24 was higher for males with CLD compared with females (225.4 stays per 100,000 compared with 135.3 stays per 100,000) and in the most deprived areas compared with the least deprived areas (371.4 stays per 100,000 compared with 85.4 stays per 100,000).[24]

Mortality rates in Scotland in 2023 were higher for males compared with female (23.5 per 100,000 compared with 13.3 per 100,000) and 4.5 times higher in people residing in the most deprived areas compared with the least deprived areas (41.5 per 100,000 compared with 9.3 per 100,000).[24]

Summary of clinical evidence

Primary studies

A retrospective case notes review (n=323) aimed to validate the iLFT pathway in NHS Tayside for detecting abnormal liver enzymes. The iLFT pathway was designed to provide a diagnosis of common liver conditions, fibrosis staging (using non-direct tests such as FIB-4 and NFS) and management recommendations. 116 people (35.9%) with potential CLD could be managed in primary care without referral to secondary care and according to the authors, this mostly included patients with NAFLD or ARLD and low indirect fibrosis scores (number not provided by the authors).[29]

One pilot cluster randomised study explored the clinical effectiveness of the iLFT pathway (n=554).[1] A stepped wedge design was used to randomise the order of GP practice involvement. The purpose of the iLFT pathway implementation was to increase the number of people with potential CLD who received investigation, diagnosis and correct management for their condition.

In the study, diagnostic and LFT outcomes at six GP practices in NHS Tayside were compared in the 6 months before (control or comparator group representing real world clinical practice, n=490) and 6 months after the introduction of the iLFT pathway (iLFT group, n=64). The authors reported that the study under recruited in the iLFT group as only those recruited by GPs who selected the iLFT at referral were included (representing 13% of all potentially eligible people with potential CLD in the practices). The control population included all people with potential CLD with abnormal LFTs (retrospective assessment). The following results were reported:

- a statistically significant increase of 43% in the diagnosis rate of CLD in the iLFT pathway group (n=54) was observed compared with the control group (n=486) (95% CI 27% to 59%, p<0.0002). The authors state that the increase in diagnosis rate was due to LFTs being automatically investigated, compared with 59% of results not being investigated in the control group
- a statistically significant increase in the number of GP visits after liver diagnosis was reported (after diagnosis relative risk [RR] 3.47, 95% CI 1.63 to 7.36, p=0.0013; before diagnosis RR 2.00, 95% CI 1.37 to 2.91, p=0.0003). The implications of an increase in GP appointments post diagnosis were not directly discussed by the authors, but can be considered in the context of the 59% of results that were not investigated in the control group (ie no action taken). The results may be driven by all LFTs being automatically investigated in the intervention group
- there was a statistically significant increase in the number of people being referred to secondary care in 6 months after the intervention compared with 6 months before (OR

8.44, 95% CI 1.99 to 35.73, p=0.0040). The authors highlight that an increase in referrals to secondary care is to be expected when an intervention increases the diagnosis rate

- no statistically significant differences were observed in the number of non-liver-related visits to the GP, nurse visits or blood test requests
- diagnostic accuracy was reported to be over 90% for the iLFT pathway, although further information in support of this figure is unclear.[1]

One cohort study (retrospective and prospective) investigated the addition of the ELF test to the iLFT pathway in NHS Tayside (n=1,327; ELF score ≥9.8 n=845; ELF score <9.8 n=482).

The ELF test was added to the iLFT pathway to support risk stratification of people with potential CLD and indeterminant fibrosis scores, with the aim of reducing the number of people with potential CLD being referred to secondary care.

The authors reported that there was a 34% reduction in people with potential CLD being referred to a specialist in secondary care after the additional of the ELF test (ELF score higher risk threshold ≥9.8), but do not provide any statistics or comparisons for this figure.[4]

Real world evidence

Reviews

A narrative review incorporated real world data from the first year of using the iLFT pathway in NHS Tayside (n=2,362). The iLFT algorithm recommended that 509 people (25.3%) with potential CLD be referred to secondary care, of which 393 (77.2%) were referred for fibrosis assessment. Primary care management was recommended for 1,504 people with potential CLD (74.7%).[3]

Data from the first three years of using the iLFT pathway in NHS Tayside were reported in another narrative review (total number of people with potential CLD was not reported). The iLFT pathway recommended that 74.3% (number not reported) of people with potential CLD could be managed in primary care without a hospital referral. Referral to secondary care was recommended for 2,837 people with potential CLD (overall percentage not reported), representing 28.7% of total outcomes reported and 25.7% of iLFT requests (calculation is not clear).[2]

Neither narrative review provided information about methodology (eg population, comparators). It is unclear whether the ELF test was used as part of the iLFT pathway for fibrosis assessment in these reviews.

Health board internal communication

A 'situation background assessment and recommendation' (SBAR) report describing the impact of adding ELF testing to the iLFT pathway in NHS Tayside was shared with the Scottish Healthcare Technologies Group (SHTG). Approval was obtained for publication of the sub-analysis of the data in the SBAR for this IMTO. Using the National Institute for Health and Care Excellence (NICE) recommended ELF test cut off of ≥10.51 (compared with the NHS Tayside of ≥9.8), referral of people with potential CLD to secondary care reduced by 58.5% (Dr R Lynch, Consultant Hepatologist, NHS Tayside. Personal communication, 02 October 2025). No further information is provided by the author regarding methodology which limits the conclusions we can draw from the sub-analysis.

A report describing the impact of adding ELF testing to the iLFT pathway in NHS Fife was shared with SHTG. Approval was obtained for publication of the data included in the report for this IMTO. In the report, there were 491 people with potential CLD who had received an ELF test of which 107 (22%) people with potential CLD had an ELF score of <9.8, indicating a 'no fibrosis' outcome and direction towards management in primary care. (Dr H Holmes, Consultant Clinical Biochemist, NHS Tayside. Personal communication, 15 October 2025). No further information regarding methodology is provided in the report, which limits the conclusions that we can draw.

Conference abstracts

We identified four conference abstracts from the UK that presented clinical effectiveness data on iLFT pathways from regions other than NHS Tayside, with two studies from England (north Cumbria),[30, 31] one from Wales (Gwent)[32] and another from Scotland (Fife).[13] We did not identify any published, peer reviewed articles associated with these conference abstracts.

Summary of safety evidence

The iLFT pathway, with the addition of ELF, is a non-invasive method for the diagnosis of CLD and the focus of safety for this should consider test accuracy compared with usual care.

A retrospective case notes review (n=323) aimed to validate the iLFT pathway in NHS Tayside for detecting abnormal liver enzymes. The iLFT pathway was designed to provide a diagnosis of common liver conditions, fibrosis staging (using non-direct tests such as FIB-4 and NFS) and management recommendations.[29] The following results were reported:

- diagnostic agreement was reached between the iLFT algorithm and clinicians in 82.4% (n=266) of people with potential CLD. Of the 266 people with potential CLD where diagnostic agreement was reached, the appropriate referral option was selected (by both clinicians and the iLFT algorithm), with one hundred sixty-eight people allocated to the refer to secondary care group and 98 people with potential CLD allocated to refer for GP management group

- referral recommendation was also reported for the entire cohort in the study (n=323), irrespective of the accuracy of final diagnosis. The correct referral route was selected by the iLFT algorithm and clinicians for 295 people with potential CLD (91.5%). The algorithm had a sensitivity of 94.3% and specificity of 86% when using the ultimate referral decision.[29] Sensitivity and specificity was not presented for diagnosis.[29]

Summary of economic evidence

Technology costs

The total implementation cost of a standard cascaded iLFT at NHS Tayside is £10.50 per person. ELF costs an additional £51 per test. This estimate includes the cost of staffing and facilities in addition to the cost of reagents.

The cost of iLFT varies based on the number of tests ordered as part of the algorithm; more testing further downstream in the cascade will incur higher costs. Standalone costs (reagents only) of iLFT obtained from NHS Tayside are as follows:

- 'Basic' iLFT (all results normal)=£0.73.
- 'Standard' cascaded iLFT (no immunology or ELF)=£9.40.
- 'Complex' cascaded iLFT (with basic immunology and ELF)=£75.83.
- Extended immunology testing (complex iLFT plus added immunology)=£195.96.

Published evidence

Our search identified one published economic evaluation conducted alongside the pilot trial across GP practices in NHS Tayside.[1]

The cost-effectiveness analysis explored the incremental cost per correct diagnosis of the iLFT intervention compared to routine clinical practice, at 6 months follow-up from the NHS perspective. Resource use data (eg GP visits, blood test requests, ultrasounds, fibroscans, and secondary care referrals) and primary outcome diagnostic data were obtained from the trial.

The model extrapolated trial outcomes at diagnosis to account for differences in the impact of ARLD and NAFLD on the lifetime costs and quality-adjusted life year (QALY) gains of patients receiving the iLFT intervention or routine care.[1]

According to the authors, iLFT performed better than the control group for detecting liver disease (sensitivity) and identifying healthy people (specificity), resulting in a 51% increase in the probability of correct diagnosis. Within trial mean costs were £328 and £185 per person for iLFT and control. iLFT had an incremental cost per correct diagnosis (including true positive and true negative) of £284.

iLFT reduces the future burden of liver disease by enabling earlier interventions. The impact of this was demonstrated in the lifetime economic analysis which modelled the pathway for detected and undetected ARLD and NAFLD. In the lifetime model, iLFT resulted in a cost saving of £3,216 per person, with an additional 0.021 QALYs gained.

iLFT was therefore not only cost-effective but a dominant strategy (ie better outcomes at a lower cost). This dominance was robust across a range of sensitivity analysis.

The authors concluded that while iLFT was costlier than current clinical practice, these short-term additional costs were outweighed by the longer-term savings to the NHS attributed to the earlier detection of ARLD and NAFLD.

Unpublished evidence

We identified one conference abstract which compared the incremental cost per diagnosis of three testing approaches for people with abnormal LFTs with current clinical practice of 20% of people with abnormal LFT's undergoing downstream testing. [40] The three approaches were:

- iLFT (full aetiology testing)
- Comprehensive testing (full aetiology and non-invasive fibrosis tests)
- Fibrosis first testing (abbreviated aetiology testing [hepatitis B, hepatitis C and iron] and non-invasive fibrosis tests).

All tested approaches identified more persons with treatable liver disease (with or without advanced liver fibrosis) than the current standard of care. Fibrosis first had the lowest incremental cost per diagnosis (£1,349) compared with iLFT (£3,247) and comprehensive testing (£2,964). The authors concluded that a fibrosis first pathway had the greatest net benefit amongst different approaches to identifying people with liver disease in primary care.

Budget impact analysis

We applied standalone iLFT costs to current steady state data on GP requests from NHS Tayside to estimate the total iLFT expenditure per 1,000 people (*Table 1*). Our preliminary analysis shows that approximately £22,879 would be spent for every 1,000 iLFT GP requests. The budget impact analysis does not include any additional staffing resource costs or facilities charges that might be attributed to iLFT testing.

Table 1: estimated total iLFT expenditure per 1,000 people

Test	Cost per test (£)	Request rate	Spend (£) per 1,000
Basic ILFT	0.73	52%	379.6
Standard iLFT	9.4	24%	2256
Complex iLFT	75.83	22.50%	17,061.75
Extended	195.96	1.50%	2,939.4
Gilberts disease	5.32	3.90%	207.48
Wilsons disease	0.28	12.60%	35.28
Budget impact			**22,879.51**

Experience

In a published survey, twenty-three GPs that had taken part in a pilot cluster randomised study of the iLFT pathway in NHS Tayside were asked to complete a study feedback questionnaire. No details about the methods were provided by the authors. The results of the questionnaire are presented in *Table 2*. GPs reported that using the iLFT pathway was easy (15 out of 23), that it reduced their workload (11 out of 23) and that they would like to see the iLFT pathway rolled out as a standard clinical system (21 out of 23).[1]

Table 2: GP responses (n=23) to the NHS Tayside iLFT study feedback questionnaire

Question	Response	Number
1.How easy did you find the iLFT request process on the integrated clinical environment system?	Easy	15
	Same as usual	4
	Difficult	4
2.Did using iLFT increase or decrease your own and your practices workload?	Reduce	11
	About the same	9
	Increase	3
3.Would you like to see iLFT rolled out as a Standard Clinical System?	Yes	21
	No	2

A study in a doctoral thesis reported results from a survey of 100 GPs in NHS Tayside, focusing on their use of the iLFT pathway.[5] The survey results indicated that:

- 97% (n=97) of GPs had used the iLFT pathway and 97.9% (n=95) would recommend using the iLFT pathway to a colleague
- 80 out of 97 (82.4%) GPs liked the automated fibrosis scoring
- 77 GPs (total respondent n not reported) felt that use of the iLFT pathway reduced the number of consultations required before diagnosis
- 63 GPs (total respondent n not reported) liked that use of the iLFT pathway prevented the need for further phlebotomy

- 52 GPs found that the iLFT pathway outcomes reported were very helpful, 43 GPs found them somewhat helpful, two GPs did not find them helpful at all and would not recommend the iLFT pathway to a colleague (total respondent n not reported).[5]

No details about the methods were provided by the thesis author. It is unclear whether the total sample of GPs reported in the doctoral thesis is the same reported in the published survey study.[1,5]

We did not identify any evidence exploring the experience of people with potential CLD using the iLFT pathway or laboratory technicians supporting an iLFT pathway.

Conclusions

Evidence from a single health board area suggests that implementing the iLFT pathway improved diagnosis rates for CLD. Alongside an increase in diagnosis rates, the iLFT pathway increased the number of GP visits after diagnosis and increased referrals of people with potential CLD to secondary care, as expected. The addition of ELF testing as part of the iLFT pathway in NHS Tayside reduced the number of referrals to secondary care for people with potential CLD. We did not identify evidence that discussed the long term implications of the pathway and impact on outcomes such as morbidity and mortality.

While iLFT implementation will incur additional costs in the short-term, the earlier detection of liver disease is expected to generate longer-term savings for the NHS.

Using the iLFT pathway in primary care was acceptable to GPs in NHS Tayside. The perspectives of people with potential CLD is unknown.

Work in implementing the iLFT pathway is ongoing in other health boards within NHSScotland, as well as in NHS England. Evidence gathered from these ongoing implementation projects will inform the future evidence base on iLFT pathways. Further evaluation may be required to determine the impact of iLFT (with and without ELF) on equality, mortality and morbidity outcomes. Methodology should be fully reported to enable suitable conclusions to be drawn.

Acknowledgments

Healthcare Improvement Scotland development team

- Dr Rohan Deogaonkar, Senior Health Economist
- Ms Lucinda Frank, Senior Project Officer
- Ms Charis Miller, Information Scientist
- Dr Rachel A Moss, Health Services Researcher (lead author)
- Mr James Stewart, Programme Manager

Public Health Scotland

- Ms Ellie Bates, Senior Information Analyst
- Dr Tara Shivaji, Consultant in Public Health Medicine
- Ms Lynn Wallace, Principal Information Analyst

What is an IMTO?

An IMTO provides a high-level summary of health and care innovations. IMTOs include a description of the technology and its potential use in Scotland, and an overview of the evidence to help gauge the potential impact of the technology on people and health and care services.

References

1. Dillon JF, Miller MH, Robinson EM, Hapca A, Rezaeihemami M, Weatherburn C*, et al.* Intelligent liver function testing (iLFT): A trial of automated diagnosis and staging of liver disease in primary care. J Hepatol. 2019;71(4):699–706.
2. Nobes J, Leith D, Handjiev S, Dillon JF, Dow E. Intelligent Liver Function Testing (iLFT): An Intelligent Laboratory Approach to Identifying Chronic Liver Disease. Diagnostics. 2024;14(9):1–15.
3. Macpherson I, Nobes JH, Dow E, Furrie E, Miller MH, Robinson EM*, et al.* Intelligent Liver Function Testing: Working Smarter to Improve Patient Outcomes in Liver Disease. J Appl Lab Med. 2020;5(5):1090–100.
4. Pearson M, Nobes J, Macpherson I, Gold L, Miller M, Dow E*, et al.* Enhanced liver fibrosis (ELF) score predicts hepatic decompensation and mortality. JHEP Rep. 2024;6(6):1–10.
5. Macpherson I. Improving the community diagnosis of chronic liver disease using an automated, real-time system: intelligent liver function testing (iLFT). 2023 [cited 2025 Oct 20]; Available from: https://discovery.dundee.ac.uk/ws/portalfiles/portal/108550061/iain_macpherson_final_MD_thesis_submission.pdf.
6. Yeoman AD. Novel Approaches to Detect Significant Liver Disease in the General Population. Clin Liver Dis 2021;18(2):99–103.
7. Newsome PN, Cramb R, Davison SM, Dillon JF, Foulerton M, Godfrey EM*, et al.* Guidelines on the management of abnormal liver blood tests. Gut. 2018;67(1):6–19.
8. King J, Bains V, Doidge J, Van Der Meulen J, Walker K, Bernal W. Identifying emergency presentations of chronic liver disease using routinely collected administrative hospital data. JHEP Rep. 2025;7(5):1–12.
9. Donnan PT, McLernon D, Dillon JF, Ryder S, Roderick P, Sullivan F*, et al.* Development of a decision support tool for primary care management of patients with abnormal liver function tests without clinically apparent liver disease: a record-linkage population cohort study and decision analysis (ALFIE). Health Technol Assess. 2009;13(25):1–134.
10. Tamaki N, Kurosaki M, Huang DQ, Loomba R. Noninvasive assessment of liver fibrosis and its clinical significance in nonalcoholic fatty liver disease. Hepatol Res. 2022;52(6):497–507.
11. Lee J, Byrne CJ, Brennan PN, MacPherson I, Dow E, Dillon JF. Optimal ALT threshold for the automated diagnosis of MASLD: A population-based study using iLFT. Ann Hepatol. 2024;29(2):1–9.
12. Dillon J. Intelligent Liver Function Testing. 2021 [cited 2025 Oct 13]; Available from: https://results2021.ref.ac.uk/impact/ae705f7a-501c-4514-8453-4b81b2d6eadf?page=1.
13. Ranade V, Chalmers V, Maxwell L, Holmes H, Jafferbhoy H, Gilchrist S. P89 Introduction of iLFT in NHS Fife. Gut. 2023;72(Suppl 3):A71–A2.
14. County Durham and Darlington NHS Foundation Trust. Intelligent Liver Function Testing. 2025 [cited 2025 Oct 10]; Available from: https://www.cddft.nhs.uk/application/files/8217/3021/4232/Intelligent_Liver_Function_Test.pdf.
15. McPherson S. Guidelines for the Management of Adults with Asymptomatic Liver Blood Test Abnormalities. 2024 [cited 2025 Oct 13]; Available from: https://ntag.nhs.uk/wp-content/uploads/2024/08/Abnormal-Liver-blood-test-Guidelines-NENC-Hepatology-Network-V3.1-01-08-2024.pdf.
16. British Liver Trust. Liver disease - examples of good practice in primary care. 2025 [cited 2025 Oct 13]; Available from: https://britishlivertrust.org.uk/health-professionals/good-practice/.

17. NHS Cheshire and Merseyside. Cheshire and Merseyside Joint Forward Plan 2023-28. 2023 [cited 2025 Oct 13]; Available from: https://www.cheshireandmerseyside.nhs.uk/media/smxb240m/cm-joint-forward-plan-supporting-content-_v17_section_3.pdf.
18. Williams R, Alexander G, Aspinall R, Batterham R, Bhala N, Bosanquet N, *et al.* Gathering momentum for the way ahead: fifth report of the Lancet Standing Commission on Liver Disease in the UK. Lancet. 2018;392(10162):2398–412.
19. Palladino A, Gee M, Shalhoub V, Kiaei D. Analytical performance of the Enhanced Liver Fibrosis (ELF) Test on the Atellica IM Analyzer. Clin Chim Acta. 2023;548:117461.
20. Medicines and Healthcare products Regulatory Agency. Medical devices: post-market surveillance. 2025 [cited 2025 Nov 11]; Available from: https://www.gov.uk/government/collections/medical-devices-guidance-for-manufacturers-on-vigilance.
21. Medicines and Healthcare products Regulatory Agency. Medical devices: software applications. 2023 [cited 2025 Nov 11]; Available from: https://www.gov.uk/government/publications/medical-devices-software-applications-apps.
22. British Liver Trust. Symptoms of liver disease. 2025 [cited 2025 Oct 13]; Available from: https://britishlivertrust.org.uk/information-and-support/liver-health-2/symptoms-of-liver-disease/?gad_source=1&gad_campaignid=22146960879&gclid=EAIaIQobChMIkY_ZvYSakAMVLZZQBh1LzC3mEAAYASAAEgK_kvD_BwE#early.
23. Sharma A, Nagalli S. Chronic Liver Disease. 2023 [cited 2025 Sept 29]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK554597/.
24. Scottish Public Health Observatory. Chronic liver disease: key points. 2025 [cited 2025 Sept 29]; Available from: https://www.scotpho.org.uk/health-conditions/chronic-liver-disease/key-points/.
25. Innes H, Morling JR, Aspinall EA, Goldberg DJ, Hutchinson SJ, Guha IN. Late diagnosis of chronic liver disease in a community cohort (UK biobank): determinants and impact on subsequent survival. Public Health. 2020;187:165–71.
26. Public Health Scotland. Scottish Burden of Disease: Future prevalence and burden of chronic liver disease. 2025 [cited 2025 Sept 29]; Available from: https://www.scotpho.org.uk/media/2631/2025-03-18-scottishburdenofdisease-chronicliverdisease.pdf.
27. Public Health England. Liver disease profiles: statistical commentary , February 2020. 2020 [cited 2025 Sept 29]; Available from: https://www.gov.uk/government/statistics/liver-disease-profiles-february-2020-update/liver-disease-profiles-statistical-commentary-february-2020.
28. Cancer Research UK. Risks and causes of liver cancer. 2025 [cited 2025 Sept 29]; Available from: https://www.cancerresearchuk.org/about-cancer/liver-cancer/risks-causes.
29. Miller MH, Fraser A, Leggett G, MacGilchrist A, Gibson G, Orr J, *et al.* Development and validation of diagnostic triage criteria for liver disease from a minimum data set enabling the 'intelligent LFT' pathway for the automated assessment of deranged liver enzymes. Frontline Gastroenterol. 2018;9(3):175–82.
30. Burke D. Intelligent LFTs (iLFTs), improving detection, improving assessment, improving referrals and improving care (page 35). 2025 [cited 2025 Oct 13]; Available from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjCmav2_ZmQAxVYU0EAHe0WGscQFnoECCAQAQ&url=https%3A%2F%2Fdlaqljgi7pm30.cloudfront.net%2Fattachments%2F3r9r4sqr9cle%2F6vbn4brjvlqi%2FProgramme_Final_Version.pdf%3FX-Amz-Expires%3D1800%26X-Amz-Date%3D20250724T112718Z%26X-Amz-Algorithm%3DAWS4-HMAC-SHA256%26X-Amz-Credential%3DAKIAILOFNLAXWGA6K66A%252F20250724%252Feu-west-

1%252Fs3%252Faws4_request%26X-Amz-SignedHeaders%3Dhost%26X-Amz-Signature%3D3df5d621e50d2deda24166abea9b0b286dfacd46bffa06acbed15b83b4f333d1&usg=AOvVaw2VpXMPgnCQHYRzHkI6L40r&opi=89978449.
31. Rowe I, Parker R. Testing for liver disease in primary case: fibrosis first. J Hepatol. 2022;77:S213.
32. Yeoman A, Samuel D, Yousuf DF, Czajkowski MA, Venn S, Salmon J*, et al.* Introduction of "reflex" AST testing in primary care increases detection of advanced liver disease: the Gwent AST project (GAP). J Hepatol. 2020;73:S19.
33. Tomaino G, Walters DJ. Presenting time-series data as absolute versus relative changes impacts judgments and choices. Journal of Consum Psychol. 2024;34(3):510–8.
34. The Alan Turing Institute. Defining data science and AI. 2025 [cited 2025 Sept 29]; Available from: https://www.turing.ac.uk/news/data-science-and-ai-glossary.
35. British Liver Trust. The stages of long term liver disease. 2024 [cited 2025 Sept 29]; Available from: https://britishlivertrust.org.uk/information-and-support/liver-health-2/stages-of-liver-disease/.
36. Siemens Healthineers. Literature Compendium Volumn 1: The Enhanced Liver Fibrosis (ELF) Blood Test. 2021 [cited 2025 Sept 29]; Available from: https://marketing.webassets.siemens-healthineers.com/8f5cdbb2d5ed0014/54c771b687e8/ES-ELF-Literature_Compendium_Vol1.
37. Health Technology Wales. Topic exploration: ELF (Enhanced Liver Fibrosis) test for the assessment of liver fibrosis. 2024 [cited 2025 Sept 29]; Available from: https://healthtechnology.wales/wp-content/uploads/TER506-Elf-Test.pdf.
38. Patient. Liver function tests. 2024 [cited 2025 Sept 29]; Available from: https://patient.info/digestive-health/abnormal-liver-function-tests-leaflet.
39. Last J. A Dictionary of Epidemiology. 4th ed: Oxford University Press, New York; 2001.
40. Office for National Statistics. Health state life expectancies, UK: 2018 to 2020. 2022 [cited 2025 Sept 29]; Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/healthstatelifeexpectanciesuk/2018to2020.

Appendix 1: definitions

Absolute change: represents the actual change in the number of actual cases between the two time periods.[33]

Algorithm: a set of rules used by a computer system to complete a task by taking an input and producing an output.[34]

CLD: the progressive reduction of liver functioning for 6 months or more.[23] The stages of CLD are:

- fatty liver: too much fat built up in the liver
- hepatitis: inflammation of the liver, often caused by a build up of fat
- fibrosis: scar tissue on the liver, causing it to become hard and bumpy
- cirrhosis: permanent and irreversible scarring of the liver.[35]

ELF test: a non-invasive blood (serum) test for liver fibrosis that combines three biomarkers (hyaluronic acid, procollagen III aminoterminal peptide and tissue inhibitor of matrix metalloproteinase 1).[36, 37]

LFTs: a set of blood tests used to assess the health and functioning of the liver.[38]

Relative change: represents the percentage scale of change in the number of cases between the two time periods.[33]

Sensitivity: the probability that a person having a disease will be correctly identified by a clinical test, that is the number of true positive results divided by the total number with the disease.[39]

Specificity: the probability that a person not having a disease will be correctly identified by a clinical test, that is the number of true negative results divided by the total number of those without the disease.[39]

YLD: a measure of years lived with a restriction on the ability to conduct day-to-day activities because of an illness or medical condition.[40]

Appendix 2: abbreviations

ALT	alanine transaminase
ARLD	alcohol-related liver disease
BMI	body mass index
CE	conformité Européenne
CI	confidence interval
CLD	chronic liver disease
ELF	enhanced liver fibrosis
FIB-4	fibrosis-4
GP	general practitioner
iLFT	intelligent liver function testing
IMTO	Innovative Medical Technology Overview
K-EDTA	potassium-ethylenediaminetetraacetic acid
LFT	liver function test
MASLD	metabolic dysfunction-associated steatotic liver disease
NAFLD	non-alcoholic fatty liver disease
NFS	NAFLD fibrosis score
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
OR	odd ratio
PHS	Public Health Scotland
RR	relative risk
SBAR	situation background assessment and recommendation
SHTG	Scottish Health Technologies Group
UK	United Kingdom
YLD	years lived with a disability