National Consensus Guidelines on Deceased Donor Liver Graft Allocation in South Africa

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Abstract

Background:

Liver transplantation in South Africa remains constrained by limited deceased donor availability, geographic disparities, and a two-tiered healthcare system. Historical allocation practices have evolved in an ad hoc manner, contributing to regional inequities in access to transplantation and variability in clinical decision-making. In response, the South African Transplantation Society (SATS) convened an expert panel to develop a national consensus framework to guide eligibility, prioritisation, and allocation of deceased donor liver grafts (DDLGs).

Recommendations:

Using a modified Delphi approach, consensus was achieved on key principles underpinning equitable liver allocation. The panel supported standardised eligibility criteria across centres and emphasised the national prioritisation of the sickest suitable candidates while maintaining acceptable post-transplant outcomes. Paediatric recipients should receive priority for appropriately sized grafts, and the use of split liver transplantation should be encouraged to maximise donor utility. Urgent listing criteria were defined, with agreement on case-by-case inter-regional discussion for high-acuity patients, although consensus was not reached on broader national sharing for high MELD/PELD score patients. The committee suggested rationalising historical drainage areas to better reflect population distribution and donor availability, thereby promoting proportional access. Furthermore, the importance of fostering collaborative inter-regional networks, rather than competitive centre-based practices, was highlighted.

Conclusion:

This consensus document represents an important step toward establishing a transparent, equitable, and contextually appropriate framework for LT eligibility, prioritisation, and deceased donor liver graft allocation in South Africa. By aligning clinical practice with ethical principles and national resource constraints, it provides a foundation for more consistent decision-making across regions. While areas of uncertainty and disagreement remain, the process highlights the value of ongoing dialogue and collaboration between centres. Future refinement, supported by prospective data collection and broader stakeholder engagement, will be essential to optimise allocation strategies, improve access, and ultimately enhance patient outcomes at a national level.

Recommendations

- **A transparent, standardised national framework for LT eligibility and allocation is necessary, as donated organs are a national resource.**
- **Equity in access to liver transplant across geographic regions and healthcare sectors should be promoted.**
- **The urgency of candidates and the utility of donated grafts must be carefully balanced.**

- **Candidates on standard regional waiting lists will be prioritised according to disease severity using the MELD-Na or PELD-Cr score.**
- **The allocation of exception points must be standardised nationally.**
- **Urgent listing criteria must be clearly defined, but case-by-case discussion if outside of criteria are encouraged.**
- **Mandatory documentation and audit processes should accompany priority listings.**
- **Regional LT systems will be maintained.**
- **Splitting of selected deceased donor livers must be encouraged, and reasons for not splitting when appropriate must be documented.**
- **Systems for data collection and audit should be prioritised to inform future guidelines.**

Suggestions

- **Historical transplant regions should be reassessed and rationalised to reflect population distribution and regional waiting list metrics.**
- **Collaborative national networks should be prioritised over competitive practices.**
- **A national allocation authority and unified national waiting list should remain a future strategic goal once appropriate governance and infrastructure exist.**

Abbreviations

AARC – APASL ACLF Research Consortium
ABO – Blood Group System
ACLF – Acute-on-Chronic Liver Failure
AGREE II – Appraisal of Guidelines for Research and Evaluation II
AIDS – Acquired Immunodeficiency Syndrome
ALF – Acute Liver Failure
ALT – Alanine Aminotransferase
APASL – Asian Pacific Association for the Study of the Liver
AST – Aspartate Aminotransferase
BMI – Body Mass Index
CPP – Cerebral Perfusion Pressure
CSS – Clinical Severity Score
CSS-A – Clinical Severity Score for Adults
CSS-P – Clinical Severity Score for Paediatrics
CTP – Child-Turcotte-Pugh
DDLG – Deceased Donor Liver Graft
DDLT – Deceased Donor Liver Transplantation

EAD – Early Allograft Dysfunction
ECD – Extended Criteria Donor
ELAS – Eurotransplant Liver Allocation System
EP – Expert Panel
HCC – Hepatocellular Carcinoma
HRSA – Health Resources and Services Administration
ICU – Intensive Care Unit
ICP – Intracranial Pressure
INR – International Normalised Ratio
IPTA – International Pediatric Transplant Association
LDLT – Living Donor Liver Transplantation
LT – Liver Transplantation
LT-CoMet – Liver Transplantation for Colorectal Metastases
MELD – Model for End-Stage Liver Disease
MELD-Na – Model for End-Stage Liver Disease–Sodium
NET – Neuroendocrine Tumour
NHSBT – National Health Service Blood and Transplant
NPWL – National Priority Waiting List
OPTN – Organ Procurement and Transplantation Network
PBC – Primary Biliary Cholangitis
PELD – Paediatric End-Stage Liver Disease
PELD-Cr – Paediatric End-Stage Liver Disease–Creatinine
pmp – Per Million Population
PSC – Primary Sclerosing Cholangitis
RCWMCH – Red Cross War Memorial Children's Hospital
SA – South Africa
SATS – South African Transplantation Society
SC – Steering Committee
SVMK – SurveyMonkey
UCSF – University of California, San Francisco
UNOS – United Network for Organ Sharing
UCT – University of Cape Town
WDGMC – Wits Donald Gordon Medical Centre

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1) Introduction:

Liver transplantation in South Africa (SA) was infrequently performed during the eighties. Since the late-eighties, and before 2004, all deceased donor liver grafts (DDLGs) and liver transplant candidates were referred to Groote Schuur Hospital and Red Cross War Memorial Children's Hospital (RCWMCH) in Cape Town, as these were the only active liver transplant centres at the time. (1,2) In 2004, the liver transplant unit at Wits Donald Gordon Medical Centre in Johannesburg was opened, necessitating a review of donor and recipient drainage areas and allocation practices. (3)

In May 2012, a controversies workshop on liver allocation took place under the auspices of the Southern African Transplantation Society (SATS) where it was decided to establish two liver transplant regions. The Southern region included the Western, Eastern and Northern Cape Provinces. The Northern region included Gauteng Province, Kwa-Zulu Natal, North-West Province, Limpopo Province and Mpumalanga Province. It was decided that DDLGs from the Free State Province would first be discussed with RCWMCH, as many paediatric patients from the Free State were referred to Cape Town for LT at the time. When no paediatric liver recipient from the Free State Province could be identified, the livers would be shared between the two regions on a 1:1 basis. It was agreed that patients in need of urgent transplantation would be discussed on a case-by-case basis with a view of expediting transplant.

The next discussion on liver allocation took place in January 2017, when eight senior liver transplant clinicians (four from each region) proposed a liver allocation policy on behalf of SATS. It was reaffirmed that the two liver transplant units at the time would run independent standard regional waiting lists. Agreement could not be reached on the concept of dual listing, and it was decided not to allow this at the time. Agreement could not be reached on the national allocation of DDLGs to United Network for Organ Sharing (UNOS) status 1b patients with a MELD score > 35, paediatric patients with respiratory failure requiring ventilation, acute kidney injury requiring renal replacement therapy or uncontrollable bleeding due to portal hypertension. Agreement could be reached on preferentially allocating all DDLGs from donors <18 years of age to paediatric recipients, counselling patients regarding living donation, increasing the use of split livers and abandoning the use of reduced-size grafts where the right lobe is discarded. Urgent listing criteria were discussed and agreed on, with the proviso that a payback system would be implemented with the first available ABO-identical liver of the same quality group or better on a 1:1 basis. Although a draft version of the proposed recommendations was circulated for comment, it was never formally adopted and only partially implemented. The recommendations were due for formal review in January 2018, which did not occur.

In March 2024, the need to re-discuss liver transplant eligibility, waiting list prioritisation and DDLG allocation principles in favour of a transparent and nationally uniform system was

highlighted by a survey undertaken by the SATS liver working group and endorsed by SATS. A two-year long process of consensus building followed, with the following objectives:

- To support transplant clinicians in decisions on transplant eligibility and waiting list prioritisation, with the aim of establishing a nationally consistent approach.
- To establish a transparent framework for DDLG allocation that ensures fairness for patients in need of LT while respecting the contribution of donor families.
- To consider specific challenges relevant to health care provision in South Africa

A modified Delphi process was employed to achieve consensus, with guideline development conducted in accordance with the Appraisal of Guidelines for Research and Evaluation (AGREE II) framework. (4) This document represents the first of its kind guiding DDLG allocation in South Africa and creates a model that can be applied to other solid organ allocation systems to follow.

2) Methodology:

a) Selection of Steering Committee and Expert Panel

A Steering Committee (SC), comprising seven local experts in liver transplantation with strong research backgrounds, was established. Members were selected by the SATS liver working group leads to ensure balanced representation across medical and surgical disciplines, adult and paediatric practice, and included representatives of both the public and private healthcare sectors.

A broad range of topics was identified, including issues of global relevance as well as those specific to the South African liver transplant context. The SC conducted a comprehensive literature search of PubMed, Web of Science, Scopus, and grey literature to identify international society guidelines on DDLG allocation. Based on an extensive review of the evidence for each topic, the SC developed the initial questionnaire.

Subsequently, a multidisciplinary Expert Panel (EP) was convened, comprising 20 adult and paediatric healthcare professionals—including surgeons, hepatologists, transplant coordinators, intensivists, and allied health practitioners—with more than five years of experience in LT. To incorporate an international perspective, the SC also invited an external member who, although not currently practising in South Africa, possesses extensive knowledge of global DDLG allocation policies as well as the South African transplant landscape.

The study methodology was approved by the University of the Witwatersrand Human Research Ethics Committee (M240637). Informed consent was obtained from all EP members, with the understanding that their identities would be disclosed in the publication.

b) Overview of the modified Delphi process

The modified Delphi consultation process facilitates the development of consensus guidelines in areas where the available evidence is limited or unclear. Over two rounds of a modified Delphi process were conducted via the web-based platform SurveyMonkey (SVMK Inc., USA), the SC iteratively refined the content by modifying, removing, or adding questions and components.

Participants were given three weeks to complete each questionnaire and were asked to rate their level of agreement using a seven-point Likert scale, or to indicate if they were unable to comment. Consensus was defined *a priori* as ≥80% agreement. A second round of questions was designed to clarify areas where responses from the first round were inconclusive. Although five to ten experts are generally considered sufficient for content validation, a total of 27 participants were included to ensure broad representation. (5)

After completion of the analysis of the second-round responses was completed, and feedback was provided to the EP. Approximately seven months later, an in-person consensus meeting was convened, attended by most EP members and active participants from the transplant community, to further discuss areas where consensus had not been achieved. EP members presented summaries of the survey findings alongside the supporting evidence for the draft recommendations. This was followed by open discussion, leading to further revision and refinement of the recommendations.

The final draft was published on the SATS website for one month to allow for additional feedback, after which it was submitted for publication. All SC and EP members approved the final document. Statements achieving consensus are presented as strong recommendations, while those based on weaker evidence or without consensus are described as “conditional recommendation” to reflect a lower level of underlying evidence or agreement. A formal review is planned five years after publication, unless earlier revision is required considering emerging high-quality evidence or changes in legislation.

3) General comments:

This document summarises the survey findings and subsequent discussions aimed at developing nationally consistent guidance for assessing liver transplant eligibility, prioritising patients on the waiting list, and allocating DDLGs. The recommendations and suggestions are grounded in the National Health Act of 2003, Chapter 8, (6) as well as the Regulations on General Control of Human Bodies, Tissue and Organs for Transplantation, 2008. (7)

DDLGs are a nationally shared public resource that were altruistically donated by the family of a deceased person. As custodians of this resource, transplant clinicians need to ensure that utilisation is transparent, and follow the principles of equity, utility and justice. As these principles are often juxtaposed, the below recommendations aim to establish a framework of what is considered reasonable in the South African context.

Transplant eligibility assessment and waiting list prioritisation are inextricably linked to the allocation process, collectively ensuring that the limited supply of donor organs is utilised in a responsible manner that maximises overall benefit while maintaining public trust in the transplant system. While some variation between units in risk tolerance is to be expected, accountability in the utilisation of DDLGs remains essential. Transplant centres must be able to justify their use of this scarce resource, and should document deviations from the eligibility criteria, prioritisation and allocation principles to better understand unit-specific practices and patient needs.

South African deceased donation rates remain consistently low at 1.43 donors per million population in 2024, further highlighting the responsibility to ensure fair and equitable utilisation. (8) The two-tiered healthcare system remains difficult to navigate in a resource-intensive field such as LT, particularly within a constitutional framework that both guarantees the right to healthcare and acknowledges the finite nature of available resources. (3, 9)

At the same time, indications for LT continue to expand - especially in transplant oncology - where outcomes in carefully selected patients now approach those achieved for traditional end-stage liver disease indications. (10) As a result, a growing disparity between organ supply and demand is anticipated, a challenge best addressed through proactive, transparent, and collaborative engagement among stakeholders.

4) Eligibility criteria for DDLT:

Liver transplantation is well established as a safe and accepted intervention for acute liver failure, acute-on-chronic liver failure, end stage chronic liver disease, hepatocellular carcinoma as well as selected other malignancies. Indications are continuously evolving, and due to the global shortage in DDLGs, extended indications are typically explored in regions with a relative oversupply of DDLGs, by utilising grafts that would otherwise have been discarded, or selectively through avenues such as living donor liver transplantation (LDLT).

In South Africa, 0.47 deceased donor liver transplantation (DDLT) per million population (pmp) were performed in 2024, (8) with a national waiting list mortality of --%. Therefore, in the setting of DDLT, transplantation should only be considered where the individual has a significant mortality risk without a transplant and there is proven acceptable long-term benefit from LT. It is

important that the process and indications for listing are transparent and consistently applied to ensure equitable access to LT for those in need.

a) Recommended criteria for elective DDLT listing on the standard regional waiting list

For some time, the widely accepted listing threshold for elective DDLT was a MELD-Na score of 15 or above. (11) However, recent evidence suggests that recipients with end-stage chronic liver disease may benefit from LT at MELD scores of 12 or above. (12) The following criteria were proposed when listing a patient on the standard regional waiting list for elective DDLT, and were accepted by the expert panel:

Table 1: Recommended criteria for elective DDLT listing on the standard regional waiting list

Cirrhosis of any cause with

- MELD-Na 12 or above OR
- Child Turcotte Pugh (CTP) score 8 or above OR
- Other features of decompensation
    - Refractory ascites
    - Spontaneous bacterial peritonitis
    - Chronic or recurrent encephalopathy affecting activities of daily living
    - Hepatic encephalopathy secondary to an event
    - Recurrent variceal bleed refractory to endoscopic/percutaneous therapies
    - Hepatic hydrothorax
    - Portopulmonary hypertension
    - Hepatopulmonary syndrome

Autoimmune liver disease

- Primary biliary cirrhosis with complications of portal hypertension or severe intractable pruritus
- Primary sclerosing cholangitis with complications of portal hypertension or recurrent cholangitis

Liver-based metabolic conditions with systemic manifestations ● Haemochromatosis ● Wilson's disease ● Primary hyperoxaluria ● Alpha-1-antitrypsin deficiency ● Familial hyperlipidaemia ● Cholesterol ester storage disease ● Familial amyloidosis ● Glycogen storage disease
Hepatocellular carcinoma (HCC) within UCSF criteria at presentation, after downstaging or as salvage post-resection
Irresectable non-HCC liver tumours ● Colorectal liver metastasis ● Neuro-endocrine neoplasm ● Perihilar cholangiocarcinoma ● Hepatic epithelioid haemangioendothelioma ● Multiple hepatic adenomas
Re-transplantation for chronic ductopaenic rejection and ischaemic cholangiopathy
Miscellaneous ● Severe acute alcoholic hepatitis refractory to medical therapy ● Secondary biliary cirrhosis ● Symptomatic polycystic liver disease ● Budd Chiari syndrome with liver decompensation refractory to medical or percutaneous therapy

b) Recommended criteria for urgent DDLT listing on the national priority waiting list

Most international liver allocation policies offer a mechanism to expedite transplantation in urgent recipients by granting them access to DDLGs beyond their standard deceased donor drainage area.

(13-15) However, definitions and terminology vary across regions, with the UK's National Health Service Blood & Transplant (NHSBT) criteria classifying these patients as 'super-urgent' (13), the UNOS as Adult or Paediatric 'status 1a' (14), and Eurotransplant as 'high urgency'. (15) Despite these differences, there is broad agreement that, for the patient to justify urgent listing, the mortality rate should approach 100% if not transplanted within 7 days.

In South Africa, a national priority waiting list (NPWL) has been utilised since early 2017 and most expert panellists regarded this as a useful tool to expedite liver transplant for urgent indications. It was agreed that the criteria for national prioritisation needed to be standardised, with room for case-by-case discussion between regions should clinicians deem it appropriate. It was agreed that a standardised national priority listing sheet (Appendix b) would be used to capture available clinical information, and that the listing would only be activated once it has been submitted to a central coordinator. Although some experts proposed daily re-listing of active patients, the majority supported the current practice of relisting on Monday mornings as a more practical approach. The importance of capturing information at delisting was emphasised, as this would support future audit processes and quality improvement efforts.

Although the liver allocation policy proposed in 2017 was predominantly based on UNOS criteria (14), the steering committee felt it necessary to consider a broader view of criteria applied outside of the United States. (13,15) The following criteria were proposed when listing a patient as a national priority for DDLT, and were accepted by the expert panel:

Table 2: Recommended criteria for urgent DDLT listing on the national priority waiting list

Acute liver failure (ALF) fulfilling Kings College Criteria (Adult and Paediatric)
Acute Autoimmune hepatitis presenting as ALF
Hepatic artery thrombosis within 21 days of transplant
Severe early allograft dysfunction (EAD) within 7 days of transplant, characterised by at least 2 of the following: ● INR > 3, ● arterial lactate > 3 mmol/L ● AST > 10 000 IU/ml
Acute Wilson's disease presenting as ALF

Acute Budd Chiari syndrome with a combination of coagulopathy and encephalopathy
Severe liver failure in a living liver donor within 4 weeks of donation
Anhepatic patient

Although some policies have included the absence of bile production as an indicator of EAD, the panel questioned the practicality and value of including such a criterion, as external biliary drains are rarely used in modern liver transplant units. Therefore, the panel agreed to exclude bile production from the definition of EAD.

c) Acute-on-chronic liver failure

Patients with acute-on-chronic liver failure (ACLF) can deteriorate rapidly and should ideally be considered for transplant within 7–10 days for best outcomes. (16) An additional tier of urgency between ALF and chronic liver disease was considered but deemed to be inappropriate due to the lack of a universally accepted definition of ACLF and the difficulties in regulating such an additional tier. The feasibility of adopting a 'Share 35'-like policy with national prioritisation of high MELD patients was mentioned, but some members were concerned that such a policy may lead to the preferential allocation of DDLGs to large volume centres with a large recipient base, irrespective of their own ability to generate donations within their region.

5) Contraindications to DDLT:

The following contraindications to DDLT were proposed and accepted by the expert panel.

Table 3: Contraindications to DDLT

Absolute ● ALF with sustained ICP >50 mm Hg or CPP <40 mmHg for more than 2 hours ● Severe cardiac or pulmonary disease ● Uncontrolled sepsis, including biliary sepsis ● Ongoing alcohol or substance abuse ● Extrahepatic malignancy (except in selected cases with NET) ● Intrahepatic cholangiocarcinoma ● Haemangiosarcoma ● AIDS ● Anatomical abnormalities that preclude LT ● Persistent non-adherence
Relative ● Advanced age: Need to assess physiological, rather than chronological age and to consider the patient's functional status ● Obesity (BMI >40 kg/m^2) ● Previous non-hepatic malignancies within 5 years

6) Prioritisation on the standard regional waiting list:

Although the MELD-Na score is being used as a prioritisation tool in many transplant regions worldwide, its limitation in predicting wait-list mortality in specific groups of patients is widely recognised. (17) These patients typically include:

- PSC with recurrent cholangitis
- Retransplant for chronic rejection
- Complications of hepatopulmonary syndrome or portopulmonary hypertension

Furthermore, the need for multi-organ transplant, or the time spent on the waiting list are not recognised at all. The inadequacies of MELD-based systems have led many to explore alternative

scoring systems, including the UK's transplant benefit model of prioritisation which includes 21 recipient criteria (clinical, diagnosis and laboratory variables) instead of exclusively laboratory parameters. (13) The Liver Transplant Society of India recently implemented a clinical composite scoring system called the Clinical Severity Score for adults (CSS-A) and children (CSS-P), where the MELD points contribute 50% to the final score, with additional points awarded in the presence of complications of cirrhosis, HCC, acute deterioration and a waiting time beyond 3 months. (18)

The proposal was to adopt the CCS score as a prioritisation tool as it addresses many limitations of the MELD-Na score, including standardised exception points, without disregarding it in its entirety. The panel disagreed on the use of the CCS-A in the SA context due to a lack of evidence. It was decided to trial the CSS over a year, while still using the MELD-Na score for allocation, to validate its use and decide on further utility in the future. The panel agreed that exception points should continue to be allocated by the respective transplant centre multidisciplinary teams on a case-by-case basis. In the absence of nationally standardised criteria, existing historical UNOS/National Liver Review Board (NLRB) standardised exception point recommendations may serve as a reference framework where clinically appropriate (Supp Table). Nationally agreed exception point criteria should be developed and validated in future iterations of the allocation policy (references in the comments section) The allocation of exception points will be decided by respective transplant panels on a case-by-case basis. The panel recommended that MELD-Na scores should be updated weekly for MELD-Na >30, monthly for 20-30, and every 3 months if <20.

7) Prioritisation on the national priority waiting list:

Patients listed on the national priority waiting list will be presumed suitable for transplantation by other centres unless communicated otherwise. If a DDLG from another region is accepted, but not utilised for an urgently listed recipient, the reason should be documented. The DDLG should be allocated to an alternative recipient, and the procuring unit should be informed and offered the first available ABO-compatible DDLG of equivalent quality group in exchange. In situations where multiple priority-listed recipients exist across different regions, priority should be given to the recipient in the region where the DDLG becomes available, irrespective of the order in which patients were listed. ABO-incompatible DDLT for those listed on the NPWL will be supported and facilitated, if the recipient centre has the necessary facilities and expertise to perform immunoadsorption safely.

8) DDLT for malignancy:

Liver transplant has emerged as a potentially curative treatment option for highly selected patients with irresectable primary and secondary liver tumours and is anticipated to become a major indication for transplant soon. Transplant clinicians should be aware of the common and disease-

specific pitfalls that have been described and should present these cases to a multidisciplinary tumour board prior to acceptance.

The panel recognised the need to standardise listing criteria in the field of transplant oncology. However, some panellists argued that listing outside of these standard criteria should be the prerogative of the regional multidisciplinary tumour board, if patients are informed that an acute re-transplant with a DDLG from another region may not be an option should it be required. Other panel members contended that, given DDLGs are regarded as a national resource, eligibility criteria should be applied uniformly, with alternatives such as LDLT or the use of otherwise discarded grafts considered when extending beyond established criteria.

Transplant oncology remains a rapidly evolving field with multiple randomised-controlled trials due for publication within the next couple of years. In-depth discussion is outside of the scope of this document. The panellists recommended that the following criteria be adopted with the intention of standardising listing criteria for oncological indications. When patients are appropriately selected according to the recommended guidelines, 5-year overall survival is equivalent to that of recipients transplanted for non-oncological indications, then the allocation of DDLGs that would otherwise have been discarded, is no longer justified.

9) Paediatric liver transplantation

a) Indications for paediatric liver transplant

Table 5: Indications for paediatric liver transplant

Chronic liver disease decompensation
● Biliary atresia ● Alagille syndrome ● Progressive familial intrahepatic cholestasis ● Autoimmune hepatitis ● Primary Sclerosing cholangitis ● Caroli disease ● Wilson disease ● Cystic fibrosis ● Glycogen storage disease type 3&4 ● Tyrosinaemia type 1 ● Budd-Chiari syndrome

Non-cirrhotic metabolic liver disease ● Criggler Najar syndrome type 1 ● Primary hypercholesterolaemia ● Urea cycle defects ● Organic acidaemias ● Primary hyperoxaluria ● Porphyria
Liver tumours ● Unresectable hepatoblastoma after neoadjuvant chemotherapy ● Unresectable benign liver tumours with symptoms
Acute liver failure
Retransplantation for chronic ductopaenic rejection or ischaemic cholangiopathy

In selected cases with compensated cirrhosis associated with severe growth retardation and / or sarcopaenia, liver transplantation should be considered.

Specific section on HCC and Hepatoblastoma in children:

b) Paediatric Liver allocation

Currently in South Africa, the paediatric end stage liver disease (PELD) score in children younger than 12 years of age and the medical end stage liver disease (MELD) score in children older than or equal to 12 years of age. Studies have compared successful international paediatric liver allocation strategies to identify potential global strategies. Recommendations have also been made for broader sharing of liver allografts to tackle geographic disparities in liver transplantation. Currently, the PELD system for paediatric liver allocation is being revised to evolve into a continuous distribution system taking into consideration other important factors like social determinants as studies by Chang et al have found that the PELD score underscores 90-day mortality in 17% of paediatric patients requiring liver transplantation (23,24). One of the major limitations of the traditional PELD model is the absence of a renal function parameter, despite renal dysfunction being a strong predictor of mortality in paediatric liver failure. Incorporation of serum creatinine into the score (PELD-Cr) has therefore been proposed and increasingly adopted

in allocation practice internationally to improve mortality prediction and better align paediatric prioritisation with adult MELD-Na–based allocation (25).

The PELD Creatinine (PELD Cr) has been utilised in the USA since July 2023 due to being a better predictor of waitlist mortality by converting age and growth failure from categorical to continuous variables thus also improving how paediatric candidates are ranked relative to adolescent and adult candidates. The consensus reached by the panel was to utilise the PELD Cr score for waitlisting paediatric patients younger than 12 years of age and the MELD-Na score for those older than 12 years of age. This is particularly relevant in the South African setting, where paediatric liver transplantation is frequently performed for cholestatic disorders such as biliary atresia and conditions in which malnutrition and evolving renal dysfunction may not be adequately reflected by the traditional PELD score.

The allocation of additional points for time on the waiting list and for infants with biliary atresia, which is successfully being utilised by Eurotransplant, Canada and Brazil, was also suggested by the steering committee to decrease waitlist mortality in paediatric patients (25). However, the panel disagreed with this, relating that this would disadvantage the adult patients on the waiting list. It was decided to continue with the standardised exception points as per UNOS which was currently being utilised for conditions like hyperoxaluria, metabolic liver disease and other conditions where the PELD score does not adequately reflect the underlying liver condition and expected mortality. (26) Non-standardised exception points would still be at the discretion of the non-centralised transplant panels.

c) Splitting as a strategy to improve access to LT for children

With the view and purpose of further optimising liver utility, we focussed on the need for mandatory splitting of suitable whole livers into 2 segments of liver, transplantable into 2 separate recipients. (27) The typical scenario will split the whole graft into a small segment 2, 3 left graft, suitable for a paediatric recipient, and a larger segment 4, 5 ,6 ,7 and 8 right graft, typically suitable for a large paediatric or smaller adult recipient. Decision making complexity can be slightly escalated, by splitting the whole graft into a full left (segments 2, 3 and 4) and right sided graft (segments 5, 6, 7 and 8), transplantable into 2 adult recipients. (28) The premise behind splitting is the ability to predict accurate graft weights, and that each graft will have the inherent function to sustain the demands of each recipient.

There was broad consensus within our transplant community that splitting of suitable DDLG's should be mandatory where feasible, and that as a part of our experiential growth, it is essential to document when suitable livers are, and are not, split, and to share these reports with SATS. Beyond utilising the criteria below, there is no consensus that utilising a split scoring system would be beneficial.

The donor criteria below are not steadfast, but used as a collective, and are reliable predictors of suitability to split a liver (28):

- Age less than or equal to 50 years
- ALT / AST < 3 x normal
- ICU admission less than 7 days duration
- Haemodynamically stable on low dose inotropic support
- Histology of donor liver demonstrates minimal to mild fatty liver disease with less than 20-30 percent macrosteatosis, and no fibrosis
- Body Mass Index < 30
- Serum sodium on a downward trend from a maximum of 160
- If present, a short duration of cardiac arrest, with improving trend in cellular enzymes and lactate levels

10) Extended Criteria Donors

In keeping with international trends, it was agreed that the term Extended Criteria Donor (ECD), as opposed to Marginal Donor, is preferred when referring to a deceased donor that carries an increased risk of severe EAD or graft failure should the liver be transplanted. (29)

It was agreed that ECDs should be clearly defined as utilisation of such a liver may have clinical implications for the recipient, and may impact transplant logistics and liver allocation practices in South Africa.

Several factors have been associated with an increased risk of severe EAD or graft failure, with the below criteria adopted by the panel. (Modified from Vodkin *et al.)* (30)

Table 6: Definition of Extended Criteria Liver Donors

Definition of Extended Criteria Liver Donors (1≥ criteria present)

- Advanced age > 65 years
- Macro-vesicular steatosis > 30%
- Donation after circulatory death
- ICU stay > 7 days
- Need for cardio-pulmonary resuscitation
- Pre-retrieval serum sodium > 160 mmol/L
- Serum bilirubin > 86 umol/L
- Elevated AST or ALT
    - > 10 times upper limit of normal
    - > 5 times upper limit of normal, and rising trend
- High vasopressor requirements
    - Dopamine > 15 ug/kg/min
    - Noradrenaline > 0.3 ug/kg/min
    - Adrenaline > 0.3 ug/kg/min
    - Vasopressin > 2.4 units/hour
    - Three or more vasopressors required at any dose
- Anoxia or hanging as cause of death
- Cold ischaemic time > 12 hours

The panel agreed not to include reduced or split liver grafts as a criterion for ECD, as the donors are carefully selected according to objective and well-defined criteria. In addition, WDGMC has published a local series comparing patient and graft survival between LDLT and split recipients and reported equivalent outcomes in both adult and paediatric cohorts. (31)

Transplant clinicians are advised to clearly state the increased risk of severe EAD and graft failure, and to mention the potential benefits of reduced waiting time to the prospective recipient. ECD grafts should ideally be allocated to the highest priority recipient deemed suitable and willing to accept the offer. Centres utilising ECDs are encouraged to closely monitor outcomes in anticipation of future guideline development.

The panel recognised the role of novel preservation techniques in the optimisation of ECD grafts and will review the above criteria and allocation principles once these technologies are available locally.

11) Equity, Access and Transparency

a) National waiting list of deceased donor liver transplant candidates

A national centralised listing and prioritisation system which is overseen by representatives from each transplant centre and where allocation prioritises patients based on medical urgency while maintaining regional considerations was proposed. Despite broad conceptual support for national allocation, the panel concluded that a fully national waiting list is currently not feasible in the South African context. Instead, separate regional waiting lists for deceased donor liver transplantation would be maintained, with urgent cases continuing to be managed through the national priority waiting list and routine allocation decisions occurring through regional multidisciplinary allocation structures.

This decision reflected both practical and structural constraints, especially the absence of a formally mandated national organ procurement and allocation authority, comparable to systems such as UNOS, with the governance framework, regulatory oversight, real-time data infrastructure, and operational capacity required to administer and audit a centralised allocation system. Regardless, all LT units are encouraged to document the decision-making process following DDLG allocation and should have an internal mechanism where these decisions can be reviewed periodically.

b) Payback system

The term "payback" in organ allocation refers to mechanisms by which an organ or allocation advantage granted to one recipient (often within a local or regional sharing arrangement) is offset or repaid by providing a reciprocal benefit to the donor's centre or allocation unit. (32) A payback system which was agreed on in 2017, but only partially implemented, was reconsidered by the panel as a potential mechanism to maintain equity between regions and healthcare sectors when organs are shared for urgent national priority recipients.

The proposal was that a DDLG provided by one region to facilitate transplant of a priority listed patient in another region be paid back with the first available ABO compatible liver of equivalent or superior quality. Should the originating centre that initially provided the liver not be able to utilise the first available offer, the payback obligation lapses. These "payback" system frameworks have been utilised in several allocation systems globally to balance equity, utility, and regional participation in organ donation and allocation. Consensus could not be reached, as some panellists argued that DDLGs should be regarded as a national resource and be allocated to the candidate with highest clinical urgency, regardless of region or health care sector. Others felt that a review of post-transplant outcomes in urgently listed patients is required, as being the most urgent candidate at the time may not necessarily result in the best utilisation of a DDLG unless outcomes are equivalent to transplant for elective indications. Therefore, the panel agreed that further outcome data and national governance structures would be required before a formal payback policy could be implemented.

c) Geographic factors

South Africa currently has two liver transplant centres, each operating within distinct geographic regions. In Cape Town, DDLT is primarily conducted within the public sector at Groote Schuur Hospital and Red Cross War Memorial Children's Hospital, with additional procedures performed in the private sector at UCT Private Academic Hospital. In Johannesburg, the Wits Donald Gordon Medical Centre, a private-sector institution, provides DDLT services to both public and private sector patients.

In May 2012 it was decided that deceased donors and liver transplant candidates from the Cape Provinces (including the Western, Eastern and Northern Cape) must be directed to Cape Town, and the remainder of the Provinces to Johannesburg. During re-discussion, some members of the EP argued that the current regions perpetuate geographic inequity, as only 26% of the population currently reside within the Cape Provinces. As it stands, 74% of the SA population must access liver transplantation through a single centre based in the private sector, which has previously reported waiting list mortality three times that observed in Cape Town, while procuring half the number of deceased donors in 2023 (0.8 pmp compared to 1.7 pmp in the Cape Provinces).

The committee suggested that historical drainage areas should be rationalised to better reflect population distribution and deceased donor rates, thereby promoting proportional access. It further emphasised the importance of prioritising collaborative, inter-regional networks over competitive centre-based dynamics to optimise transplant outcomes and volumes at a national level.

12) Non-South African Citizens

All non-South Africans can support deceased donation in South Africa in the same way as South Africans can, should their next-of-kin grant consent. Similarly non-South African living donors can donate if assessed as suitable.

As per the National Health Act 'an organ may not be transplanted into a person who is not a South African citizen or a permanent resident of the Republic without the Minister's authorisation in writing.' (33)

Although liver failure can present as a medical emergency, liver transplantation per se is not an emergency medical treatment. LT is a specialised, costly service, utilising a scarce resource of donors and requires long-term follow-up, lifelong immunosuppressive therapy and ongoing medical support to ensure good outcomes.

Refugees, asylum seekers and permanent residents must be assessed for eligibility in the same standardised way as South African citizens, prior to liver transplant listing.

The national waiting list criteria in this document focuses purely on the medical component of liver transplantation but a full and exhaustive social assessment takes place for all LT patients as per regional criteria. In this system, refugees, asylum seekers and permanent residents must be treated the same as South African citizens. This includes approval from a local multidisciplinary team that assesses multiple factors, which influence long-term outcomes, in deciding to list a patient on the waiting list. These are outlined in detail elsewhere in this document.

13) Strengths and limitations

This guideline document is believed to be of national relevance and addresses the highly consequential and underexplored area of liver allocation in South Africa. The committee attempted to tailor recommendations and suggestions to the South African healthcare landscape, partly accounting for disparities in infrastructure, donor availability, and public - private sector dynamics.

However, it must be recognised that the relatively small and specialised expert panel, selected from existing transplant centres, may introduce institutional or regional bias, particularly given differing resource environments. Persistent lack of consensus on key issues highlights ongoing uncertainty and may limit immediate implementation.

As an initial effort to standardise eligibility, prioritisation, and DDLG allocation, this document emphasises a broad framework and may not fully address the finer nuances of each domain. As a transplant community, we intend to refine and expand in future iterations.

14) Audit, quality control and periodic review

The success of any new recommendation or suggestion is entirely dependent on its actual implementation at the level of the transplant unit. Units are strongly encouraged to practice self-audit to monitor compliance with the listing, prioritisation and organ allocation recommendations, and to hold each other accountable.

As the DDLT landscape in South Africa evolves, these recommendations should be periodically reassessed using accumulated data to ensure they continue to support a fair and equitable allocation of DDLGs. A formal review is scheduled five years after publication of this document, unless earlier revision is warranted by emerging high-quality evidence or changes in legislation.

15) Areas of future research

The recommendations and suggestions included in this document, which are informed by international literature and expert consensus, must be validated in the South African liver transplant setting. The adoption of the Clinical Severity Score is an appealing prospect, as it seemingly addresses many of the limitations of MELD-based scoring systems, without disregarding the MELD score entirely. It was decided to trial the CSS over a year, while still using the MELD-Na score for allocation to validate its use and decide on further utility in the future.

A comprehensive review of the National Priority Waiting List is overdue and would provide valuable insight into listing indications, outcomes following listing and transplantation, and the life-years gained in this critically ill population.

Liver transplant for highly selected patients with non-resectable colorectal liver metastases is likely to emerge as a significant indication in the future, and it will be essential to monitor the impact on waiting times for patients listed for non-oncological indications.

16) Credit authorship contribution statement

P. Walabh, T. du Toit, C.W.N. Spearman, D. Thomson, J. Loveland, M. McCulloch: Conceptualisation, project administration, supervision, methodology, data collection and analysis, writing, and approval.

M. Sonderup, N. Gogela, D. Batty, M. Bernon, E. Jonas, B. Bobat, S.Rambarran, L. Jacobs, D. Mokgoko, D. Parbhoo, F. McCurdie, A. Meyer, R. de Lacy, T. Siyotula, N.P. Moshesh, C. Hajinicolaou, M. Duncan, S.T. Palweni, V. Mudau, I. Joubert, A. de Vos: Supervision, methodology, writing, and approval.

J. de Ville de Goyet: International reviewer, supervision, writing and approval

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18) Conflicts of interests

All authors have none to declare.

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22) Appendix

a) Survey questionnaires Round 1 and 2:

SATS Liver Allocation Delphi Consensus Questionnaire – Round 1 (Likert Scale 1-7)

A. Rationale for Revising Allocation Policy

Question	Consensus (%)
There is a need to re-discuss deceased donor liver graft allocation	78.7
Clinical urgency should be a more important consideration than wait-list time	80.7
Prioritisation criteria of wait-listed patients should be standardised	84.7

B. General Considerations

Question	Consensus (%)
Need to standardise eligibility/minimal listing criteria	78.6
Standardise frequency of recalculation of clinical severity scores while wait-listed	77.9
Standardise and expand liver allocation exception points (paediatric & adult)	81.1
Add extra points for time on the waiting list	67.2
Consider scoring systems beyond PELD/MELD to determine clinical urgency	71.5
Add extra points for biliary disease where MELD/PELD underestimates severity	70.7
Introduce a composite scoring system similar to Indian National policy	71.1
Standardise listing for CRLM, hilar CCA and NET with mandatory tumour MDT	78.6

C. Paediatric Liver Allocation

Question	Consensus (%)
PELD/MELD inadequate — replace/complement with composite scoring system	73.5
Allocate exception points for metabolic and malignant conditions	76.7
Mandatory consideration of liver splitting for paediatric recipients	68.9
Composite scoring system incorporating urgency, exceptions and waiting time	74.8

D. National Urgent Priority Listing

Question	Consensus (%)
Criteria for national liver priority listing should be standardised	92.9
A database/documentation required for all urgent/priority listings	82.1
Living donor developing severe liver failure within 4 weeks qualifies for priority listing	88.9
Severe early allograft dysfunction within 7 days qualifies for priority listing	88.5
Anhepatic patient after total hepatectomy (e.g. trauma) qualifies for priority listing	76.9
Fulminant liver failure meeting King's College criteria qualifies for priority listing	92.3
Hepatic artery thrombosis within 21 days qualifies for priority listing	85.2
Acute Wilson disease/AIH/Budd-Chiari with coagulopathy and encephalopathy qualifies for priority listing	88.9

E. Equity, Access and Transparency

Question	Consensus (%)
Payback system between provinces/transplant units	65.4
Single national waiting list (regional allocation retained except national priority)	67.6
Single national waiting list improves equity and transparency	73.1

SATS Liver Allocation Delphi Consensus Questionnaire – Round 1 (Likert Scale 1-7)

A. Adult Liver Transplantation

Question	Consensus (%)
Add capped waiting-time points (max 6)	65.6
Biliary disease severity should be incorporated into scoring	70.4
Composite Clinical Severity Score-Adult (CSS-A) acceptable	72.0
Patients transplanted outside tumour criteria not eligible for DDLT retransplant	65.8

B. Paediatric Liver Transplantation

Question	Consensus (%)
Add waiting-time points (max 12)	73.1
Composite paediatric scoring system acceptable	72.8
Criteria to determine splittable donor acceptable	77.7
Mandatory documentation when a suitable liver is not split	75.9
Simple scoring system to determine splittability useful	58.8

C. Urgent Priority Listing

Question	Consensus (%)
Prefer ABO-compatible transplant unless national priority patient	76.5
Documentation required if ABO-incompatible used despite compatible recipient	83.5
National priority listing proportion impacts organ utility	65.2

D. Equity, Access and Transparency

Question	Consensus (%)
Net organ export disincentivises donation	60.8
Regional multidisciplinary allocation team required	75.4
National waiting list with regional allocation (except priority)	66.8

b) National Priority Waiting List sheet

SOUTHERN AFRICAN TRANSPLANTATION SOCIETY

National priority liver transplant listing sheet

TRANSPLANT CENTRE DETAILS			
Transplant centre		Coordinator name	
Date of listing		Time of listing	
PATIENT DETAILS			
Patient name and surname		Hospital number	
Age		Height (cm)	
Recipient ABO		Weight (kg)	
Donor ABO considered			
INDICATION			
Hepatic artery thrombosis		Primary non-function	
Fulminant liver failure		Metabolic condition	
Acute Wilson's disease		Organic acidaemia	
Hepatoblastoma		Combined heart liver, with P1 heart	
Other (please provide additional information)			
RELEVANT ADDITIONAL INFORMATION			

RESPONSIBLE CLINICIANS		
	Responsible surgeon	Responsible physician
Name and surname		
Signature		

Document to be completed for all priority listings and retained in patients file. A copy of the document is to be sent to the central coordinator.

DELISTING INFORMATION					
Date of delisting		Time of delisting		Coordinator name	
Died prior to transplant		Transplant from deceased donor		Transplant from living donor	
Condition improved					