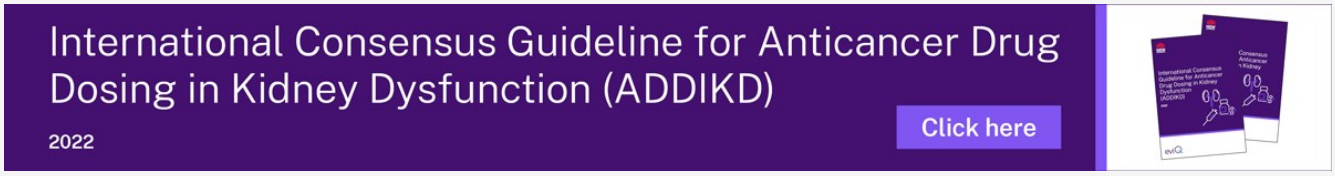
# Acute lymphoblastic leukaemia BFM 2000 maintenance phase SUPERSEDED

**ID: 1288** v.4 **Superseded** Essential Medicine List

This protocol has been superseded as native form L-asparaginase is no longer available in Australia. Acute lymphoblastic leukaemia ALL06 is the recommended treatment.

Patients with leukaemia should be considered for inclusion into clinical trials. Link to ALLG website and ANZCTR website.

The anticancer drug(s) in this protocol may have been included in the ADDIKD guideline. Dose recommendations in kidney dysfunction have yet to be updated to align with the ADDIKD guideline. Recommendations will be updated once the individual protocol has been evaluated by the reference committee. For further information refer to the ADDIKD guideline. To assist with calculations, use the eviQ Estimated Glomerular Filtration Rate (eGFR) calculator.




**Related pages:**

- Acute lymphoblastic leukaemia BFM 2000 overview SUPERSEDED

- Overall BFM 2000 treatment schema
- Overall BFM 2000 protocol flow diagram

## Treatment schedule - Overview

### Cycle 1 and further cycles

| Drug | Dose | Route | Day |
|---|---|---|---|
| mercaptOPURine * | 50 mg/m$^2$ ONCE a day | PO | 1 to 7 |
| Methotrexate * | 20 mg/m$^2$ ONCE a week | PO | 1 |

* Doses are titrated according to WCC (target range 2 to 3 x $10^9$ /L) as per the table below:

| WCC | % Dosage |
|---|---|
| < 1 x $10^9$ /L | 0 |
| 1 to 2 x $10^9$ /L | 50 |
| 2 to 3 x $10^9$ /L | 100 |
| > 3 x $10^9$ /L | to 150 |

**Criteria for starting Maintenance Phase:**

- neutrophils greater than 1.0 x $10^9$/L
- platelets greater than 100 x $10^9$/L

A bone marrow aspirate is required for MRD testing 12 months after diagnosis, then again at the completion of Maintenance

Phase.

**Frequency:** 7 days
Commence Maintenance Phase two weeks after the end of Protocol II depending on bone marrow recovery.

**Cycles:** Total duration of therapy: 104 weeks (24 months) as calculated from the START of Protocol I.

---

**Notes:**
Consider thiopurine methyltransferase (TPMT) testing prior to administration of mercaptopurine.

**Drug status:** All drugs in this protocol are on the PBS general schedule

Mercaptopurine is available as **50 mg** tablets
Methotrexate is available as **2.5 mg and 10 mg** tablets

## Treatment schedule - Detail

*The supportive therapies (e.g. antiemetics, premedications, etc.), infusion times, diluents, volumes and routes of administration, if included, are listed as defaults. They may vary between institutions and can be substituted to reflect individual institutional policy.*

*Antiemetics if included in the treatment schedule are based upon recommendations from national and international guidelines. These are **defaults only** and may be substituted to reflect individual institutional policy. Select here for recommended doses of alternative antiemetics.*

### Cycle 1 and further cycles

| Day 1 | | |
|---|---|---|
| mercaptOPURine | 50 mg/m$^2$ (PO) | ONCE a day. Take on an empty stomach at least one hour before or two hours after food. |
| Methotrexate | 20 mg/m$^2$ (PO) | ONCE a week. Take on an empty stomach at least one hour before or two hours after food. |

| Day 2 to 7 | | |
|---|---|---|
| mercaptOPURine | 50 mg/m$^2$ (PO) | ONCE a day. Take on an empty stomach at least one hour before or two hours after food. |

Note: doses are titrated according to WCC (target range 2 to 3 x $10^9$ /L) as per the table below:

| WCC | % Dosage |
|---|---|
| < 1 x $10^9$ /L | 0 |
| 1 to 2 x $10^9$ /L | 50 |
| 2 to 3 x $10^9$ /L | 100 |
| > 3 x $10^9$ /L | to 150 |

**Criteria for starting Maintenance Phase:**

- neutrophils greater than 1.0 x $10^9$/L
- platelets greater than 100 x $10^9$/L

A bone marrow aspirate is required for MRD testing 12 months after diagnosis, then again at the completion of Maintenance Phase.

**Frequency:** 7 days
Commence Maintenance Phase two weeks after the end of Protocol II depending on bone marrow recovery.

**Cycles:** Total duration of therapy: 104 weeks (24 months) as calculated from the START of Protocol I.

## Indications and patient population

- For the treatment of adolescent and young adult (AYA) patients with acute lymphoblastic leukaemia (precursor B-ALL, T-ALL but not mature B-ALL/Burkitt lymphoma).
- This regimen could be reasonably be considered for patients < 30, although published data are not available for patients older than 18 years of age.
- All risk groups (not transplanted) receive maintenance treatment. Link to definition of risk groups.

## Clinical information

| | |
|---|---|
| **Caution with oral anti-cancer drugs** | Select links for information on the safe prescribing, dispensing and administration of orally administered anti-cancer drugs.<br>Read more about the COSA guidelines and oral anti-cancer therapy |
| **Emetogenicity minimal or low** | No routine prophylaxis required. If patients experience nausea and/or vomiting, consider using the low emetogenic risk regimen.<br>Read more about preventing anti-cancer therapy induced nausea and vomiting |
| **Thiopurine-S-methyltransferase (TPMT) enzyme deficiency** | Patients with an inherited deficiency of the TPMT enzyme are at an increased risk of, and prone to developing, rapid bone marrow depression which may lead to severe, life-threatening myelosuppression when undergoing treatment with thiopurines (azathioprine, mercaptopurine, tioguanine). This may be exacerbated by coadministration with drugs that inhibit TPMT, such as olsalazine, mesalazine or sulfasalazine.<br>Consider assessing thiopurine-S-methyltransferase (TPMT) activity prior to administration of thiopurines. |
| **Pneumocystis jirovecii pneumonia (PJP) prophylaxis** | PJP prophylaxis is recommended e.g. trimethoprim/sulfamethoxazole 160/800 mg PO one tablet twice daily, twice weekly (e.g. on Mondays and Thursdays) OR one tablet three times weekly (e.g. on Mondays, Wednesdays and Fridays)<br>**Note**: do not administer on day of oral methotrexate.<br>Read about prophylaxis of pneumocystis jiroveci (carinii) in cancer patients |
| **Antifungals and antivirals** | There are no specific recommendations for the use of antifungal or antiviral prophylaxis with this treatment. The use of prophylaxis should be at the discretion of the treating clinician and based on patient risk factors and local guidelines.<br>Read more about antifungal and antiviral prophylaxis |
| **Blood tests** | FBC every 4 weeks, LFTs every 12 weeks at a minimum throughout maintenance treatment. |
| **Hepatitis B screening and prophylaxis** | Routine screening for HBsAg and anti-HBc is recommended prior to initiation of treatment. Prophylaxis should be determined according to individual institutional policy.<br>Read more about hepatitis B screening and prophylaxis in cancer patients requiring cytotoxic and/or immunosuppressive therapy |
| **Vaccinations** | Live vaccines are contraindicated in cancer patients receiving immunosuppressive therapy and/or who have poorly controlled malignant disease.<br>Refer to the recommended schedule of vaccination for immunocompromised patients, as outlined in the Australian Immunisation Handbook.<br>Read more about COVID-19 vaccines and cancer. |
| **Fertility, pregnancy and lactation** | Cancer treatment can have harmful effects on fertility and this should be discussed with all patients of reproductive potential prior to commencing treatment. There is a risk of foetal harm in pregnant women. A pregnancy test should be considered prior to initiating treatment in females of reproductive potential if sexually active. It is important that all patients of reproductive potential use effective contraception whilst on therapy and after treatment finishes. Effective contraception methods and adequate contraception timeframe should be discussed with all patients of reproductive potential. Possibility of infant risk should be discussed with breastfeeding patients.<br>Read more about the effect of cancer treatment on fertility |

## Dose modifications

*Evidence for dose modifications is limited, and the recommendations made on eviQ are intended as a guide only. They are generally conservative with an emphasis on safety. Any dose modification should be based on clinical judgement, and the individual patient's situation including but not limited to treatment intent (curative vs palliative), the anti-cancer regimen (single versus combination therapy versus chemotherapy versus immunotherapy), biology of the cancer (site, size, mutations, metastases), other treatment related side effects, additional co-morbidities, performance status and patient preferences.Suggested dose modifications are based on clinical trial findings, product information, published guidelines and reference committee consensus . The dose reduction applies to each individual dose and not to the total number of days or duration of treatment cycle unless stated otherwise. Non-haematological gradings are based on Common Terminology Criteria for Adverse Events (CTCAE) unless otherwise specified. Renal and hepatic dose modifications have been standardised where possible. For more information see dosing considerations & disclaimer .*

The dose recommendations in kidney dysfunction (i.e.renal impairment) displayed may not reflect those in the ADDIKD guideline and have been included for historical reference only. Recommendations will be updated once the individual protocol has been evaluated by the reference committee, with this version of the protocol then being archived. Clinicians are expected to refer to the ADDIKD guideline prior to prescribing in kidney dysfunction.
**International Consensus Guideline for Anticancer Drug Dosing in Kidney Dysfunction (ADDIKD)**.

Doses are titrated according to WCC (target range 2 to 3 x $10^9$/L) as per instructions above.

Consider dose reduction in renal impairment and particularly of methotrexate in hepatic impairment. Consult with treating team and pharmacist.

## Interactions

*Drug interactions in eviQ protocols are under review and being updated to align with current literature. Further site-wide updates and changes will occur in due course.* References & Disclaimer

*The drug interactions shown below are not an exhaustive list. For a more comprehensive list and for detailed information on specific drug interactions and clinical management, please refer to the specific drug product information and the following key resources:*

- *MIMS - interactions tab (includes link to a CYP-450 table) (login required)*
- *Australian Medicines Handbook (AMH) – interactions tab (login required)*
- *Micromedex Drug Interactions (login required)*
- *Cancer Drug Interactions*
- *Cytochrome P450 Drug Interactions*

| Mercaptopurine | | |
|---|---|---|
| | **Interaction** | **Clinical management** |
| **Allopurinol** | Increased toxicity of mercaptopurine due to reduced clearance as a result of inhibition of xanthine oxidase | If the combination is used the dose of mercaptopurine must be reduced by 75 % (i.e. only one quarter of the usual mercaptopurine dose is used) |
| **Methotrexate, aminosalicylate derivatives (e.g. balsalazide, olsalazine, mesalazine, sulfasalazine)** | Increased toxicity of mercaptopurine possible due to reduced clearance | Avoid combination or monitor closely for mercaptopurine toxicity |
| **Ribavirin** | Increased toxicity and reduced efficacy of mercaptopurine possible due to metabolic enzyme inhibition by ribavirin | Avoid combination or monitor closely for toxicity of and decreased clinical response to mercaptopurine |

| Methotrexate | | |
|---|---|---|
| | **Interaction** | **Clinical management** |
| **Ciprofloxacin**<br><br>**NSAIDS**<br><br>**Probenecid**<br><br>**Proton pump inhibitors (e.g. esomeprazole, omeprazole, pantoprazole)** | Increased toxicity of methotrexate possible due to reduced clearance | Avoid combination or monitor for methotrexate toxicity<br><br>Important note: with high-dose methotrexate therapy, many of these drug combinations are *contraindicated* |
| **Sulphonamides and penicillins (e.g. sulfamethoxazole (in Bactrim®, Septrin®), piperacillin (in Tazocin®) etc.)** | Increased toxicity of methotrexate possible due to displacement from serum protein binding | Avoid combination or monitor for methotrexate toxicity |
| **Trimethoprim** | Increased toxicity of methotrexate possible due to additive antifolate activity | Avoid combination or monitor for methotrexate toxicity |
| **Mercaptopurine** | Increased toxicity of mercaptopurine possible due to reduced clearance | Avoid combination or monitor for mercaptopurine toxicity |
| **Nephrotoxic drugs (e.g. aminoglycosides, amphotericin, contrast dye, frusemide, NSAIDs)** | Additive nephrotoxicity | Avoid combination or monitor kidney function closely |
| **Hepatotoxic drugs (e.g. azathioprine, leflunomide, retinoids, sulfasalazine)** | Additive hepatotoxicity | Avoid combination or monitor liver function closely |
| **Folic acid (e.g. as in multivitamins)**<br><br>**Asparaginase (administered immediately prior or concurrently)** | Reduced efficacy of methotrexate possible due antagonism of its action | Avoid combination or monitor for decreased clinical response to methotrexate<br>Note: asparaginase administered shortly after methotrexate can enhance its efficacy and reduce its toxicity |

| General | | |
|---|---|---|
| | **Interaction** | **Clinical management** |
| **Warfarin** | Anti-cancer drugs may alter the anticoagulant effect of warfarin. | Monitor INR regularly and adjust warfarin dosage as appropriate; consider alternative anticoagulant. |
| **Direct oral anticoagulants (DOACs) e.g. apixaban, rivaroxaban, dabigatran** | Interaction with both CYP3A4 and P-gp inhibitors /inducers.<br><br>DOAC and anti-cancer drug levels may both be altered, possibly leading to loss of efficacy or toxicity (i.e. increased bleeding). | Apixaban: avoid concurrent use with strong CYP3A4 and P-gp inhibitors. If treating VTE, avoid use with strong CYP3A4 and P-gp inducers.<br><br>Rivaroxaban: avoid concurrent use with strong CYP3A4 and P-gp inhibitors.<br><br>Dabigatran: avoid combination with strong P-gp inducers and inhibitors.<br><br>If concurrent use is unavoidable, monitor closely for efficacy/toxicity of both drugs. |
| **Digoxin** | Anti-cancer drugs can damage the lining of the intestine; affecting the absorption of digoxin. | Monitor digoxin serum levels; adjust digoxin dosage as appropriate. |
| **Antiepileptics** | Both altered antiepileptic and anti-cancer drug levels may occur, possibly leading to loss of efficacy or toxicity. | Where concurrent use of an enzyme-inducing antiepileptic cannot be avoided, monitor antiepileptic serum levels for toxicity, as well as seizure frequency for efficacy; adjust dosage as appropriate. Also monitor closely for efficacy of the anti-cancer therapy. |
| **Antiplatelet agents and NSAIDs** | Increased risk of bleeding due to treatment related thrombocytopenia. | Avoid or minimise combination.<br>If combination deemed essential, (e.g. low dose aspirin for ischaemic heart disease) monitor for signs of bleeding. |
| **Serotonergic drugs, including selective serotonin reuptake inhibitors (SSRIs e.g. paroxetine) and serotonin noradrenaline reuptake inhibitors (SNRIs e.g. venlafaxine)** | Increased risk of serotonin syndrome with concurrent use of 5-HT3 receptor antagonists (e.g. palonosetron, ondansetron, granisetron, tropisetron, dolasetron, etc.) | Avoid combination.<br>If combination is clinically warranted, monitor for signs and symptoms of serotonin syndrome (e.g. confusion, agitation, tachycardia, hyperreflexia).<br>For more information link to TGA Medicines Safety Update |
| **Vaccines** | Diminished response to vaccines and increased risk of infection with live vaccines. | Live vaccines (e.g. BCG, MMR, zoster and varicella) are contraindicated in patients on immunosuppressive therapy. Use with caution in patients on non-immunosuppressive therapy.<br>For more information; refer to the recommended schedule of vaccination for cancer patients, as outlined in the Australian Immunisation Handbook |

## Administration

*eviQ provides safe and effective instructions on how to administer cancer treatments. However, eviQ does not provide every treatment delivery option, and is unable to provide a comprehensive list of cancer treatment agents and their required IV line giving set/filter. There may be alternative methods of treatment administration, and alternative supportive treatments that are also appropriate. Please refer to the individual*

*product information monographs via the TGA website for further information.*

## Day 1

**This is an oral treatment**

Safe handling and waste management

Safe administration

General patient assessment prior to each treatment.

Any toxicity grade 2 or greater may require dose reduction, delay or omission of treatment and review by medical officer before recommencing treatment.

### Pre treatment medication

Verify antiemetics taken or administer as prescribed.

### Chemotherapy - Time out

### Mercaptopurine

- administer orally ONCE a day until ceased by the haematologist
- to be swallowed whole with a glass of water; do not break, crush or chew
- to be taken preferably on an empty stomach, one hour before or at least 2 hours after food
- avoid concomitant consumption of milk or dairy products

**Note:** missed doses should not be replaced, if a dose is forgotten or vomited, normal dosing should be resumed at the next scheduled dose.

### Methotrexate

- administer orally ONCE a week on **the same day each week**
- to be swallowed whole with a glass of water; do not break, crush or chew
- if PJP prophylaxis with trimethoprim/sulfamethoxazole is prescribed, ensure this is not administered on the same day as oral methotrexate.

**Note**: if a dose is forgotten or vomited, contact treating team.

**Continue safe handling precautions until 7 days after completion of drug(s)**

## Days 2 to 7

**This is an oral treatment**

Safe handling and waste management

Safe administration

General patient assessment prior to each treatment.

Any toxicity grade 2 or greater may require dose reduction, delay or omission of treatment and review by medical officer before recommencing treatment.

### Pre treatment medication

Verify antiemetics taken or administer as prescribed.

### Chemotherapy - Time out

### Mercaptopurine

- administer orally ONCE a day until ceased by the haematologist
- to be swallowed whole with a glass of water; do not break, crush or chew
- to be taken preferably on an empty stomach, one hour before or at least 2 hours after food
- avoid concomitant consumption of milk or dairy products

**Note:** missed doses should not be replaced, if a dose is forgotten or vomited, normal dosing should be resumed at the next

scheduled dose.

**Continue safe handling precautions until 7 days after completion of drug(s)**

## Discharge information

### Mercaptopurine tablets

- Mercaptopurine tablets with written instructions on how to take.

### Methotrexate tablets

- Methotrexate tablets with written instructions on how to take them.

### Prophylaxis medications

- Prophylaxis medications (if prescribed) e.g. PJP prophylaxis, antifungals, antivirals.

### Patient information

- Ensure patient receives patient information sheet.

## Side effects

*The side effects listed below are not a complete list of all possible side effects for this treatment. Side effects are categorised into the approximate onset of presentation and should only be used as a guide.*

| Immediate (onset hours to days) | |
|---|---|
| **Hypersensitivity reaction** | Anaphylaxis and infusion related reactions can occur with this treatment.<br>Read more about hypersensitivity reaction |
| **Nausea and vomiting** | Read more about prevention of treatment induced nausea and vomiting |
| **Taste and smell alteration** | Read more about taste and smell changes |

| Early (onset days to weeks) | |
|---|---|
| **Neutropenia** | Abnormally low levels of neutrophils in the blood. This increases the risk of infection. Any fever or suspicion of infection should be investigated immediately and managed aggressively.<br>Read more about immediate management of neutropenic fever |
| **Thrombocytopenia** | A reduction in the normal levels of functional platelets, increasing the risk of abnormal bleeding.<br>Read more about thrombocytopenia |
| **Oral mucositis** | Erythematous and ulcerative lesions of the gastrointestinal tract (GIT). It commonly develops following chemotherapy, radiation therapy to the head, neck or oesophagus, and high dose chemotherapy followed by a blood and marrow transplant (BMT).<br>Read more about oral mucositis |
| **Anorexia** | Loss of appetite accompanied by decreased food intake.<br>Read more about anorexia |
| **Arthralgia and myalgia** | Generalised joint pain or and/or stiffness and muscle aches, often worse upon waking or after long periods of inactivity. Can improve with movement. May be mild or severe, intermittent or constant and accompanied by inflammation.<br>Read more about arthralgia and myalgia |
| **Fatigue** | Read more about fatigue |
| **Hepatotoxicity** | Anti-cancer drugs administered either alone or in combination with other drugs and/or radiation may cause direct or indirect hepatotoxicity. Hepatic dysfunction can alter the metabolism of some drugs resulting in systemic toxicity. |
| **Photosensitivity** | Increased sensitivity to ultraviolet (UV) light resulting in an exaggerated sunburn-like reaction accompanied by stinging sensations and urticaria. |
| **Skin rash** | Anti-cancer drugs can cause a number of changes in the skin with maculo-papular rash the most common type of drug-induced skin reaction.<br>Read more about skin rash |

| Late (onset weeks to months) | |
|---|---|
| **Anaemia** | Abnormally low levels of red blood cells (RBCs) or haemoglobin in the blood.<br>Read more about anaemia |
| **Alopecia** | Hair loss may occur from all parts of the body. Patients can also experience mild to moderate discomfort of the hair follicles, and rarely pain as the hair is falling out.<br>Read more about alopecia and scalp cooling |
| **Cognitive changes (chemo fog)** | Changes in cognition characterised by memory loss, forgetfulness and feeling vague. This is also referred to as 'chemo brain' or 'chemo fog'.<br>Read more about cognitive changes (chemo fog) |

| Delayed (onset months to years) | |
|---|---|
| **Pulmonary toxicity** | Pulmonary toxicity may include damage to the lungs, airways, pleura and pulmonary circulation.<br>Read more about pulmonary toxicity associated with anti-cancer drugs |

## Evidence

This protocol has been superseded as native form L-asparaginase is no longer available in Australia. Acute lymphoblastic leukaemia ALL06 is the recommended treatment.

In most published studies, adolescent patients with ALL achieve better results when treated with paediatric rather than adult protocols.[1, 2, 3] It is unclear as to the relative contributions of the composition of paediatric protocols, disease differences between children and older patients, the hospital settings in which they are delivered or the effects of selection bias.

A collaborative French study[4] retrospectively analysed patients aged between 15 and 20 who had been treated with either an adult ALL protocol (LALA94) or a paediatric protocol (FRALLE-93) showing a 5 year event free survival (EFS) advantage in favour of FRALLE-93 (67% versus 41% 5 year EFS, P<0.001) as well as an advantage for the paediatric protocol in overall survival (78% versus 45% at 5 years, P<0.001). Pui et al 2011 reported an event free survival at 5 years of 86.4% for adolescent patients aged 15 to 18 treated with a paediatric protocol (total therapy study XV, st Jude).

Moricke et al 2008[5] reported the results of 2169 paediatric and adolescent patients up to age 18 treated for ALL with the ALL-BFM95 protocol. Overall event free survival was estimated to be 79.6% at 6 years. Patients were stratified and treated according to risk (standard, medium and high risk). The 6 year EFS in the MR patients was 79.7% and 49.2% in the HR patients, and 58.3% for all patients aged 15 and older. Minimal residual disease criteria were not used for risk stratification in the ALL-BFM95 regimen. The published results of the ALL-BFM95 study did not demonstrate a benefit from the two randomisations (cytarabine in the intensification phase and pulse during maintenance).[6]

One retrospective Finnish study[7] did not show any improvement in the survival for patients aged 10 to 25 treated on a paediatric rather than an adult protocol, with a 5 year event free survival of 67% for the paediatric and 60% for the adult.

The ALL-BFM95 regimen was used as the standard arm of ALL-BFM 2000 with the incorporation of the minimal residual disease testing in patients with precursor B ALL. With this ALL- BFM 2000 regimen, the 5 year event free survival in this pre-B ALL subpopulation were 92.3%, 77.6% and 50.1% for the standard (42% of patients), intermediate (52% of patients) and high risk patients (6% of patients).[8]

The ALL- BFM 2000 standard arm has been used as the treatment regimen in this protocol, since it is common to both ALL-BFM95 and ALL- BFM 2000 regimens. If minimal residual disease (MRD) testing is available, then the incorporation of these results appears justified on the published data, at least for the pre-B ALL group.[8]

The selection of asparaginase preparations is reviewed in the Asparaginase document. Leunase® (colaspase, E. coli preparation) is the most commonly used preparation and the default option as presented in these protocols. Pegasparaginase is given as an alternative preparation and has the advantage of longer half life, lower immunogenicity and more efficient asparaginase depletion than standard preparatations.[9, 10] All patients on the ongoing MRC UKALL 14 protocol receive pegylated asparaginase. The doses employed in the current treatment protocol are in line with those employed in the ongoing ANZCHOG, ALLG ALL6 and MRC UKALL 14 studies.

MRD testing has become a standard part of managing children with acute lymphoblastic leukaemia, but is not generally available outside clinical trials. Since many centres are performing MRD testing in AYA patients, the ALL-BFM 2000 risk groups defined on MRD are included. With no standard care approach to ALL in the younger population of patients defined, which risk criteria to utilize is not yet defined. To avoid confusion between groups of patients on studies such as ALLG ALL6 and ANZCHOG, the risk group definitions from these protocols have been adopted.

### Toxicity

ALL BFM 2000 is a high intensity regimen with the published results for patients up to the age of 18 years. It is unknown what is the safe upper age limit in tolerability for this regimen.

## References


1 Seibel, N. L. 2008. "Treatment of acute lymphoblastic leukemia in children and adolescents: peaks and pitfalls." Hematology Am Soc Hematol Educ Program:374-380.

2 Wood, W. A. and S. J. Lee. 2011. "Malignant hematologic diseases in adolescents and young adults." Blood 117(22):5803-5815.

3 Taizo AN &Hunger SP. Blood consult: therapeutic strategy and complications in the adolescent and young adult with acute lymphoblastic leukemia. Blood 2012; DOI 10.1182/blood-2011-10-36712

4 Boissel, N., M. F. Auclerc, V. Lheritier, et al. 2003. "Should adolescents with acute lymphoblastic leukemia be treated as old children or young adults? Comparison of the French FRALLE-93 and LALA-94 trials." J Clin Oncol 21(5):774-780.

5 Ching-Hon P et al. "Improved Prognosis for Older Adolescents With Acute Lymphoblastic Leukemia." J Clin Oncol 2010; 29:386-391.

6 Moricke, A., A. Reiter, M. Zimmermann, et al. 2008. "Risk-adjusted therapy of acute lymphoblastic leukemia can decrease

treatment burden and improve survival: treatment results of 2169 unselected pediatric and adolescent patients enrolled in the trial ALL-BFM 95." Blood 111(9):4477-4489.

7 Usvasalo, A., R. Raty, S. Knuutila, et al. 2008. "Acute lymphoblastic leukemia in adolescents and young adults in Finland." Haematologica 93(8):1161-1168.

8 Conter, V., C. R. Bartram, M. G. Valsecchi, et al. 2010. "Molecular response to treatment redefines all prognostic factors in children and adolescents with B-cell precursor acute lymphoblastic leukemia: results in 3184 patients of the AIEOP-BFM ALL 2000 study." Blood 115(16):3206-3214.

9 Stock, W., D. Douer, D. J. DeAngelo, et al. 2011. "Prevention and management of asparaginase/pegasparaginase-associated toxicities in adults and older adolescents: recommendations of an expert panel." Leuk Lymphoma 52(12):2237-2253.

10 Wetzler M et al. "Effective asparagine depletion with pegylated asparaginase results in improved outcomes in adult acute lymphoblastic leukemia: Cancer and Leukemia Group B Study 9511." Blood 2007;109:4164-4167

## History

### Version 4

| Date | Summary of changes |
|---|---|
| **30/03/2021** | Protocol reviewed electronically by Haematology Reference Committee in September 2020 with consensus to supersede once the ALL06 protocol is published given L-asparaginase is no longer available. Version number increased to 4. Review in 2 years. |
| **21/12/2021** | Changed antiemetic clinical information block to minimal or low, to align with new categories. See ID 7: Prevention of anti-cancer therapy induced nausea and vomiting (AINV) v5. |
| **21/01/2022** | Pulmonary toxicity added to side effects. |
| **29/07/2022** | Clinical information block updated: Thiopurine-S-methyltransferase (TPMT) enzyme deficiency. |

### Version 3

| Date | Summary of changes |
|---|---|
| **04/05/2012** | New protocol taken to Haematology Committee meeting |
| **18/12/2012** | Approved and published on eviQ |
| **27/06/2014** | Protocol reviewed by email survey. Added link to ALLG and ANZCTR with statement 'Patients with ALL should be considered for inclusion into clinical trials'. Next review in 2 years. |
| **20/05/2016** | Protocol reviewed at Haematology Reference Committee meeting. Added - Consider thiopurine methyltransferase (TPMT) testing prior to administration of mercaptopurine. No other changes, review in 2 years. |
| **31/05/2017** | Transferred to new eviQ website. Version number change to V.3<br>• added in patient information: 'Information for patients on allopurinol' |
| **12/04/2019** | Reviewed by Haematology Reference Committee with no significant changes, review in 2 years. |
| **29/08/2019** | Clinical information for consideration of thiopurine methyltransferase (TPMT) testing prior to administration of mercaptopurine added. |

**First approved:** 18 December 2012
**Last reviewed:** 23 September 2020
**Review due:** 31 December 2022
**Superseded:** 30 March 2021

***The currency of this information is guaranteed only up until the date of printing, for any updates please check:***
*https://www.eviq.org.au/p/1288*
*26 Jun 2023*

# Patient information - BFM 2000 maintenance phase

**Patient's name:**

## Your treatment

The treatment schedule below explains how the drugs for this treatment are given.

| BFM 2000 maintenance phase | | |
|---|---|---|
| This treatment is continuous. Your doctor will advise you how long to take the treatment for. | | |
| **Day** | **Treatment** | **How it is given** |
| 1 to 7 | **Mercaptopurine** (*mer-KAP-toe-PURE-een)* | Take orally ONCE a day on days 1 to 7 on an empty stomach, at least one hour before or two hours after food. Swallow whole with a glass of water, do not break, crush or chew.<br><br>Avoid taking with dairy products as they may decrease its absorption. |
| 1 | **Methotrexate** (*meth-o-TREX-ate*) | Take orally ONCE a week on day 1. Swallow whole with a glass of water on an empty stomach at least one hour before or two hours after food. |

**Missed doses:**

- **Mercaptopurine**: if you forget to take a tablet or vomit a tablet, take your normal dose the next time it is due. Do not take an extra dose.
- **Methotrexate**: as this is only to be taken ONCE a week, if you forget to take a tablet or vomit a tablet, call your doctor for further instructions.

## When to get help

Anticancer drugs (drugs used to treat cancer) can sometimes cause serious problems. It is important to get medical help immediately if you become unwell.

| **IMMEDIATELY go to your nearest hospital Emergency Department, or contact your doctor or nurse if you have any of the following at any time:** | **Emergency contact details**<br><br>Ask your doctor or nurse from your treating team who to contact if you have a problem |
|---|---|
| • a temperature of 38°C or higher<br>• chills, sweats, shivers or shakes<br>• shortness of breath<br>• uncontrolled vomiting or diarrhoea<br>• pain, tingling or discomfort in your chest or arms<br>• you become unwell. | Daytime:<br>Night/weekend:<br>Other instructions: |

## Other information about your treatment

### Information for patients on allopurinol

Tell your doctor, nurse or pharmacist if you are taking allopurinol tablets (including Progout®, Zyloprim® and Allosig®). This treatment contains mercaptopurine, and allopurinol can increase the levels of this drug in the body. This can cause low white blood cells and increase your risk of infection. If you need to take both medicines, your doctor will reduce your dose of mercaptopurine and monitor your blood counts more regularly.

### Changes to your dose or treatment delays

Sometimes a treatment may be started at a lower dose or the dose needs to be changed during treatment. There may also be times when your treatment is delayed. This can happen if your doctor thinks you are likely to have severe side effects, if you get severe side effects, if your blood counts are affected and causing delays in treatment, or if you are finding it hard to cope with the treatment. This is called a dose reduction, dose change or treatment delay. Your doctor will explain if you need any changes or delays to your treatment and the reason why.

### Blood tests and monitoring

You will need to have a blood test before you start treatment and regularly throughout your treatment. Your doctor or nurse will tell you when to have these blood tests.

### Other medications given during this treatment

- **Anti-sickness (anti-nausea) medication:** you may be given some anti-sickness medication. Make sure you take this medication as your doctor or nurse tells you, even if you don't feel sick. This can help to prevent the sickness starting.
- **Prophylaxis medication:** you may need to take some medications to prevent infection and to help prevent or reduce some of the side effects of the chemotherapy. Your doctor or nurse will tell you how and when to take these medications.

### Superseded treatments

This treatment is superseded meaning that better treatments have taken its place. Uncommonly superseded treatments are still used. Your doctor will explain why this treatment has been selected for you.

## Side effects

Cancer treatments can cause damage to normal cells in your body, which can cause side effects. Everyone gets different side effects, and some people will have more problems than others.

The table below shows some of the side effects you may get with this treatment. You are unlikely to get all of those listed and you may also get some side effects that have not been listed.

Tell your doctor or nurse about any side effects that worry you. Follow the instructions below and those given to you by your doctor or nurse.

| Immediate (onset hours to days) | |
|---|---|
| **Allergic reaction** | • Allergic reactions are uncommon but can be life threatening.<br>• **If you feel unwell during the infusion or shortly after it, or:**<br>  ◦ **get a fever, shivers or shakes**<br>  ◦ **feel dizzy, faint, confused or anxious**<br>  ◦ **start wheezing or have difficulty breathing**<br>  ◦ **have a rash, itch or redness of the face**<br><br>**<u>While you are in hospital:</u> Tell your doctor or nurse immediately.**<br>**<u>After you leave:</u> Contact your doctor or nurse immediately, or go to the nearest hospital Emergency Department.** |
| **Nausea and vomiting** | • You may feel sick (nausea) or be sick (vomit).<br>• Take your anti-sickness medication as directed even if you don't feel sick.<br>• Drink plenty of fluids (unless you are fluid restricted).<br>• Eat small meals more frequently.<br>• Try food that does not require much preparation.<br>• Try bland foods like dry biscuits or toast.<br>• Gentle exercise may help with nausea.<br>• Ask your doctor or nurse for eviQ patient information - Nausea and vomiting during cancer treatment.<br>• **Tell your doctor or nurse immediately, or go to the nearest hospital Emergency Department if you have uncontrolled vomiting or feel dizzy or light-headed.** |
| **Taste and smell changes** | • You may find that food loses its taste or tastes different.<br>• These changes are likely to go away with time.<br>• Do your mouth care regularly.<br>• Chew on sugar-free gum or eat sugar-free mints.<br>• Add flavour to your food with sauces and herbs.<br>• Ask your doctor or nurse for eviQ patient information - Taste and smell changes during cancer treatment. |

| Early (onset days to weeks) | |
|---|---|
| **Infection risk (neutropenia)** | • This treatment lowers the amount of white blood cells in your body. The type of white blood cells that help to fight infection are called neutrophils. Having low level of neutrophils is called neutropenia. If you have neutropenia, you are at greater risk of getting an infection. It also means that your body can't fight infections as well as usual. This is a serious side effect, and can be life threatening.<br>• Wash your hands often.<br>• Keep a thermometer at home and take your temperature regularly, and if you feel unwell.<br>• Do your mouth care regularly.<br>• Inspect your central line site (if you have one) daily for any redness, pus or swelling.<br>• Limit contact with people who are sick.<br>• Learn how to recognise the signs of infection.<br>• Ask your doctor or nurse for eviQ patient information - Infection during cancer treatment.<br>• **Tell your doctor or nurse immediately, or go to the nearest hospital Emergency Department if you get any of the following signs or symptoms:**<br>  ◦ **a temperature of 38°C or higher**<br>  ◦ **chills, shivers, sweats or shakes**<br>  ◦ **a sore throat or cough**<br>  ◦ **uncontrolled diarrhoea**<br>  ◦ **shortness of breath**<br>  ◦ **a fast heartbeat**<br>  ◦ **become unwell even without a temperature.** |

| | |
|---|---|
| **Low platelets (thrombocytopenia)** | • This treatment lowers the amount of platelets in your blood. Platelets help your blood to clot. When they are low, you are at an increased risk of bleeding and bruising.<br>• Try not to bruise or cut yourself.<br>• Avoid contact sport or vigorous exercise.<br>• Clear your nose by blowing gently.<br>• Avoid constipation.<br>• Brush your teeth with a soft toothbrush.<br>• Don't take aspirin, ibuprofen or other similar anti-inflammatory medications unless your doctor tells you to.<br>• Tell your doctor or nurse if you have any bruising or bleeding.<br>• **Tell your doctor or nurse immediately, or go to your nearest hospital Emergency Department if you have any uncontrolled bleeding.** |
| **Mouth pain and soreness (mucositis)** | • You may have:<br>◦ bleeding gums<br>◦ mouth ulcers<br>◦ a white coating on your tongue<br>◦ pain in the mouth or throat<br>◦ difficulty eating or swallowing.<br>• Avoid spicy, acidic or crunchy foods and very hot or cold food and drinks.<br>• Try bland and soft foods.<br>• Brush your teeth gently with a soft toothbrush after each meal and at bedtime. If you normally floss continue to do so.<br>• Rinse your mouth after you eat and brush your teeth, using either:<br>◦ 1/4 teaspoon of salt in 1 cup of warm water, or<br>◦ 1/4 teaspoon of bicarbonate of soda in 1 cup of warm water<br>• Ask your doctor or nurse for eviQ patient information - Mouth problems during cancer treatment.<br>• **Tell your doctor or nurse if you get any of the symptoms listed above.** |
| **Appetite loss (anorexia)** | • You may not feel like eating.<br>• Try to avoid drinking fluids at meal times.<br>• Try to eat small meals or snacks regularly throughout the day.<br>• Try to eat food that is high in protein and calories.<br>• If you are worried about how much food you can eat, or if you are losing weight, ask to speak to a dietitian. |
| **Joint and muscle pain and stiffness** | • You may get muscle, joint or general body pain and stiffness.<br>• Applying a heat pack to affected areas may help.<br>• Talk to your doctor or nurse about other ways to manage these symptoms. You may need medication to help with any pain. |
| **Tiredness and lack of energy (fatigue)** | • You may feel very tired, have no energy, sleep a lot, and not be able to do normal activities or things you enjoy.<br>• Do not drive or operate machinery if you are feeling tired.<br>• Nap for short periods (only 1 hour at a time)<br>• Prioritise your tasks to ensure the best use of your energy.<br>• Eat a well balanced diet and drink plenty of fluids (unless you are fluid restricted).<br>• Try some gentle exercise daily.<br>• Allow your friends and family to help.<br>• **Tell your doctor or nurse if you get any of the symptoms listed above.** |

| | |
|---|---|
| **Liver problems** | • You may get:<br>  ◦ yellowing of your skin or eyes<br>  ◦ itchy skin<br>  ◦ pain or tenderness in your stomach<br>  ◦ nausea and vomiting<br>  ◦ loss of appetite<br>• You will have regular blood tests to check how well your liver is working.<br>• **Tell your doctor or nurse as soon as possible if you notice that your urine is a dark colour, the whites of your eyes look yellow, or if you have stomach pain.** |
| **Skin that is more sensitive to the sun (photosensitivity)** | • After being out in the sun you may develop a rash like a bad sunburn.<br>• Your skin may become red, swollen and blistered.<br>• Avoid direct sunlight.<br>• Protect your skin from the sun by wearing sun-protective clothing, a wide-brimmed hat, sunglasses and a sunscreen of SPF 50 or higher.<br>• **Tell your doctor or nurse if you get any of the symptoms listed above.** |
| **Skin rash** | • You may get a red, bumpy rash and dry, itchy skin.<br>• Moisturise your skin with a gentle non-perfumed moisturising cream like sorbolene or aqueous cream.<br>• Do not scratch your skin.<br>• Protect your skin from the sun by wearing sun-protective clothing, a wide-brimmed hat, sunglasses and sunscreen of SPF 50 or higher.<br>• **Talk to your doctor or nurse about other ways to manage your skin rash.** |

| **Late (onset weeks to months)** | |
|---|---|
| **Low red blood cells (anaemia)** | • You may feel dizzy, light-headed, tired and appear more pale than usual.<br>• Tell your doctor or nurse if you have any of these signs or symptoms. You might need a blood transfusion.<br>• **Tell your doctor or nurse immediately, or go to the nearest hospital Emergency Department if you have any chest pain, trouble breathing, or feel like your heart is racing.** |
| **Hair loss (alopecia)** | • Your hair may start to fall out from your head and body.<br>• Hair loss usually starts 2 to 3 weeks after your first treatment.<br>• You may become completely bald and your scalp might feel tender.<br>• Use a gentle shampoo and a soft brush.<br>• Take care with hair products like hairspray, hair dye, bleaches and perms.<br>• Protect your scalp from the cold with a hat, scarf or wig.<br>• Protect your scalp from the sun with a hat or sunscreen of SPF 50 or higher.<br>• Moisturise your scalp to prevent itching.<br>• Ask your doctor or nurse about the Look Good Feel Better program |
| **Chemo brain (chemotherapy-related cognitive impairment)** | • You may notice that you are unable to concentrate, feel unusually disorganised or tired (lethargic) and have trouble with your memory.<br>• These symptoms usually improve once treatment is completed.<br>• Ask your doctor or nurse for eviQ patient information – Memory changes and chemotherapy (chemo brain).<br>• Tell your doctor or nurse if you get any of the symptoms listed above. |

| Delayed (onset months to years) | |
|---|---|
| **Lung problems** | • Lung problems are rare, but can be serious. They may occur throughout treatment or after the completion of treatment.<br>• You may get:<br>  ◦ shortness of breath<br>  ◦ fever<br>  ◦ dry cough<br>  ◦ wheezing<br>  ◦ fast heartbeat<br>  ◦ chest pain.<br>• Your doctor will monitor how well your lungs are working during your treatment.<br>• **Tell your doctor or nurse immediately, or go to the nearest hospital Emergency Department if you have chest pain or become short of breath.** |

## General advice for people having cancer treatment

### Chemotherapy safety

- Learn how to keep you and your family safe while you are having anticancer drugs.
- See our patient information sheet - Chemotherapy safety at home.

### Blood clot risk

- Cancer and anticancer drugs can increase the risk of a blood clot (thrombosis).
- Tell your doctor if you have a family history of blood clots.
- A blood clot can cause pain, redness, swelling in your arms or legs, shortness of breath or chest pain.
- If you have any of these symptoms go to your nearest hospital Emergency Department.

### Medications and vaccinations

- Before you start treatment, tell your doctor about any medications you are taking, including vitamins or herbal supplements.
- Don't stop or start any medications during treatment without talking to your doctor and pharmacist first.
- Paracetamol is safe to take if you have a headache or other mild aches and pains. It is recommended that you avoid taking aspirin, ibuprofen and other anti-inflammatory type medications for pain while you are having treatment. However, if these medications have been prescribed by your doctor, do not stop taking them without speaking with your doctor.
- Vaccinations such as flu and tetanus vaccines are safe to receive while having treatment. Do not have any live vaccines during your treatment or for 6 months after it finishes. If you are unsure, check with your doctor before you have any vaccinations.
- People you live with should be fully vaccinated, including having live vaccines according to the current vaccination schedule. Extra care needs to be taken with hand washing and careful disposal of soiled nappies for infants who have recently received the rotavirus vaccine.

### Other medical and dental treatment

- If you go to hospital or any other medical appointment (including dental appointments), always tell the person treating you that you are receiving anticancer drugs.
- Before you have any dental treatment, talk to your doctor.

### Diet and food safety

- While you are receiving this treatment it is important that you try to maintain a healthy diet.
- Speak to your doctor or nurse about whether drinking alcohol is safe with your treatment.
- If you have any concerns about recent weight loss or weight gain or questions about your diet, ask to speak to a dietitian.
- There are some foods that may cause infection in high risk individuals and should be avoided. For more information on foods to avoid and food hygiene please ask for a copy of the Listeria and food brochure.

### Fertility

- Some cancer treatments can reduce your fertility. This can make it difficult or impossible to get pregnant or father a child.
- Talk to your doctor or nurse before you start any treatment. Depending on your situation there may be fertility sparing options available to you and/or your partner, discuss these with your doctor or nurse.

### Pregnancy and breastfeeding

- Some cancer treatments can be dangerous to unborn babies. Talk to your doctor or nurse if you think there is any chance that you could be pregnant.
- Do not try to get pregnant or father a child during this treatment. Contraception should be used during treatment and after stopping treatment. Ask your doctor or nurse about what type of contraception you should use.
- If you are planning pregnancy/fatherhood after completing this treatment, talk to your doctor. Some doctors advise waiting between 6 months and 2 years after treatment.
- Do not breastfeed if you are on this treatment, as anti-cancer medications can also pass into breast milk.

### Sex life and sexuality

- The desire to have sex may decrease as a result of this treatment or its side effects.
- Your emotions and the way you feel about yourself may also be affected by this treatment.
- It may help to discuss your concerns with your partner and doctor or nurse.

### Quitting smoking

- It is never too late to quit smoking. Quitting smoking is one of the best things you can do to help your treatment work better.
- There are many effective tools to improve your chances of quitting.
- Talk to your treating team for more information and referral to a smoking cessation support service.

### Staying active

- Research shows that exercise, no matter how small, has many benefits for people during and after cancer treatment.
- Talk to your doctor before starting an exercise program. Your doctor can advise whether you need a modified exercise program.

**For more information about cancer treatment, side effects and side effect management see our Patient and carers section.**

## Where to get more information

### Telephone support

- Call Cancer Council on 13 11 20 for cancer information and support
- Call the Leukaemia Foundation on 1800 620 420 (Mon to Fri 9am – 5pm)
- Call the Lymphoma Nurse Support Line on 1800 953 081 (Mon to Fri 9am - 5pm)

### Haematology, transplant and cellular therapy information

- Arrow bone marrow transplant foundation – arrow.org.au
- Australasian Menopause Society – menopause.org.au
- Chris O'Brien Lifehouse - Total Body Irradiation - mylifehouse.org.au/departments/radiation-oncology/total-body-irradiation/
- Healthy Male Andrology Australia – healthymale.org.au/
- International Myeloma Foundation – myeloma.org
- Leukaemia Foundation – leukaemia.org.au
- Lymphoma Australia – lymphoma.org.au
- Myeloma Australia – myeloma.org.au
- NSW Agency for Clinical Innovation, Blood & Marrow Transplant Network – aci.health.nsw.gov.au/resources/blood-and-marrow-transplant
- NSW Agency for Clinical Innovation - aci.health.nsw.gov.au/projects/immune-effector-cell-service
- NCCN Guidelines for Patients Immunotherapy Side Effects: CAR T-Cell Therapy - nccn.org/patientresources/patient-resources/guidelines-for-patients
- Talk Blood Cancer – cmlsupport.org.uk/organisation-type/social-media-groups

### General cancer information and support

- Australian Rare Cancer (ARC) Portal – arcportal.org.au/
- Beyondblue – beyondblue.org.au
- Cancer Australia – canceraustralia.gov.au
- Cancer Council Australia – cancer.org.au
- Cancer Voices Australia – cancervoicesaustralia.org
- CanTeen – canteen.org.au

- Carers Australia – carersaustralia.com.au
- eviQ Cancer Treatments Online – eviQ.org.au
- Food Standards Australia New Zealand: Listeria & Food Safety – foodstandards.gov.au/publications/pages/listeriabrochuretext.aspx
- LGBTQI+ People and Cancer - cancercouncil.com.au/cancer-information/lgbtqi
- Look Good Feel Better – lgfb.org.au
- Patient Information - patients.cancer.nsw.gov.au
- Radiation Oncology Targeting Cancer - targetingcancer.com.au
- Redkite – redkite.org.au
- Return Unwanted Medicines – returnmed.com.au
- Staying active during cancer treatment – patients.cancer.nsw.gov.au/coping-with-cancer/physical-wellbeing/staying-active

### Quit smoking information and support

Quitting smoking is helpful even after you have been diagnosed with cancer. The following resources provide useful information and support to help you quit smoking. Talk to your treating team about any other questions you may have.

- Call Quitline on 13 QUIT (13 78 48)
- iCanQuit – iCanQuit.com.au
- Patient Information - patients.cancer.nsw.gov.au/coping-with-cancer/physical-wellbeing/quitting-smoking
- Quitnow – quitnow.gov.au

**Additional notes:**



**First approved:** 18 December 2012
**Last reviewed:** 23 September 2020
**Review due:** 31 December 2022
**Superseded:** 30 March 2021

***The currency of this information is guaranteed only up until the date of printing, for any updates please check:***
*https://www.eviq.org.au/pi/1288*
*26 Jun 2023*