Consultative Council on
Obstetric and Paediatric
Mortality and Morbidity

Good practice points for clinicians caring for children

CCOPMM Child and Adolescent subcommittee

Consultative Council on Obstetric and Paediatric Mortality and Morbidity

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Introduction

The Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) Child and Adolescent (C&A) committee reviews all child deaths in Victoria. From these reviews important insights provide opportunity to improve clinical practice and prevent serious harm or death in children in the future. The C&A committee publishes 'Good Practice Points' (GPPs), providing valuable clinical insights and suggestions for clinicians caring for children. Some of these GPPs may not have been widely shared and circulated or implemented as many of the same causes and harms re-occur in our health system.

In 2023 the C&A committee reviewed, updated, and collated the previous decade of GPPs to share with health care practitioners. These GPPs are drawn from the many reviewed cases, but they do not represent a comprehensive syllabus of paediatric care. They do however cover a broad range of paediatric conditions and represent care and interventions that have caused the greatest and reoccurring harm in our health system.

All clinicians caring for children want to perform their job well and avoid harm occurring to the children they care for. However sometimes cognitive biases or lack of specific knowledge may affect clinical decision making and contribute to medical error. Errors may result in near misses or no harm, yet there continues to be devastating outcomes for some children, impacting their families and the clinicians involved. The GPPs are aimed at assisting clinicians overcome these biases and knowledge gaps by providing flags to indicate the seriousness of a clinical presentation, and by making recommendations for system change.

CCOPMM commends these updated GGPs from the last 10 years and believe they inform better care for children and reduce harm.

Consultative Council on Obstetric and Paediatric Mortality and Morbidity

Identifying serious infections and severe illnesses in children

Urgent treatment and referral of children with suspected serious bacterial infection by General Practitioners

Children and adolescents may develop serious bacterial infections associated with, or after, a viral infection. This has commonly been seen in severe Group A Streptococcus infection, but also infections from *Streptococcus pneumoniae* and *Staphylococcus aureus*. These bacterial infections include pneumonia, empyema, septicaemia, meningitis, and bone and soft tissue infections.

Children with these infections can deteriorate rapidly, and antibiotic treatment is time-critical and improves outcomes. It is important that whenever serious bacterial infection is suspected in primary care, the first dose of effective antibiotics is given as soon as possible*, and the child referred to a hospital urgently via ambulance or Emergency Retrieval (PIPER) so complete assessment and investigation can occur.

In a child with suspected serious bacterial infection:

Fever (temperature >38° C) plus other symptoms and signs in a sick child, including:

- erythematous, sunburn-like or purpuric skin rash
- lethargy, persistent drowsiness, or high-pitched cry
- hypoxaemia, grunting or other signs of severe respiratory distress, pneumonia, or pleural effusion.
- cold or mottled limbs, >3 seconds capillary refill, tachycardia
- severe limb pain or refusal to walk.
- inability to feed or persistent vomiting
- oliguria

No one sign is specific, but the more signs that are present, or the more severe, the more likely it is there is a serious bacterial infection. Prolonged fever (>5 days) or very high fever (T>40 C) are also more likely to indicate a serious bacterial infection. Parents of children with serious bacterial infections often correctly express concern about their failure to improve or their significant difference from normal.

* Take a blood culture if you can, but if not possible, diagnostic tests can still be done at a hospital.

Give first dose of ceftriaxone 100mg/kg up to 2g IM or IV, or benzylpenicillin 50mg/kg up to 1.8g IM or IV, and urgently refer by ambulance.

PIPER can also be contacted from a primary care clinic or urgent care centre on 1300 137 650 for management and transfer advice and support.

Identification and management of empyema in children

Infants and children with respiratory virus infections may have further complication with empyema and a secondary bacterial pneumonia caused by Group A Streptococcus, *Streptococcus pneumoniae* and *Staphylococcus aureus*.

Although less common than viral bronchiolitis, it is very important to be alert for children with bacterial pneumonia and complications.

The signs that point to a serious bacterial infection include:

- persistent fever
- severe respiratory distress, including grunting or cyanosis.
- tachycardia
- poor feeding
- lethargy or other signs of toxicity
- failure to follow the expected course of recovery from a viral infection.

Recognition

A child with acute viral bronchiolitis is generally not toxic, has minimal fever or a low-grade (< 39°C) non-persisting fever, and is alert and active.

If a child has a high or persisting fever or persisting tachycardia even when calm, an alternative diagnosis should be considered.

A child who is sicker than expected, or is not following the expected path of improvement, should be reassessed by a paediatrician or senior doctor and examined for signs of:

- effusion (dullness to percussion and reduced air entry on auscultation)
- other complications including signs of systemic sepsis or signs of heart failure (pallor, cyanosis, tachycardia, gallop rhythm, enlarged liver) such as those that occur with acute viral myocarditis.

An infant with a diagnosis of bronchiolitis and high or persisting fever or persisting tachycardia should have a:

- chest x-ray to investigate for effusion or consolidation, or cardiomegaly suggestive of myocarditis.
- full blood examination
- blood culture
- A venous or capillary blood gas.

Signs on laboratory investigations that suggest serious bacterial infection include neutropenia, marked neutrophilia, left shift or high immature to total granulocyte ration (> 0.2) and a venous blood lactate > 3 mmol/L.

A child with pleural effusion or any of these signs should be considered to have a serious bacterial infection.

Please note that having had pneumococcal vaccine does not mean a child cannot develop empyema.

Treatment

Treatment of community-acquired pneumonia is outlined at:

https://www.rch.org.au/clinicalguide/guideline_index/Pneumonia_Guideline

Some children with effusion do not need urgent drainage and can be referred for review by a respiratory paediatrician or surgeon. However, a child with a large effusion and severe respiratory distress, hypoxaemia or severe sepsis should have the effusion drained urgently. This should be done with an experienced operator who is trained to insert a pleural drainage catheter in the presence of an anaesthetist or other senior doctor to monitor the airway and give sedation. The procedure should occur in the safest possible place depending on the urgency of the situation, ideally in an operating theatre. In a severe situation, draining a pleural effusion using a dose of intravenous ketamine (0.5–1 mg/kg), local anaesthetic and intercostal insertion of an intravenous cannula and aspiration of the fluid is sufficient to stabilise the child.

A PIPER paediatric ICU consultant is available for consultation 24 hours a day on 1300 137 650, and PIPER registrars are trained to insert intercostal catheters to drain large effusions.

In summary

Children with unrecognised empyema can deteriorate, therefore:

- consider the possibility of empyema due to assumptions made about the diagnosis of bronchiolitis/viral infection.
- reassess, including a proper clinical examination, and recognise when a child is not following the expected clinical path.
- listen to nurses' or parents' concerns.
- escalate when a child is persistently in the Purple Zone of the Victorian Children's Tool for Observation and Response (ViCTOR) charts.
- do a chest x-ray and blood test in infants with a diagnosis of bronchiolitis but atypical features.

- urgently drain the empyema in children with hypoxaemia, severe respiratory distress, or severe sepsis.

Case study – sepsis and empyema, a case that went well

A four-year-old girl presented to an emergency department (ED) with a history of one day of fever, cough, a sore throat. A nasal swab showed rhinovirus. She re-presented 3 days later as she had become lethargic and had not passed urine since the day before. She had cold limbs, and prolonged capillary refill, and a blanching red rash on her face, chest, and arms. At triage, sepsis was suspected, and within an hour of being in the ED she had received antibiotics, 30ml/kg fluid, and a full blood count, blood gas and electrolytes were taken which showed neutropenia, a lactate of 5mmol/L and a creatinine of 150. An ultrasound was done of her chest which showed a large pleural effusion. A low-dose adrenaline infusion was started, and a pigtail intrapleural catheter was inserted by ED and anaesthetic staff with light ketamine sedation and local analgesia, yielding 400ml of pus. She was transported by PIPER to the Royal Children's Hospital ongoing management. Her blood culture and pleural fluid grew *Streptococcus pyogenes*.

Criteria for rapid ICU admission of children with sepsis

It is important to recognise children with suspected sepsis who are at high risk for deterioration.

Any child with suspected severe sepsis who has any one or more of the following criteria should be rapidly escalated and discussed urgently with a PIPER paediatric ICU consultant: 1300 137 650

- venous blood lactate > 3 mmol/L
- neutropenia (neutrophil count < 1,000 / mm3) – unexpected and not related to cancer chemotherapy.
- large pleural effusion (for example, near white-out of hemi-thorax)
- coagulopathy (INR > 1.6, APTT > 60, Fib < 1)
- signs of shock persisting despite a total of 40 mL/kg fluid.

Signs of shock include capillary refill > 3 seconds, low-volume pulses, hypotension, tachypnoea and lethargy or poor conscious state.

Identifying serious illness in neonates and young infants

Signs of severe illness in neonates and infants in the first 6 months of life can be subtle, often changes in usual activity or behaviour. They may be remembered as ABC – Other:

Activity

- sleepy – does not wake fully as usual for feeds
- low activity – moves arms and legs less than normal

- abnormal activity – repetitive or stereotyped movement of a limb
- low intake – <50% of normal feeds in last 24 hours
- weak or high-pitched cry

Breathing

- chest retraction – moderate or severe
- grunting
- apnoea

Circulation

- pallor – onset of persistent generalised pallor
- tachycardia >160/min
- cold limbs

Other

- fever, green or bile-stained vomiting, abdominal distension

Health care practitioners should be alert for these features, be aware of the age-specific norms of heart rate, respiratory rate, and blood pressure (use of ViCTOR charts can be helpful for this) and pay attention to trends in repeated observations (for example a rising heart rate).

Practitioners can also teach parents the signs of illness in newborns and young infants.

Recognising myocarditis as a rare cause of respiratory distress

Myocarditis is a much less common cause of respiratory distress than viral or bacterial pneumonia, but myocarditis can mimic diseases such as bronchiolitis or sepsis. Symptoms suggestive of myocarditis are tachypnoea and persistent marked tachycardia, often pallor, cold hands and feet, peripheral cyanosis and an enlarged liver. Cardiomegaly is seen on chest x-ray. Kawasaki disease is a differential diagnosis if there has been fever for several days in young children. In cases reviewed by CCOPMM, myocarditis was not recognised because of:

- a fixed diagnosis of bronchiolitis in an infant with atypical features, particularly pallor and persistent tachycardia
- failure to reassess and recognise when a child is not following the expected clinical path.
- failure to listen to parents' concerns.
- failure to escalate when a child is persistently in the Purple Zone of the ViCTOR charts.

For a child with suspected myocarditis, do a chest x-ray and give oxygen. Minimal handling is important. Get an echocardiograph if you can. Call PIPER and a paediatric cardiologist. Suspected myocarditis is a 'Go Now' criterion for PIPER.

Stridor that is not acute viral croup

Croup is common in young children and is usually caused by respiratory viruses (especially parainfluenza). Sometimes stridor is not dure to viral croup, but differentiating uncommon causes of stridor from viral croup can be difficult. If a child has acute stridor, it should be investigated and escalated if:

- stridor exists without coryza or signs of an upper respiratory infection, or
- there is any episode of cyanosis, or
- where the stridor fails to resolve by 3–5 days, or
- the child is toxic or has signs of sepsis.

A chest X-ray and lateral neck x-ray should be done for any child who has atypical clinical features. Further investigations may require ENT review, an echocardiogram, or other tests depending on the clinical picture.

An episode of cyanosis in any child with stridor is an emergency.

Lymphopenia in hospitalised children

Lymphopenia (low blood lymphocytes) is common in seriously ill children and is associated with acute infections, and usually resolves in 1-2 weeks. If a child has lymphopenia, this needs to be followed up with a repeat full blood count (FBC).

In an otherwise well child, 1-2 weeks after an acute infection, if lymphopenia persists on follow-up FBC, measure lymphocyte subsets to detect low or absent T-cell levels and rule out severe combined immunodeficiency (SCID) or another immunodeficiency.

If a child with lymphopenia has any signs that are suspicious for immune deficiency: recurrent infections, failure to thrive, cytomegalovirus viremia, or pneumonia suspicious of pneumocystis, measure lymphocyte subsets to investigate urgently for SCID.

High-dose long-term steroids and risk of infection

Children who receive high-dose long term corticosteroids (such as prednisolone 1mg/kg/day or more for a month or longer, or equivalent steroid) are at increased risk of infections, including pneumocystis pneumonia. They should be on cotrimoxazole prophylaxis (three times weekly or single daily dose). Cotrimoxazole preventative therapy will also prevent serious infection from *Streptococcus pneumoniae,* which is a risk with long-term high dose steroid treatment.

CCOPMM has reviewed deaths from pneumocystis pneumonia caused by (*Pneumocystis jiroveci, PjP*) and pneumococcal sepsis in children on long-term high dose steroid treatment.

Other immune suppressive therapies that require PjP prevention with cotrimoxazole include: alemtuzumab and fludarabine, and all children with persistent lymphopenia, SCID and ALL.

Immunosuppression and infection

Children with immunosuppression may not show the typical features of severe infection or other inflammatory conditions such as appendicitis.

For example, they may not develop:

- High fever
- Localising signs
- Elevated white cell count.

Importance of cardiac review of any child who collapses and requires resuscitation

Transient loss of consciousness in children and young people is a somewhat common presentation to health practitioners and emergency departments. Most events have a simple benign cause, such as vasovagal syncope (fainting). A small proportion are due to a more important cause such as a seizure disorder, or a cardiac dysrhythmia or structural cardiac cause (such as aortic stenosis or hypertrophic cardiomyopathy).

Seizure disorders will usually be suspected based on physical features such as convulsive movements, and / or an EEG.

Cardiac disorders, in particular dysrhythmias, are important not to miss because subsequent episodes may be fatal. Following an episode of collapse in a child that requires resuscitation, the child should be referred to a paediatric cardiologist or a paediatrician and admitted as an inpatient.

All patients following an unexplained loss of consciousness should have a standard 12-lead ECG to look for a dysrhythmia or pro-dysrhythmic abnormality (such as Wolff Parkinson-White, prolonged QT and Brugada syndromes).

Red flags that suggest the need for more extensive investigation and / or referral include:

- exertional onset of loss of consciousness, i.e collapse while engaged in physical activity.
- chest pain
- dyspnoea
- palpitations
- family history of dysrhythmia or sudden unexpected death in young adults
- need for cardiopulmonary resuscitation during an event
- severe headache
- focal neurologic deficits
- diplopia
- ataxia
- dysarthria
- any relevant abnormality on physical examination or in the standard electrocardiogram (ECG).

Reading paediatric ECGs

Paediatric ECGs have significant differences from adult ECGs. Sometimes ECGs need to be performed in emergency department settings after hours or in other circumstances where there may not be expertise in reading paediatric ECGs. When this is the case, it is important that a mechanism is in place to ensure the ECG is reviewed by someone experienced in paediatric ECG reading (paediatric cardiologist or paediatrician) and follow up organised when abnormalities are found.

Febrile encephalopathy: any child with fever and abnormal neurological signs needs immediate treatment and escalation of care

In recent years CCOPMM has reviewed many deaths from severe febrile encephalitis in otherwise well children, related to *HHV6, influenza, enterovirus, human metapneumovirus*, and bacterial meningitis from *Streptococcus pneumoniae.* These children presented with seizures, high fever (T39-40+) and abnormal neurological examination and progression.

It is not always easy to distinguish a child with a severe febrile encephalopathy from one that is self-resolving (such a child with a prolonged febrile convulsion who has been sedated with midazolam), but repeated clinical examination, prompt treatment, and escalation are needed.

The differential diagnosis of febrile encephalopathy includes:

- Bacterial meningitis
- Acute viral meningitis, such as enterovirus
- Virus associated acute necrotizing encephalitis
- Autoimmune encephalopathy
- Other conditions that may lead to neurological symptoms include severe hypertension (PRES), electrolyte imbalance, seizures, venous sinus thrombosis.

Any child with a febrile encephalopathy should be assessed by a senior paediatrician or emergency physician. A child who has a fever and abnormal neurological examination (posturing, clonus, hypertonicity or hyperreflexia, pupil changes) has a severe form of febrile encephalopathy, and immediate treatment including treatment for meningitis with ceftriaxone and HSV encephalitis with acyclovir. Escalation should be sought, call PIPER for support.

Certain clinical features: hyper-pyrexia (T>39 or 40 C), and abnormal progression of neurology, should trigger a higher emergency response:

- Immediate stabilisation: airway, oxygenation, and circulation support.
- Give antibiotics: ceftriaxone / cefotaxime plus acyclovir.
- Neuroprotection: nurse at 30° head up, ensure a BP in the upper range of normal for age, serum Na^{+}145-150mmol/L, $PaCO_2$ 35mmHg.
- Active cooling to a normal temperature.
- Consider antiviral agents to treat HHV6 (high-dose ganciclovir) which will also cover Herpes simplex virus.
- Corticosteroids –30mg/kg methylprednisolone (once daily for 3 days)

- Maintenance anticonvulsant
- MRI – an MRI of children with progressive encephalitis will show symmetrical hyperintensity on T2 weighted images, often in thalami, basal ganglia, brain stem and / cerebellum (virus associated necrotising encephalitis), or temporal lobes with HSV or autoimmune encephalitis. The above treatment can be commenced before an MRI scan, in any child with hyperpyrexia and abnormal neurological examination.
- Seek help urgently in such children and discuss the above treatments and referral to intensive care.

Anaphylaxis and severe asthma: resuscitation if a child arrests

Adrenaline is the primary treatment for anaphylaxis, and it is usually highly effective. Similarly, in severe asthma, bronchodilator therapy, steroids and oxygen is usually very effective. However, in a child or adolescent with anaphylaxis or severe asthma who is unconscious and needing bag and mask ventilation (i.e., in respiratory arrest), **there is a need for urgent intubation, not other forms of respiratory support.**

In the event of arrest delaying intubation will lead to prolonged hypoxaemia and its consequences. It takes 4 minutes of hypoxia after an arrest for irreversible death of brain cells, so intubation cannot be delayed.

CCOPMM has reviewed deaths in which delayed intubation in such caseshas been an important factor. There are reasons why intubation in these cases may have been delayed: the successful use of non-invasive methods of respiratory support in many respiratory conditions where the patient is awake encourages an escalation ladder, which is not appropriate in a patient in arrest; in adult hospitals the success of defibrillation for ventricular fibrillation has led people to de-emphasise airway in the treatment algorithms; and the general success of adrenaline in anaphylaxis may delay airway management in cases of arrest.

If a young person with anaphylaxis or asthma is unconscious, and needing bag and mask ventilation, intubation by a skilled anaesthetist, intensivist, emergency physician, or MICA paramedic should occur within 4 minutes.

Genome sequencing and diagnosis of complex, unexplained or uncommon disorders

Whole exome sequence testing (WES) is now available for the diagnosis of some uncommon conditions. In some circumstances WES can identifying a cause of a chronic or severe acute illness, and this may help families.

Conditions appropriate for WES, in the absence of a diagnosis, include:

- Neuromuscular diseases
- Syndromic cardiovascular malformations
- Hypertrophic cardiomyopathy
- Skeletal malformations and/or dysplasia

- Neonatal cholestasis and liver failure
- Cystic renal disease
- Metabolic disorders with lactic acidosis
- Immunodeficiency or bone marrow failure

WES may also be useful where the child has died unexpectedly with the above conditions, or in the case of a sudden unexpected death in infancy which is not explained by environmental or other conditions, or where a child has died from necrotising encephalitis, even if a common virus is identified.

In some cases, a clinical syndrome specific panel will be required. Seek advice from the Victorian Clinical Genetics Service (VCGS).

Seizures and epilepsy

The CCOPMM Child and Adolescent subcommittee reviews between three and five deaths per year of unexpected deaths that occur in children with epilepsy (or a history of seizures, including febrile seizures). Some of these deaths are due to sudden unexplained death in epilepsy (SUDEP), some are drownings, and some are due to other unintentional injuries. While some deaths are not predictable or preventable, children with epilepsy should never be left unattended in the bath or near water.

For more information visit The Royal Children's Hospital website:

https://www.rch.org.au/kidsinfo/fact_sheets/Seizures_safety_issues_and_how_to_help/

Although the causes of SUDEP are uncertain, improved seizure control has been shown in randomised trials to reduce the risk. Children and adolescents with refractory or difficult-to-control epilepsy should have an individualised care plan and be under the care of a paediatrician with expertise in epilepsy, with regular review of the adequacy of seizure control, dosage and compliance with medication.

Children and adolescents with epilepsy should have a regular review with their medical practitioner for dose adequacy. As children grow and gain weight, their dose may need to be increased. This could explain poor seizure control despite good compliance.

Malnutrition in children

Malnutrition is a high-risk factor for morbidity and mortality. There is an urgent need to strengthen primary healthcare systems including maternity, maternal and child health and general practice services to detect, monitor and treat malnutrition, especially in vulnerable families.

CCOPMM has reviewed several deaths in infants and children from malnutrition and its complications. These deaths occurred in vulnerable and marginalised families who were either minimally, or not at all, engaged with maternal and child health services and general practitioners. The limited face-to-face

consultations with primary care providers and a lack of recorded weight and growth monitoring resulted in these children suffering unrecognised severe malnutrition.

When nutritional status is borderline, severe acute malnutrition and death can occur within a few weeks if a child is underfed. For children who are living in high-risk social environments where they are vulnerable to neglect, growth monitoring and assessment of risk are essential. The mortality rate of children with severe malnutrition is high. Severe malnutrition may be complicated by sepsis, hypoglycaemia, hypophosphataemia, hypothermia and dehydration.

Areas for improvement include:

- in-person appointments – telehealth consultations are a barrier to recognising failure to thrive and/or severe malnutrition because physical observations and growth monitoring cannot be adequately completed.
- awareness of the complications of syringe feeding babies – although widespread, it potentially clouds recognition of a baby's incapacity to suck feed, which needs to be considered when there are growth concerns.
- diagnosis awareness – in a highly developed country, the diagnosis of malnutrition is less considered than other causes of poor growth.
- strengthening the transition of care from maternity to maternal and child health services
- strengthening the Electronic Client Development Information System flagging tool for maternal and child health nurses and general practitioners. This tool identifies vulnerable families and prioritises them for appointments and follow-up if they fail to attend booked appointments.
- referral to Child Protection if families disengage with services and there is a risk of malnutrition that can result in morbidity and mortality.

Community service agencies involved following a Child Protection referral should ensure there is support for families to remain engaged. If they disengage then referral back to Child Protection is necessary. Across all types of deaths and all age groups, CCOPMM continues to observe an overrepresentation of children from vulnerable families. CCOPMM is concerned that the recent increase in economic pressures on families will worsen this problem.

Case study – Malnutrition

A 15-month-old boy was brought into a Maternal and Child Health (MCH) centre by an aunt due to concern about the child's weight.

The family was very mobile locally as well as interstate. The child was last seen at a Victorian hospital at 10 months of age, when he weighed 9.0 kgs (50th centile), length 71cm (15th centile), head circumference 45.5cm (50th centile). The child was formula fed and was reported to be eating baby foods with textures. Anticipatory guidance was given about increasing texture of foods. Some concern was noted regarding the child's posture and a referral to a paediatric physiotherapist and GP was made. The child was rebooked at that hospital for follow-up at 12-months.

The child was not brought to the paediatric physiotherapist, GP nor the 12-month key age-and-stage consultation and could not be contacted.

At 15 months, the child weighed 8.0kgs (<3rd centile), a decrease of 1kg from 10 months of age, length: 72cm (<3rd centile), head circumference: 46cm (25th centile). The child was reported to be crying all the time. He was referred to the local regional emergency department for immediate paediatric review. He was admitted and ultimately discharged into foster care.

At 18 months, his weight was 11.8kg (75th centile), an increase of 3.8 kg in 3 months, length 77cm (3rd centile), head circumference 47.5cm (75th centile). He was beginning to use words, walking, following simple instructions and enjoying food.

Systems to improve the safety and quality of health care for children

'Three strikes and you are in': admit to hospital an infant, child or adolescent who has presented three times with the same acute illness.

Repeat presentation to any health service during the same acute illness is a red flag.

Repeated presentations (that are not planned reviews) may indicate:

- The child is deteriorating, or the illness is fluctuating.
- The child is developing complications (for example, secondary bacterial infection of a viral illness).
- The severity of the illness has not been appreciated by healthcare staff.
- The diagnosis needs to be reviewed.
- The parents or caregivers are extremely concerned about their child.

Parents often seek health care from several health services, especially when they are very concerned. It is important to establish how many times a child has presented for the same illness.

A child who presents a second time for the same acute illness should be reviewed by a senior doctor.

If the child presents unexpectedly for a third time during the same illness, there should be serious consideration for hospital admission, even if the child does not look unwell at the time.

Vulnerable children and high risk of poor outcome

There are several social risk factors that characterise the vulnerable (or high-risk) child and family; these include high level of social disadvantage, being known to Child Protection services, domestic violence, and substance abuse.

These factors are associated with poorer outcomes and increased complications in chronic illness, higher risk of injury and accidents, and even a higher risk of death.

Social determinants of poor outcomes in children can manifest early in poor care-seeking behaviour. This includes:

- late presentation of acute illness
- not being brought to follow-up appointments
- non-adherence with chronic therapy, and evidence of poor control of treatable diseases (such as asthma or diabetes)
- non-attendance at school
- nutritional deficiencies, including failure to thrive and severe iron deficiency.

Additional measures are needed to ensure vulnerable children are cared for by health care providers and social welfare organisations.

Systems to detect acute deterioration

All health services providing paediatric services should implement a comprehensive and integrated organisational-wide approach to detect and respond to any paediatric deterioration. That approach requires multiple processes and practices, including:

- thresholds for admission (such as repeated presentations for same illness
- specific skills for paediatric Medical Emergency Team (MET) attendance
- assessing parental concerns about a child's condition/change in condition openly
- use of specific paediatric observation charts, such as the Victorian Children's Tool for Observation and Response (ViCTOR)
- embedding the value of review/reassessment by a second, independent clinician at critical points in the care pathway, including when:

  - questions remain about a diagnosis.
  - the signs and symptoms are atypical.
  - normal clinical resolution is not occurring with adequate treatment.
  - it is requested by parents, caregivers or staff caring for the child.
- escalation procedures (including links with tertiary paediatric centres and PIPER)
- informing parents and carers about the expected clinical course their child's illness and the symptoms or signs to look for which should prompt medical review. In addition, parents or carers should be encouraged to re-present their child to a medical practitioner if they have concerns about the progress of their child's illness following discharge from a health service
- ongoing paediatric education and skills training.

Whenever there are questions about a child's diagnosis, the child's signs are atypical, or the normal clinical pathway of resolution despite adequate treatment is not occurring, the child should be re-assessed, have further investigation, a second opinion or referral to a specialist in paediatric care.

Parental concerns about their child's health status should be always considered, because parents know their children best. When parents report concerns about a child's wellbeing or change in status (in the context of severe chronic disease or developmental disability) their concerns should be taken seriously and addressed without delay.

Several studies have shown higher rates of serious pathology in children who have repeated medical attendances during a single acute illness. Multiple representations should serve as a trigger for careful re-evaluation of the clinical picture. Any child who presents on multiple occasions in the same illness should be seen by a senior doctor experienced in childhood illnesses.

The importance of comprehensive, timely and accurate communication at the points of transfer of care is critical in paediatric care. This includes between teams within a hospital, or between hospital clinical staff and an outside practitioner such as a GP or MCH nurses.

The use of 'track and trigger' paediatric early warning charts such as ViCTOR have been demonstrated to be an effective tool to assist in recognising and responding to clinical deterioration in children.

Case study – a deteriorating child

A five-year-old boy came to the Emergency Department with a history of two days of abdominal pain, fever, diarrhoea and vomiting. He was carried in by his father. He was miserable, HR 140, RR 30, T38.6C. His abdomen was soft. He was given a triage category of 4. He was given paracetamol and hydrolyte. While in the waiting room he vomited again and refused to drink. He slept in his father's arms. After 2 hours his parents were concerned that he was still drowsy and not drinking and asked for him to be reviewed. He was still sleeping and would open his eyes only briefly when roused. HR 166, RR 32, T 39.6C. He was given ibuprofen. An hour later he was mottled, and his parents tried to find staff to review him. He was grunting, barely rousable, HR 170, and his limbs were cold. He was then taken to a resuscitation cubicle and soon after had a cardiac arrest. A chest x-ray showed pneumonia and a small heart (hypovolaemia), and a blood culture grew *Streptococcus pyogenes*.

Extra vigilance for signs of injury or illness in children with complex communication needs

Children who are not able to communicate their medical symptoms effectively, particularly those with a neurodisability and present with a change in behaviour, increased irritability, or a symptom such as vomiting or pain, must be treated with extra vigilance. Sometimes there is an underlying serious medical condition requiring treatment that can be missed. The importance of listening to parents and caregivers is especially vital in children and adolescents with complex communication needs.

Understand the total fluid intake and type of intravenous fluid in children

Intravenous fluids are one of the most prescribed components of treatment for hospitalised children. Internationally many deaths have occurred in children from iatrogenic hyponatraemia and cerebral oedema when hypotonic intravenous solutions (4% dextrose and one-fifth normal saline) were used.

These adverse outcomes occurred from excessive amounts of an inappropriate IV fluid in patients who had high antidiuretic hormone levels from common infections (bronchiolitis, pneumonia, meningitis, post-operative, burns).

Even when standard amounts of maintenance intravenous fluid are prescribed, children may end up receiving much larger volumes as their **total fluid intake**.

Pay attention to the child's total fluid intake, which includes other sources such as enteral fluids, drug flushes and dilutions, blood products. In unwell children these additional sources of fluid can add 50% to the prescribed maintenance fluid.

When children need intravenous fluids, use fluid with some glucose and a similar sodium concentration to plasma: balanced salt solutions are best: Plasma-Lyte 148 with 5% glucose, Hartmann's solution with 5% glucose. If not available, 0.9 per cent NaCl (normal saline).

If children with severe pneumonia, bronchiolitis or meningitis need to be on intravenous fluid, unless they have signs of dehydration, start with 50% of standard maintenance fluid rates.

Alert card for children with complex or chronic illness

CCOPMM recommends that tertiary children's hospitals in Victoria take responsibility for ensuring that children with complex medical needs are discharged with a medical history 'card', letter, or electronic format, that can be readily presented to external health care services to ensure appropriate care.

Children with complex or chronic medical conditions often require treatment in the event of an acute illness that is not covered by emergency services protocols or guidelines for common illnesses. Families of these children should have a personalised medical information card that they can give to

emergency services clinicians (ambulance, emergency departments, general practitioners) to guide them in the early management of the child. Specialists and general paediatricians should adopt the practice of providing a personalised medical information card for the children and young people they care for.

While it is not possible to anticipate every situation that may result in a child becoming unwell, there are many situations that are predictable or need to be guarded against. For example, children with:

- severe asthma that has required intensive care admission or ventilation in the past
- unstable diabetes
- complex seizure disorders
- surgical conditions that may result in a serious complication.
- complex congenital heart conditions, where acute intercurrent illness may cause deterioration.
- immune deficiency
- metabolic conditions that require specific treatments in specific situations.

The information on the Alert Card should be enough to allow a junior doctor in a regional centre to safely manage a child with complex needs presenting to an emergency department at 2am.

The information should be standardised and include at least the following:

- The diagnosis (es)
- A list of current medications, and any medications to be avoided.
- Symptoms and signs that would be of concern for this child and when further medical advice should be sought.
- Special needs on sick days, such as fluid requirements or additional medications.
- The contact details of a paediatrician or person at the tertiary hospital who can be consulted during an acute illness.

Case study – Alert card for children with chronic or complex illness

Jeremy, an eight-year-old boy with an inherited mitochondrial condition (ECHS1 mutation, Leighs-like syndrome) developed vomiting and diarrhoea whilst on holiday with his family. He was brought to a regional hospital. He had not been able to tolerate his specialised feeds (he has a protein restricted diet) and had been unable to take his usual medications – a complex medication regime for his movement disorder, epilepsy, and metabolic condition. His family relied on receiving care from his specialist paediatric centre who knew him very well. His usual team had a developed a personalised sick day plan for him, documented on a laminated card, which included the use of intravenous 10% dextrose and normal saline intravenously for resuscitation and maintenance, thiamine, his usual medications, and the need to avoid conditions that might make him deteriorate, such as ketogenesis, and not give drugs such as sodium valproate and propofol. It was fortunate his family carried this card on their holidays, as the staff at the hospital were not familiar with Jeremy or his condition, and without that guidance were unsure of what to do.

Reassessment of patients during changes in their therapy or de-escalation of treatment

Children and adolescents with chronic health conditions are a vulnerable group who are at added risk when they miss medication or miss appointments. They may have conditions that require the input of multiple services. Clinicians need to be aware of the risks and ensure follow-up appointments are made and consider comprehensive care planning. Children and adolescents with potentially life-threatening conditions who frequently miss appointments or are noncompliant with medication, or whose caregivers are not able to meet the needs of the child, require additional involvement.

If after discharge there is a planned reduction in intensity of treatment (e.g., cessation of an anticonvulsant, tapering in the dose of other treatments), it is important to have a plan that includes a check that the child is stable after a suitable period.

For example: book a GP or outpatient appointment a week later / arrange a follow-up phone call or visit at three days, give parents clear plan as to when to seek treatment of recovery does not follow the usual course.

In inpatient hospital settings, reduction in care such: as weaning from ventilation or CPAP or oxygen should be based on a plan for reassessment at each step, with clear goals of stability before taking the next step.

Adolescent health care

Adolescent screening for emotional health and wellbeing

Screening for emotional health and wellbeing should be part of preventative healthcare. Significant changes in behaviour outside the person's normal range of behaviour may be a warning sign of mental health risk. Such changes may include loss of interest in previously pleasurable activities, disengagement from friends and social activities, missing school or work, problem behaviour, substance misuse, significant distress over a relationship breakdown, lack of care about dress and appearance.

At-risk adolescents need regular engagement with and support from skilled health care professionals. Their families also need support. Where a health professional believes they do not have the capacity to provide support, referral and liaison with specialised adolescent mental health services must be undertaken.

At-risk adolescents who fail to attend services should be actively followed up, because disengagement may be a sign of increased risk of intentional self-harm. Verbal communication or threats of suicide, and/or previous attempted intentional self-harm are serious and require urgent specialist mental health assessment.

Friends and family may be aware of threats or communication about self-harm and should act on their concerns. Many cases of lowered mood/depression can be managed by a GP or paediatrician, providing they have adequately assessed the risk of intentional self-harm as being low. However, health professionals not confident or trained to assess this risk and support at-risk adolescents should refer to specialised adolescent mental health services.

An unexpected improvement in mood can also occur just prior to intentional self-harm. When low mood is continuing despite appropriate intervention, and then there is an unexpected mood improvement that is sudden in onset, it is possible that the young person has made a decision to end their life. Mental health reassessment should be sought at this point.

Many young people can be supported to share their distress with people (for example, parents) to help keep them safe. Occasionally, at times of very high risk, professionals are required to break a young person's desire for confidentiality (around them not wanting to let others know the extent of their distress) to keep them safe.

Depression in young people

Evidence-based psychological therapies such as cognitive behavioural therapy (CBT) are recommended for depression in young people.

Participation in psychological therapies is vital. It is common that those with suicidal ideation and behaviours do not engage in therapies and follow up.

All clinicians have a vital role in ensuring attendance and participation in interventions and can improve outcomes including reducing suicidal ideation and improving school attendance.

Prescribing Selective Serotonin Uptake inhibitors

SSRIs prescribed for depression can increase suicidal thoughts – particularly on initiation or after dose increases.

Advise on common and serious adverse effects and have a clear plan for review as required.

At initiation the dosage should be low e.g., one quarter of the eventual target dose. Monitor initiation or change of treatment – for adverse effects and assessment of improvement.

If there is further deterioration in symptoms (for example, insomnia, agitation, or suicidal ideation) or a lack of improvement after four weeks review plans and consider specialist consultation or referral.

Overdose of unknown synthetic recreational drugs: the need for toxidromic approaches

The range and availability of synthetic recreational drugs has rapidly increased over recent years. Health professionals working in emergency departments and intensive care units are increasingly faced with patients presenting with overdose, intoxication and/or the behavioural or mental health effects resulting from the ingestion of substances (often multiple), the composition of which is unknown at the time of presentation.

Clinicians need to become familiar with 'toxidromic' approaches (rather than drug-specific) to manage such ingestions.

Early consultation with on-call toxicologists is essential in managing such patients. In general, adult services have more expertise in managing recreational drug toxidromes, but paediatric services need to ensure they can respond as needed to younger adolescents presenting in this way.

The Poisons Information Centre can provide support on 13 11 26.

Eating disorders

Eating disorders are mental health conditions that affect both females and males. Eating disorders often cause serious physical morbidity or even life-threatening complications. Anorexia nervosa has the highest lifetime mortality rate of any psychiatric disorder (estimates up to 25 per cent lifetime risk of premature death). The risk of premature death is usually related to medical complications. However, intentional self-harm (including suicide) has also been identified as a major cause of death.

Optimal treatment of eating disorders involves a multidisciplinary approach. While general practitioners and paediatricians are well placed to monitor the physical condition of patients with eating disorders, effective therapeutic psychological interventions, such as family-based therapy, are best delivered through a mental health practitioner experienced in treating eating disorders.

Specialist eating disorder services for children exist, often within the infant child and youth area mental health and wellbeing services (ICY AMHWS) across Victoria.

Weight restoration early in treatment suggests better long-term prognosis.

Children/adolescents with any of the following symptoms or signs are likely to need admission to a hospital ward for medical stabilisation and should be discussed with a paediatrician with experience in stabilising such patients:

- significant weight loss (> 30 per cent of pre-morbid weight, even if current weight is not low: about one in six patients with anorexia nervosa who are medically unstable due to weight loss are overweight at the time)
- bradycardia
- postural hypotension (fall in systolic blood pressure lying to standing > 20mmHg)
- dehydration
- hypothermia (temperature <35° C oral)

- electrolyte abnormalities (for example, hypokalaemia, hypernatremia).

Risk of pulmonary embolism when starting the oral contraception pill

Recent commencement of the oral contraception pill, smoking, obesity (BMI > 30), immobilisation and family history of venous thromboembolism are associated with increased risk of venous thromboembolism. The risk of venous thromboembolism is two to three times greater in users of oral combined hormonal contraception compared with non-users. The risk is highest in the first four months of use.

If the oral contraceptive pill has been recently commenced, any symptoms such as chest pain, shortness of breath, dyspnoea, dizziness, collapse or palpitations should prompt investigations for pulmonary embolism.