November 2012

HEALTH QUALITY & SAFETY COMMISSION NEW ZEALAND
Kupu Taurangi Hauora o Aotearoa

The Global Trigger Tool

A Practical Implementation Guide for New Zealand District Health Boards

Published in November 2012 by the Health Quality & Safety Commission,
PO Box 25496, Wellington 6146.

ISBN 978-0-478-38537-3 (online)

Citation: Health Quality & Safety Commission. 2012. *The Global Trigger Tool – A Practical Implementation Guide for New Zealand District Health Boards*. Wellington: Health Quality & Safety Commission.

This document is available on the Health Quality & Safety Commission website at: www.hqsc.govt.nz.

Acknowledgements

Firstly, acknowledgements are due to the Institute for Healthcare Improvement (IHI), the authors of the Global Trigger Tool (GTT) methodology and training programme. Its willingness to share information and deliver the GTT training programme 'down under' has meant that New Zealand District Health Boards (DHBs) have been able to take advantage of this methodology and implement the process in their respective organisations.

This implementation guide builds on a number of earlier documents, including the:

- IHI White Paper (Griffin and Resar 2009) which has provided the basis for the background and methodology
- Florida Hospital (Orlando, Florida, USA) Implementation Toolkit, available via the IHI website: http://www.ihi.org/knowledge/Pages/Tools/GlobalTriggerToolImplementationToolkit.aspx

Acknowledgements are also due to the Health Round Table which was instrumental in introducing the GTT in New Zealand by hosting and supporting the IHI's GTT training programme. Through their membership in the Health Round Table, 11 New Zealand DHBs have participated in the GTT training to date, and are at varying stages of implementing this methodology.

Thanks in particular to Dr Mary Seddon, Aaron Jackson and Ashika Maharaj who have been instrumental in establishing both the Adverse Drug Event (ADE) Trigger Tool and the GTT at Counties Manukau DHB. The depth of their experience has provided much of the resource for this implementation guide.

The advice and feedback from the other Northern Region DHBs (Northland, Waitemata and Auckland) and Hawke's Bay DHB in preparing this guide has been greatly appreciated.

Finally, thanks to Carmela Petagna, Deborah Jowitt and the Health Quality & Safety Commission team for their assistance in reviewing, editing and publishing this guide.

Foreword

The Health Quality & Safety Commission (the Commission) was established in November 2010 to reduce deaths, harm and waste from preventable errors across the health and disability sector, and build a culture of ongoing quality improvement.

The practice of medicine today is very effective and offers significant benefits. It is however complex and at times carries risks. Serious and sentinel events reporting identifies infrequent events that cause major harm that is devastating for patients and their families. The Global Trigger Tool (GTT) identifies common 'everyday' harm that is often below the threshold for serious and sentinel events reporting, but which still has the potential to impact on patient care and add to health care costs. Both types of events are important, but there is every reason to identify problems with the system early, before disasters occur.

The GTT identifies adverse events using medical record reviews. It is one source of information about the harm that occurs in health care. It should be used as part of a suite of measures, because no single measure provides the complete picture.

The GTT is relatively simple and cost effective to use. The primary purpose of using it is to highlight areas for improvement. Patients need to know problems are being identified and addressed, and this is one effective way of doing that.

The Commission has a number of work streams which collectively aim to improve the patient's experience of care and to make our health and disability system safer. The GTT will be used within this framework as part of the overall strategy to improve the services our patients receive.

The Commission's current focus is on trigger tools for acute adult care in hospitals, but there are also tools available for paediatrics, primary health care and mental health.

I hope this document will be a useful guide for DHBs and other providers of health care services, to implement the GTT process.

Prof Alan Merry, ONZM
Chair
Health Quality & Safety Commission

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Executive Summary

The overall goal of improved safety in health care is to reduce patient injury and harm. Trigger Tools contribute to this goal by providing a robust methodology which identifies adverse events (AEs) and provides a measure of unanticipated patient harm from clinical care. Using trigger tools complements other reporting systems for patient harm, providing a broader perspective.

The Global Trigger Tool (GTT) is a methodology developed by the Institute for Healthcare Improvement (IHI) in 2003 to identify adverse events using medical record reviews. This methodology built on experience from the initial trigger tool which was developed in 1999 to identify adverse drug events (ADEs) and subsequent trigger tools that had been adapted from the ADE tool for specific settings (for example in intensive care). The GTT includes a broader range of modules, providing a more global measure of patient harm.

The focus is on harm rather than error. Focusing on actual patient harm, whether or not it was caused by a medical error and whether or not it was preventable, targets the system rather than individuals and allows the analysis of 'unintended consequences' from a patient perspective.

The process involves a retrospective review of a random set of medical records using sets of triggers to screen for potential AEs. This is a simple, validated, and cost-effective methodology and has been widely used to identify, quantify and track patient harm. While not an improvement methodology itself, the tool can provide a means of identifying areas for improvement and measuring improvement efforts over time.

This implementation guide is intended to be used as a practical guide for District Health Boards (DHBs) choosing to include a trigger tool process as part of their 'window' on patient harm to improve patient safety.

The IHI White Paper has provided the basis for much of the background and methodology. This information has been adapted for the New Zealand setting based on the experiences of the Northern Region DHBs which have now been using the tool for two to three years.

While some DHBs have chosen to focus on the ADE Trigger Tool only using the expanded set of medication triggers, the Health Quality & Safety Commission (the Commission) recommends DHBs implement the GTT which incorporates the medication module. For little additional resource, a broader perspective on harm is obtained that is sufficient for the design of patient safety initiatives across the spectrum of care.

While the primary focus of this guide is on the Implementation of the GTT, it is equally applicable to the ADE Trigger Tool process. A separate section on the ADE Trigger Tool has been incorporated to highlight aspects specific to the ADE process alone.

Brief overview of the process

Getting started

- Seek agreement from the senior management team to support the process and provide the necessary resources.
- Establish a steering group which includes senior clinical personnel who have an interest in supporting the process.
- Appoint a coordinator.
- Recruit and train reviewers.
- Set up a specific location for managing records and completing record reviews.

Record review process

- A random sample of 20 medical records a month of patients discharged at least one month prior is obtained. Some DHBs may choose to do 40 records a month. Some exclusions apply.
- Medical record reviews are carried out by a team of trained primary reviewers who have a clinical background (usually nursing or pharmacy).
- Each medical record is reviewed separately by each of the reviewers and the results compared and discussed to achieve consensus. This improves the reliability of results.
- The review is carried out according to a strict systematic process and the time taken for each review is limited to 20 minutes per medical record, regardless of the size of the record.
- Any triggers identified are further investigated to confirm whether actual harm has occurred.
- Harms are classified using the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) Index.
- The process is overseen by a medical doctor who authenticates the harms identified through the review process.

Managing the data

- Data collection tool to collect relevant information.
- Customised database for data entry.

Managing and analysing the data

Main results reported include:

- AEs per 1000 patient days
- AEs per 100 patient admissions
- percent admissions with an AE
- events by categories of harm
- common AEs.

The primary purpose of using a trigger tool to identify harm is to highlight areas for improvement.

Using a more detailed classification system (for example the Florida Classification System[1]) to further categorise events helps to identify specific aspects of care for further exploration.

Reporting

Results are most relevant for frontline clinicians but are also reported to the senior executive leadership group and to the board.

Making the results visible and communicating these across the organisation will raise awareness about patient safety among staff and patients and provide some impetus to taking action.

Sustainability

There needs to be a long-term commitment to using a trigger tool process to learn more about patient harm. Because the sample is small, it takes time to get sufficient data for meaningful analysis.

This requires ongoing resources and support to train new reviewers and maintain motivation of the team. Regular meetings and refresher training not only helps sustain interest in the process, but also helps learning and improves consistency between reviewers.

Presenting the data about particular problems and trends is a way of engaging clinical staff. Getting them involved in using the data for improvement helps their recognition of the ongoing value of the trigger tool approach.

[1] The Florida Classification System was developed by Florida Hospital (Orlando, Florida, USA) and is part of its implementation toolkit. Refer Appendix Eight.

Background

The overall goal of improved safety in health care is to reduce patient injury and harm (Griffin and Resar 2009). The GTT contributes to this goal by providing a robust tool for identifying AEs and by giving hospitals a global measure of all patient harm caused by medical care. Compared with other methods of detecting patient harm, it is reasonably sensitive and reliable, but should be seen as only part of a range of measurement tools that provide an insight into the causes of patient harm (Parry, Cline et al. 2012).

What is the Global Trigger Tool?

The GTT is a methodology developed by the IHI to identify AEs using medical record reviews.

The idea of looking for 'key triggers' in medical records as a way of detecting AEs was initiated by IHI in the late 1990s (Classen, Lloyd et al. 2008). The initial focus was on detecting ADEs (Rozich, Haraden et al. 2003) however this was later broadened to include trigger tools developed for other settings of care such as surgery and intensive care. (Resar, Rozich et al. 2006; Griffin and Classen 2008). Building on this knowledge, the IHI went on to develop the GTT to detect AEs 'across the spectrum of adult inpatient care' (Classen, Lloyd et al. 2008).

The GTT represents a shift in focus from medical errors to patient harm as an outcome of care. A focus on actual patient harm, whether or not it was caused by a medical error and whether or not it was preventable, targets the system rather than individuals and allows the analysis of 'unintended consequences' from a patient perspective.

The process involves a retrospective review of a random set of medical records using triggers to screen for potential AEs. This is a simple, validated, and cost-effective methodology and has been widely used to identify, quantify and track patient harm. While not an improvement methodology itself, the tool can provide a means of identifying areas for improvement and measuring improvement efforts over time.

What is the ADE Trigger Tool?

Because medications are the most frequent causes of patient harm, a specific focus on ADEs resulting from the prescribing, dispensing and administration of medications is justified.

The ADE Trigger Tool (ADE TT) is a standalone tool for medication-related harm. It includes the standard GTT medication and laboratory modules, one trigger from the GTT Cares module, plus eight additional triggers specific to the ADE. Ideally it is undertaken in the context of the wider GTT, but some DHBs have chosen to focus solely on ADEs or to run this in parallel with the GTT. Preferably, the ADE TT should be led by clinical pharmacists who have an in-depth understanding of medication-related harm.

Why focus on patient harm?

Patient harm is common and costly. A number of international studies conducted over the past 20 years found that the median incidence of in-hospital AEs was 9.2 percent, with a median percentage of preventability of 43.5 percent. While more than half of these events resulted in none or minor harm, 7.4 percent were 'lethal' (de Vries, Ramrattan et al. 2008).

In New Zealand, the cost of all AEs is around NZ$10,000 per patient, and the cost of preventable AEs is estimated at around NZ$590 million. In other words, around 30 percent of public hospital expenditure goes towards treating preventable AEs (Brown, McArthur et al. 2002).

Measuring the extent to which patients experience harm, and developing an in-depth understanding of how we harm our patients, are important steps in initiating improvement efforts to reduce harm and improve the safety of care (Neale, Woloshynowych et al. 2001; de Vries, Ramrattan et al. 2008).

Sources of information about patient harm

In the health care setting, there are a currently a number of sources of information about patient harm.

Internal sources

- Incident reporting systems
- Serious and sentinel event reporting and reviews
- Mortality reviews
- Morbidity and mortality (M&M) meetings
- Verbal reports
- Clinical coding. Clinical coders are employed by the Ministry of Health to code clinical information (including AEs) for the National Collection
- Routine surveillance (for example infection rates)

External sources

- Accident Compensation Corporation (ACC) claims for treatment-related injuries
- Coronial reports
- Health and Disability Commissioner (HDC) complaints from consumers

Patients

- Patient complaints
- Patient surveys

Most of these sources of information rely on voluntary reporting of single and more serious events. These represent important sources of information about serious harm and provide qualitative information about the nature of such events. By understanding the systems factors that contribute to such events, changes can be made to prevent future similar recurrences. It is well known however that voluntary

incident reporting systems account for less than 10 percent of all AEs. (Sari, Sheldon et al. 2006).

In contrast, the GTT provides more consistent and accurate information about the level of patient harm in a health care organisation, identifying up to 80 percent of patient harms (Classen, Resar et al. 2011).

Most of the harms identified through the GTT methodology are common, everyday harms that are frequently not recognised by health care professionals as an AE. This, plus the fact they are generally regarded as not preventable, often means such harms do not reach the threshold for reporting. The GTT therefore complements the information provided through other sources. It increases the volume of data and broadens the perspective on harm.

Bringing together all sources of harm allows health care organisations to work towards a more integrated approach to managing harm (Hogan, Olsen et al. 2008).

Definition and classification of patient harm

IHI definition of harm:

'Unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalisation or that results in death.'

The IHI definition of harm is broad, and encompasses all harms, whether preventable or not. From a patient perspective, whether preventable or not, any harm is unpleasant and not a desirable consequence of their encounter with the health care system.

The rationale for including non-preventable harms is that preventability is a 'moving target'. Over time, previously accepted levels of treatment-related complications become unacceptable given advances in medicine. Including all harms provides a truly 'global 'measure of the extent of harm associated with medical care, however the focus in terms of improvement efforts remains on the balance of harm that is preventable.

The GTT further limits harm to those events resulting from the active delivery of care (commission) rather than the omission of care. Substandard care is much less easily defined, but when recognised, it should certainly be the focus of quality improvement efforts.

The IHI trigger tool used the National Coordinating Council for Medication Error reporting and Prevention (NCC MERP) Index for recording errors. This index defines nine categories of error, but because the IHI Trigger Tool counts only AEs that result in harm, it excludes the first four categories (A–D) which do not cause harm.

Table 1: Categories of Harm

Category	Description
Category E	Temporary harm to the patient and required intervention
Category F	Temporary harm to the patient and required initial or prolonged hospitalisation
Category G	Permanent patient harm
Category H	Intervention required to sustain life
Category I	Patient death

Triggers

Triggers are not harms in themselves – but 'clues' that harm may have occurred. They have been identified as being associated with patient harms, but not all positive triggers necessarily identify an AE (Resar, Rozich et al. 2003).

Conversely, harm may be identified without a specific trigger.

Examples

- An INR of ≥ 4 is not classified as 'harm' in itself, but if a bleed is identified, then harm has occurred.
- The administration of naloxone may indicate that a person has been over-sedated.
- Escalation to a higher level of care is not classified as 'harm' in itself but harm may have occurred resulting in admission to an intensive care unit.

Using sets of triggers provides an efficient systematic methodology for a targeted medical record review.

The following trigger modules have been developed and are included in the GTT (Appendix Four).

- Cares
- Medication
- Laboratory
- Surgical
- Intensive care
- Emergency care

The expanded set of medication triggers in the ADE TT includes a total of 21 triggers (Appendix Six).

- The standard GTT Medication Module triggers (7)
- The standard GTT Laboratory Module triggers (5)
- Triggers from GTT 'Cares' module (1)
- Additional ADE specific triggers (8)

Why use the GTT?

The IHI recommends the GTT for the following reasons:

- resource requirements for reviews with IHI GTT are predictable and generally accepted
- reviewers can be trained with a high degree of consistency on both events and severity
- concept of total harm is well accepted by most clinicians
- a run chart of AEs detected from IHI GTT reviews fits well in a board level report
- the IHI GTT is currently one of the best tools currently available for detecting AEs.

Other in-patient based trigger tools

A number of Trigger tools have now been produced and are available on the IHI Website:
http://www.ihi.org/knowledge/Pages/Tools/IntrotoTriggerToolsforIdentifyingAEs.aspx

In addition to the GTT, the following trigger tools are listed:

- Trigger Tool for Measuring Adverse Drug Events in a Mental Health Setting
- Trigger Tool for Measuring Adverse Drug Events in the Nursing Home
- Surgical Trigger Tool for Measuring Peri-operative Adverse Events
- Intensive Care Unit Adverse Event Trigger Tool
- Paediatric Trigger Toolkit: Measuring Adverse Drug Events in the Children's Hospital
- Perinatal Trigger Tool
- Trigger Tool for Measuring Adverse Events in the Neonatal Intensive Care Unit.

Trigger tools for primary care

Despite the fact that primary care is where most patient contact with the health system occurs, there is limited information about the nature and extent of AEs in the primary care setting (de Wet and Bowie 2009).

A recent report however found that about 1 to 2 percent of primary care consultations may include AEs, many of which were associated with medication and communication (The Evidence Centre 2011). A review of studies that measured harm due to contact with primary health care services using routinely collected data found common factors associated with AEs in primary care were prescribing errors, poor communication between clinicians and diagnostic failures (Tsang, Majeed et al. 2012).

In New Zealand, the Accident Compensation Corporation treatment injury claims database has also provided a useful insight into primary care patient safety events (Wallis and Dovey 2011).

A preliminary Primary Care Trigger Tool to detect error and harm in primary care records was developed and tested in Scotland in 2007 (de Wet and Bowie 2009).

The basis for the tool was the IHI Outpatient Trigger Tool which was modified, resulting in a 10-item primary care tool.

Subsequently, the NHS Institute for Innovation and Improvement had developed a Primary Care Trigger Tool:
http://www.institute.nhs.uk/safer_care/primary_care_2/introductiontoprimarycaretriggertool.html

A Primary Care Trigger Tool has been validated for the New Zealand setting by a team from Manaia Health Primary Healthcare Organisation led by Dr Kyle Eggleton. This tool shows promise as a practical mechanism to identify harm in General Practice, and inform patient safety initiatives in the primary care setting.

Chapter One: Getting Started

The following chapters apply to both the ADE TT and the GTT.

Seek agreement from senior management

Seek agreement from your senior management team to support the process and provide the necessary resources.

If necessary, develop a project charter (see Appendix One) to outline the scope of the project and the anticipated benefits and costs.

Establish a steering group

Establish a steering group of senior clinical staff and other interested parties who are willing to work with the reviewers to support and promote the GTT process. This is particularly important once there is sufficient data to undertake analyses and initiate improvement work.

Get set up for the GTT process

Dedicated place:

A dedicated room or place where reviewers can carry out their medical record reviews is useful. Security is essential to protect the confidentiality & safety of the medical records, and there should be electronic access to check information that is available electronically (laboratory results, discharge summaries etc).

Appoint a coordinator

A coordinator maintains oversight of the entire process, including:

- the randomisation process for selecting medical records
- handling and security of the medical records
- managing the team schedule for completing record reviews
- coordinating follow up meetings to discuss complex cases, troubleshoot issues and review methodology
- complete data entry and data analyses
- generate the relevant reports.

Develop standard operating procedures

It is useful to develop a set of standard operating procedures (SOP) to ensure the process is consistent over the long term in the event of staff turnover.

For a sample SOP see Appendix Two.

Recruit reviewers and select teams

Each team consists of two or three primary reviewers and one medical reviewer. The number of teams should ensure the review workload is appropriate, typically 5 to 10 cases per reviewer per month.

Having three primary reviewers per team allows some flexibility with respect to the demands on time as well as providing cover when leave is taken.

Primary reviewers

Primary reviewers are typically senior nurses and/or pharmacists who have a clinical background and reasonable experience with the management of adult medical and surgical patients. The primary reviewer can operate on either a part-time or full-time basis depending on the level of approved resources.

Medical reviewers

Medical reviewers are typically those who have a broad knowledge base across a wide range of conditions. Examples include anaesthetists, ICU, emergency department specialists and general physicians. Others may also be considered, and this should pose no problem as long as they are able to collaborate with other colleagues if unfamiliar with any aspect of care.

Recruitment of reviewers

This can be achieved by word of mouth through the senior clinician networks (clinical directors or clinical nurse directors).

The 'group email' function can be used to request expressions of interest from staff. It needs to be made clear that an ongoing regular time commitment is required and involvement is for a minimum of one year.

To ensure support for the programme, reviewers and their managers can be asked to sign a memorandum of understanding which outlines the required commitment (Appendix Three).

Train reviewers

Training for all reviewers is mandatory. In New Zealand this training has to date been provided by IHI via the Health Round Table.

The IHI training is delivered by senior IHI personnel using webcast technology. Training occurs over a three to four month period. There is an initial series of three one-hour presentations which outline the background and describe the methodology. Subsequent sessions are provided to support implementation and to troubleshoot issues that arise.

Specifically trainees are asked to:

- read the IHI–GTT white paper to familiarise themselves with the methodology
- complete the six training records developed by IHI
- undertake and actively participate in all webcast training sessions
- complete organisation-specific training records
- start data collection and bring specific problems to the follow-up problem solving sessions.

While this implementation guide can be used to train new reviewers and for refresher training for established reviewers, reviewers are advised to complete the IHI Health Roundtable training where possible.

Online training resource

The IHI provides a five-step training plan which includes readings and audio recordings:
http://www.ihi.org/knowledge/Pages/Tools/IHIGlobalTriggerToolTrainingResources.aspx

Randomisation process

Patient encounters (admission to discharge) for a given week/month are generated from the hospital's patient administration system (PAS).

The following criteria need to be applied to the data extract:

Inclusion criteria

- Patients (age ≥ 18 years) (note: some hospitals may elect to use a ≥15 years cut off, as this aligns with the operational adult/child cut off).
- Length of stay at least 24 hours and formally admitted to the hospital.
- Closed and completed record (discharge summary and all coding is complete).

Exclusion criteria

- Paediatric patients (age ≤ 18). The triggers developed by IHI are tailored to the adult patients. IHI has developed a separate Paediatric Trigger Tool methodology.
- Mental health admissions.

This data extract should contain the following data items:

- patient identifier (NHI)
- admission date
- discharge date
- discharge week of year (week one of year begins the first Monday of the year)
- discharge ward
- discharge specialty/service
- Total length of stay (LOS) in days/part days.

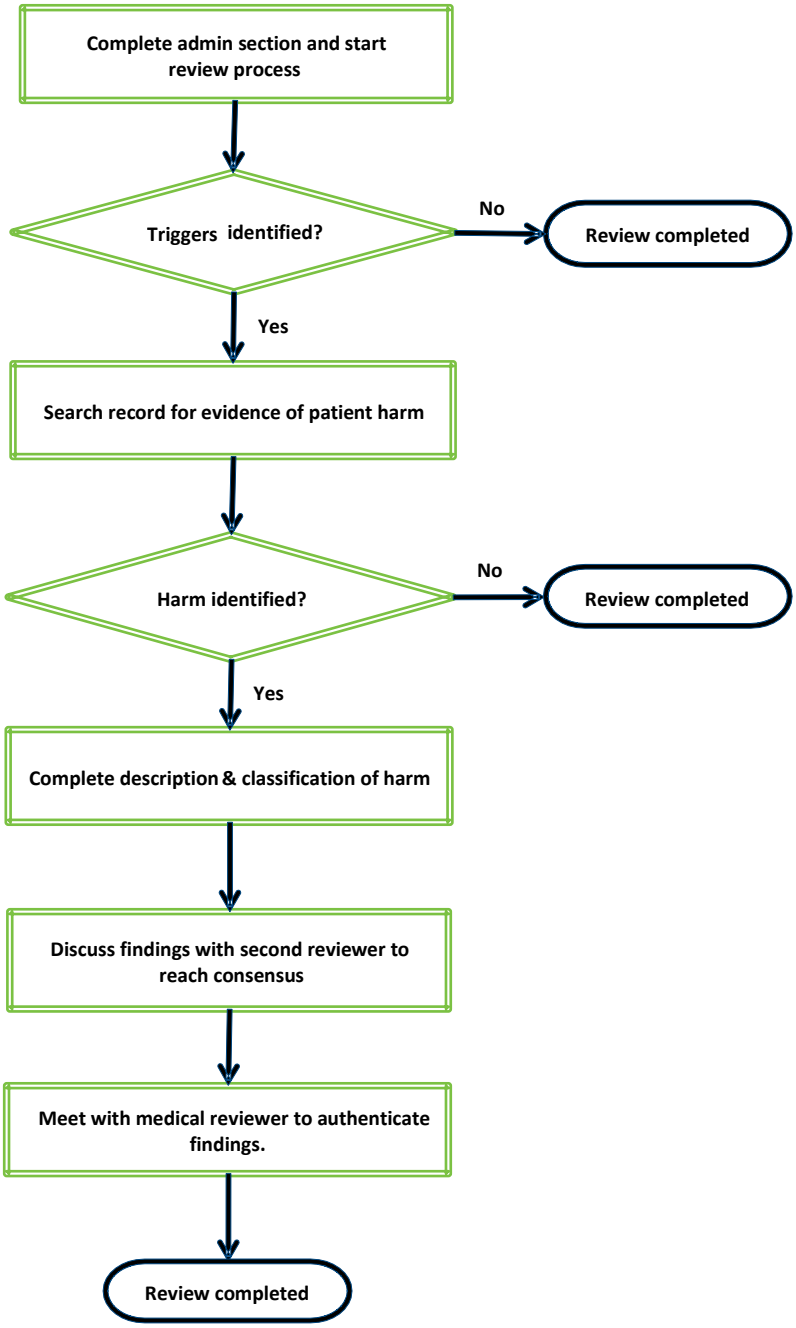
A random sample of the required number of discharges meeting the inclusion and exclusion criteria is obtained.

To ensure this is done correctly, we suggest you seek the advice of someone in your organisation who is familiar with this process.

Overview of the medical record review process

The medical record review process follows the standardised IHI process as outlined in the 2009 White Paper (Griffin and Resar 2009).

Figure 1: Medical Record Review Process



Finding triggers

Set a 20-minute limit for reviewing the medical record (regardless of size).

Do not read the entire record.

The following process has been recommended by IHI for reviewing medical records.

1. Discharge summary.
2. Medications administration record.
3. Laboratory results.
4. Medication chart: prescriber orders and administration record.
5. Operating theatre and anaesthetic notes.
6. Nursing notes.
7. Physician progress notes.
8. If time permits, any other areas of the record (such as history and physical, consult notes, or emergency department notes).

The GTT is not designed to identify all harms, but by using the recommended IHI systematic process, sufficient harms are identified to provide useful information for the organisation.

Note

- A positive trigger is not an AE. For example, an INR > 4 is not 'harm' in itself. Search the relevant parts of the record to determine if harm (Bleeding) occurred).
- Some triggers are AEs by definition:
    - Nosocomial infections
    - Pulmonary embolus.
- If an AE is identified but no antecedent trigger found, this is still logged as an AE.

Determining an adverse event

In determining whether an AE has occurred:

- GTT includes only physical harm and specifically excludes psychological harm
- the harm must be the result of an act of commission rather than the omission of care
- take the perspective of the patient: would you be happy if this happened to you?
- unintended consequences are included, as preventability is not a factor
- the harm should be the result of some clinical treatment, not part of the natural progression of the disease.

Classifying harm

Harms are classified according to the following NCC MERP categories.

Table 2: Categories of Harm

Category	Description
Category E	Temporary harm to the patient and required intervention
Category F	Temporary harm to the patient and required initial or prolonged hospitalisation
Category G	Permanent patient harm
Category H	Intervention required to sustain life
Category I	Patient death

What data should be collected?

Design a Data Collection Tool that includes all relevant material required to conduct meaningful analyses. It should be designed in a way that facilitates easy and accurate data entry.

An example of a data collection form for the GTT is provided in Appendix Nine and for the ADE TT in Appendix Ten.

The basic minimum data set should contain the following data items.

- NHI
- Gender
- Age/date of birth
- Discharge date
- Discharge week
- Discharge specialty
- Year
- LOS
- Primary trigger for identified harms
- Harm category (Table 2)
- Sub-Category (Florida Classification)
- Description of AE (narrative)
- Clinical context (narrative)
- When occurred (Table 3)
- Where occurred (Table 4)
- Primary medication
- Secondary medication
- Learning case (useful to flag difficult cases for learning /training purposes)

The Florida Classification system (Appendix Eight) was developed by Florida Hospital (Orlando USA) to help identify sub-categories of patient harm. It is recommended that this classification system is used when entering data to enable more in-depth analysis.

Key headings include:

- events related to medication/intravenous fluids
- events related to patient care
- hospital-acquired infection
- events related to surgery or other procedure
- events related to intensive care.

Completing the data collection form

Each reviewer uses a standardised data collection tool to collect data. The primary reviewers are encouraged to write sufficient information on the data collection form so the information collected is meaningful for the analysis phase.

Clinical context:

The clinical context should include the patient age, gender, admitting diagnosis/presenting complaints.

Example: 83 year old female admitted with fractured neck of femur from aged care facility; previous history of stroke; mild dementia.

Adverse events:

The identified AE should give sufficient detail about the harm that occurred and any other supporting information that enhances understanding why it is an AE and which sub-categories of severity and event type applies.

Example: Post-op catheterisation resulting in UTI; patient became disoriented and confused; antibiotics administered.

When the harm occurred:

All harms are counted. It is recommended a distinction is made between harms that occurred during the index admission and those that occurred prior to the admission and were present on admission. This information can be useful when analysing the data for trends. When the harm occurred can be coded according to the sub-categories in Table 3.

Table 3: Coding Definitions for when Harm Occurred

InPt	AE occurred during this hospital admission
Adm 1	AE present on admission, or occurred **within 30** days of this admission. For example: Patient A was admitted to ED secondary to a bleed caused by an INR of 10 due to Warfarin. This harm occurred in the last 30 days but was not an inpatient harm as it was present on admission and in this case was the cause of the admit.
Adm 2	AE present on admission, or occurred **between 30 days and 12 months** of this admission.
Adm 3	AE present on admission, or occurred **more than 12 months prior to** this admission. For example: Patient C was repeatedly admitted to hospital secondary to shortness of breath. It was discovered patient had pulmonary fibrosis secondary to long-term amiodarone (>5 years). Amiodarone was stopped in this discharge.

Re-Admit	AE present on admission, related to a prior discharge, within 30 days of the index admission. For example: Patient D was recently discharged from ward X on antibiotics for infection. A week later, patient was re-admitted with C. difficile diarrhoea secondary to the prescribed antibiotics. This harm was caused by a recent medical intervention.

Where the harm occurred

Accurately identifying where the harm occurred can provide useful information about the source of harms both within the hospital or in the community, for those harms that were present on admission.

These may be coded according to the sub-categories in Table 4.

Table 4: Coding Definitions for where Harm Occurred

InPt	Emergency department, ICU, theatre, ward x, etc (during this admission)
Adm1	Ward x (prior admission at this DHB),another DHB, private hospital, aged care facility, primary care provider, at home etc
Adm2	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, primary care provider, at home etc
Adm3	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, primary care provider, at home etc
Re-admit	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, primary care provider, at home

Note

These tables can be modified to suit the needs of each DHB. For example, some DHBs may choose not to focus on events occurring more than 12 months prior to the selected admission.

Data entry and analysis

Data entry

There are a number of options for data entry and analysis. A GTT database has been developed in New Zealand to facilitate data entry and reporting and is being used by a number of DHBs. Melbourne Health is also willing to share its Excel-based database with any DHB doing the Global Trigger Tool.

Data analysis

Three measures are used to report rates of harm:

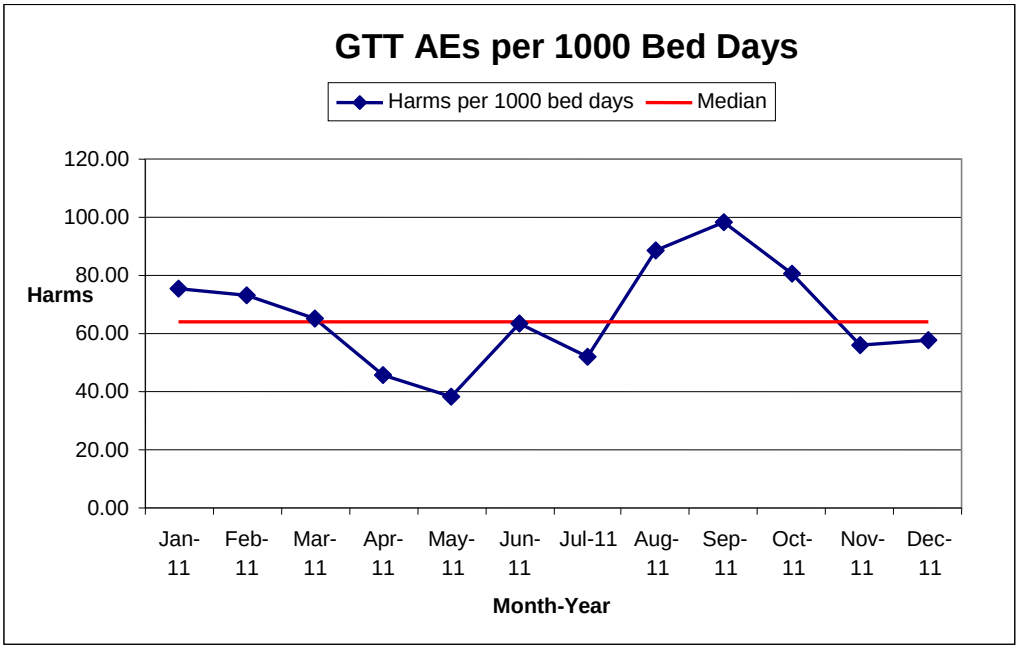
- AEs per 1000 patient days
- AEs per 100 patient admissions
- percent of admissions with an AE.

The operational definitions for these indicators are provided in Appendix Eleven. It is recommended advice is sought from personnel with expertise in data analysis to analyse and present the data using run charts and bar graphs.

Presenting data

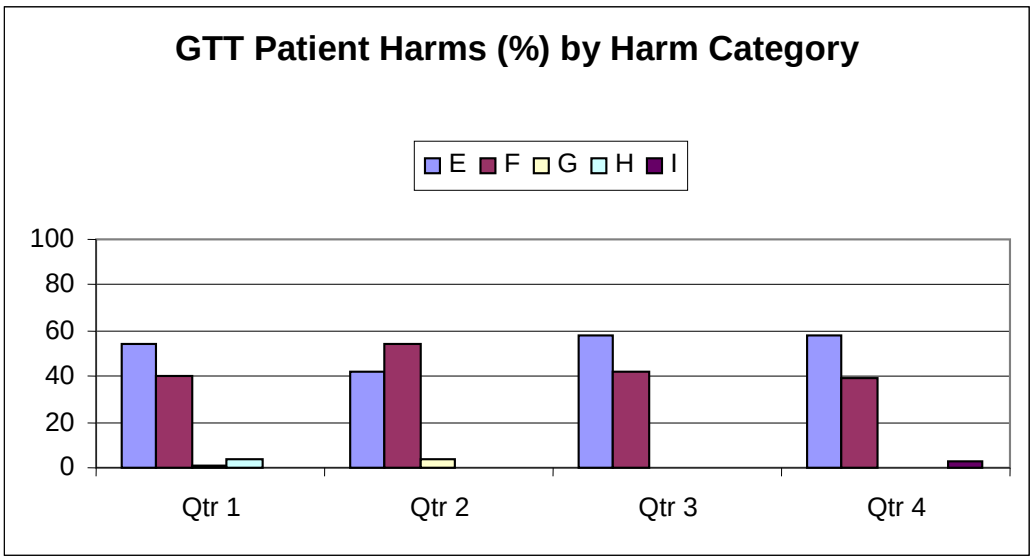
Simple run charts (see Figure 2) can be developed for each of the three performance indicators used for reporting GTT results.

Figure 2: Example Run Chart



A bar chart is useful for displaying data relating to categories of patient harm (Example Figure 3).

Figure 3: Example Bar Chart



Chapter Four: Identifying Improvement Opportunities

The GTT identifies potential patient safety issues but does not provide information about why such events are occurring to inform focused improvement efforts.

Some limited information can be gained by drilling down into the data. A good starting point is the Florida Classification System Subcategories (Table 5)

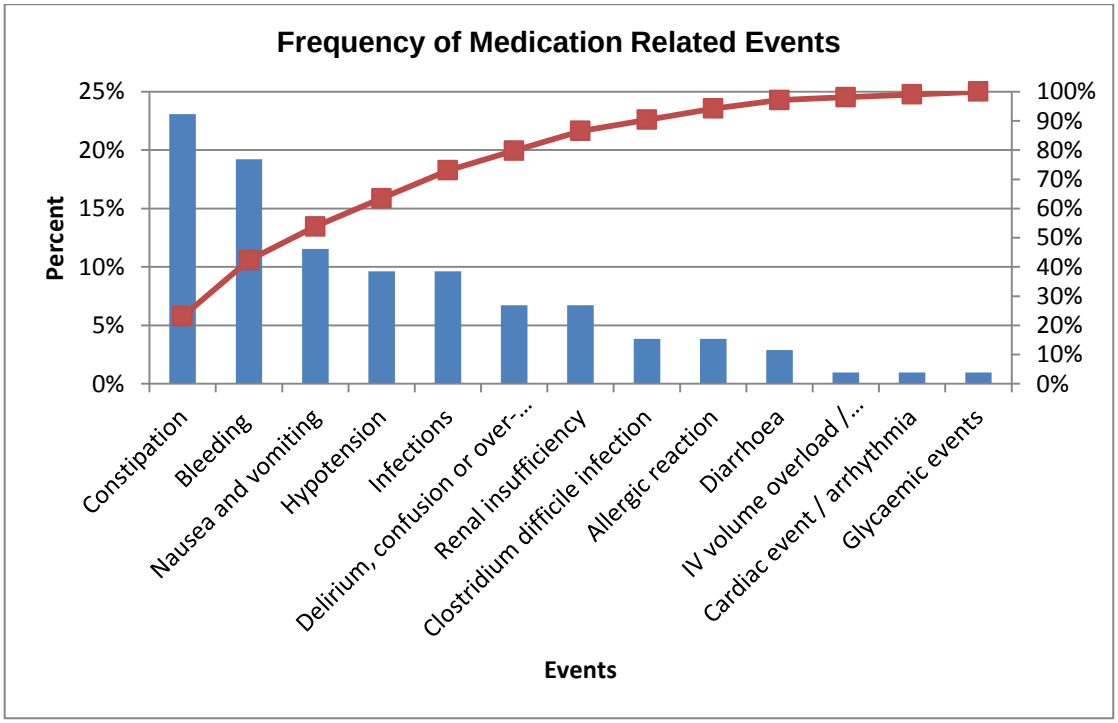
Table 5: Example Table for Presenting Frequency of Events using the Florida Subcategories

Florida subcategory		Severity				
	N (total)	E	F	G	H	I
Medication/IV fluids						
Hospital-acquired infection						
Surgery or other procedure						
Patient care						
Other						

Having identified the areas with the most events, further analyses can be undertaken to rank events within that subcategory by frequency.

A Pareto chart is useful for presenting this data in a report (Figure 4).

Figure 4: Example Pareto Chart for Medication-Related Events



This Pareto chart indicates three potential problem areas that could benefit from additional investigation; constipation, bleeding, and nausea and vomiting.

Identifying the medications implicated with each of these harms is the next logical step (Table 6).

Table 6: Medications Implicated in Harm

Event	No. of Events (%)	Primary Drug	Secondary Drug
Constipation	24 (23%)	Morphine	Oxycodone
Bleeding	20 (19%)	Aspirin	Enoxaparin Warfarin
Nausea & vomiting	12 (11.5%)	Morphine	Oxycodone

In this example, the use of opioids and aspirin are two potential areas for further analysis.

Next steps

Having identified an area for improvement, the next step is to set up a working group that includes clinicians with specialist knowledge in the identified area and people with skills in quality improvement methods to facilitate the process.

Additional information is usually required to explore the issues in more depth and to clearly define the problem. An enriched sample of medical records may be required to collect more data. At this stage it is also advisable to consult with the organisation's decision support analysts who can provide additional relevant information from routinely collected data.

Effective improvement work requires a clear definition of the problem to be addressed. For example, it may be that the harm involves particular patient groups (eg, surgical patients); a particular time (eg, the immediate post-operative period or after hours); variation in practice (eg, prescribing).

Once the problem has been identified, improvement methods can be applied to initiate change to achieve the desired outcome.

Sharing the information

Some DHBs are already starting improvement work as a direct result of using the GTT methodology. The Commission is keen to share these experiences among all DHBs and plans to publish the results of this work as it becomes available. We encourage DHBs to write up their work.

A useful framework for reporting quality improvement work is that recommended by the *British Medical Journal Quality & Safety* for its quality improvement reports: http://qualitysafety.bmj.com/site/about/guidelines.xhtml#quality

Chapter Five: Reporting

It is important that the information about the extent and type of patient harm identified by the GTT process is disseminated to those who can do something about it.

Who gets the results?

Clinical directors/clinical nurse directors

This information is most relevant to clinicians at the frontline, as it highlights common harms that impact on the patient experience, patient safety and costs and provides ideas for improvement opportunities. Getting clinicians engaged is key to the success of the GTT Programme.

The senior management team

The senior management team needs to understand what the GTT is about, why it is used and how it can benefit the organisation.

Understanding that the GTT complements other sources of information about patient harm and provides a global measure of harm across the organisation is important if the executive leadership group is to lend support to subsequent improvement activities.

The board

A high-level report to the board provides information about the level of patient harm in the organisation. It is critical this is reported in a way that ensures board members understand the context in which the GTT is used and the nature of the harms being reported. The emphasis should be on reporting the impact of improvement activities that have been undertaken as a consequence of using this methodology.

Reporting format

The report format will vary depending on the audience. A suggested format would include the following sections:

- brief background of GTT and current status
- report results:
    - run charts for the relevant measures measure (select depending on audience)
    - harms by severity of harm category
- examples from each of the harm categories for the relevant time period
- current improvement activities.

Ideally the frequency of reporting is quarterly or each six months. Given the small sample size, there is nothing to be gained by reporting results on a monthly basis. An example template is included in Appendix Twelve.

Chapter Six: Sustainability

The key challenges for a DHB in sustaining the GTT process are to maintain the resource allocation and team motivation. Because of the small number of medical records sampled each month, there needs to be a long-term commitment to the process and an understanding that it takes at least six to twelve months to get sufficient data for analysis.

The GTT should be regarded as part of the overall picture of patient harm. It identifies common harms that are not typically identified by any other method and takes into account the patient perspective. It therefore represents a useful source of information for informing improvement opportunities.

Ongoing team support

Clinical leadership is essential to maintain the momentum of the team.

Scheduling monthly meetings for the teams to get together to discuss difficult cases and debate harms and classification of harms provides the opportunity for learning and helps maintain consistency among the team members in classifying harms.

Presenting the results of analyses back to the clinical team and the senior management team profiles the values of the GTT alongside other reporting systems for patient harm and garners support for subsequent improvement work.

Recruiting and training new reviewers

To maintain viability of the team, new reviewers need to be recruited and trained from time to time.

While it is desirable that all GTT reviewers have undergone the IHI training through the Health Round Table, this is not always possible.

Key points for new recruits to the GTT team:

- read the IHI White Paper and this guide to familiarise themselves with the purpose and process of the GTT
- read the Commission's implementation guide
- complete the IHI training records and go through these with the trainer (another reviewer or the GTT coordinator)
- buddy up with a team and act as a third reviewer until familiar with the process (note: their data will not be included at this stage)
- start as an independent reviewer when they have demonstrated competence to the trainer and feel confident
- attend the GTT meetings where learning cases are reviewed and discussed.

Appendix One: Project Charter

Project Charter[2]	
Project Title	Implementation of the GTT
Overview	Brief statement outlining what the GTT is about
Problem Statement	• Why is this project important? • What problem does it seek to solve? • Who will be affected by the success or failure of this project (patients, staff, administration, funders, community etc)? • How does it impact the lives or wellbeing of patients? • What other stakeholders are involved? • How does it fit into the strategic vision of your programme? • What are the potential risks of not doing it?
Project Scope	• Overview of process
Resource Requirements	• Staffing • Space • Equipment • Training requirements • Database requirements • Administration support (data entry)
Potential Barriers	• Lack of support from senior clinical /management groups • Lack of adequate resource to support the programme • Reviewers not able to maintain commitment • Etc
Expected Outcomes (Deliverables)	Key milestones: • Steering Group established • Review team selected • Training completed • Trial data collection period • Formal data collection started • Analysis and improvement opportunities identified Key deliverables: • Reporting on level of harm • Improvement opportunities initiated • GTT Process embedded and sustained

[2] Adapted from the IHI Improvement Science Training Programme Project Charter

Appendix Two: Standard Operating Procedures[3]

	XXX DHB
Purpose	To standardise methodology based on IHI GTT methodology
Policy	Data collection to be undertaken (specify frequency) using the standardised tools and methods as outlined in this document
Procedure	

Random Record selection	• Monthly data provided by (IT/Decision support group) that meets inclusion / exclusion criteria:
	  ○ Inclusions:
	  ▪ Patient aged 18 years or older
	  ▪ Discharged ≥ 2 months
	  ▪ LOS ≥ 24 hours
	  ○ Exclusions:
	  ▪ Mental Health admissions
	  ▪ Paediatrics / Neonatal
	• Randomisation process applied according to agreed protocol (specify)
	• List of included records developed

Record Collection	• List of required records emailed to Medical Records by GTT coordinator • Records delivered to (location) by XXXX • Allocate records to teams • Use a tracking process to ensure security of records is maintained
Review Team	• A review team consists of two (or three) primary reviewers and a medical reviewer who have undertaken training in the GTT process • The primary responsibilities of the primary review team are to complete medical record reviews within the specified time frames using the standard process and complete the data collection tool for each record • The primary responsibilities of the medical reviewer is to meet with the review team and authenticate the findings of the reviewers
Record Review process	Record reviews are undertaken using the process recommended by IHI: • use approved DHB data collection tool • 20 minute limit for each patient record regardless of size • records are reviewed independently by each reviewer and data form completed • record reviewed using recommended approach and relevant trigger modules • for each identified trigger: ○ search record for presence of AE

[3] Adapted from the Florida Hospital (Orlando, Florida, USA) SOP from its implementation toolkit.

	○ identify and document harm ○ describe with adequate detail ○ include any AE identified with no trigger found • note any issues for discussion • complete all sections providing sufficient detail for analysis
Reviewer Consensus	• Review each record with second primary reviewer • Identify discrepancies • Arrive at consensus if possible • If consensus not reached, note issue for discussion with medical reviewer • Document outcome of the discussion with medical reviewer
Authentication by Medical Reviewer	• Meet as required with review team • Review identified harms flagged for discussion • Authenticate primary reviewer findings • Adjust numbers where appropriate • Notify Patient Safety Officer of potential serious and sentinel events during reviews/discussions Note: The medical reviewer is the final arbitrator
Data Entry & Analysis	The designated person (GTT coordinator) enters the data into customised database or Excel spread sheet and undertakes the analyses The data are analysed to provide the following basic information: • AEs per 1000 patient days • AEs per 100 patient admissions • percent admissions with an AE • AEs by harm category Further in-depth analyses are undertaken quarterly or six-monthly to identify trends
Reporting	• A quarterly or six-monthly report is presented to the: ○ clinical leadership team ○ senior management team ○ board

Appendix Three: Memorandum of Understanding

This memorandum of understanding represents an agreement between _____ and nursing and medical staff who have been selected to be involved in the Global Trigger Tool (GTT) Project.

XXXX DHB is planning to use the GTT to provide more consistent and accurate information about the level of patient harm in our organisation. This will be a core patient safety measure to inform patient safety initiatives for the organisation.

Results will be reported to the board, senior management team and clinical management teams on a quarterly (six-monthly) basis.

Because consistency is important for the quality of data collection, this project requires commitment to:

1. being available for agreed time periods as specified below
2. a minimum involvement for a period of one year.

Terms of agreement

Medical reviewers

As a medical reviewer, I agree to:

a. be available for approximately one hour every two weeks to meet the medical record review team to authenticate the findings of the record review and to answer questions about any issues that arise
b. participate in training/meetings that are required in support of the programme
c. commit to a minimum of a period of one year.

Nursing/pharmacy staff

As medical record reviewer I agree to:

a. six to eight hours a month to undertake medical record reviews and meet with the medical reviewer to authenticate findings and to discuss any issues that arise
b. participate in training/meetings that are required in support of the programme
c. commit to a minimum of a period of one year.

Signed: _____

Date: _____

Signed (Staff Member): _____

Date: _____

Manager: _____

Date: _____

Appendix Four: GTT Triggers

Section	Trigger
C	**Cares Module Triggers**
C1	Transfusion/use of blood
C2	Code/arrest/rapid response
C3	Acute dialysis
C4	Radiological investigation for PE/DVT
C5	Patient fall
C6	Pressure ulcer/injury
C7	Re-admission within 30 days
C8	Restraint use
C9	Healthcare associated infection
C10	In-hospital stroke
C11	Transfer to higher level of care
C12	Any procedure/treatment complication
C13	Early warning score (PUP) requiring response
C14	Decrease of greater than 25% in Hb or Hct
C15	Positive blood culture
C16	Other
M	**Medication Module Triggers**
M1	Vit K administration
M2	Antihistamine use
M3	Flumazenil use
M4	Naloxone use
M5	Anti-emetic use
M6	Over-sedation/Hypotension
M7	Abrupt medication stop
M8	Other
L	**Laboratory Module Triggers**
L1	C. difficile positive stool
L2	Partial thromboplastin time > 100 secs
L3	INR > 6
L4	Hypoglycaemia (< 3 mmol/L)
L5	Raised urea/creatinine (> 2 x baseline)
S	**Surgical Module**
S1	Return to theatre
S2	Change in procedure
S3	Admission intensive care post-op
S4	Intubation/re-intubation/BiPap in PACU
S5	X ray intra-op or in PACU
S6	Intra-op or post-op death
S7	Mechanical ventilation > 24 hours post-op
S8	Intra-op: adrenalin/noradrenalin/naloxone/flumazenil
S9	Injury, repair or removal of organ
S10	Post-op troponin level greater than 1.5 ng/ml
S11	Any operative complication
I	**Intensive Care Module Triggers**
I1	Pneumonia onset
I2	Re-admission ICU / HDU
I3	In-unit procedure
I4	Intubation or re-intubation
E	**EC Dept Module Triggers**
E1	Re-admission to ED within 48 hours discharge ED
E2	Time in ED > 6 hours

Appendix Five: GTT Trigger Definitions (Based on IHI White Paper 2009)

Triggers	Description	Definitions
Cares		
C1	Transfusion/use of blood	Any transfusion of packed red blood cells or whole blood should be investigated for causation, including excessive bleeding (surgical or anticoagulation-related), unintentional trauma of a blood vessels etc. Transfusion of many units beyond expected blood loss within the first 24 hours of surgery, including intra-operatively and post-operatively will likely be related to a peri-operative AE. Cases in which excessive blood loss occurs pre-operatively are not typically AEs. Patients receiving anticoagulants who require transfusions of fresh frozen plasma and platelets have likely experienced an AE related to the use of anticoagulants.
C2	Code/arrest/ rapid response	All emergency codes should be investigated, however not all codes are AEs. Some may be related to progression of disease. Check for medication-related issues. Cardiac or pulmonary arrest intra-operatively or in PACU should be considered an AE. However, a sudden cardiac arrhythmia resulting in a cardiac arrest may not be an AE but related to cardiac disease. Failure to recognise signs and symptoms would be an example of an error of omission and would not be counted as an AE unless the changes in patient condition were the result of some medical intervention.
C3	Acute dialysis	A new need for dialysis may be the course of a disease process of the result of an AE. Eg, drug-induced renal failure or reaction to the administration of a dye for radiological procedures.
C4	Radiological investigation for PE/DVT	DVT/PE in most cases is an AE. Rare exceptions are those related to disease process (cancer/clotting disorders). If hospitalisation occurs, look for causation prior to admission that could be attributed to medical care such as prior surgical procedure. Lack of prophylaxis with no DVT or PE is not an AE (it is an error of omission).
C5	Patient fall	A fall in a care setting represents a failure of care and may be the result of medications, equipment failure or failure of adequate staffing. A fall with injury is an AE. A fall without injury is not an AE. A fall resulting in injury due to medical treatment (eg, medications) should be considered an AE even if it occurred outside the hospital.
C6	Pressure ulcer	Pressure ulcers are AEs. Chronic decubiti are AEs if they occurred during a hospitalisation. If the ulcer occurred in the outpatient setting, consider the cause (eg, over-sedation) to

Triggers	Description	Definitions
		assess if an AE occurred.
C7	Re-admission within 30 days	Any re-admission within 30 days of discharge could be an AE. Eg, surgical site infection, DVT, PE.
C8	Restraint use	Whenever restraints are used, review the documented reasons and evaluate the relationship between use of restraints and confusion from drugs etc (which would indicate an AE).
C9	Healthcare associated infection	Any infection after admission is likely an AE. Infections that cause admission to hospital should be reviewed to determine whether they are related to medical care (prior procedure, urinary catheter at home or in long-term care) versus naturally occurring disease (community acquired pneumonia).
C10	In-hospital stroke	Evaluate the cause of the stroke to determine whether it is associated with a procedure (eg, surgical, conversion of AF) or anticoagulation. When procedure or treatments have likely contributed to stroke this is an AE.
C11	Transfer to higher level of care	Review all transfers. As they are likely to be the result of an AE where patient's condition deteriorated secondary to an AE. Eg, if admission due to respiratory arrest and intubation: this could be a natural progression of exacerbation of COPD (not AE) or due to PE post operatively (AE) or over-sedation of patient with COPD. Higher level of care may include telemetry, HDU, step down unit or if patient transferred from general medical or surgical nursing unit.
C12	Any procedure/treatment complication	A complication resulting from any procedure is an AE. Procedure notes frequently do not indicate complications, especially if they occur hours or days after the procedure note has been dictated. Watch for complications noted in coding or discharge summary or other progress notes.
C13	Early warning score (EWS) requiring response	This includes EWS scores requiring medical review as well as an emergency response. Check the notes for reasons for medical review.
C14	Decrease of greater than 25% in Hb or Hct	Any decrease of 25 % or more in Hb Grams of Hct should be investigated – particularly if it occurred in a relatively short period of time (72 hours or less). Bleeding events are commonly identified by this trigger and may be related to use of anticoagulants or aspirin or a surgical misadventure. The decrease in Hb or Hct in itself is not an AE unless related to some medical treatment. A decrease associated with a disease proves is not an AE.
C15	Positive blood culture	A positive blood culture should be investigated as an indicator of an AE – specifically a hospital acquired infection. Generally AEs associated with this trigger include infections diagnosed 48 hours or more after admission: blood stream infections, sepsis from other device infections (catheter associated UTI) or any other hospital associated infection. Positive blood

Triggers	Description	Definitions
		cultures related to other diseases (Community Acquired Pneumonia) would not be considered to be an AE).
C16	Other	Frequently when the record is reviewed, an AE is uncovered that does not fit a trigger. Any such event can be placed under this 'other' category. An event does not require a listed trigger to be counted as an event.
Meds		
M1	Vit K administration	If Vit K used as a response to prolonged INR, review record for evidence of bleeding. An AE has likely occurred if there are laboratory reports indicating a drop in Hematocrit or guiac-positive stools. Check the progress notes for evidence of excessive bruising, GI bleed, hemorrhagic stroke, or large haematoma as examples of AEs.
M2	Antihistamine use	Antihistamine use is frequently associated with allergic reactions to drugs but can also be ordered as a sleep aid, pre-op/pre-procedure medication or for seasonal allergies. If the drug has been administered, check the record to determine if it was ordered for symptoms of an allergic reaction to a drug or blood transfusion administered either during the hospital stay or prior to admission – these are AEs.
M3	Flumazenil use	Flumazenil reverses the effect of benzodiazepine drugs. Determine why the drug was used. Examples of AEs are severe hypotension, or marked prolonged sedation.
M4	Naloxone use	Naloxone is a powerful narcotic antagonist. Usage likely represents an AE except in cases of drug abuse of self-inflicted overdose.
M5	Anti-emetic use	Nausea and vomiting commonly are the result of drug administration both in surgical and non-surgical settings. Anti-emetics are commonly administered. Nausea and vomiting that interferes with feeding, post-operative recovery or delayed discharge suggest an AE. One or two episodes treated successfully with anti-emetics would suggest no AE. Three episodes is considered an AE.
M6	Over-sedation/Hypotension	Review the physician progress notes, nursing or multidisciplinary notes for evidence of over sedation and lethargy. Review vital signs records or graphics for episodes of hypotension related to the administration of a sedative analgesic or muscle relaxant. Intentional overdose is not considered an AE.
M7	Abrupt medication stop	Although the discontinuation of medications is a common finding in the record, abruptly stopping medications is a trigger requiring further investigation for cause. A sudden change in patient condition requiring adjustment of medications is often related to an AE. 'Abrupt' is best described as an unexpected stop or deviation from typical ordering practice. For example, discontinuation of an IV antibiotic for switch to oral is not

Triggers	Description	Definitions
		unexpected.
M8	Other	Use this trigger for ADEs detected but not related to one of the medication triggers listed above.
Lab		
L1	C-difficile positive stool	A positive C-difficile assay is an AE if a history of antibiotic use of present.
L2	Partial thromboplastin time > 100 secs	Elevated PTT measurements occur when patients are on heparin. Look for evidence of bleeding to determine if an AE has occurred. Elevated PTT in itself is not an AE – there must be manifestation such as bleeding, drop in Hg or Hct or bruising.
L3	INR > 4	Look for evidence of bleeding to determine if an AE has occurred. An elevated INR in itself is not an AE.
L4	Hypoglycaemia (< 3 mmol/L)	Review for symptoms such as lethargy, shakiness documented in nursing notes and the administration of glucose, orange juice or other interventions. If symptoms are present, look for associate use of insulin or oral hypoglycaemics. If the patient is not symptomatic, there is no AE.
L5	Raised Urea / Creatinine (> 2 x baseline)	Review lab records for raised Urea/Creatinine. If a change of 2 x greater than baseline levels if found, review medication administration records for medications known to cause renal toxicity. Review physician progress notes and the Hx and physical for other causes of renal failure (such as pre-existing renal disease or diabetes) that could have put the patient at greater risk for renal failure. This would not be an AE but rather the progression of disease.
Surgical		
S1	Return to theatre	A return to theatre can either be planned or unplanned and both can be a result of an AE. An example of an AE would be a patient who had internal bleeding following the first surgery and required a second surgery to explore for the cause and stop the bleeding. Even if the second surgery is exploratory but reveals no defect, this should be considered an AE.
S2	Change in procedure	When the procedure indicated in the post-operative notes is different from the procedure planned in the pre-operative notes or documented in the surgical consent, a reviewer should look for details as to why the change occurred. An unexpected change in procedure due to complications or device or equipment failure should be considered an AE, particularly if LOS increases or obvious injury has occurred.
S3	Admission intensive care post-op	Admission to ICU/HDU can be either a normal post-operative journey or it may be unexpected. The unexpected admissions frequently are related to operative AEs. For example, admission to intensive care following aortic aneurysm repair may be expected, but admission following knee replacement

Triggers	Description	Definitions
		would be unusual. The reviewer needs to determine why the admission occurred.
S4	Intubation/re-intubation/BiPap in PACU	Anaesthesia, sedatives or pain medications can result in respiratory depression requiring the use of BiPap or re-intubation post-operatively which would be an AE.
S5	X-ray intra-op or in PACU	Imaging of any kind that is not routine for the procedure requires investigation. An x-ray taken due to suspicion of retained items or incorrect instrument count or sponge count would be a positive trigger. The identification of a retained item necessitating an additional procedure is an AE. If the retained item is identified and removed without additional evidence of harm or re-operation, this is not considered an AE.
S6	Intra-op or post-op death	All deaths that occur intra-operatively should be considered AEs unless death is clearly expected and the surgery was of a heroic nature. Post-operative deaths will require review of the record for specifics, but in general all post-op deaths will be AEs.
S7	Mechanical ventilation > 24 hours post-op	Short-term mechanical ventilation post-operatively for cardiac, major thoracic and certain abdominal procedures is planned. If the patient required mechanical ventilation beyond 24 hours, an intra-operative or post-operative AE should be considered. Patients with pre-existing pulmonary or muscular disease may experience more difficulty in quickly weaning from a ventilator post-operatively but this should not automatically exclude the possibility of an AE. Reviewers must use clinical judgment to determine whether the intra-operative and post-operative care was event-free or part of the disease process.
S8	Intra-op: adrenalin/noradrenalin/naloxone/flumazenil	These medications are not routinely administered intra-operatively. Review anaesthesia and operative notes to determine the reasons for administration. Hypotension caused by bleeding or over-sedation are examples of AEs that might be treated with these medications.
S9	Post-op troponin level greater than 1.5 ng/ml	A postoperative increase in troponin levels may indicate a cardiac event. Reviewers will need to use clinical judgment as to whether a cardiac event has occurred.
S10	Injury, repair or removal of organ	Review operative notes and post-operative notes for evidence that the procedure included repair or removal of any organ. The removal or repair must be part of the planned procedure or this is an AE and likely the result of a surgical misadventure such as accidental injury.
S11	Any operative complication	This refers to any number of complications, including but not limited to PE, DVT, decubiti, MI renal failure etc.
ICU		
I1	Pneumonia onset	Any pneumonia diagnosed in ICU needs to be looked at carefully. If the evidence suggests pneumonia started prior to

Triggers	Description	Definitions
		admission to the hospital, there is no AE, but if the review suggests initiation in the hospital, it is an AE. In general, any infection starting in not only the ICU but in any hospital unit will be considered nosocomial. Re-admissions either to the hospital or the ICU could represent a nosocomial infection from a previous hospital admission.
I2	Re-admission ICU / HDU	Admission to ICU/HDU can be either a normal post-operative journey or it may be unexpected. The unexpected admissions frequently are related to operative AEs. For example, admission to intensive care following aortic aneurysm repair may be expected, but admission following knee replacement would be unusual. The reviewer needs to determine why the admission occurred.
I3	In-unit procedure	Any procedure occurring on a patient in the ICU requires investigation. Look at all bedside procedures and the procedures done while the patient was in ICU. Complications will commonly not be on the dictated procedure note, but may be evidence by the care required which might indicate an event has occurred.
I4	Intubation or Re-intubation	Anaesthesia, sedatives or pain medications can result in respiratory depression requiring the use of BiPap or re-intubation post-operatively which would be an AE.
ED		
E1	Re-admission to ED within 48 hours of discharge ED	Look for drug reactions, infection or other reasons that events may have brought the patient back to the ED and then required admission.
E2	Time in ED > 6 hours	Long ED stay in some cases can represent less than optimal care. Look for complications arising from the ED such as falls, hypotension, or procedure related complications.

Appendix Six: ADE Triggers

	ADE Triggers
ADE 1	Vit K administration
ADE 2	Antihistamine use
ADE 3	Flumazenil use
ADE 4	Naloxone use
ADE 5	Anti-emetic use
ADE 6	Over-sedation /hypotension
ADE 7	Abrupt medication stop
ADE 8	Laxatives
ADE 9	Anti-diarrhoeal
ADE 10	Resonium/Calcium/sodium polystyrene sulfonate
ADE 11	C. difficile positive
ADE 12	APTT >100 seconds
ADE 13	INR > 4
ADE 14	Hypoglycaemia: serum glucose <3.0 mol/L
ADE 15	Rising serum creatinine
ADE 16	WBC $<3 \times 10^{9}$/L
ADE 17	Platelet count $<50 \times 10^{9/}$L
ADE 18	Digoxin level >2 nmol/L
ADE 19	Rash
ADE 20	Transferred to a higher level of care/rapid response team/arrest
ADE 21	Other

Appendix Seven: ADE Trigger Definitions

ADE Trigger	GTT Related Trigger	Definition
ADE 1	M1	Vitamin K)/prothrombinex If this trigger is found, review the medical record for any evidence of bleeding. Any bleeds that can be related to anticoagulants (eg Warfarin, Enoxaparin, Heparin, Dabagatrin or even Aspirin) is an ADE.
ADE 2	M2	Antihistamines)/IV Corticosteroid The M1 trigger denotes allergic reactions to a medication, but antihistamines on a regular basis can also be used for conditions such as sinusitis, as a sleep aid etc. On many occasions they are prescribed as a stat dose. Review notes to determine if the antihistamine was ordered secondary to an allergic reaction caused by a medication. Whether it is ***one-off or ongoing*** antihistamine use, if an allergic reaction secondary to a medication has occurred than it is counted as an ADE.
ADE 3	M3	Flumazenil Flumazenil reverses the effects of benzodiazepines such as Diazepam. Prolonged sedation or marked hypotension are the ADEs caused by benzodiazepines.
ADE 4	M4	Naloxone Naloxone is a powerful opioid antagonist. Its use indicates an ADE, such as a decrease in level of consciousness (as measured by GCS), decrease in rate of respiration and hypotension, due to over-dosage of narcotics.
ADE 5	M5	Antiemetics Antiemetics are prescribed regularly. Their use may indicate an ADE secondary to medications such as opiates and antibiotics. Though on many occasions we come across one-off administration of antiemetics, only ongoing nausea and vomiting caused by a medication is recorded as an ADE***. Three*** or more episodes of nausea or vomiting is defined as ongoing.
ADE 6	M6	Falls and/or hypotension or over-sedation For this trigger, we need to refer to the clinical notes and PUP chart. If over-sedation, hypotension or falls occurred as a result of administration of a sedative, analgesic, or muscle relaxant, an ADE has occurred. Do not include intentional overdose resulting in sedation.
ADE 7	M7	Abrupt cessation of medication This trigger is readily picked up in the medication charts. Also, look for 'withheld (w/h)' annotations in the administration charts. Then look for the reason the medication has been stopped or withheld.
ADE 8	None	Laxatives Constipation is a very common ADE that we encounter. This can be due to medications such as opiates or regularly used antiemetics such as Ondansetron. If laxatives have been prescribed, review notes and bowel chart (if present) to see whether constipation has occurred and whether this is secondary to medication. ***Bowels not opened for > 3 days is defined as constipation.***
ADE 9	None	Anti-diarrhoeal Look for diarrhoea associated with antibiotics/other medications or C.

		difficile infection caused by antibiotics.
ADE 10	None	Resonium Calcium/sodium resonium is used for the treatment of hyperkalemia. Look for the reason for hyperkalemia and ensure it is medication related. Administration of resonium in response to an overdose of potassium with associated symptoms is an ADE.
ADE 11	L1	Clostridium difficile positive stool sample A positive stool sample for C. difficile is a likely complication for patients on multiple antibiotics and an indication of an ADE.
ADE 12	L2	APTT > 100 second High PTT is a frequent occurrence but an ADE has only occurred if evidence of a bleed is present when patients are on heparin.
ADE 13	L3	INR > 4 High INR is also a frequent occurrence but as with heparin, an ADE has only occurred if evidence of a bleed is present secondary to warfarin.
ADE 14	L4	Serum Glucose < 3.0 mol/L The Nurses' Chart for Glucose Monitoring and Insulin Administration is the best indicator to see whether hypoglycaemia occurred secondary to insulin administration. However, low serum glucose does not necessarily mean an ADE has occurred. Check notes for signs and symptoms (eg, lethargy, shakiness etc).
ADE 15	L5	Raised creatinine > 2 x baseline Here we need to consider several sequential results to see whether serum creatinine levels rose more than twice from baseline. If this rise can be correlated to a nephrotoxic medication and interventions were required to correct renal problems, then an ADE has occurred.
ADE 16	None	WBC < $3x10^9$/L Harm such as infections/pneumonia secondary to decreased WBC (secondary to medications such as carbamezapine or methotrexate) is considered an ADE. However, do not include patients *currently* receiving chemotherapy.
ADE 17	None	Platelet count < 50 x 10^9/L A decrease in platelet count can increase the risk of bleeding such as stroke, haematomas and haemorrhages. Look for information about why the platelet count decreased and whether it was the result of medications. A platelet transfusion is also an indication the patient has a low platelet count. Bleeding from low platelet count (secondary to medications such as sodium valproate) is an ADE.
ADE 18	None	Digoxin level > 2 nmol/L – level taken six hours after administration Toxicity secondary to digoxin manifests itself as arrhythmias, bradycardia, nausea and vomiting, vision changes or anorexia. A digoxin level above therapeutic norm with the associated symptoms is an ADE.
ADE 19	None	Rash There are many causes for a rash such as an allergy or fungal infections. To determine if an ADE has occurred, look for evidence that the rash is related to a medication. For example: A fungal infection secondary to a six-week course of antibiotics would be an ADE.
ADE 20	C11	Transfer to a higher level of care)/rapid response team/arrest Transfer to a higher level of care includes transfers within the institution, to another institution from yours, or to yours from another institution. A

		higher level of care is indicated when a patient's clinical condition deteriorates and a rapid response team is called. Look for the reason for the transfer or the change in condition.
ADE 21	None	Non-trigger ADE The non-trigger ADE is for any AEs that may be picked up from the review process but do not have a specific trigger.

Appendix Eight: Florida Classification

Florida Hospital Adverse Event/Harm Categories & Sub-Categories
Events Related to Medication/Intravenous Fluids
Clostridium difficile medication associated infection
IV volume overload/electrolyte imbalance
Kidney damage due to contrast dye
Medication related cardiac even/arrhythmia
Medication related renal insufficiency
Medication related allergic reaction
Medication related bleeding
Medication related delirium, confusion, or over-sedation
Medication related diarrhoea
Medication related glycemic events
Medication related hypotension
Medication related nausea and vomiting
Other (eg, events related to laboratory)
Events Related to Patient Care
DVT/VTE
Fall with injury
Pressure ulcer
Skin tear, abrasion, or other breakdown
Stage I or II pressure ulcer
Stage III or IV pressure ulcer
Other
Hospital Acquired Infection
Catheter associated urinary tract infection
Central line associated blood stream infection
Peripheral or central line non-blood stream infection
Respiratory infection (non-ventilator associated)
Surgical infection
Ventilator associated pneumonia
Other
Events Related to Surgery or Other Procedure
Abnormal bleeding following surgery or procedure
Blood clots and other occlusions related to surgery or procedure

Cardiac complications related to surgery or procedure
Complications related to peripheral venous or arterial puncture
Hypotension/blood loss
Post-op acute renal failure
Post-op spinal tap headache
Premature extubation causing respiratory failure
Prolonged post-op ileus
Radiation related injury
Removal retained foreign body
Removal, injury or repair of organ
Respiratory complications related to surgery or procedure
Other
Events Related to Intensive Care
Catheter associated urinary tract infection
Central line associated blood stream infection
Peripheral or central line non-blood stream infection
Respiratory infection (non-ventilator associated)
Surgical Infection
Ventilator associated pneumonia
Other

TRIGGER TOOL FOR MEASURING ADVERSE EVENTS					**Status**: Awaiting Peer/Dr Review: Y ☐ N ☐		Chart Review Complete: Y ☐ N ☐	
Review Team #:					Reviewer name:	Date of chart review:	Week of year:	Admission date:
NHI:		DOB:			Discharge ward:	Discharge specialty:	LOS days:	Discharge date:
Triggers	Harm Cat.	Sub Cat.	When	Where	Description: Harm, cause, intervention, outcome		Review? Peer	Dr
							☐	☐
							☐	☐
							☐	☐

Clinical Context:		
Chart Review Issues:	Issue 1.	Outcome 1.
	Issue 2.	Outcome 2.
	Issue 3.	Outcome 3.

HARM CATEGORY		WHEN - To identify WHEN harm occurred, prior to, or during admission		WHERE did the harm occur? (Examples)
Category E	Temporary harm to the patient and required intervention	InPt	AE occurred during this hospital admission	EC, ICU, Theatre, Ward X, AT&R etc (during this admission)
Category F	Temporary harm to the patient and required initial or prolonged hospitalisation	Adm1	AE present on admission , occurred **within 30** days of admission	Ward X (prior admission at CMDHB), Another DHB, Private Hospital, Aged Care Facility, At Home etc
Category G	Permanent patient harm	Adm2	AE present on admission , occurred **between 30 days and 12 months** of admission	Ward X (prior admission at CMDHB), Another DHB, Private Hospital, Aged Care Facility, At Home etc
Category H	Intervention required to sustain life	Adm3	AE present on admission, occurred more than 12 months prior to this admission	Ward X (prior admission at CMDHB), Another DHB, Private Hospital, Aged Care Facility, At Home etc
Category I	Patient Death	Re-admit	AE present on admission, related to prior d/c, occurred within 30 days of admission.	Ward X (prior admission at CMDHB), Another DHB, Private Hospital, Aged Care Facility, At Home etc

Section	Trigger	Trigger Found	AE Yes	AE No	Harm Category	Comments
C	**Cares Module Triggers**					
C1	Transfusion/use of blood					
C2	Code/arrest/rapid response					
C3	Acute dialysis					
C4	Radiological investigation for PE/DVT					
C5	Patient fall					
C6	Pressure ulcer/injury					
C7	Re-admission within 30 days					
C8	Restraint use					
C9	Health care associated infection					
C10	In-hospital stroke					
C11	Transfer to higher level of care					
C12	Any procedure/treatment complication					
C13	Early warning score (PUP) requiring response					
C14	Decrease of greater than 25% in Hb or Hct					
C15	Positive blood culture					
C16	Other					
M	**Medication Module Triggers**					
M1	Vit K administration					
M2	Antihistamine use					
M3	Flumazenil use					
M4	Naloxone use					
M5	Anti-emetic use					
M6	Over-sedation/hypotension					
M7	Abrupt medication stop					
M8	Other					
L	**Laboratory Module Triggers**					
L1	C. difficile positive stool					
L2	Partial thromboplastin time > 100 secs					
L3	INR > 6					
L4	Hypoglycaemia (< 3 mmol/L)					
L5	Raised urea/creatinine (> 2 x baseline)					
S	**Surgical Module**					
S1	Return to theatre					
S2	Change in procedure					
S3	Admission intensive care post-op					
S4	Intubation/re-intubation/BiPap in PACU					
S5	X-ray intra-op or in PACU					
S6	Intra-op or post-op death					
S7	Mechanical ventilation > 24 hours post-op					
S8	Intra-op: adrenalin/noradrenalin/ naloxone/flumazenil					
S9	Injury, repair or removal of organ					

S10	Post-op troponin level greater than 1.5 ng/ml					
S11	Any operative complication					
I	**Intensive Care Module Triggers**					
I1	Pneumonia onset					
I2	Re-admission ICU / HDU					
I3	In-unit procedure					
I4	Intubation or re-intubation					
E	**EC Dept Module Triggers**					
E1	Re-admission to ED within 48 hours discharge ED					
E2	Time in ED > 6 hours					

Appendix Ten: ADE Data Collection Tool

Patient NHI:	Audit date:
Discharge date (dd-mm-yyyy):	Specialty #1:
Review team:	Specialty #2:

Adverse Drug Events (ADE) - Triggers

Drugs		**Lab values**	
ADE 1	Vit K administration	ADE 11	C. difficile positive
ADE 2	Antihistamine use	ADE 12	APTT >100 seconds
ADE 3	Flumazenil use	ADE 13	INR > 4
ADE 4	Naloxone use	ADE 14	Hypoglycaemia: Serum glucose <3.0 mol/L
ADE 5	Anti-emetic use	ADE 15	Rising Serum Creatinine
ADE 6	Over-sedation/hypotension	ADE 16	WBC <3 x 10^9/L
ADE 7	Abrupt medication stop	ADE 17	Platelet count <50x $10^{9/}$L
ADE 8	Laxatives	ADE 18	Digoxin level >2 nmol/L
ADE 9	Anti-diarrhoeal	**Other**	
ADE 10	Resonium/calcium/sodium polystyrene sulfonate	ADE 19	Rash
		ADE 20	Transferred to a higher level of care/rapid response team/arrest
		ADE 21	Other

Triggers	ADE found		Harm category	Sub category	When	Where	Description ADE
	Y	N					
Clinical Context							

Harm Category		**Classification of Harm**	
Category E	An error occurred that may have contributed to or resulted in temporary harm to the patient and required intervention	1	Clostridium difficile medication related infection
		2	IV volume overload/electrolyte imbalance
		3	Kidney damage due to renal contrast
Category F	An error occurred that may have contributed to or resulted in temporary harm to the patient and required initial or prolonged hospitalisation	4	Medication related cardiac event/arrhythmia
		5	Medication related renal insufficiency
		6	Medication related allergic reaction
		7	Medication related bleeding
Category G	An error occurred that may have contributed to or resulted in permanent patient harm	8	Medication related delirium, confusion, or over-sedation
		9	Medication related diarrhoea
Category H	An error occurred that required intervention necessary to sustain life	10	Medication related glycemic events
		11	Medication related hypotension
Category I	An error occurred that may have contributed to or resulted in the patient's death	12	Medication related nausea and vomiting
		13	Other

To identify WHEN harm occurred, prior to, or during admission		WHERE did the harm occur? (Examples)
InPt	AE occurred during this hospital admission	EC, ICU, theatre, ward x, AT&R etc (during this admission)
Adm1	AE present on admission, occurred **within 30** days of admission	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, at home etc
Adm2	AE present on admission, occurred **between 30 days and 12 months** of admission	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, at home etc
Adm3	AE present on admission, occurred **more than 12 months prior to this** admission	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, at home etc
Re-Admit	AE present on admission, related to prior discharge, occurred within 30 days of admission	Ward x (prior admission at this DHB), another DHB, private hospital, aged care facility, at home etc

Appendix Eleven: Performance Indicators

Performance Indicator Name	**Number of adverse events per 1,000 patient days**
Definition	Adverse Event (harm): "Unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalisation, permanent harm or that results in death." (Institute for Healthcare Improvement. 2007. *IHI GTT for Measuring Adverse Events*. Innovation Series: 4.)
Numerator Definition	Total number of adverse events
Denominator Definition	Total length of stay (LOS) for all records reviewed
Calculate	Total number of adverse events/total length of stay (LOS) for all records reviewed x 1000
Performance Indicator Name	**Adverse events per 100 patient admissions**
Definition	Adverse Event (harm): 'Unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalisation, permanent harm or that results in death.' (Institute for Healthcare Improvement. 2007. *IHI GTT for Measuring Adverse Events*. Innovation Series: 4.)
Numerator Definition	Total number of adverse events
Denominator Definition	Number of admissions with 1 (one) or more Adverse Events (see Definitions) AND number of admissions without an Adverse Event
Calculate	Total number of Adverse Events/total length of stay (LOS) for all records reviewed x 1000
Performance Indicator Name	**Percent admissions with an adverse event**
Definition	Adverse event (harm): 'Unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalisation, permanent harm or that results in death.' (Institute for Healthcare Improvement. 2007. *IHI GTT for Measuring Adverse Events*. Innovation Series: 4.)
Numerator Definition	Number of admissions with 1 (one) or more adverse events (see definitions)
Denominator Definition	Number of admissions with 1 (one) or more adverse events (see definitions) AND number of admissions without an adverse event
Calculate	Numerator/denominator x 100

Appendix Twelve: Example Template for Reporting Results

Global Trigger Tool Report Results: (Specify time period)

Brief background

The Institute for Healthcare Improvement (IHI) has developed the Global Trigger Tool (GTT) to monitor adverse events in hospitals. This is a validated methodology that uses a systematic medical record review process to identify adverse events (AEs) using sets of triggers.

Xxx DHB is using the GTT to provide more consistent and accurate information about the level of patient harm in our organisation. This will complement the voluntary reporting system already in place and provide additional insights into system vulnerabilities.

A focus on harm targets the system and allows the analysis of 'unintended results'. It does not focus on individuals so fears of a punitive response are ungrounded. It is a cost effective and simple methodology that has been widely used to identify, quantify and track patient harm so improvement efforts can be appropriately targeted.

IHI Definition of Harm

This IHI definition of harm used for the GTT is:

Unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment or hospitalisation or that results in death.

- This definition focuses on harms as experienced by the patient as an unintended consequence of a medical intervention, whether preventable or not.
- The tool attempts to quantify actual patient harm, whether or not it was caused by medical error.
- It includes only physical harm through acts of commission rather than omission and specifically excludes mental or emotional harm.

Categories of harm recorded

The IHI trigger tool used the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) Index for recording errors. This index defines nine categories of error, but because the IHI trigger tool counts only AEs that result in harm, it excludes the first four categories (A–D) which do not cause harm.

The remaining categories of harm include:

Category	Description
Category E	Temporary harm to the patient and required intervention
Category F	Temporary harm to the patient and required initial or prolonged hospitalisation
Category G	Permanent patient harm
Category H	Intervention required to sustain life
Category I	Patient death

Inclusion and exclusion criteria

Inclusion criteria:

- length of stay at least 24 hours and formally admitted to the hospital
- age 18 years or older
- closed and completed record (discharge summary and all coding is complete).

Exclusion criteria:

- paediatric and psychiatric admissions (these require different trigger tool sets)
- harm caused by inappropriate patient use of medications (for example, overdoses or self-cessation of therapy)
- harm caused by omission of therapy (although omitting to provide evidence-based medication may cause harm, it is not the focus of this tool).

Results

Begin this section with a narrative summary outlining the results in plain language.

Report selected results using run charts for:

- AEs per 1000 patient days
- AEs per 100 patient admissions
- percent admissions with an AE.

Include 'events by categories of harm' using a bar chart.

Highlight cases for each harm category as appropriate by way of illustrating.

Example: Category E

ADEs causing temporary harm and requiring intervention.
Medication related nausea and vomiting, and constipation (inpatient harm).
Thirty-three year old female presented to hospital for a total abdominal hysterectomy. Post-operatively she suffered nausea ++ secondary to morphine PCA and morphine-based analgesics. She was changed to fentanyl PCA and oxycodone. Ondansetron and cyclizine were administered regularly. Subsequently, she developed constipation (BNO x3/7) secondary to the oxycodone and ondansetron. Laxatives were charted two days later and administered regularly from thereon.

Example: Category F

ADEs causing admission or prolonging hospital stay.
Medication related bleeding (inpatient harm)
Fourty-four year old male patient experienced excess amount of bleeding from a procedure to clear right fistula thrombus secondary to initiation of heparin infusion post-op (commenced four hours after operation – APTT 129). Haemoglobin (Hb) decreased to 80 from 116 but patient refused transfusion secondary to transplant status. Bleeding settled after heparin was stopped and Hb remained stable at 82.

Additional reporting as a result of further analyses

- Events by Florida Classification Categories (refer Appendix Eight).

Improvement work

Once the GTT process has been underway for 12 to 18 months and sufficient data has been collected and analysed, note any improvement work that is being undertaken as a direct result of the GTT findings.

Improvement in quality of care is the key purpose of doing the GTT and justifies its ongoing support.

Discussion

Key points to include in the discussion:

- harm is viewed from the patient perspective
- highlight the nature of harms particularly in the E and F categories. Emphasise these are 'common harms' not typically identified by other methods and because these are considered minor and not preventable they are below the reporting threshold using other methods
- initiating quality improvement initiatives – these harms represent opportunities for improving the experience of care for patients and potentially reducing costs for DHBs
- sustaining the team
- regional and national links/collaborations.

References

Brown, P, C. McArthur, et al. (2002). "Cost of medical injury in New Zealand: a retrospective cohort study." Journal of Health Services Research Policy **7**(Suppl 1): S29-34.

Classen, D., R. Lloyd, et al. (2008). "Development and evaluation of the Institute for Healthcare Improvement Global Trigger Tool" Journal of Patient Safety **4**(3): 169-177.

Classen, D. C., R. Resar, et al. (2011). "Global trigger tool' shows that adverse events in hospitals may be ten times greater than previously measured." Health Affairs **30**(4): 581-9.

de Vries, E. N., M. A. Ramrattan, et al. (2008). "The incidence and nature of in-hospital adverse events: a systematic review." Quality & Safety in Health Care **17**: 216-223.

de Wet, C. and P. Bowie (2009). "The preliminary development and testing of a global trigger tool to detect error and patient harm in primary-care records." Postgraduate Medical Journal **85**(1002): 176-80.

Griffin, F. A. and D. C. Classen (2008). "Detection of adverse events in surgical patients using the Trigger Tool approach." Quality & Safety in Health Care **17**(4): 253-8.

Griffin, F. A. and R. K. Resar (2009). IHI GLobal Trigger Tool for measuring adverse events (Second Edition) IHI Innovation Series White Paper. Cambridge Massachusetts, Institute for Healthcare Improvement.

Hogan, H., S. Olsen, et al. (2008). "What can we learn about patient safety from information sources within an acute hospital: a step on the ladder of integrated risk management." Quality & Safety in Health Care **17**: 209-215.

Neale, G., M. Woloshynowych, et al. (2001). "Exploring the causes of adverse events in NHS hospital practice." Journal of the Royal Society of Medicine **94**: 322-330.

Parry, G., A. Cline, et al. (2012). "Deciphering harm measurement." JAMA **307**(20): 2155-2156.

Resar, R. K., J. D. Rozich, et al. (2003). "Methodology and rationale for the measurement of harm with trigger tools." Quality & Safety in Health Care **12 Suppl 2**: ii39-45.

Resar, R. K., J. D. Rozich, et al. (2006). "A trigger tool to identify adverse events in the intensive care unit." Joint Commission Journal on Quality & Patient Safety **32**(10): 585-90.

Rozich, J. D., C. R. Haraden, et al. (2003). "Adverse drug event trigger tool: a practical methodology for measuring medication related harm." Quality & Safety in Health Care **12**(3): 194-200.

Sari, A. B., T. A. Sheldon, et al. (2006). "Sensitivity of routine system for reporting patient safety incidents in an NHS Hospital: A retrospective patient case note review." BMJ Online **BMJ, doi:10.1136/bmj.39031.507153.AE**.

The Evidence Centre (2011). Evidence Scan: Levels of Harm in Primary Care, Health Foundation.

Tsang, C., A. Majeed, et al. (2012). "Routinely recorded patient safety events in primary care: A literature review." Family Practice **29**: 8-15.

Wallis, K. and S. Dovey (2011). "No-fault compensation for treatment injury in New Zealand: Identifying threats to patient safety in primary care." BMJ Quality & Safety **20**: 587-591.