

health

A guide to chemotherapy day unit redesign measures for improvement

How will this guide help you?

This guide is one of a series of documents published by the Redesigning Hospital Care Program to help health services select appropriate measures for their redesign work.

This guide focuses on ambulatory chemotherapy services, referred to universally as chemotherapy (chemo) day units (CDUs). It provides:

- detailed and high-level CDU process maps
- a detailed chemotherapy manufacturing process map
- a variety of recommended measures for CDU process redesign.

This guide is not a stand-alone document or a 'how-to' manual. It provides a suite of measures that health services can choose from, depending on their specific needs and priorities. It is designed to be used in the context of a comprehensive redesign and change management framework and in conjunction with advice from the health service's redesign team. It is useful to read this guide in combination with *A guide to surgical services redesign measures for improvement*, which is the introductory guide in this series.

Why are measures important?

Measurement is an essential step in the redesign process. It provides an external and objective template against which to assess the impact of process improvement.

Measurement issues need to be thought about at the beginning of a process improvement program, not when the program is running or complete. Measures can be used through the life of a project to:

- identify and prioritise areas for projects
- develop a baseline against which to measure improvement
- track the impact of redesign
- demonstrate results at the end of the project.

How do I select measures?

No two CDUs are exactly the same and a well-structured diagnostic phase is necessary to ensure the focus of an improvement program is clear and that appropriate measures are selected. There are three viewpoints from which to assess the benefits of redesign work. The viewpoints are complementary; each contributes a perspective and ensures multiple goals are met:

- The patient viewpoint: Have the safety, quality, access, acceptability and outcomes of care improved?
- The staff viewpoint: Are care processes more acceptable for the staff? Is staff time being used more efficiently and effectively?
- The organisational viewpoint: Does the improvement program align with institutional priorities? Has progress been made on those priorities?

The important role of the chemotherapy day unit

Victorian cancer incidence and cancer service demand influences the requirements of CDUs. The number of new cancer cases is increasing each year, with more than 29,000 new cases reported in 2012, and nearly 11,000 deaths during this time.¹ As the incidence of cancer and chemotherapy separations continue to rise at reported and projected estimates of 2.5–3.5 per cent per annum,^{2–4} along with increasing complexity around delivery of chemotherapy treatments, treatment centres will face upward pressures on timeliness of care. Although standards for CDUs are generally high, some patients still experience problems, which present opportunities to build on the strength of CDUs. It is well described in the literature that excessive appointment delays are emerging as a primary source of overall dissatisfaction among oncology patients and staff both in Australia and internationally.^{5–7} Furthermore, long wait times may adversely affect patient adherence to scheduled appointments and recommended oncology treatment schedules.^{8–11} Accordingly, there is growing acceptance of the need to broaden the definition of quality to include both efficiency and timeliness.^{12–15}

Measuring chemotherapy day unit performance

CDU measures can be grouped into four categories:

1. Key performance measures (KPIs)

These are measures of overall performance and relate to the achievement of specific goals or problems to be addressed. Unlike some services (such as surgery and emergency departments), CDUs currently do not have any defined KPIs that are reportable to the Department of Health.

2. Demand and capacity measures

These measures set the scene by defining demand, capacity and activity. They also assist when writing a problem statement for a process redesign program of work.

3. Process measures

These measures capture, validate and track the impact of improvement initiatives on process performance, including times taken to perform process elements within the day chemotherapy journey.

4. Check measures

These measures capture the quality and safety outcomes, as well as unintended effects elsewhere in the patient journey or hospital system. The choice of measures to monitor and evaluate quality and safety will relate to the focus of the program of redesign.

The feasibility of using the measures described in this guide (Table 1) will depend on the availability of reliable data and/or the capacity of health services to collect the data.

Inter-relationships between chemotherapy day units and hospital and community services

As the delivery of chemotherapy continues to shift from the inpatient setting to ambulatory day services the demand for rapid access to treatment in CDUs is on the rise. For many health services, admission for day chemotherapy treatment is a high-volume diagnosis-related group (DRG) that impacts on a broad range of hospital services. Furthermore, many patients treated in the CDU require community services in between chemotherapy treatments, with coordination of such services extending beyond the CDU. In practice there are many different ways of organising the flow of patients through the CDU. Figure 1 outlines the basic process for a typical day chemotherapy patient, while Figure 2 shows the process in more detail. Table 1 lists CDU measures for improvement.

Figure 1: High-level chemotherapy day unit process map

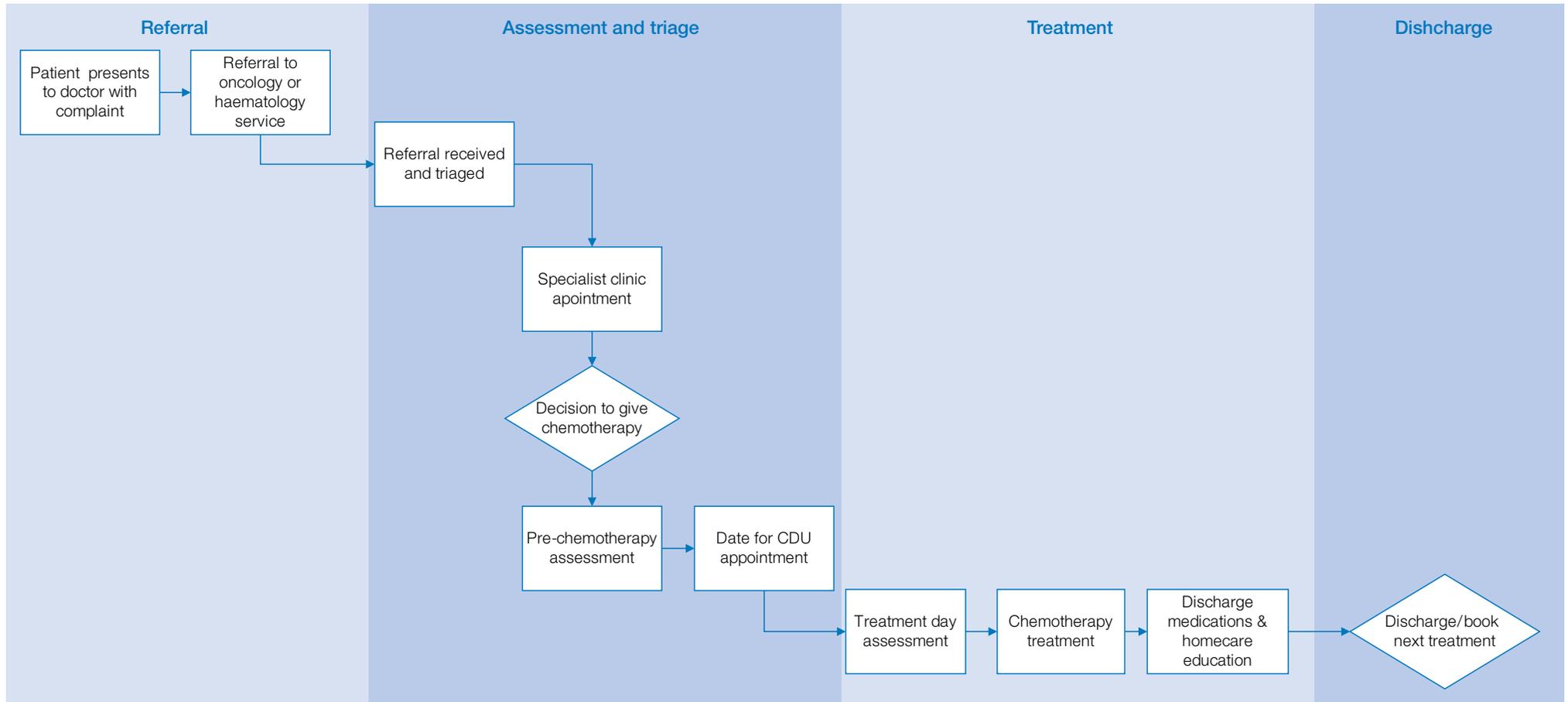
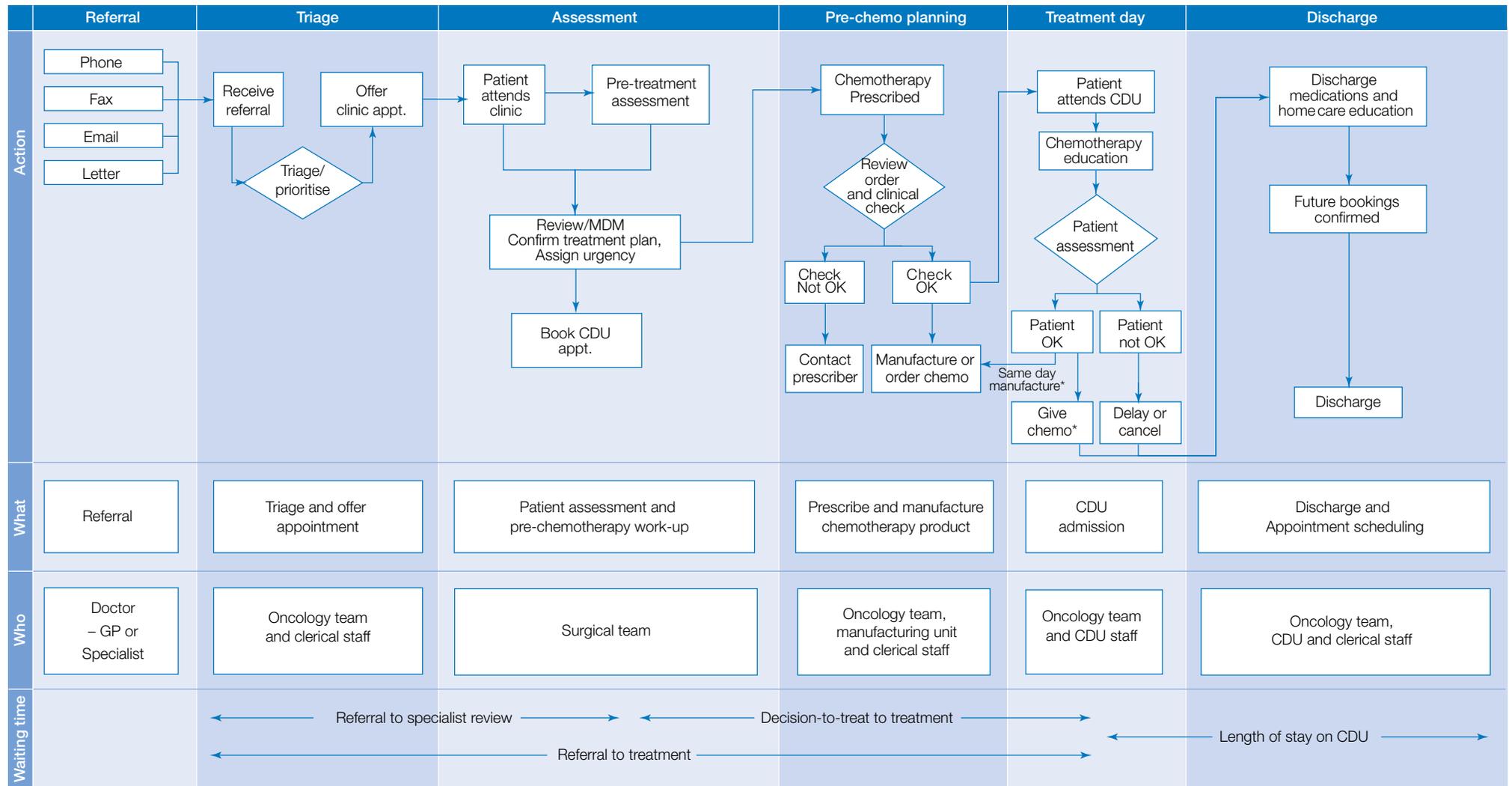


Figure 2: Detailed chemotherapy day unit process map – generic representation of processes



*Some chemotherapy products (for example, those with short expiry or high cost) may not be manufactured until after 'treatment day' assessment.
 Appt. = appointment; MDM = multidisciplinary meeting; Chemo = chemotherapy; CDU = chemotherapy day unit; GP = general practitioner

Table 1: Chemotherapy day unit measures for improvement

	Demand and capacity measures	Key performance measures	Process measures	Check measures
Purpose	To define demand, capacity and activity	A direct measure of the goal you are trying to achieve or problem you are trying to address	To capture, validate and track the impact of improvement initiatives on process performance	To demonstrate the improvement did not have unintended effects elsewhere in the patient journey or hospital system
Examples	<p>Demand: all patients referred to CDU</p> <ul style="list-style-type: none"> Number of new referrals over a time period expressed as either whole patient numbers or as numbers of required treatment hours <p>Demand by treatment type:</p> <ul style="list-style-type: none"> Oncology Non-oncology Clinical trials <p>Capacity: resource available to provide a service to the patient, including staff</p> <ul style="list-style-type: none"> Number of staffed CDU chairs/beds in hours per time period 	<p>Access to treatment:</p> <ul style="list-style-type: none"> Time from referral received to first specialist review Time from decision for chemotherapy to treatment commence Time for referral to treatment commence (total waiting time) <p>Patient treated within designated timeframe¹ such as:</p> <ul style="list-style-type: none"> 1 (< 2 days) 2 (< 7 days) 3 (< 14 days) <p>Utilisation:</p> <ul style="list-style-type: none"> Percentage of available CDU chair/bed time utilised² 	<p>Flow on the day of treatment:</p> <ul style="list-style-type: none"> Scheduled and actual appointment start time Pre-chemo assessment start and stop time Treatment start and stop time Length of stay (LOS)³ Cancellations on day of treatment⁴ (percentage of all treatments) Day unit median start and finish times Delay reasons Percentage of chemotherapy product ready at the scheduled appointment time Pathology turnaround time Proportion of patients with medical review on same day as treatment <p>Efficiency measures:</p> <ul style="list-style-type: none"> Percentage of LOS that is value added (total LOS minus patient waiting) Median deviation from scheduled to actual appointment time (waiting time on the day)⁵ Chair time allocated vs chair time required Total time lost to same day cancellations per time period LOS reduced by safe modifications to chemotherapy pathways⁶ 	<p>Quality and safety measures:</p> <ul style="list-style-type: none"> Number and severity of reported medication incidents per time period Percentage of consent forms complete before first day of treatment Percentage of first-time patients who had a pre-treatment chemotherapy education session prior to starting treatment <p>Patient satisfaction:</p> <ul style="list-style-type: none"> Targeted surveys Net promoter scores (recommending the service to others) Qualitative patient feedback/complaints <p>Staff satisfaction:</p> <ul style="list-style-type: none"> Targeted surveys Turnover and sick leave Occupational health and safety incidents <p>Cost measures</p> <ul style="list-style-type: none"> Performance against budget Cost of chemotherapy product expired/disposed Overtime expenditure/agency use <p>Workforce data</p> <ul style="list-style-type: none"> CDU workforce hours⁷ (overall and by craft group) per hour of patient treatment

1. Peter MacCallum Cancer Centre and Melbourne Health agreed clinical prioritisation criteria (defined on page 8); 2. Percentage utilised: total hours of actual treatment divided by capacity (hours of available staffed CDU chair/bed time) for defined time period; 3. LOS: total chair time (in minutes) including pre-chemotherapy assessment and treatment time; 4. Capturing reasons for cancellation may facilitate targeted improvement programs; this can be achieved using CDU Flow Manager; 5. Patient waiting time on day: time from scheduled appointment time to treatment commence, where treatment commence could be nursing assessment, pre-medication or chemotherapy administration; 6. Safe medications may include changing from intravenous to oral premedications or altering the sequence of agents such that manufacturing constraints do not delay administration; 7. CDU workforce hours: include clerical staff, nursing staff (floor and management), pharmacy staff (only dedicated CDU pharmacist and not manufacturing pharmacist or technician) and patient service assistants; does not include medical staff as many units share medical staff with inpatient wards or outpatient clinics.

Chemotherapy day unit access, clinical prioritisation and performance measures

There are currently no reportable cancer access performance measures mandated by the Victorian Department of Health. However, performance targets relating to timely access to specialist cancer clinics and cancer treatments are mandatorily reported by hospitals in the United Kingdom and New Zealand.¹⁶⁻¹⁸ Currently, within the Victorian Integrated Non-Admitted Health (VINAH) Minimum Dataset (VINAH), patients can be allocated into two triage categories: urgent (requiring specialist clinic review within 30 days) or routine (not requiring specialist clinic review within 30 days).¹⁹ As VINAH was developed to cover all specialist services, it is recommended that oncology services are further prioritised with shorter timeframes to better reflect the associated clinical risks of the oncology service (Figure 3).

Cancer access performance targets as defined by UK's National Health Service (NHS) and the New Zealand Ministry of Health (MoH).¹⁶⁻¹⁸

GP referral to specialist clinic appointment Access within 14 days

Decision-to-treat to first treatment Access within 31 days

GP referral to first treatment Access within 62 days

Figure 3: Cancer treatment access process



The following prioritisation criteria proposed by Peter MacCallum Cancer Centre and Melbourne Health in the publication *Developing a performance data suite to facilitate lean improvement in a chemotherapy day unit*⁶ is a suggested criteria only. The aim of implementing prioritisation criteria is to improve consistency of access to the CDU based on clinical need.

Category 1: Urgent

Treatment to commence within two days

Patient at imminent risk of significant complication or deterioration if chemotherapy not started within two days such as imminent airway obstruction or superior vena cava obstruction.

Category 2: Semi-urgent

Treatment to commence within seven days

Patient at significant risk of complication or deterioration if chemotherapy not started within seven days such as rapidly progressive disease or advanced disease with risk of critical organ/structure compromise.

Category 3: Next available appointment

Treatment to commence within 14 working days

All other groups of patients not meeting the above category criteria. The KPI is 95 per cent of patients commence treatment within 14 days.

Recommended routine performance measures

It is recommended that a mechanism for the routine (for example, monthly) collection and reporting of performance measures relevant to individual CDUs be developed.

- Routine reporting is essential for assessing performance and improvements and to help with managing the CDU.
- Consistent reporting among CDUs, although not mandated, can facilitate benchmarking across different units (see Table 2 for a set of suggested minimum performance measures to be included in routine reporting).
- A database tool, *CDU Flow Manager*,²⁰ has been developed to capture and report a set of performance measures relevant to CDUs, (detailed in appendix) and is available as freeware from: <http://www.wcmics.org/CDUFlowManager/>

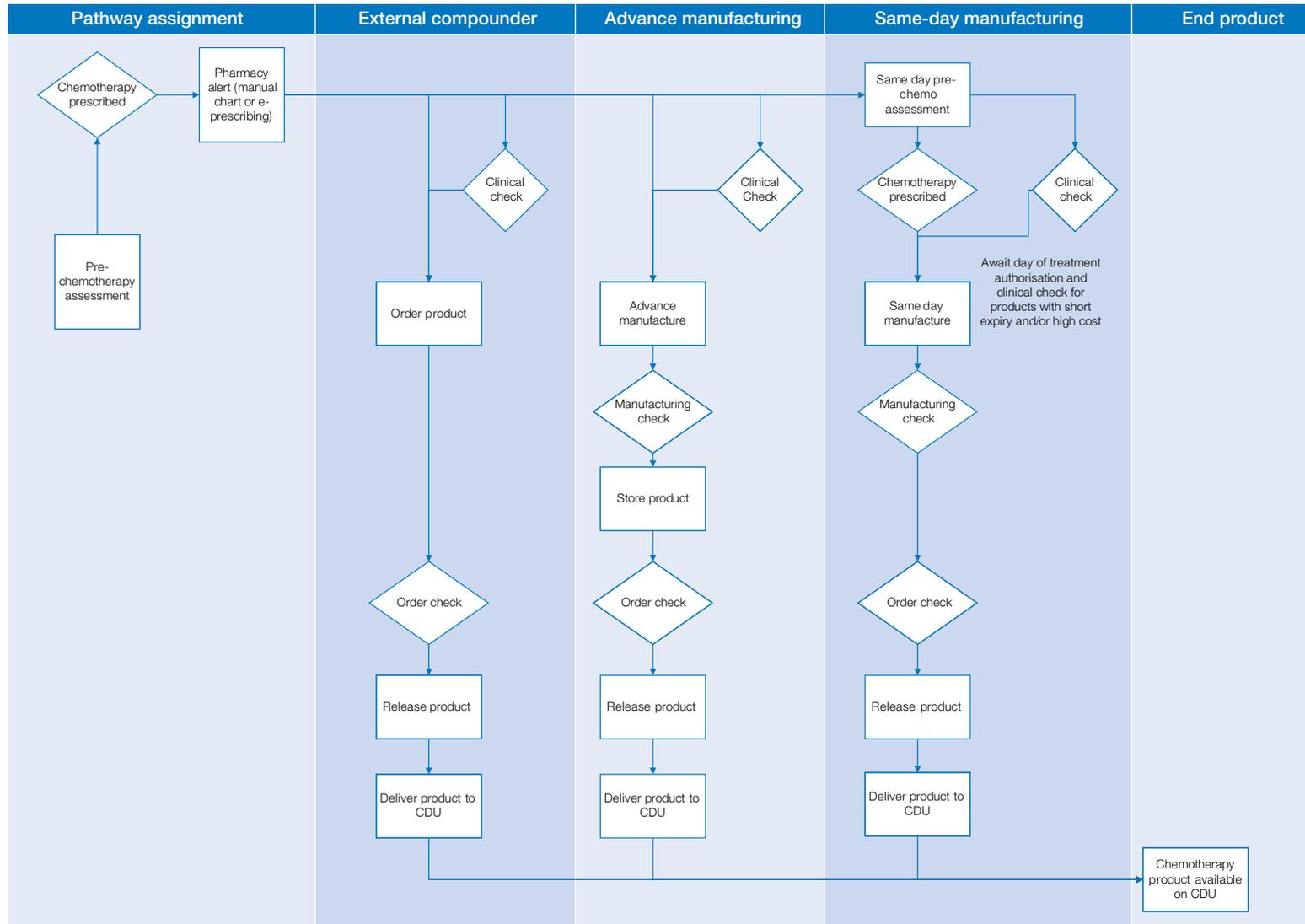
Table 2: Suggested minimum performance measures for routine reporting

Performance measure	Rationale
Chair utilisation Total hours of actual treatment given divided by the total available capacity (hours of available staffed CDU chair/bed time) for defined time period	The percentage utilisation of the available capacity (in this case staffed CDU chairs) is perhaps the best measure for service capacity planning. As demand rises and utilisation increases services can use this data to help forecast when they will need to expand service capacity (open and staff more chairs). There is currently no published target for CDU chair utilisation. As CDU is by definition a day service, it is expected that the average utilisation will be significantly less than 100 per cent. Higher average utilisation (~ 80 per cent and above) increases the likelihood of patients and staff finishing late, mean longer waiting times on the day and leads to increased staff over time. If possible, chair utilisation should be measured as 'value added' and 'non-value added' to identify opportunities to eliminate time wasted in the chair.
Waiting times on treatment day Time from scheduled appointment time to treatment commence	Treatment commence could be nursing assessment, pre-medication or chemotherapy administration. Waiting time on the day of treatment has a high impact on the patient's overall experience of care. This is one of the best measures of overall CDU process efficiency. Even with the combination of low demand, low chair utilisation and high nursing hours per patient day, waiting times could still be significant if other processes or team work are poor.
Access to first treatment Measure chemotherapy only and combined chemotherapy–radiotherapy pathway access separately	The time from decision to treat to actual treatment commence (cycle one, day one) is an important measure of timely access. In addition, monitoring trends in access data provides an early warning of a demand capacity mismatch. If access to first treatment is prolonged and chair utilisation low then this may reflect problems with the quality and speed of pre-treatment processes such as CVAD insertion, treatment planning and scheduling of patient appointments. If access is prolonged and utilisation is high then it is time to start thinking about increasing chair capacity or triaging patients elsewhere.
Chemotherapy product availability Proportion of chemotherapy product available at scheduled appointment time	This is a good indicator of the reliability and timeliness of the entire chemo ordering, manufacturing and delivery system. Poor performance can indicate: inappropriate lead time on orders being provided to the chemotherapy manufacturing unit; an under resourced or inefficient manufacturing unit; or inefficient or unreliable chemotherapy outsourcing processes.
CDU workforce hours (by craft group) per hour of patient treatment	This is a useful measure of the efficiency of the combined CDU workforce/team model, which could enable benchmarking with other services. The CDU workforce should comprise clerical staff, nursing staff (including nurse assistants – floor and management), pharmacy staff (only dedicated CDU pharmacist and not manufacturing pharmacist or technician) and patient service assistants; do not include medical staff as many units share medical staff with inpatient wards or outpatient clinics.
Quality and safety measures	Number and severity of reported medication incidents and serious complaints per time period.

Chemotherapy manufacturing

Whether chemotherapy manufacturing occurs on-site or externally, the manufacturing process (including ordering, manufacturing and delivery of the chemotherapy product) is an integral part of the CDU. Performance and reliability of the manufacturing unit (or external manufacture) has flow-on effects to the CDU. Figure 4 outlines the basic process for the ordering, manufacturing (internal or external) and delivery of chemotherapy product.

Figure 4: Detailed level generic chemotherapy product process map



Clinical check: Pharmacist, nurse or doctor independently verifies chemotherapy order based on pre-treatment blood (and other relevant) results

Manufacturing check: Pharmacist signs off on product (quality assurance check)

Order check: Pharmacist checks manufactured chemotherapy product against original chemotherapy order (patient label, agent, strength)

Chemotherapy manufacturing unit measures for improvement

The performance measures listed in Table 3 apply specifically to pharmacy manufacturing units and may be used in addition to the suggested CDU measures for improvement.

Table 3: Pharmacy manufacturing units performance measures

Performance measure	Rationale
Percentage of chemotherapy available at scheduled appointment time	Poor performance can indicate inappropriate lead time for manufacturing unit, capacity demand mismatch in manufacturing unit, underperforming manufacturing unit or unreliable chemotherapy product outsourcing processes
Percentage of product waste (expired, discarded)	This will increase if chemotherapy is produced too far in advance and if manufacturing units don't manage expiry dates closely or maximise dose recycling for other patients
Cost value of product waste (expired, discarded)	Financial impact of above
Percentage of product re-made/recycled (for example, remanufactured due to dose change)	Good indicator of working 'just in time' vs too far ahead – this can be multiplied by an agreed average recycling process cost to identify pharmacy labour waste
Total manufacturing unit workforce hours per product manufactured (workforce to include manufacturing and checking pharmacists, technicians and robots if appropriate)	Ratio of staff to product: It is important to factor in other products such as parenteral nutrition or antibiotics manufactured by the same staff in the unit, as well considering the complexity of product being manufactured (for example, clinical trial drugs) A unit manufacturing high volumes of 'complex products' and or clinical trials work may have a higher ratio of workforce hours/product

Key tips to remember when collecting and presenting data

- All measures should be collected prior to implementing improvement initiatives to establish baseline performance. Measures should then be collected post-implementation of improvement initiatives to determine the impact on process performance and achievement of the overall goal.
- It is important that measures collected after an improvement is implemented are comparable to the baseline data – for example, the same questions are repeated in a follow-up staff survey, or staff tracking is repeated at approximately the same time of day or day of week.
- Processes will vary depending on time of day, day of the week and time of year. During the diagnostic stage it is necessary to collect a representative sample of data (in other words, different time of day, day of week) in order to analyse and understand existing variations.
- It is recommended that a minimum of one month of historical data (for example, patient presentations) is used to establish baseline performance. However, to establish trends in demand over time, at least 12 months of historical data would be required.
- Measures should be described by their range, median and percentage within the goal or target.
- When tracking patients and staff it is important to collect enough data so it is a representative sample of all patients and staff. It is difficult to make hard-and-fast rules about when this point is reached, but it will be clear that enough patients have been tracked when patterns start to repeat. Tracking can be hard work, so if the basic issues are not clear after 20 patients then it might be time to reassess the objectives of the tracking exercise.
- When presenting measures some suggestions are:
 - Data related to time can be presented and analysed using run charts, which can reveal seasonal, weekly, daily or hourly variation.
 - Data related to categories (for example, type of error, admitting department) can be presented and analysed using bar or pie charts.

Appendix: CDU Flow Manager

The Victorian Department of Health, Peter MacCallum Cancer Centre and Western & Central Melbourne Integrated Cancer Services have developed a tool, *CDU Flow Manager*²⁰ for collecting and reporting performance data for CDUs. The tool exists as a Microsoft Access database with data collection, data entry and automated reporting functions. Upon registration (one registration per health service) and agreement to defined terms of use, *CDU Flow Manager* will be available free of charge to health services including access to future updates. To download the terms and conditions of use or view a sample report from *CDU Flow Manager* please go to the website below.

CDU Flow Manager www.wcmics.org/CDUFlowManager

Example data collection sheet from CDU Flow Manager (direct data entry and bedside audit functionalities)

Date: ___/___/___

Chair number _____

Record 'Time' in 24Hr Clock to the nearest minute

Patient	UR Number/ Insert Bradman Sticker	Scheduled Tx /Procedure	Procedure Cancelled?	Med review today	Blood test today	Sched Appt Time	Nursing /Patient Assess		Authority to make chemo today Time	Chemo arrived CDU Time	Tx / Procedure		D/C from chair Time
							Start Time	End Time			Start Time (First Tx)	End Time (Last Tx)	
1		Onc related Tx? [] Yes [] No	[] No	[] No	[] No								
		Type (✓any given today) [] Clinical Trial [] Chemo/MAB [] BM Biopsy [] Blood/IVIG [] CVAD Care [] Bisphosphonate [] Iron Infusion [] Education [] Other	Yes (✓main cause only) [] Toxicity [] Inpatient [] Ceasing Tx [] Patient failed to attend [] Other	[] No [] Yes	[] No [] Yes		Was Nursing/ Patient Assess start time delayed? [] No Yes (✓main cause only) [] Patient late [] Waiting for pathology [] Waiting for med review [] Waiting for nurse [] Waiting for chair [] Waiting for orders [] Waiting for product	Was treatment start time delayed? [] No/ No further delay Yes (✓main cause only) [] Waiting for pathology [] Waiting for med review [] Waiting for nurse [] Waiting for orders [] Waiting for product	Was D/C delayed ? [] No / No further delay Yes (✓main cause only) [] Waiting for nurse /disconnection [] Waiting for D/C orders [] Waiting D/C drugs				

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