Cancer Care Ontario

Complex Malignant Hematology Models of Care

Recommendations for Changes in the Roles and Composition of the Multi-disciplinary Team and the Setting of Care to Improve Access for Patients in Ontario

March 2017

Overview

Background

The demand for complex malignant hematology (CMH) services has increased over time resulting in long wait times for acute leukemia care and hematopoietic cell transplants (HCT) and pressures on the care delivery system in terms of human resources and inpatient beds. During this same period, advances in treatment modalities, supportive care and care delivery models have facilitated changing the way services are delivered to this patient population. To address the needs of CMH patients, Cancer Care Ontario undertook a quality improvement initiative to support timely access to high quality, coordinated CMH services, guided by the following core objectives:

- Ensure patients have timely access to high quality care in appropriate settings, as close to home as possible;
- Support providers to collaborate and align around best practices, and have a manageable workload; and,
- Optimize use of healthcare resources.

The service model for the delivery of CMH care varies across the province. Cancer Care Ontario identified that there were opportunities for centres to learn from each other, and from other jurisdictions, to develop more effective and efficient models of care that better fit patient needs. The CMH Models of Care Working Group (WG) was convened by Cancer Care Ontario as part of the CMH improvement initiative to identify opportunities to better use existing resources to meet the needs of CMH[1] and HCT patients.

Approach

This document outlines the recommendations from the WG, a multi-stakeholder panel from across the province. The terms of reference of the WG are provided in Appendix A. The WG reviewed information from the scientific literature, as well as current practices in Ontario and other jurisdictions. Each of the proposed models were discussed in detail by sub-groups. The sub-groups identified characteristics of models and discussed how they could be applied based on a number of factors. The result is a set of opportunities to re-configure roles in the multidisciplinary care team and shift the settings where portions of care are delivered. If implemented these opportunities are expected to improve resource utilization and access to care. Although the focus of the recommendations is on the management of CMH and HCT, it is expected some of these recommendations may apply to malignant hematology more generally.

Next Steps

These recommendations are intended to be implemented by Ontario's hospitals and service providers caring for patients with CMH. To improve access to services for patients, it is envisioned that some recommendations may be implemented at the individual and team level in the short term without additional resources. Other recommendations will require organizational changes and additional supports at the hospital, regional, and system level in order to be fully realized. The next step is to work with hospital administrators, care providers and other relevant stakeholders to develop an implementation strategy and plan.

[1] CMH includes acute myeloid leukemia (AML), acute lymphoblastic leukemia (ALL), high grade lymphoma, and aplastic anemia

Principles for New Models of Care for CMH

The WG agreed to the following guiding principles, which formed the basis for discussion around proposed models of care. Specifically, the model of care should:

- Improve access to care;
- Be patient-centred;
- Not compromise patient safety;
- Maximize scope of practice of each type of provider on the multidisciplinary health care team;
- Accommodate needs in remote/geographically dispersed regions of Ontario;
- Utilize current and potential advances in technology and therapies; and,
- Align with regulatory and accreditation standards.

Recommendations

Team: optimizing the roles within the multidisciplinary team

Many aspects of CMH and HCT patient care that have traditionally been provided by specialist physicians, such as a hematologist or oncologist, can be safely delivered by other providers (e.g. Clinical Associate [CA], Nurse Practitioner [NP], Physician Assistant [PA], or Registered Nurse [RN]) with the right training and oversight by a hematologist/oncologist. This set of recommendations focuses on ensuring that the multidisciplinary team utilizes the most appropriate type of provider, and that each provider is working to full scope of practice.

Each of these provider types have different educational programs, regulatory status and potential roles in the implementation of new models of care for CMH and HCT patients.
For a description of these provider types see Appendix B.

The role of the hematologist/oncologist, in keeping with the CanMEDs model[2], is to act as a medical expert, communicator, collaborator, leader, health advocate, scholar, and professional. The hematologist/oncologist has ultimate responsibility for all aspects of the patient's care from diagnosis onward. This includes but is not limited to making the diagnosis based on the diagnostic work-up and clinical presentation, defining the appropriate treatment plan and communicating it to the patient, family, and other members of the healthcare team. The hematologist/oncologist is also responsible for oversight of the prescribed treatment including management of expected and unexpected toxicities and evaluation of response to therapy. They are also responsible for counselling the patient and family throughout the patient's journey. While day-to-day management of supportive care and monitoring of a patient may be delegated to another member of the multidisciplinary team, the hematologist/oncologist is ultimately responsible for the patient as the medical expert and the most responsible physician (MRP).

The WG acknowledges that a wide variety of provider types are required in the overall management of CMH and HCT patients, however the following recommendations *do not* address a comprehensive list of all members of the care team, nor a comprehensive list of all activities associated with caring for patients with CMH and HCT. Rather they highlight types of providers that may facilitate new models of care and that would represent a novel provider type or role in many institutions. The recommendations are organized according to steps in the care continuum for CMH and HCT patients.

[2] Royal College of Physicians and Surgeons of Canada (2015). *CanMEDS Framework: Medical Expert*. Accessed January 2017. http://www.royalcollege.ca/rcsite/canmeds/framework/canmeds-role-medical-expert-e

Consultation, Diagnosis & Intake:

Patients referred on suspicion of CMH or as potential candidates for HCT will have their consultation and intake managed by a multidisciplinary team under the supervision of a hematologist/oncologist. The hematologist/oncologist is ultimately responsible for providing the patient with the diagnosis, their plan of care, and the decision on suitability for transplant.

1. The initial intake of eligible CMH patients and candidates for HCT, new HCT patients, and HCT donors should be carried out by CAs, NPs, or PAs, in conjunction with RNs, working within their scope of practice and as outlined within medical directives, where necessary, and under the oversight of the hematologist/oncologist. A comprehensive intake assessment may vary across patient conditions. It may include but is not limited to, completion of a comprehensive health history and physical examination, performing bone marrow aspiration and biopsy, review and interpretation of diagnostic test results, and patient and family education. Once the comprehensive assessment and review have been completed, results are presented to the hematologist/oncologist for review.

Graft Procurement:

2. Bone marrow graft harvest should be carried out by CAs, NPs, or PAs with oversight by a transplant physician.

Inpatient CMH and Transplant Units:

Care on an inpatient unit is provided by a multidisciplinary team with oversight from the hematologist/oncologist. The focus of the hematologist/oncologist should be on reviewing and revising the plan of care based on patient response to treatment, providing patient consultations between cycles of chemotherapy or with major changes to the care plan, and issue escalation from other members of the care team (as required).

3. The role of CAs and NPs should include the day-to-day assessment and management of patient care on the inpatient CMH and HCT units, working within their scope of practice and as outlined in medical directives (as required). This may include but is not limited to regular and as-needed assessments, ordering diagnostic tests, admitting and discharging patients, performing procedures such as marrow aspirations and lumbar punctures, ordering chemotherapy and other treatments, participating in family meetings, managing patient symptoms and toxicities and providing ongoing patient education, with oversight by the hematologist/oncologist.

Outpatient Chemotherapy & Supportive Care (day-hospital, medical day care, or infusion clinic):

Patients receiving care in an outpatient treatment area should have their care provided by appropriate members of a multidisciplinary team under the supervision of a hematologist/oncologist. The hematologist/oncologist is responsible for the decision to commence outpatient chemotherapy and developing the plan of care and addressing issues brought to them by other care team members. For the purpose of this report, supportive care refers to general toxicity management and monitoring during and in-between cycles of treatment, which may include (but is not limited to) blood product transfusions, infection control/antibiotic support, delivery of anti-emetics and delivery of pain medication.

4. The role of CAs, NPs, and PAs, in conjunction with RNs, should include the day-to-day assessment and management of eligible CMH patients in the outpatient setting, working within their respective scope of practice and as outlined in medical directives (as required). This includes but is not limited to the delivery

of outpatient chemotherapy, monitoring of patients post-chemotherapy or transplant recovery phase, performance of procedures (i.e. bone marrow aspirates/biopsies and lumbar punctures), management of acute complications and the provision of supportive care, with oversight by the hematologist/oncologist.

5. The care of eligible HCT patients including the pre-transplant, peri-transplant phase, monitoring post-transplant while waiting for engraftment, management of complications and the provision of supportive care should be provided by CAs or NPs, in conjunction with RNs and with oversight by the hematologist/oncologist.

6. Evening and weekend coverage for patients is required and should be provided by CAs, NPs or nocturnists with back-up from a hematologist/oncologist.

Long-Term Follow-up Care:

7. Eligible CMH and autologous HCT patients should have their long-term follow-up care (post the completion of all treatment and after day 100 respectively) provided by a CA, NP, or PA with oversight from the hematologist/oncologist (as required).

8. Eligible allogeneic HCT patients may have portions of their long-term follow-up care (after day 100) provided by a CA, NP, or PA, but will continue to require regular follow-up with the hematologist/oncologist.

Rationale/Evidence for the multi-disciplinary team recommendations

There is limited published evidence on the optimal roles for different providers in the healthcare team caring for CMH patients. Recommendations from Australia[3], the United Kingdom[4], and FACT[5] describe the types of providers that should be available to care for malignant hematology and HCT patients more broadly, but offer limited guidance in terms of the actual functions of these care providers.

These recommendations are based on the learnings from sites in Ontario that have successfully introduced new roles, provided support for full scope of practice and/or expanded the scope of practice for providers on their care team in order to address care gaps.

Settings: optimizing use of care settings

Many aspects of CMH and HCT patient care that have traditionally been provided in a resource intensive setting, such as an inpatient unit, can be safely delivered in a lower resource intensity setting (e.g. in an outpatient day hospital or infusion clinic) with the right providers and supports in place.

[3] Department of Health WA. Hematologic Malignancy Model of Care. 2009. Cancer and Palliative Care Network, Department of Health, Western Australia.
[4] Haematological cancers: improving outcomes. 2016. National Institute for Health and Care Excellence.
[5] Foundation for the Accreditation of Cellular Therapy, Joint Accreditation Committee - ISCT and EBMT. FACT-JACIE International Standards for Hematopoietic Cellular Therapy: Product Collection, Processing, and Administration. 2015. Foundation for the Accrediation of Cellular Therapy

Patient Factors to Consider when Determining the Appropriate Setting of Care

Patient needs should be regularly assessed to determine the most appropriate setting of care. The following are general guidelines when considering whether or not a patient may be eligible for outpatient management (as opposed to inpatient care) at any given point in their journey:

- Medically stable
- Able to take a prophylactic or therapeutic antimicrobial regimen
- Ability/capacity to self-manage and follow care instructions
- Availability of willing and able caregiver 24/7
- Availability of local accommodation within 60 minutes of centre
- Access to hospital emergency department within 60 minutes of where the patient will be staying

Consultation, Diagnosis and Intake:

9. CMH and HCT patients should have the opportunity to have their initial new patient consultation remotely via Telehealth as medically appropriate.

Outpatient Chemotherapy and Supportive Care:

If the patient meets outpatient criteria for care, the following services should be transitioned to outpatient care with the right supports and resources in place:

Acute Leukemia Patients

10. Delivery of consolidation chemotherapy and supportive care.

Other CMH Patients

11. Delivery of chemotherapy amenable to outpatient delivery and supportive care.

HCT Patients

12. Conditioning regimens for HCT patients (autologous and allogeneic). Note that depending on the conditioning agent (e.g. ATG), portions of the regimen may require delivery on an in-patient basis.
13. Graft infusion.
14. Post-infusion supportive care until engraftment and discharge to a follow-up clinic.

Long-term Follow-up:

15. Eligible CMH and autologous HCT patients should have the option to receive ongoing specialist long-term follow-up closer to home via the use of Telehealth, as medically appropriate. Eligible allogeneic HCT patients should have the option to receive some of their ongoing specialist long-term follow-up care via telehealth, as medically appropriate.

Organizational Enablers: Ensuring appropriate supports are available to enable new models of care

In order to provide safe and efficient care and to prevent an increased burden on hospital emergency departments, the following must be available to CMH and HCT patients receiving treatment or being followed post-treatment in one of the outpatient care settings outlined in this document:

16. Patients should have symptoms and toxicities (including febrile neutropenia) managed on an outpatient basis where medically appropriate, including:
    a. Access to a symptom treatment area/unit with extended hours of operation (i.e. 12hrs/day, 7days/week) for management of emerging symptoms/toxicities.

b. Access to a 24/7 telephone support/triage line staffed by providers who understand the CMH population, including acute leukemia and HCT with the hematologist/oncologist available for issue escalation as required.
c. Access to pharmacy services 24/7, including access to outpatient infusion pumps.

17. "Flex beds" or "protected beds" should be available to facilitate admission of patients receiving therapy or being followed after therapy in the outpatient models outlined in this document.

Rationale/Evidence for Settings of Care Recommendations

Recommendations for this section are based on the experience of hospitals in Ontario that have successfully transitioned components of care for CMH and HCT patients to less resource-intensive settings, as well as a review of the literature.

A number of studies were identified that examined transitioning services historically conducted on an inpatient basis to a non-inpatient setting (i.e. outpatient clinic, medical day care, etc.). Results of controlled studies comparing inpatient management to similar early-discharge or outpatient managed services found that with proper patient selection and appropriate supports, comparable clinical outcomes could be achieved (i.e. no difference in the average number of febrile episodes, transfusion requirements, number of deaths, or ICU admissions) while potentially reducing the number of days of IV antibiotics, inpatient bed days, and overall hospital costs. For a summary of comparative studies see Appendix D.

Implementation Considerations

Members of the WG identified a number of enablers, process improvements, and general considerations to support the successful implementation of these recommendations.

- Based on the experience of WG members, it is recommended that centres introducing new roles into their models (e.g. NP or CA or PA) have comprehensive competency-based orientation/educational programs to build expertise and capacity. Given the complexity of the CMH population, when planning for the introduction of new models, centres should consider that competency development can take 6-12 months with an annual review process thereafter.
- Depending on the size of the centre and the volumes of CMH patients, centres may consider combining some services between disease sites/programs in order to support efficient resource utilization (e.g. telephone triage/symptom management support).
- Centres should consider developing a standard operating procedure and checklist of required documentation for referrals which should be shared with all partner/referring sites to ensure patients can proceed to evaluation and treatment in a timely manner.
- Centers should consider streamlining components of education for new patients by developing group-based educational classes, which may be offered in-person or online.
- Centres which currently do not offer outpatient services for acute leukemia and/or HCT patients should consider starting with lower complexity treatments/patient populations (e.g. consolidation) to build up sufficient competency within the care team prior to advancing to more complex treatments populations.
- In order to support outpatient management of patients, hospitals should facilitate access to specialist consults including respirology, infectious diseases, gastroenterology, ICU outreach teams, diagnostic services, and allied health workers (e.g. social work).

- To facilitate efficient use of these new models of care, patients with CMH should have priority access to diagnostics, imaging and treatment (e.g. having febrile neutropenia antibiotics available for immediate infusion) in a manner analogous to patients in the emergency room.
- Centres should consider developing an inventory of local resources/affordable accommodations available for patients and families who need it in order to support outpatient management of patients.
- Where possible, inpatient and outpatient services should be co-located to facilitate sharing of resources (including cross-trained providers) and smooth transitions for patients.

Appendix A: Complex Malignant Hematology Models of Care Working Group Terms of Reference

Background

The service model for Complex Malignant Hematology (CMH) in Ontario varies across the province. The demand for CMH services has increased over time and is expected to continue to do so. CMH patients require complex care with high resource utilization. Regional Cancer Programs have identified pressures in meeting patient needs resulting in long wait times and stresses on health human resources.. To address the needs of CMH patients in a comprehensive way, CCO is implementing the CMH Quality Initiative to support timely access to high quality, coordinated CMH services guided by the following core objectives.

1. Ensure patients will have timely access to high quality care in appropriate settings, as close to home as possible
2. Support providers to collaborate and align around best practices, and have a manageable workload
3. Optimize health system resource utilization

Scope

Models of Care (MoC) in the context of CMH seeks to determine what constitutes the best service delivery models for patients, focusing on optimal use of healthcare personnel such physicians, nurses and other health professionals, and administrative personnel, as well as settings (e.g. inpatient, outpatient).

The following target populations are within the scope of this project: adult patients with acute myeloid leukemia (AML), acute lymphoblastic leukemia (ALL), high grade lymphoma, aplastic anemia; and stem cell transplant eligible patients.

Deliverables

The purpose of the Working Group is to make recommendations regarding the optimal service delivery model by:

- Advising on the interpretation of the findings from
    - the Adult Acute Leukemia Services Questionnaire (2015)
    - the Transplant Centre Regional Resource Planning Survey (2013)
- Advising on the design and interpretation of an evidence review/jurisdictional scan regarding CMH models of care
- Recommending any other inputs necessary to design a future state model of care
- Developing recommendations for the optimal service delivery model for Ontario
- Providing input into health human resources planning models related to CMH, including recommended provider workload measures.

Meetings and Term

The working group will meet approximately six times beginning in June 2016. The work is expected to continue until March 2017.

- Members are asked to make every effort to attend meetings. Members unable to attend meetings are encouraged to review meeting notes, materials and connect with other Working Group members or the CCO team to provide input
- Meetings will be one to two hours in length, to be held in person and with a teleconference option provided

Membership

Health professionals and administrators currently in engaged in the care of the in-scope patient populations

- Chair, Hematologists with expertise in CMH and allogeneic stem cell transplant (1)
- Hematologists with expertise in CMH and allogeneic stem cell transplant (2)
- Radiation oncologist treating CMH patients
- General Practitioner in Oncology
- Medical Oncologist
- Nurse
- Stem Cell Transplant Coordinator
- Hospital administrators (2)

Patient/caregiver representatives (2)

Decision-Making Process

Decisions will be made by consensus of the members. If there are any issues on which consensus cannot be achieved, the decision-making approach will be decided upon by the Chair in consultation with the Project Leadership.

Accountability

The Working Group is accountable through its Chair to the Leadership of the Complex Malignant Hematology Quality Improvement Initiative.

Conflict of Interest

Working Group members must ensure that any actual or potential conflict of interest in regard to any matter under discussion by the committee is drawn to the attention of the Chair. The Chair will decide what action, if any, is required arising from the conflict of interest and will take appropriate action, including but not limited to requesting the member absent him or herself from participation in discussion of the matter. Members will be required to complete a Conflict of Interest Declaration upon joining the Working Group

Confidentiality

Unless it is generally available to the public, all data and information acquired or prepared by or for the committee should be treated as confidential. Members should keep these data and information confidential and not directly or indirectly disclose them during or subsequent to their term as a member of the committee. Members will be required to complete a Statement of Confidentiality upon joining the Working Group.

Expenses

CCO will reimburse travel expenses incurred by meeting participants in accordance with CCO's policies.

Appendix B: Description of Providers

Table 1: Description of Providers

Provider Type	Description	Regulatory Status	Education
Hematologist	Hematologists treat all age groups and should be able to provide consultant advice in diagnosis and management of patients. Hematologists use highly developed technology to make specific diagnoses and treat illnesses occurring in all organ systems.	Self-regulated and registered to practice through the College of Physicians and Surgeons of Ontario.	1. Medical Degree from an accredited program 2. Completion of Post-Grad Training in Internal Medicine 3. Completion of Post-Grad training in Hematology 4. Must include training in clinical hematology, pediatric hematology, stem cell transplantation, and lab hematology. Must also cover training in medical oncology and research related to hematology 5. Certificate of Special Competence in hematology 6. Certification with RCPSC
Medical Oncologist	A subspecialty of internal medicine closely associated with hematology and deals with tumors occurring in all organ systems. Medical oncologists coordinate multidisciplinary care of cancer patients.	Self-regulated and registered to practice through the College of Physicians and Surgeons of Ontario.	1. Medical Degree from an accredited program 2. Completion of Post-Graduate Training in Internal Medicine 3. Completion of Post-Graduate Training in Medical Oncology (after completion of Internal Medicine) 4. Certificate of Special Competence in medical oncology 5. Certification with RCPSC
Clinical Associate (CA)	A primary care provider or internist who supervises cancer therapy in a shared-care relationship with an oncology specialist in cancer centres.	Self-regulated and registered to practice through the College of Physicians and Surgeons of Ontario.	1. Medical Degree from an accredited program 2. Completion of Post-Grad Training in Family Medicine or Internal Medicine.
Nocturnist	A hospital-based physician who works overnight. Most often a primary care provider or internist.	Self-regulated and registered to practice through the College of Physicians and Surgeons of Ontario.	1. Medical Degree from an accredited program 2. Completion of Post-Graduate Training in Family Medicine or Internal Medicine.
Nurse Practitioner (NP)	NPs are Registered Nurses (RNs) in the Extended Class [RN(ECs)] who have additional nursing education and experience. NPs can diagnose, order and interpret diagnostic tests, prescribe pharmaceuticals and perform procedures. For certain controlled acts a Medical Directive may be required.	Self-regulated and licensed to practice through College of Nurses of Ontario.	1. An approved Canadian university baccalaureate degree in nursing 2. Completion of a masters level (may also be called certificate) university program in one of the three NP speciality certificate areas, from an approved Canadian university

Physician Assistant (PA)	Physician Assistants work under the supervision of a physician in a variety of clinical and team structures and settings. Physician Assistants are always under supervision of a physician who will provide direct or indirect supervision as they deem appropriate.	Unregulated.	1. Completion of two years of an undergraduate degree in any discipline at a Canadian University OR Completion of the equivalent of two years of a Canadian University undergraduate program 2. Completion of accredited PA Education Program in Canada or USA 3. Certification by the Canadian Association of Physician Assistants by completing the PA Certification Council of Canada PA Entry to Practice Certification Examination (PA CERT EXAM)
Registered Nurse (RN)	A graduate of a nursing program that provides a nurse with foundational knowledge in clinical practice, decision-making, critical thinking, leadership, research utilization and resource management, and has passed the NCLEX-RN exam	Self-regulated and licensed to practice through College of Nurses of Ontario.	Completion of an approved Canadian University baccalaureate degree in nursing.

Table 2: Roles of Advanced Practice Providers in new Models of Care

Phase	Clinical Associate (CA)	Nurse Practitioner (NP)	Physician Assistant (PA)
Diagnosis Consultation and Intake	✓	✓	✓
Graft Procurement – bone marrow harvest	✓	✓	✓
Inpatient CMH and Transplant Wards	✓	✓	✓
Outpatient Chemotherapy and Supportive Care – CMH patients	✓	✓	✓
Outpatient Chemotherapy and Supportive Care – HCT patients	✓	✓	×
Outpatient Chemotherapy and Supportive Care – Evening/Weekend Coverage	✓	✓	×
Long-Term Follow-up Care	✓	✓	✓

Appendix C: Description of Settings

Term	Description	Patient acuity
Inpatient unit	Refers to the location of care for a patient who is formally admitted to an institution (i.e. hospital) for treatment and/or care.	High
Day Hospital	A type of outpatient unit where intensive therapies and supportive care requiring specialized expertise are delivered to patients. Staffing ratios are typically higher than for a Medical Day Care/Transfusion Unit.	Med-High
Medical Day Care/ Transfusion Unit	A type of outpatient unit where moderate intensity therapies and supportive care that require the patient to stay longer than a typical consultation may be delivered to a wide variety of patients (not necessarily limited to CMH patients). Examples may include infusion/chemotherapy clinics, apheresis clinics, symptom management clinics, etc.	Low-Med
Out-patient Clinic	A type of outpatient area where medically stable patients are seen for consultation, counseling, follow- up. Therapy generally not delivered in these clinics.	Low

Appendix D: Summary of Literature Comparing Inpatient vs. Non-Inpatient Management

Search Strategy: Searches were conducted using Ovid Medline between September and November 2016. The search strategy used MeSH keywords and free text terms related to ("Acute Leukemia" OR "Stem Cell Transplant") AND ("Outpatient" Or "Early Discharge") AND ("chemotherapy" OR "symptom management" OR "telemedicine"). Results were downloaded to reference manager and screened by a single reviewer. A summary of the *comparative* studies examining the difference in outcomes between inpatient vs. non-inpatient management is provided below.

Data Extraction Table:

Study	Population	Summary of Findings
Aw et al (2016) Evaluation of an Outpatient model for Treatment of Acute Myeloid Leukemia	AML consolidation	**Inpatient (primarily) (N=11) vs. Outpatient (primarily) (N=18)** • Fewer **inpatient days** for outpatient cohort: median 24 vs. 12.5 for inpatient vs outpatient respectively (p=0.04) • No significant difference in **neutropenic days**: median 14 days vs. 16 days for inpatient vs outpatient respectively (p=0.735) • No significant difference in **febrile days**: median 1 for both groups (p=0.542) • No significant difference in **units of PRBC transfused**: median 2 for both groups (p=0.838). • No significant difference in **platelet pools transfused**: median 0 for both groups (p=0.594)
Vaughn et al (2015) Resource Utilization and Safety of Outpatient Management Following Intensive Induction or Salvage Chemotherapy for Acute Myeloid Leukemia or Myelodysplastic Syndrome A Nonrandomized Clinical Comparative Analysis	AML, MDS	**Inpatient (N=29) vs Early-Discharge/Outpatient (N=107)** • Fewer **inpatient days** for early discharge/outpatient cohort: median 16 vs 8 for inpatient vs outpatient (p<0.001) • No significant difference in units **of RBC transfused/day**: median 0.29 vs. 0.27 for inpatient vs outpatient respectively (p=0.55) • No significant difference in **platelet transfusions/day**: median 0.29 vs. 0.26 for inpatient vs outpatient respectively (p=0.31) • Fewer **days of IV antibiotics** for early discharge/outpatient cohort: median 0.71 vs. 0.48 for inpatient vs. outpatient (p=0.007) • Higher number of patients with **bloodstream infections** in early discharge/outpatient cohort: 4 vs. 37 for inpatient vs. outpatient respectively (p=0.039) • No significant difference in number of patients with ***C. diff* infections**: 0 vs. 10 for inpatient vs outpatient respectively (p=0.12) • No significant difference in number of patients requiring **ICU-level care**: 0 vs. 9 for inpatient vs outpatient respectively (p=0.20) • No significant difference in number of **early deaths**: 0 vs. 4 for inpatient vs outpatient respectively (p=0.58) • Lower **costs per study day** for early discharge/outpatient cohort: median $5,582 vs. $3,480 for inpatient vs outpatient (p<0.001)
Mank et al (2015) Early discharge after high dose chemotherapy is safe and feasible: a prospective evaluation of 6 years of home care	Acute Leukemia, Auto SCT (for lymphoma and MM)	**Inpatient (N=101) vs Outpatient (N=123)** • Authors did not directly compare *clinical* outcomes of outpatient vs inpatient group due to differences in baseline characteristics. • Fewer **inpatient days** for outpatient cohort: median 22 days per cycle vs 14 days per cycle for inpatient vs outpatient respectively. Authors concluded that "theoretically 92 extra patients could be admitted in the study period" due to the bed days saved. • Lower **total hospital costs** for outpatients: cumulative costs of 991,820 EUR vs. 505,184 EUR for inpatient vs outpatient respectively – note that this was not a comprehensive costing exercise.

Allan et al (2001) Outpatient Supportive Care following Chemotherapy for Acute Myeloblastic leukemia	AML Induction and Consolidation	**Inpatient (N=9) vs. Outpatient (N=10)** • No significant difference in **febrile episodes**: mean 2.2 vs. 1.8 for inpatient vs. outpatient respectively • Fewer **days of intravenous antibiotics** for the outpatient/early-discharge group: mean 27.2 vs. 11.6 for inpatient vs outpatient; p=0.01 • No significant difference in **red blood cell transfusions**: mean 11.7 vs 9.2 for inpatient vs outpatient respectively. • No significant difference in **platelet transfusions**: mean 27.0 vs. 36.8 for inpatient vs outpatient respectively. • Fewer **total inpatient days** for outpatients vs inpatients: mean 33.8 vs. 23.8 for inpatients vs outpatient respectively; p=0.034.
Walter et al (2011) Outpatient management following intensive induction chemotherapy for myelodysplastic syndromes and acute myeloid leukemia: a pilot study	AML, High-Risk Myelodysplastic Syndromes	**Inpatient (N=5) vs. Early-Discharge/Outpatient (N=15)** • Fewer **inpatient days** for outpatient cohort: median 21 vs. 6 for inpatient vs. outpatient respectively (p<0.01) • No significant difference in **days of intravenous antibiotics**: median 16 vs. 6 for inpatient vs. outpatient respectively (p=0.11) • No significant difference in number of **red blood cell transfusions**: median 9 vs. 4 for inpatient vs. outpatient respectively (p=0.08) • No significant difference in number of **platelet transfusions**: median 5 for inpatient and outpatient. • No patients required **ICU-level care** in either group**.** • No **deaths** occurred in either group. • Lower **charges per day** on study for outpatient cohort: median $5,467 vs. $3,270 for inpatient vs. outpatient respectively (p=0.01). Note that this does not represent *costs*, rather cumulative inpatient and outpatient hospital *charges*.
Meisenberg et al (1997) Outpatient High-Dose Chemotherapy With Autologous Stem-Cell Rescue for Hematologic and Non-hematologic Malignancies	High-Dose Chemotherapy and Autologous Stem Cell Rescue (multiple disease sites)	**Inpatient Only (N=20) vs. Early Discharge (N=46) vs. Outpatient Only (N=27)** • Fewer **inpatient days** for the outpatient only cohort: median 6 vs. 0 for early-discharge vs. outpatient only (p<0.001) and 18 vs. 0 for inpatient only vs. outpatient only (p<0.001) • No significant difference in the **number of Colony-Forming Units Granulocyte-Macrophage (CFU-GM)** infused after chemotherapy: median 3.5 vs. 3.6 vs. 3.9 for inpatient vs. early-discharge vs. outpatient respectively (p-value not reported). • No significant difference in the number of **days to absolute neutrophil count/recovery**: median 10 for all three groups (p-value not reported). • No significant difference in **red blood cells transfused**: mean 3 vs. 3.3. vs. 3 for inpatient vs. early-discharge vs. outpatient respectively (p-value not reported). • No significant difference in **platelets transfused**: mean 2.5 vs. 3.5 vs. 3.3 for inpatient vs. early-discharge vs. outpatient respectively (p-value not reported) • No significant difference on **days of IV antibiotics:** median 6 vs. 7 vs. 6 for inpatient vs. early-discharge vs. outpatient respectively (p-value not reported) • No significant difference in percentage of patients with **febrile neutropenia**: 73% vs. 78% vs. 70% for inpatient vs. early-discharge vs. outpatient respectively (p-value not reported)

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