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INSTRUCTIONS

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Cancer drugs: the role of the pharmacy technician

by Sanna Pellatt, BSc(Pharm)



Learning objectives

Upon completion of this lesson, the pharmacy technician will be able to do the following:

1. Describe the general classes of oral treatment for cancer.
2. Describe the risks involved in handling hazardous drugs.
3. Describe the processes required to minimize risk of exposure to hazardous drugs.
4. Describe the role of the pharmacy technician in supporting the pharmacist in providing care to cancer patients.
5. Understand the importance of the several checks required before the pharmacist can dispense oral cancer drugs.
6. Educate the patient and family caregiver on safe handling of cancer drugs to minimize exposure of family members and the environment.

Oncology pharmacy has become a prominent specialty over the last few years. With an increase in population size and age, cancer rates continue to rise, but thanks to advances in diagnosis and treatments, patients on

average are living longer and cancer is often being managed as a chronic disease. However, the American Institute for Cancer Research reported in 2012 that without lifestyle changes, the number of new cancer

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cases in the United States will increase by 50% by 2030. In Canada, the increase is predicted to be 66%.⁽¹⁾

The 2015 national Canadian cancer statistics indicate that

- an estimated 196,900 new cases of cancer (excluding non-melanoma skin cancers) and 78,000 deaths occurred in Canada in 2014.
- more than half of all new cases will be prostate, breast, lung and colorectal cancers.
- about 2 in 5 Canadians will develop cancer in their lifetime and 1 in 4 will die of the disease.
- 63% of Canadians diagnosed with cancer will survive at least 5 years after their diagnosis.
- at the beginning of 2009, there were about 810,045 Canadians living with a cancer that had been diagnosed in the previous 10 years.⁽²⁾

What is cancer?

Cancer is a group of diseases that can start almost anywhere in the body. It is characterized by the uncontrolled growth of abnormal cells, which may form tumours. Cancerous tumours are malignant and can spread to distant sites via the blood or lymphatic system. Benign (noncancerous) tumours do not spread.⁽³⁾

Cancer treatments

There are a number of parenteral and oral drug treatments for cancer, which include the following:

- Chemotherapy, which works by inhibiting division of cells, both malignant and normal, at various stages of the cell cycle.
- Immunotherapy, which enhances the body's immune system to fight the cancer.
- Targeted therapy, which interferes with specific molecules or enzymes involved in the growth of cancer cells, with less harm to normal cells.
- Hormonal therapy, which inhibits the production of sex hormones and slows or stops the growth of prostate or breast cancer.⁽³⁾

Until recently, oral cancer therapy comprised a small portion of treatments for cancer patients. Over the past decade, the number of oral agents has increased dramatically and is continuing to rise. The

TABLE 1 - Examples of oral cancer drugs

Drug class	Examples
Chemotherapy	Busulfan, capecitabine, chlorambucil, cyclophosphamide, etoposide, fludarabine, hydroxyurea, lomustine, melphalan, methotrexate, mitotane, procarbazine, temozolomide, thioguanine
Immunotherapy and targeted agents	Afatinib, axitinib, bosutinib, ceritinib, crizotinib, cyclosporine, dabrafenib, dasatinib, erlotinib, everolimus, gefitinib, ibrutinib, idelalisib, imatinib, interferon**, lapatinib, lenalidomide, nilotinib, pazopanib, pomalidomide, regorafenib, ruxolitinib, sorafenib, sunitinib, thalidomide, trametinib, vandetanib, vemurafenib, vismodegib,
Hormonal agents	Abiraterone, aminoglutethimide, anastrozole, bicalutamide, buserelin*, cyproterone, degarelix,* diethylstilbestrol, enzalutamide, estramustine, exemestane, finasteride, flutamide, fulvestrant*, goserelin*, letrozole, leuprolide*, megestrol, nilutamide, tamoxifen

**Injectable immunotherapy is self-administered.

*Injectable hormonal therapy is dispensed from the pharmacy and administered by a nurse at the patient's home or in the physician's office.

2008 National Comprehensive Cancer Network report estimated that more than a quarter of all 400 antineoplastic drugs in development were oral agents.⁽⁴⁾ For this discussion, oral cancer therapy (Table 1) will include hormonal and chemotherapy drugs, as well as the newer drug classes—immunotherapy and targeted therapies.

Oral cancer treatment offers several advantages over parenteral (injection) therapy. These include

- patient convenience,
- fewer visits to clinics or hospitals to receive parenteral therapy,
- no intravenous line,
- reduced use of healthcare resources, and
- increased patient autonomy and feelings of well-being.^(5,6)

Compared with the treatment of other chronic medical conditions, oral cancer treatment regimens are often complex, may be cyclical in nature and may include a combination of different drugs or drug classes, as well as a combination of oral and parenteral drugs. For certain cancers, oral treatment may be given concurrently with radiation therapy, which uses high-energy radiation to kill cancer cells by damaging their DNA; normal cells are also damaged by radiation therapy. In addition, treatment may also include supportive care medications such as antiemetics to prevent or manage the side effects (e.g., nausea and vomiting) of the cancer drugs.

Dosages of individual cancer drugs may vary significantly depending on the type of cancer being treated, the clinical status of

the individual patient and the cycle of treatment. Although administration of parenteral therapy occurs within a controlled clinical setting, the responsibility for administration of oral agents rests solely upon the patient and family caregiver. Challenges with administration of oral therapy include patient adherence to the prescribed regimen; interactions with prescription and nonprescription drugs, herbal remedies and foods; management of unique toxicities; and providing patient education regarding the medication itself, as well as its safe handling and disposal.⁽⁵⁻⁹⁾

Both parenteral and oral chemotherapeutic agents have a narrow therapeutic window, meaning that the difference between the optimal therapeutic dose and the toxic dose is small. Chemotherapeutic drugs are included in the ISMP (Institute for Safe Medication Practices) List of High-Alert Medications, which recommends special safeguards to decrease the risk of errors. These may include standardization of ordering, storage and preparation of these drugs, as well as independent double checks during dispensing.⁽¹⁰⁾

Side effects of oral cancer therapy

The range and severity of adverse effects due to chemotherapy, targeted therapy, immunotherapy and hormonal therapy varies immensely from drug to drug and patient to patient. The most common side effects of chemotherapy are bone marrow suppression, which can be serious and may lead to life-threatening infection. Fatigue, nausea, vomiting and diarrhea can also

occur frequently. Other adverse effects include anorexia, hair loss, memory changes, mouth sores, nerve changes, sexual and fertility changes and swelling of feet, hands or abdomen due to fluid retention.

Immunotherapy side effects may include flu-like symptoms such as fever, chills, muscle or joint pain and weakness, as well as fluid retention, palpitations, sinus

requirements, pre-medications, number of cycles, duration of treatment, etc. The pharmacist should also check for drug interactions as well as laboratory results and other required parameters to ensure appropriate therapy.⁽¹¹⁾

In some Canadian provinces, all oral cancer therapy is dispensed from cancer centres or hospital pharmacies; in others,

chemotherapy, damage both cancer and normal cells, resulting in toxic effects to patients. They can also cause adverse effects in healthcare workers who are inadvertently exposed to the drugs.⁽¹²⁾

The greatest risk of accidental exposure to hazardous drugs is during preparation of parenteral products when the drug is at its highest concentration before dilution. In addition, prolonged exposure to very low doses (for example, via surface contamination of drug bottles or packaging) can also result in adverse effects. These may include skin and eye irritation, nausea, vomiting, infertility, low birth weight, spontaneous abortion and DNA damage.⁽¹³⁾ Routes of accidental exposure to oral hazardous drugs can occur in a number of ways:

- direct contact via dermal (skin) absorption after touching contaminated surfaces.
- inhalation of dust from tablets or powder from damaged capsules.
- unintentional ingestion of hazardous drugs via hand to mouth.

Eating, drinking, applying cosmetics or smoking should not take place where hazardous drugs are handled. Healthcare workers should wash their hands after handling hazardous drugs, as well as before and after ingesting food or beverages.⁽¹³⁻¹⁶⁾

Safe handling

In order to limit the risks of accidental exposure of hazardous drugs for healthcare providers, patients and family caregivers, as well as to mitigate adverse effects on the environment, guidelines for safe and appropriate handling should be adhered to all times. Inadvertent exposure to oral cancer drugs can occur at any stage during

- transport,
- unpacking,
- storage,
- handling (e.g., dispensing),
- administration, or
- disposal.^(14,15)

Healthcare providers have a responsibility to ensure safe handling of oral cancer drugs. Guidelines to minimize risk of exposure should be established and followed. The use of personal protective equipment (PPE) while handling hazardous drugs minimizes the risk of occupational exposure.



congestion and diarrhea. Severe allergic reactions rarely occur.

Because they are primarily directed at cancer cells, targeted therapies were expected to be less toxic than chemotherapy; however, they too have substantial side effects, including diarrhea and liver problems, hypertension, problems with clotting and wound healing, skin problems and gastrointestinal perforation.

Hormonal agents are generally well tolerated but can still cause significant side effects. These include disruption of the menstrual cycle in women and impotence and decreased libido in men, hot flashes and night sweats, risk of clots, bone loss, mood swings and joint pain.⁽⁹⁾

Dispensing oral cancer drugs

Established protocols, guidelines and standards should be followed for the prescribing, dispensing and administration of cancer therapy. Individual patient doses are based on several factors, including patient clinical status; hematologic, renal and hepatic function; body surface area (BSA); comorbidities; and side effects to treatment. Before dispensing cancer drugs, the pharmacist should follow standard drug treatment protocols that outline patient eligibility, laboratory and imaging

these drugs are dispensed from community pharmacies. With the rise in both the number of oral cancer agents and the number of patients taking them, it is important that pharmacy technicians become familiar with these drugs and their special handling requirements so they are able to support the pharmacist and ensure the safe and effective delivery of the drug to the patient.

What are hazardous drugs?

The US National Institute for Occupational Safety and Health (NIOSH) defines hazardous drugs as those that meet one or more of the following characteristics:

- carcinogenic,
- teratogenic,
- toxic to the reproductive system,
- toxic to organs at low doses,
- genotoxic, or
- new drug with a structure and toxicity profile that mimics an existing hazardous drug (as determined by above criteria).⁽¹²⁾

Hazardous drugs include cancer drugs, antiviral drugs, hormones and other miscellaneous drugs.

Many cancer drugs bind to DNA or interfere with cell growth and proliferation. Non-selective agents, such as

Personal protective equipment

Personal protective equipment (PPE) includes gloves, gowns, N95 masks or higher and face protection; the type of PPE worn depends on the activity performed. Disposable chemotherapy gloves should be worn when handling oral chemotherapy drugs and hands must be washed before donning gloves and after gloves are removed. Manipulation of oral dosage forms, such as splitting or crushing of tablets should only be performed in a biological safety cabinet (BSC), and disposable gowns, gloves and face protection should be used. Contaminated PPE should be disposed of as hazardous waste.⁽¹⁴⁾

Storage

Hazardous drugs should be labelled as such and stored in a designated area separate from non-hazardous drugs. An updated list of hazardous drugs should be available to all staff and posted in areas, including refrigerators, where these drugs are received, stored and handled.^(14,17) These drugs may have contaminated packaging; therefore, unpacking these drugs should be done in a dedicated space separate from eating areas and gloves should be worn for this task. In the event tablets or capsules, or their containers, break, or liquids leak, a special spill management protocol should be followed.⁽¹⁶⁾

Spill management

Policies and procedures for spill management as well as a spill kit (Table 2) should be available within the work area. Staff handling hazardous drugs should be familiar with the process for cleaning a spill. Spill kits can be

purchased commercially and should contain the required PPE and equipment to safely contain and dispose of the spill. Staff who will potentially manage a spill should be fitted for N95, or better, disposable masks.^(13,16,17)

Handling

All pharmacy staff who work with hazardous drugs should receive appropriate training in the safe handling of these drugs.⁽¹⁷⁾ Automatic counting machines should not be used for counting hazardous drugs.^(14,17) Oral cancer drugs should have dedicated trays for counting loose hazardous tablets and capsules. These trays and spatulas should be cleaned with soap and water.^(14,17) The routine cleaning of pharmacy counters is important to decrease cross-contamination and limit patient and staff exposure to these drugs.^(14,16) Packaging and transportation of hazardous drugs should be carried out in a way that minimizes risk of exposure should a breakage occur in transit.^(16,17) When opening up boxes containing chemotherapy medications, it is best to wear a N95 mask and gloves at minimum to avoid exposure in the event one of the bottles or boxes have been broken during transportation. Housekeeping staff may be at risk for exposure when cleaning the hazardous drug area of the pharmacy and they should follow the same guidelines as pharmacy staff.⁽¹³⁾ Staff and family caregivers who are pregnant, breastfeeding or actively trying to conceive should minimize handling of chemotherapy agents when feasible.^(13,14)

Patient education

In addition to receiving the necessary

information about the drug treatment, patients and family caregivers should be informed of the safe transport, storage, administration and disposal requirements for cancer drugs.⁽¹⁴⁾ Family caregivers administering cancer drug doses should be advised to use gloves to avoid skin contact with the drug.⁽¹⁶⁾ Containers that were used to transport or ship drugs to patients should not be reused in the home. All unused or discontinued medications should be returned to the pharmacy for safe disposal as hazardous waste. Drugs should not be discarded in regular household garbage or flushed down the toilet as this will lead to contamination of the environment.

The role of the pharmacy technician

The pharmacy technician plays a significant role in supporting the pharmacist involved in the care of patients receiving oral cancer medications. Several of these drugs have a narrow therapeutic window, require intensive monitoring and are also implicated in a number of drug interactions. In addition, some drugs may have look-alike or sound-alike names (e.g., SORafenib/SUNItinib) increasing the risk of error during order entry or drug selection. Tallman lettering (the practice of writing part of a drug's name in upper case letters to help distinguish look-alike and sound-alike drugs) and storage on separate shelves are strategies that can be used to differentiate such drugs. The pharmacist is responsible for checking clinical parameters, ensuring the safe and effective delivery of these drugs to the patient, and providing counselling and information on side effect management.

The technician can assist the pharmacist by obtaining an accurate medication history from the patient or a database; this will enable the pharmacist to check for drug interactions and duplicate therapies.⁽¹⁸⁻²¹⁾ Medication calendars can be prepared for complicated cancer drug regimens. Blister packaging of individualized multistrength medications, such as capecitabine tablets, will ensure the patient takes the correct strength and number of tablets at each dose.

The technician can also help by ensuring that the necessary laboratory and other results are available for the pharmacist to review before dispensing the cancer drug. Once the pharmacist has completed the clinical review, and the drug has been prepared for

TABLE 2 - Recommended contents of a spill management kit⁽¹⁷⁾

Item	Description
Personal protective equipment	<ul style="list-style-type: none"> • Disposable moisture-resistant long-sleeved gown • Chemotherapy gloves • Disposable safety goggles • Shoe covers • Hair bonnet • N95, or better, mask
Supplies	<ul style="list-style-type: none"> • Disposable scoop and scraper • Sharps container (to contain any broken glass) • Absorbent material (can be wetted to absorb powder) • Waste disposal bags for hazardous drugs • Decontaminating agent • Warning sign to cordon off spill area • Puncture and leak resistant waste container
Documents	<ul style="list-style-type: none"> • Policy and procedure for spill management

dispensing, the registered technician can do the check of the final product before its release.⁽²²⁾ Some pharmacies provide a call-back service to patients taking oral cancer drugs to check on how the patient is responding to the medication; the technician can assist by placing such calls to the patient and referring patients with questions or concerns to the pharmacist.

Finally, the technician can be responsible for the safe handling aspects of cancer drugs within the pharmacy, as well as address any queries from patients and family caregivers. By taking an active role in the distribution aspect and safe handling of oral cancer drugs, the technician supports and enables the pharmacist to focus on providing patient counselling and drug information for complex oral cancer therapy regimens.

FURTHER READING

Institute for Safe Medication Practices: http://www.ismp-canada.org/download/safetyBulletins/2015/ISMPCSB2015-04_OralChemotherapyAgents.pdf#page=1.

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QUESTIONS

Please select the best answer for each question and answer online at www.CanadianHealthcareNetwork.ca for instant results.

- This cancer therapy interferes with growth of cancer cells with less harm to normal cells:**
 - Radiation therapy
 - Targeted therapy
 - Immunotherapy
 - Chemotherapy
- Oral cancer therapy offers the following advantages over parenteral therapy:**
 - Improved patient compliance
 - Better outcomes
 - Increased patient convenience
 - All of the above
- Which of the following statements is/are true?**
 - Oral cancer regimens are less complex than parenteral ones
 - Oral cancer drug dosages are standard for every patient
- Oral cancer therapy can be administered with radiation therapy and/or parenteral cancer therapy**
 - All of the above
- Several cancer drugs have a "narrow therapeutic window," which means that**
 - They are prescribed as a complex regimen
 - They can be prescribed in combination with radiation therapy
 - The difference in dose from one cycle to the next is small
 - There is little difference between toxic and therapeutic dose
- Prescriptions for oral cancer therapy may take longer to get ready than prescriptions for other chronic diseases because**
 - There are a larger number of tablets or capsules to count
 - The regimens are complex
 - The pharmacist needs to review laboratory and other results before dispensing
 - b and c only
- The following drugs are examples of oral chemotherapy:**
 - Cyclophosphamide
 - Procarbazine
 - Megestrol
 - a and b only
- Hot flashes are a side effect of therapy with**
 - Capecitabine
 - Thalidomide
 - Tamoxifen
 - Hydroxyurea

8. Hazardous drugs are classified as such because they can be

- a) Teratogenic
- b) Emetogenic
- c) Carcinogenic
- d) a and c only

9. Inadvertent exposure to hazardous drugs can occur via

- a) Inhalation
- b) Absorption
- c) Ingestion
- d) All of the above

10. Inadvertent occupational exposure to hazardous drugs can occur only when counting the oral drug in a special counting tray.

- a) True
- b) False

11. Which of the following statements about hazardous drugs is true?

- a) They should be stored alphabetically with all other drugs in the pharmacy

b) A list of these drugs should be created and posted in the area they are received and stored

- c) They can be counted in an automated counting machine
- d) They should be unpacked under the direct supervision of a pharmacist

12. The following items are examples of personal protective equipment:

- a) Gloves
- b) Masks
- c) Gowns
- d) All of the above

13. Which of the following items is not necessary in a spill management kit?

- a) Sharps container
- b) Alcohol swabs
- c) Absorbent material
- d) Gloves

14. In order to minimize cross contamination of hazardous drugs with other drugs

- a) Dedicated counting trays should be used

for loose tablets and capsules of hazardous drugs

- b) Pharmacy counters should be routinely cleaned
- c) Packaging used to transport hazardous drug should not be reused in the patient's home
- d) All of the above

15. The pharmacy technician can be responsible for these aspects of patient education:

- a) Review of medications to determine any drug interactions
- b) Counsel about side effects of cancer drug
- c) Safe disposal of unused medication
- d) All of the above

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Cancer drugs: the role of the pharmacy technician

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