

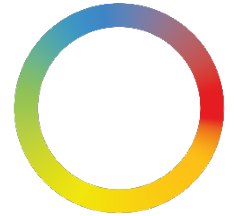
Cancer care

A handbook for pharmacists

2022



Cancer
FIP Practice
Transformation
Programme on NCDs



International
Pharmaceutical
Federation

Colophon

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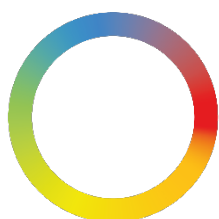
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Cancer
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 Transformation
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Executive summary

Cancer represents a large group of diseases in which cells proliferate at an abnormally rapid rate and may even extend beyond their usual sites through metastasis, invading other parts and organs of the body. The most common newly diagnosed cancers are breast, lung and colorectal cancers.² Cancer continues to be a leading cause of death around the world, with approximately 10 million attributable deaths in 2020, accounting for one in every six deaths.² Moreover, total cancer costs worldwide (taking into account the costs of prevention and treatment plus the annual economic value of disability-adjusted life years lost to cancer) have been estimated to be greater than one trillion US dollars in 2010, with costs expected to continue to grow, especially due to the development of novel therapeutic options.¹

While the global burden of cancer is significant, it is estimated that up to 50% of cancers can be avoided through risk factor mitigation and the establishment of effective prevention strategies.² Addressing risk factors for cancer development, such as tobacco use, alcohol consumption, unhealthy diet, lack of physical activity and air pollution, can directly contribute to reducing not only the burden of cancer, but also the harmful impacts of other non-communicable diseases (NCDs) on health and healthcare systems.² Other strategies may also help reduce the burden of cancer, including early detection and treatment optimisation.²

Considering the intricacies involved in cancer care, pharmacists are ideally positioned to make valuable contributions to patients' health and well-being through their expertise, accessibility and integration within healthcare teams. Most notably, pharmacists are essential in supporting patients throughout the continuum of cancer care, from prevention and screening to education, monitoring and follow-up. With regard to cancer prevention, pharmacists can serve as public health advocates, making meaningful impacts to support patients in adopting healthier lifestyles and lower their risk of developing cancer and other NCDs.

Treatment options in cancer are vast and varied, and pharmacists can utilise their expertise to ensure the safety and effectiveness of cancer treatment regimens. Pharmacists are responsible for the judicious preparation of medicines, they possess the competencies to optimise dosing strategies and provide quality patient education, and they are well-equipped to monitor and manage adverse events and complications secondary to cancer treatment, providing appropriate supportive and end-of-life care. As integral parts of healthcare teams, pharmacists are also well positioned to refer patients to relevant professionals and specialists for further management.

Pharmacists working in health institutions or establishments may also play extended roles according to their scope of practice and local regulations, such as adjusting dosing regimens, prescribing laboratory tests, and autonomously initiating medication therapies for supportive care. They can lead protocol or policy development, actively participate in advisory committees, and contribute to databanks and educational resources to further progress cancer care.

Cancer care therefore represents a key area in which pharmacists play an increasingly important role in supporting patients, working within multidisciplinary teams and improving outcomes. Pharmacists are well positioned to directly contribute to decreasing the burden of cancer and, ultimately, the burden of all NCDs.

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Foreword

By the president of the International Society of Oncology Pharmacy Practitioners

The world we live and work in continues to change rapidly, and oncology is an area where change is at its most rapid. Pharmacists are well poised to significantly implement many of the new treatments, technologies and research in cancer care. A key to progress and innovation is working together to advance the practice of oncology pharmacy practice. That is why the International Society of Oncology Pharmacy Practitioners (ISOPP) is proud to collaborate with the International Pharmaceutical Federation (FIP) on the launch of the FIP Practice Transformation Programme — supporting pharmacists' role in cancer prevention, screening, management and treatment optimisation.

As you will see, this handbook and its accompanying [knowledge and skills guide](#) covers a lot of ground and provide a comprehensive foundation. From my perspective as an oncology pharmacist and reflecting on trends in cancer care that I have seen in the ISOPP community across the world, I am excited for the impact this programme and accompanying resources will have on elevating the quality and consistency of oncology pharmacy practice globally. Considering this, I wanted to highlight three main areas that illustrate the important and expanding role pharmacists can play in supporting oncology patients and the healthcare teams caring for them around the world.

The first is the potential for pharmacists to improve clinical outcomes and the quality of patient care. Over the years, pharmacists have achieved new dimensions in our skills and contributions, going beyond traditional dispensing-based roles and adding patient-facing and clinical roles. Our unique understanding of medicines enables us to provide information, education and personalised recommendations on choice of treatment based on patient-specific factors, ensure appropriate dosing, identify and manage medicines interactions, and understand logistical and procurement issues for specialty medicines.

The second is the evolution of the oncology care team and the benefits of multidisciplinary collaboration. Many professional organisations and societies, including ISOPP, promote pharmacists as integral members of the multidisciplinary oncology care team as the medication experts, pharmacists should be. Novel practice settings for oncology pharmacists have rapidly expanded to include opportunities, such as collaborative medicines therapy management, where pharmacists collaborate with the oncology care team to prevent, monitor and manage adverse reactions and practice at the top of their licence.

Third, it is essential for pharmacists to be lifelong learners and advocates for patients and our profession. Professional organisations and educational resources such as this handbook provide a great reference and platform to elevate the quality of oncology pharmacy practice and motivate us to strive for the next level. Pharmacists have an essential role in ensuring patients and caregivers receive education about their oncology and related supportive care treatments. Given the potential adverse effects with traditional and new types of anticancer therapies, it is more important now than ever for pharmacists to have a solid understanding of the principles of cancer biology and treatment and leveraging our expertise in medication therapy management to empower oncology patients and caregivers with knowledge and support.

Each one of us wakes up every day with an opportunity to do great things and make the world a better place. Each one of us has opened this handbook for a reason: oncology pharmacy is a complex field, but one with so much potential for lasting impact and added value. I encourage you to make steady progress and stick with it even when it is hard, believe in yourself, and remember that you can use your oncology pharmacy knowledge to make a positive impact each and every day.

Evelyn Handel, PharmD, BCPS, BCOP

Director, Drugs & Biologics Programs, National Comprehensive Cancer Network
President, International Society of Oncology Pharmacy Practitioners, 2022–24

Foreword

It is estimated that approximately one in every six deaths in 2020 was attributable to cancer, rendering it one of the leading causes of mortality worldwide, with total cancer costs surpassing one trillion US dollars taking into account the costs of prevention and treatment plus the annual economic value of disability-adjusted life years lost to cancer.^{1,2} The global health and economic burden of cancer therefore cannot be understated, and concrete measures are immediately required to curb its progression and inhibit its impacts on patients, our communities and our healthcare systems.

The World Health Organization (WHO) has placed cancer as one of the key priority areas in its efforts to prevent and control non-communicable diseases (NCDs). In fact, in 2017, the World Health Assembly passed the resolution “Cancer prevention and control in the context of an integrated approach” to expedite collective efforts in improving cancer prevention, screening and treatment to ultimately reduce cancer-related mortality.²

Thanks to their expertise in medicines, proximity and accessibility to patients and integration within healthcare teams, pharmacists through their varied practice settings can play important roles in supporting patients through the continuum of patient-centred cancer care through primary, secondary and tertiary settings.

In this regard, FIP launched the FIP Practice Transformation Programme on NCDs, with the aim of providing tools and strategic support to FIP member organisations and individual pharmacists from around the world to develop and implement pharmacy services. These services can have a sustained positive impact on the prevention, screening, management and optimisation of NCDs treatments (specifically, for cancer) for improved patient outcomes and health systems efficiency and sustainability. While the project has a particular focus on low- and middle-income countries, it will of course be applicable to and encourage implementation by countries of all income levels.

This project also aims to foster a collaborative interprofessional approach to the management of NCDs that is aligned with FIP Development Goal 15 (Patient-centred care). The interventions described in this handbook will be implemented through a structured approach that will not only include a strategy for building local capacity through workforce development, but also provide the tools to facilitate service delivery and the mechanisms for evaluating and long-term monitoring of the impact of this programme through data generation and analysis. The overall aim, as the programme name states, is not simply to deliver a set of valuable professional services, but to transform pharmacy practice in a sustainable manner.

While this programme is primarily linked to delivering FIP DG 15, it also supports delivery of several other FIP Development Goals: DG 7 (Advancing integrated services), DG 18 (Access to medicines, devices and services), DG 5 (Competency development), DG 8 (Working with others), DG 11 (Impact and outcomes) and DG 12 (Pharmacy intelligence).

This handbook identifies and describes pharmacist-led interventions in cancer prevention, screening, management, and treatment optimisation to both support their implementation in pharmacy practice and to support advocacy efforts towards the optimisation and expansion of pharmacists’ scope of practice in cancer and NCDs in general.

We would like to thank the authors and editors of this handbook as well as the members of the expert advisory group who have reviewed and contributed to this important publication. We also take this opportunity to acknowledge the invaluable support and collaboration of the International Society of Oncology Pharmacy Practitioners for its participation and contributions to our expert advisory group. We wholeheartedly value its efforts in advocating the essential role of pharmacists in cancer care.

We are confident that you will find this handbook to be a valuable resource to support pharmacy practice and better serve your community. We invite you to use this and other resources that you can find at FIP’s new website dedicated to NCDs: <https://ncd.fip.org>.



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1 Background

1.1 Definition and characteristics

Cancer is a disease characterised by the abnormal growth of cells that can spread and invade other tissues and organs in the body, disrupting healthy processes and functions. Cancer can affect any part of the body and is either defined by its location or by the type of cell from which it originates.^{2,3} More specifically, cancer can be categorised as solid tumours or haematological tumours. Solid tumours are identified as a mass of abnormal cells originating from any organ system in the body, whereas haematologic tumours or liquid malignancies refer to abnormal cells circulating in either the blood, bone marrow or lymph, resulting in leukaemias, myelomas or lymphomas.³

Cancer can be categorised into nine types based on the affected cell types:³

- i. Sarcoma — cancer that forms in the bones or soft tissue
- ii. Carcinoma — cancer that forms from epithelial cells anywhere in the body
- iii. Leukaemia — cancer that forms in the bone marrow
- iv. Lymphoma — cancer that begins in T- or B-cell lymphocytes
- v. Multiple myeloma — cancer that begins in plasma cells
- vi. Melanoma — cancer that forms in skin cells, more specifically melanocytes
- vii. Brain and spinal cord tumour — cancer that forms in different cells in the nervous system
- viii. Germ cell tumour — cancer that occurs in sperm or egg cells
- ix. Neuroendocrine tumour — cancer that secretes hormones

With regard to terminology, the term “neoplasm” is used to describe the growth of abnormal cells. Cancerous tumours are called “malignant”, whereas tumours with low likelihood of developing into cancer are referred to as “benign”.

Different methods exist to classify tumours and cancers. Tumour grades are used to describe the appearance of cells in a tissue sample. In most cases, determining the tumour grade is achieved by collecting a tissue sample of the suspected organ or site through a biopsy. A pathologist will then study the tissue sample under a microscope and will assign it a grade as follows:⁴

- Grade 1 — well differentiated or close to normal cells (low grade)
- Grade 2 — moderately differentiated (intermediate grade)
- Grade 3 — poorly differentiated (high grade)
- Grade 4 — undifferentiated or mostly abnormal cells (high grade)
- Grade X — unable to assess grade (undetermined grade)

This important characterisation aids oncologists, specialists and other members of the healthcare team determine and assess treatment plans as well as provide estimations regarding prognosis.

In addition to tumour grading, cancer staging is also used to determine the severity of the cancer and help narrow down treatment options. The cancer stage also represents an important piece of information to help identify potential clinical trials for which patients may be candidates for enrolment. The TNM system is a commonly used staging system that describes various characteristics regarding the cancer using letters and numbers:⁵

- T — the size and extent of the primary tumour
 - TX — the main tumour cannot be measured
 - T₀ — the main tumour cannot be found
 - T₁, T₂, T₃, T₄ — the greater the number, the larger the tumour (subgrades a and b possible, such as T_{3a} or T_{3b})
- N — the number and local of regional lymph nodes with cancer
 - NX — the nearby lymph nodes affected with cancer cannot be measured
 - N₀ — there are no nearby lymph nodes affected with cancer
 - N₁, N₂, N₃ — the greater the number, the more nearby lymph nodes are affected with cancer
- M — the presence of cancer spreading to other parts of the body, otherwise known as metastasis

- MX — metastasis cannot be measured
- M₀ — cancer has not spread to other parts of the body (absence of metastasis)
- M₁ — cancer has spread to other parts of the body (presence of metastasis)

For example, a T₃N₂M₁ cancer refers to a larger tumour with growth in surrounding tissues (T₃) that has also spread to more than one lymph node (N₂) and to other organs in the body (M₁).⁵

Another commonly used staging system classifies cancer in general stages:^{5,6}

- Stage 0 — presence of abnormal cells, but no cancer, also known as carcinoma in situ
- Stage I — presence of cancer that is usually contained within the organ from which it originates
- Stage II — presence of cancer that is larger than in stage I and that may have spread to nearby lymph nodes
- Stage III — presence of cancer that has affected surrounding tissues and nearby lymph nodes
- Stage IV — metastatic cancer

Specific terms may also be used to characterise the cancer:⁵

- Localised — the cancer is limited to the site from which it developed
- Regional — the cancer has spread to nearby lymph nodes, tissues or organs
- Distant — the cancer has spread to distant organs (metastasis)

Beyond looking at the tumour itself, the patient's functional status can be evaluated using tools, such as the Eastern Cooperative Oncology Group (ECOG) Performance Status Scale and the Karnofsky Performance Status Scale.⁷ Determining the functional status helps guide treatment-related decisions in addition to tumour and cancer characterisation.

1.2 Prevalence and impact

Cancer represents a leading cause of death worldwide and has been attributed to approximately 10 million deaths or one in six deaths in 2020.² For the same time frame, there were close to 20 million new cases of cancer, with more than half of them reported in the Western Pacific and European regions.⁸ Projections have estimated 29 million new cases of cancer in 2040, primarily due to population ageing and growth.⁹

Data from the International Agency for Research on Cancer have shown that the most common types of new cancer cases worldwide for all sexes and all ages were breast, lung and colorectal cancer in 2020.⁸ For men, lung, colorectal and prostate cancer were the most common, whereas for women, breast, colorectal and lung cancer were the most common in those respective orders.⁸ Cancer appears more prevalent in countries with a high to very high Human Development Index as well as in countries with upper middle to high income levels, although mortality secondary to cancer appears disproportionately greater in countries with lower income levels.^{8,10} With regard to mortality, lung, colorectal and liver cancers accounted for the most deaths.⁸ In fact, survival data from the United Kingdom, United States and the Netherlands showed that five-year survival rates were approximately 20% for lung cancer in both men and women for all stages of cancer combined.¹¹

Moreover, the annual estimated cost of cancer worldwide was approximately USD 1.16 trillion in 2010, with estimates further increasing the estimated cost to over USD 2 trillion, taking into account long-term costs to patients and families.¹ Costs of cancer are also expected to increase primarily due to the development of novel therapeutic agents.

1.3 Pharmacist-led interventions in cancer care

Due to their accessibility, expertise in medicines and integration within health care teams, pharmacists can play a variety of important roles in the provision of quality cancer care. From a dispensing standpoint, pharmacists are responsible for the safe preparation, supply and dispensing of cancer treatments, which is especially important because medicines used in cancer treatment are considered hazardous and thus require the necessary safety precautions to limit their risk for contamination and accidental exposure. Cancer

treatments may also be costly and difficult to access, further leveraging pharmacists' responsibilities in ensuring accessibility to these potentially life-saving treatments. Pharmacists also play a key role in medicine selection and formulary management helping to ensure safe, rational and cost-effective use of cancer treatments and supportive medication.

Then, beyond the supply of medicines, pharmacists have continued to deliver increasingly clinical, patient-centred care to optimise cancer care as well as to improve health and patient outcomes. Through lifestyle interventions, pharmacists can meaningfully impact on preventing risk factors for cancer development. Pharmacies also represent accessible locations for active participation in screening services. The medicines expertise of pharmacists' also allows them to assess the safety and effectiveness of cancer treatment regimens according to patient parameters, investigations and concomitant medication, including non-prescription and traditional, alternative or complementary medicines. Pharmacists are also ideally placed to reinforce medication adherence as well as support the prevention and management of adverse events and complications related to cancer therapy.

Data have shown clinical and economic benefits regarding the role of the pharmacist in inpatient and outpatient settings, where pharmacists are embedded in healthcare teams and interact directly with various health professionals.¹²⁻¹⁴ With regard to community pharmacists, data have begun to emerge on the impact of community pharmacists in screening, education and medication review services specifically with regard to cancer care.¹⁵⁻¹⁸ Additional data will only supplement the benefits of the contributions of community pharmacists in this field.

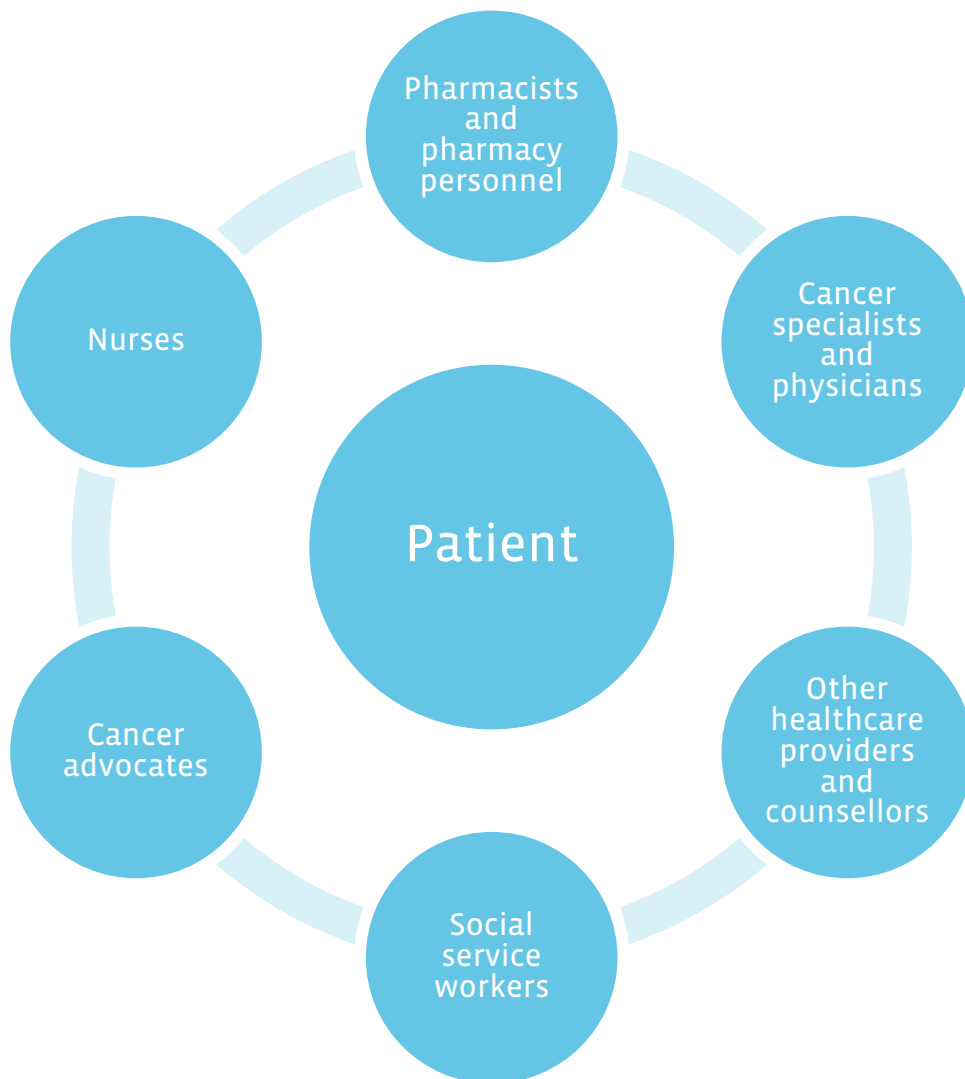
1.4 Multidisciplinary approach

Pharmacists are integral to the healthcare team and work directly with different healthcare professionals to ensure the delivery of optimal cancer care, as described in Figure 1. Pharmacists also work closely with pharmacy assistants and pharmacy technical staff to ensure the adequate handling, preparation and dispensing of anticancer medicines. Each member of the pharmacy team plays a crucial role in building relationships of trust and understanding between the pharmacy team and the patient, especially considering how complex and overwhelming the journey through cancer care can be.

Pharmacists also regularly communicate with and may work directly with different members of the cancer care team, such as cancer specialists and physicians, to optimise treatment and develop collaborative practice agreements. Pharmacists also work closely with nursing personnel, who play crucial roles in delivering holistic, patient-centred cancer care. Considering the current and projected shortages of healthcare workers, collaboration between pharmacists and other clinicians is an essential component in ensuring the sustainability of comprehensive, efficient cancer care.¹⁹

Other professionals in healthcare and social services, such as social workers, nutritionists and dieticians, rehabilitation staff, genetic counsellors, spiritual counsellors, and patient representatives or cancer advocates, also work in collaboration with pharmacists. The expertise of each of them is necessary in supporting patients and helping them maintain their quality of life.

Figure 1. Multidisciplinary patient-centred approach to cancer care



2 Cancer prevention

It is estimated that between 30 and 50% of all cases of cancer could be avoided.² Considering the significant burden that cancer places on both patients and health systems, this therefore highlights the urgency of implementing effective risk mitigation mechanisms and prevention strategies to hinder the development and progression of this disease.³ Pharmacists are well-positioned to take on critical roles in cancer prevention, due to their expertise and accessibility. Furthermore, pharmacist-led health promotion interventions would not only contribute to reducing the risk of developing cancer, but also prevent the development of other NCDs, such as diabetes and cardiovascular disease.

2.1 Nutrition, alcohol consumption, weight management, and physical activity

Unhealthy diets, excessive alcohol consumption, obesity and lack of physical activity have been identified as risk factors for cancer development and may even be associated with poorer outcomes in patients with early-stage cancer, including greater risk of recurrence, cancer-associated mortality and overall mortality for obese patients.^{20, 21} Moreover, these risk factors may be considered as connected to one another. For instance, malnutrition, excessive alcohol use and sedentary lifestyle all contribute to obesity; obesity is a significant risk factor for cancer, but also for other NCDs. This therefore highlights how targeting these risk factors is paramount to health, with benefits extending beyond cancer prevention.

Pharmacists are ideal candidates for the promotion of healthy lifestyles, and data have shown that pharmacy-based health promotion interventions have been beneficial with regard to changes in behaviour, clinical outcomes, quality of life and cost-effectiveness.²² Pharmacists may participate in counselling sessions, provide educational material, follow-up on lifestyle changes and refer patients to other relevant healthcare professionals. Thanks to their accessibility and proximity to their patients, pharmacists are encouraged to continue making lifestyle interventions to improve their patients' health by reducing their risk of developing diseases, including cancer.

2.1.1 Nutrition and alcohol consumption

The effects of nutrition and alcohol consumption are thought to be achieved through a variety of mechanisms. Diets low in nutritional value do not provide sufficient amounts of micronutrients, thus contributing to cellular damage and inhibiting optimal cellular repair.²⁰ More specifically, on one hand, certain foods, such as red and processed meat, especially those cooked at high temperatures, with high fat content, haem iron, and nitrites, are believed to contribute to the development of cancer, notably colorectal cancer.^{20, 23, 24} On the other hand, fruits, vegetables and dairy products are thought to provide beneficial micronutrients.^{20, 23} Furthermore, excessive alcohol consumption may also be linked to different forms of cancer affecting the mouth, pharynx, larynx, oesophagus, stomach and liver through different means, such as the generation of harmful metabolites, increased oxidative stress, interference with DNA repair mechanisms and changes in hormone metabolism, with alcohol itself having obtained the highest rating as a carcinogen by the International Agency for Research on Cancer.^{20, 25} Excessive alcohol consumption has also been linked to a greater risk of mortality from alcohol-related cancers.²⁴ Of note, even small amounts of any type of alcohol increases the risk for cancer development.²⁵

Different recommendations should be made to patients regarding their nutrition and alcohol consumption, which may include:^{20, 25}

- Eat a diet rich in wholegrains, vegetables, fruits, beans and fibre
- Limit the consumption of processed foods with high contents of fat, starches or sugar
- Limit the consumption of red and processed meat and sugar-sweetened drinks
- Limit alcohol consumption —

- One standard drink corresponds to either 341 ml (12 oz) of 5% alcohol content (beer or cider), 142 ml (5 oz) of wine with 12% alcohol content, or 43 ml (1.5 oz) of 40% distilled alcohol content (spirits, such as whisky, gin or rum)²⁵
- To reduce the risk for cancer development, women should consume no more than one drink per day, and men should consume no more than two drinks per day
- To reduce the long-term effects associated with chronic diseases, women should consume no more than 10 drinks per week (no more than two drinks per day), and men should consume no more than 15 drinks per week (no more than three drinks per day)

Recommendations regarding nutrition and alcohol consumption may differ according to local practices, cultures, and authorities, but generally are in line with diets that are varied and limited in processed foods in addition to avoiding alcohol use. Lifestyle recommendations should therefore be individualised according to a patient's preferences and capacities. Pharmacists hold relationships of trust with patients and therefore play meaningful roles in encouraging patients to take on and sustain such lifestyle changes. For more information, the document developed by FIP titled "[Nutrition and weight management services: A toolkit for pharmacists](#)" provides additional data and recommendations regarding pharmacist-led nutrition services. This and other FIP resources in this area, including the recordings of webinars, are available at the FIP website on NCDs, <https://ncd.fip.org/>.

2.1.2 Weight management and physical activity

Obesity and sedentary lifestyle are estimated to be causative factors in approximately one quarter of all cancer cases worldwide.²⁴ These are thought to be perpetuated by a number of different mechanisms. Obesity has also been associated with increased inflammatory mediators as well as abnormal metabolic and endocrine functions.^{20,26} The chronic state of inflammation brought on by obesity is thought to create a chronic state of stress and contribute to carcinogenesis and cancer progression, ultimately leading to an increased risk for mortality.²⁴ Regular physical activity, in contrast, has been shown to support healthy immune and hormonal functions, and it has been associated with a decrease in cancer development.^{20,24}

Maintaining a healthy weight and staying active therefore represent key lifestyle interventions to be adopted to prevent cancer development. Patients should be encouraged to:²⁰

- Be at least moderately physically active daily (at least 150 minutes of moderate-intensity, aerobic physical activity per week);
- Maintain weight within a healthy range (body mass index between 18.5 and 24.9 kg/m²); and
- Avoid excessive weight gain.

Just like counselling on nutrition and weight management, lifestyle interventions made with regard to weight management and physical activity should be adapted to a patient's preferences and capacities. Through the provision of patient-centred care, pharmacists remain important allies in supporting and accompanying patients through various lifestyle interventions to ultimately reduce their risk of developing cancer and other NCDs. FIP's "[Nutrition and weight management services: A toolkit for pharmacists](#)" also provides recommendations on weight management services in the pharmacy setting.

2.2 Smoking cessation

Smoking is regarded as one of the most important causes of preventable cancers. Tobacco smoke contains many different harmful substances, such as formaldehyde, benzene and arsenic, which have been shown to be causative factors for cancer development; it also causes inflammation and affects the immune system.²⁷ Smoking has been found to contribute to the development of many diseases, including heart disease, stroke, chronic obstructive pulmonary disease, diabetes and cancer.²⁷ In fact, a correlation has been shown between smoking and many different types of cancer, such as those affecting the lung, oesophagus, larynx, mouth, throat, kidney, bladder, liver, pancreas, stomach, cervix, colon and rectum, in addition to acute myeloid leukaemia.²⁷ Inhaling large amounts of second hand smoke may also contribute to the development of lung cancer, and all forms of tobacco, such as cigarettes, smokeless tobacco, cigars, pipes and waterpipes, carry the potential for significant harm.²⁷

Deploying efforts to implement, promote and encourage uptake of smoking cessation programmes therefore represents a key strategy in preventing the development of different types of cancers. Pharmacists are well embedded within their communities and are well trained to support patients in smoking cessation. This has been demonstrated in meta-analyses that show pharmacy-based smoking cessation programmes to be both effective and cost effective.^{28, 29}

More specifically, pharmacists may provide educational, behavioural and pharmacological support to patients. They possess the necessary training to provide counselling and education on the harms of smoking, the benefits of smoking cessation and available treatment options. They are also capable of conducting the necessary follow-ups and motivational interviewing, including using methods like the World Health Organization's 5As and 5Rs models.^{18, 30} Patients also benefit from the accessibility and extended opening hours of pharmacies to obtain the necessary support in their smoking cessation journey.¹⁸ Nicotine replacement therapy or other medicines, such as varenicline or bupropion, may be also autonomously prescribed or initiated by pharmacists according to local jurisdictions, scope of practice and prescribing authority.

2.3 Air pollution and occupational exposure

Air pollution arises from both indoor and outdoor activities, including smoking, cooking and fuel combustion for heating, power generation and industrial processes; it may also originate from natural hazards.^{31, 32} Radon is a naturally occurring radioactive gas and known carcinogen that may be present in rocks and soil.^{32, 33} In areas with specific geology that contain high levels of uranium, increased levels of radon are produced and may build up in enclosed spaces, such as homes, therefore warranting radon measurement services in these environments in particular.³⁴ In addition to posing environmental risks, air pollution has also been determined to have important health repercussions. According to the WHO, nine out of 10 individuals breathe polluted air.³⁵ It is also estimated that approximately seven million deaths per year are caused by air pollution, both ambient and indoor, with more than 90% of such deaths occurring in low- and middle-income countries.³⁵ Air pollution is also a causative factor for different diseases, including respiratory infections, stroke, heart disease and lung cancer.³⁵

Exposure to carcinogens in work settings, including through inhalation, may also contribute to the risk of developing cancers of the lung and bladder, and mesothelioma.³⁶ Exposure to asbestos, metallic compounds, smoke and other substances in manufacturing, construction, mining and other industries may contribute to the development of cancer and should not be overlooked when assessing risk factors for cancer development.³⁷ Radiation exposure is an additional factor³⁷ that contributes to cellular damage and therefore to the risk of cancer development.³³ High-energy radiation can, for example, be released in accidents at nuclear power plants.³³

Individuals working in healthcare settings may also be at increased risk of exposure to carcinogens, including those who manipulate hazardous medicines with the potential for carcinogenicity.³⁸ It is important to note, however, that while medical procedures, such as medical imaging techniques and radiation therapy, also cause some degree of cellular damage, the risk of cancer development arising from these procedures is considered small.³³ A patient's prior exposure to radiation should be discussed with the cancer care team as a potential risk factor.

Pharmacists have been called upon to take on important roles in supporting patients in respiratory care. This includes: educating on self-care, non-pharmacological measures and non-prescription medicines; supporting medication adherence; and educating on protection from pollen and other pollutants.³¹ For further information, FIP has published "[Chronic respiratory diseases: a handbook for pharmacists](#)". Also available from FIP are the results of a global survey on the role of community pharmacists in supporting patients in respiratory care titled "[Mitigating the impact of air pollution on health: The role of community pharmacists – Global survey report](#)".

On a more collective level, strict regulations limiting workers' exposure to carcinogens, controlling ventilation and engineering measures, and providing sufficient personal protective equipment are necessary measures to promote safer working environments and limit occupational exposure to carcinogens.³⁶

2.4 Exposure to sunlight and ultraviolet radiation

Exposure to ultraviolet (UV) light or UV radiation from increased sun exposure or artificial tanning devices may also predispose patients to an increased risk of developing skin cancer, including cutaneous melanoma, squamous cell carcinoma and basal cell carcinoma.³⁹ With over 1.5 million cases of skin cancer diagnosed worldwide in 2020, preventing excessive exposure to UV light remains a key priority area.³⁹

There are three types of UV rays, and two of these are primarily responsible for effects on the skin:⁴⁰

- UVA rays make up the majority of UV rays and are prevalent year-round. They penetrate deep into the skin, causing indirect cellular damage through the formation of free radicals and impairing epidermal immune function, contributing to photoageing. UVA rays are emitted by the sun and are used in UV tanning machines.
- UVB rays also carry the potential for harm through direct cellular damage by inducing the formation of photoproducts in DNA. They are also emitted by the sun year-round and are mainly responsible for causing sunburn.
- A third type of UV rays, called UVC rays, is considered more damaging to the skin, but is completely absorbed by the ozone layer.

Exposure to UV light in small amounts is healthy because it contributes to vitamin D production, strengthening the bone and musculoskeletal system.³⁹ However, as excessive exposure to UV light increases the risk for cancer development, pharmacists are called upon to take an important role in educating patients on different protective measures and recommendations, including:^{39, 40}

- Avoiding the use of artificial tanning devices such as sunbeds;
- Limiting sun exposure during peak hours and seeking shade;
- Wearing protective clothing, including broad-brimmed hats and sunglasses; and
- Using broad-spectrum sunscreen applied 20 to 30 minutes prior to sun exposure and reapplied at least every 90 minutes or following immersion in water.

Finally, pharmacists are well positioned to identify and educate patients receiving medicines that may cause photosensitivity and consequently increase the risk for skin cancer development with excessive exposure to UV light. Patients taking such medicines, which include tetracyclines, fluoroquinolones, certain diuretics and retinoids, should be counselled on various protective measures to minimise their risk.⁴⁰

2.5 Safer sexual practices

Several forms of cancer can be caused by sexually transmitted infections (STIs). Human papilloma virus (HPV) can be spread through unprotected vaginal, anal or oral sex, or through close skin-to-skin contact and may cause cervical cancer.⁴¹ Cancers affecting the vulva, vagina, penis, anus or oropharyngeal tract can also be caused by HPV.⁴¹ Viral hepatitis, notably hepatitis B and C, can be transmitted through unprotected sex and may cause liver cancer.⁴²

Thanks to their accessibility, extended opening hours, and the possibility for confidential consultations, pharmacies are ideal for the promotion and education on safer sexual practices. For instance, pharmacists may counsel patients on contraception methods that reduce the risk of sexually transmitted disease transmission. Other safer sexual practices, such as favouring mutually monogamous relationships, screening for cervical cancer, regular testing for STIs and vaccination, remain important topics for education by pharmacists.^{41, 42}

2.6 Vaccination

The immunoprevention of cancer through vaccination continues to be a key priority area. Vaccination can be perceived as primary prevention in healthy patients to prevent cancer-causing viral infections, whereas it can also be considered as tertiary prevention in patients who underwent immunosuppressive or curative therapy

to prevent viral infection recurrence.⁴³ Currently, the vaccines available for the prophylaxis of oncogenic viral infections work against HPV and hepatitis B viruses.⁴³ Immunisation programmes have been shown to be safe for patients, effective at protecting against oncogenic viral infections, and affordable and cost-effective.^{43, 44} The research and development of vaccines against other antigens is currently under way.⁴³

The potential benefits of vaccination therefore underscore the need to implement widespread and effective immunisation strategies against these viral infections to directly contribute to preventing the development of certain types of cancer. This is especially true in low- to middle-income countries, where vaccination uptake rates have been declining and access to vaccines is limited, causing them to become disproportionately affected by the burden of cancer.^{44, 45}

As pharmacies are well integrated within their communities as accessible health points, pharmacists play a crucial role in leading and actively participating in immunisation endeavours. They can contribute by providing education on vaccination and dispelling vaccination myths, identifying target groups and screening patients for vaccine eligibility, and advise on and dispense vaccines.¹⁸ Pharmacists can also collaborate with students, interns and other health professionals to organise vaccination programmes and, in certain jurisdictions, they may themselves prescribe and administer these vaccines.

On a system level, pharmacists should continue to advocate HPV and hepatitis B vaccination in national immunisation schemes. This would help promote widespread implementation, ensure adequate supply and distribution, remove financial barriers, and contribute to standardised monitoring and reporting of vaccine uptake and adverse events.⁴⁵

FIP has published a variety of documents to help support and inform pharmacy practice in immunisation, including [previous FIP Transformation Vaccination Programmes](#), [“Give it a shot: Expanding immunisation coverage through pharmacists”](#), and [“FIP vaccination reference guide: Knowledge and skills to support professional development and inform pharmacy education in vaccination”](#). Additional publications are available through the FIP website on vaccination, <https://prevention.fip.org/vaccination/>

Case study

Miguel is a community pharmacist who is well appreciated by his patients for his patience, empathy and open-mindedness. One day, one of his patients, visibly appearing a bit down, visits Miguel at the pharmacy with a new prescription for metformin. The patient informs Miguel that, following his yearly check-up with his general practitioner, he had just been diagnosed with type 2 diabetes mellitus. Already under treatment for hypercholesterolaemia and chronic obstructive pulmonary disease, the patient was overwhelmed at his new diagnosis and expresses concerns in developing other conditions and diseases, such as heart attack, stroke and cancer.

Miguel therefore decides to meet with the patient in the confidential consultation room and counsels him on his new medication. He also educates the patient on the management of his newly diagnosed health condition, including information on the disease, potential complications, and self-monitoring. Seizing the opportunity to provide more comprehensive advice, Miguel decides also to counsel the patient on healthy lifestyle interventions, including weight management, nutritional advice and respiratory care, to reduce his likelihood of developing other diseases. The patient also agrees to work towards quitting smoking, and he agrees to have Miguel independently initiate nicotine replacement therapy. Miguel also ensures that the patient's vaccination status is up-to-date by consulting the online vaccine registry.

Miguel also offers educational material and plans a follow-up phone call in one week with the patient to evaluate how he will be adapting to these significant changes in his health and lifestyle. The patient leaves the pharmacy feeling more reassured about his health, fortunate to be able to count on his pharmacist for guidance and support.

3 Screening and early diagnosis

The early detection of cancer has been shown to significantly improve the chances of successful treatment and therefore increase the probability of greater survival outcomes.⁴⁶⁻⁴⁸ As such, interventions to increase cancer screening uptake and access to early diagnostic measures should be put into place. To begin, cancer screening programmes are geared towards asymptomatic individuals to detect the presence of abnormal cells or early-stage cancer, particularly towards those deemed at greater risk of developing cancer.⁴⁹ Through screening, timely diagnosis and early treatment can be provided, which will ultimately reduce the overall incidence of a cancer as well as reduce associated morbidity and mortality.⁴⁹ In contrast, early diagnosis programmes are rather aimed at patients who have already begun developing signs and symptoms of the disease at an early stage.⁴⁹

Pharmacists are closely connected within their communities and are in close proximity to their patients, whom they see on a regular basis. There is therefore great potential for pharmacists to advocate enrolment in cancer screening programmes, refer patients as deemed necessary, and even lead screening programmes within their own pharmacies. Data from a systematic review and other literature have even reinforced the feasibility of providing increased access to early cancer detection interventions within community pharmacies, especially in deprived areas.^{15, 16, 46, 50} To be able to fully undertake these responsibilities, pharmacists must possess the necessary knowledge, skills and resources for activities that include identification of at-risk patients, conduction of point-of-care testing and management of screening results.

Advocacy of cancer screening has been widely published, including several programmes supported by the WHO.^{51, 52} Data have also shown the benefits associated with cancer screening, specifically with regard to reductions in mortality.⁴⁶⁻⁴⁸

Data continue to be collected regarding the impact of screening programmes, such as through the Cancer Screening in Five Continents (Can Screens) project of the International Agency for Research on Cancer by the WHO. The Can Screens project is a global data repository designed to gather, analyse and disseminate information on cancer screening programmes and initiatives worldwide for improved quality, monitoring and evaluation.⁵³

3.1 Risk factor assessment

Early cancer detection programmes should be optimised to target individuals at greater risk of cancer development. Pharmacists should therefore be responsible for understanding patient risk factors and other eligibility criteria for enrolment in early cancer detection programmes.

Modifiable risk factors are those that are associated with lifestyle habits and that, when avoided, may significantly contribute to preventing cancer.⁵⁴ These risk factors include tobacco use, physical inactivity, excess weight and sedentary behaviour, unhealthy diet and alcohol consumption, and increased exposure to sun and pollutants.⁵⁴ Additional data regarding the prevention of cancer through the avoidance of modifiable risk factors can be found in Chapter 2.

Non-modifiable risk factors cannot, by nature, be avoided. However, patients presenting with these risk factors may be identified more promptly for referral to and enrolment in cancer screening programmes. Such non-modifiable risk factors include age, gender, ethnicity, family history, comorbidities and genetic abnormalities.

Different cancer risk assessment tools have been developed to help guide patients and care providers in identifying patients who may be at greater risk. They include self-questionnaires or collaborative tools as well as web-based, paper-based and multi-faceted tools.⁵⁵ For instance, online website-based tools are available, such as those in Canada, Australia, the United Kingdom, and the United States, including [My CancerIQ](#), the [Breast Cancer Risk Assessment Tool](#), and the [Colorectal Cancer Risk Assessment Tool](#).⁵⁶⁻⁶¹

3.2 Screening programmes

3.2.1 Programme implementation

Screening programmes are not without risks as the results of a screening test can significantly impact the health and well-being of patients as well as warrant further resource use for additional testing and investigative measures. Furthermore, several conditions must be put into place to ensure such programmes are successful.

There are clear benefits, both individual and collective, to implementing successful screening programmes. Reduction of morbidity and mortality are among some of the main benefits of detecting cancer through screening.⁴⁹ Furthermore, by detecting cancer at an early stage, treatments may be less aggressive and may therefore have a more tolerable adverse effect profile.⁴⁹

However, it is also important to consider that screening programmes bear the potential to cause harm. The distress or discomfort associated with having to undergo screening as well as the physical effects associated with the test itself, such as with mammograms, constitute potential risks.⁴⁹ The consequences of false-positive results, which may lead to increased investigations, overdiagnosis and overtreatment, in addition to false-negative results which may delay diagnosis and treatment, are important to consider.⁴⁹

Several different conditions are important for successfully implementing screening programmes:⁴⁹

- Governance or regulatory frameworks are necessary to provide guidance on workforce, clinical management, financing and monitoring capacities of cancer screening programmes, among other topics. Such frameworks should also clearly describe and help organise patient pathways through screening and referral programmes. Community pharmacies should specifically be included as integral components of screening programmes.
- Interdisciplinary and multidisciplinary collaboration are necessary to optimise workflow and communication between different teams, establishments, and primary care and specialised care networks. Pharmacists remain essential to successful screening programmes and should thus be included in such types of collaboration.
- Training of personnel should be in place to ensure patients are appropriately supported when navigating screening programmes. Pharmacists and pharmacy personnel should possess the necessary skills to identify, educate and refer patients.
- Health information systems and registries should be adequately established and kept updated to store important documentation, maintain records, and serve as a database for quality assurance and monitoring purposes.
- Access to funding, services and infrastructure is also needed for the success of screening programmes. Screening programmes should include access to necessary services in both primary and specialised care in addition to the necessary equipment and health system capacity, all of which rely on necessary funding mechanisms to provide quality care to patients.
- Educational tools and materials are also needed to inform and reassure patients navigating screening programmes. Due to their proximity to patients, pharmacists are essential in developing and distributing such educational material.

The success of screening programmes is dependent on achieving these conditions to ensure they are comprehensive and sustainable. Through their relationship of trust with their patients, pharmacists are expected to play important roles in the development of, organisation of and participation in screening programmes.

3.2.2 Screening guidelines

The WHO has identified screening guidelines for cervical, breast and colorectal cancers according to their approach to tackling NCDs, having looked at cost-effectiveness data and additional sources of guidance.^{49, 51}

3.2.2.1 Cervical cancer

The WHO has recently made considerable efforts in advocating the prevention and treatment of cervical cancer. In recent years, it has released a call to action for the elimination of cervical cancer and launched a global strategy to accelerate its elimination, with the objective to screen 70% of eligible patients with high-performance screening tests at least twice in their lifetime and to provide treatment for 90% of women with a positive screening result for cervical cancer by 2030.⁶²

In light of these endeavours, the WHO also released updated guidelines on the screening and treatment of cervical pre-cancer lesions for cervical cancer prevention in 2021 which included a handful of recommendations and good practice statements.⁶² WHO recommendations include:⁶²

- Using HPV DNA detection screening tests as primary screening tests (taken by provider or by self-sampling) over visual inspection with acetic acid or cytology (Papanicolaou test or Pap smear) approaches, primarily due to associations with greater reductions in cervical cancer and deaths with HPV DNA detection screening tests;
- Beginning regular cervical cancer screening at 30 years of age among the general population of women at an interval of five to 10 years when using the HPV DNA detection screening test; and
- Pursuing screening until there have been two consecutive negative screening results after 50 years of age.⁶²

Additional screening recommendations may differ according to specific or subsets of populations.⁶²

3.2.2.2 Breast cancer

During mammograms, low doses of X-rays are used to generate images of the breast. When regularly performed as part of screening tests, mammograms improve the chances of detection and successful treatment while reducing the need for more aggressive treatment.⁶³

One systematic review analysed over 20 global guidelines for breast cancer screening from 11 countries or regions, with the majority of included guidelines agreeing on annual or biennial mammography screening for women at average risk of breast cancer development between the ages of 40 and 74 years.⁶⁴ Discrepancies were noted between guidelines with regard to recommended screening ages, methods and intervals.⁶⁴ Risk prediction models, including the Gail model and the BOADICEA model, may also be used and contribute to reducing breast cancer development.⁶⁴ The authors also remarked that few published guidelines came from low- and middle-income countries, citing, among main reasons, the insufficient national evidence on breast cancer screening and lack of resources required for guideline development.⁶⁴

Clinical breast examinations and breast self-examinations were not supported as reliable, routine screening methods due to the lack of strong evidence in their screening usefulness and potential benefits in women at average risk.^{63, 64} It has however been recommended that women be familiar with the usual appearance of their breasts and should report any symptoms or changes to their healthcare professional for further assessment.

In general, patients should look for breasts of usual and even size, shape and colour without any visible lumps, swelling or distortion.⁶⁵ Patients should seek further attention if they notice:⁶⁵

- Dimpling, puckering, or bulging of the skin;
- An inverted nipple or a nipple that has changed position;
- Discharge from the nipple; or
- Redness, soreness, rash or swelling.

3.2.2.3 Colorectal cancer

Colorectal cancer screening in average-risk individuals can contribute to decreasing its incidence and associated mortality.⁶⁶ Different tools and methods can be used for screening, including:⁶⁷

- **A faecal occult blood test (guaiac, FOBT) or a faecal immunochemical test (FIT)** — these detect the presence of blood in faeces, which may indicate the presence of polyps or cancer, or have other causes, such as gastrointestinal bleeds or eating certain types of food.

- **A sigmoidoscopy** — here, a light, flexible tube is inserted into the rectum and lower colon to look for polyps and cancer as well as to remove polyps or tissue samples for further examination.
- **A colonoscopy** — this is similar to a sigmoidoscopy, but the tube is inserted further, throughout the entire colon.
- **Additional methods** — these include computed tomography colonography (virtual colonoscopy), double contrast barium enema, and stool DNA tests.

One systematic review assessed the recommendations from 15 global guidelines on colorectal cancer screening.⁶⁶ In general, the majority of guidelines recommended screening average-risk patients aged 50 to 75 years at different intervals according to the screening test, namely FIT or FOBT annually or biennially, sigmoidoscopy every five years, and colonoscopy every 10 years.⁶⁶ Discrepancies regarding the screening interval, preferred screening methods and target age ranges were noted.⁶⁶

3.2.2.4 Other cancers

Additional screening programmes targeting different types of cancer are under investigation, including liver, lung, oral, ovarian, prostate, skin, stomach and thyroid cancers.⁴⁹

Similarly to breast cancer, self-examinations for these other types of cancer can also prove to be useful for patients to recognise changes and seek further evaluation if necessary. For example, patients could perform testicular self-examinations and look out for any lumps or swelling, a sensation of heaviness, or a change in size, shape, consistency or feel of the testicles.⁶⁸ Another example of self-examination is using the ABCDE method to recognise any skin abnormalities by looking for the following elements on moles:⁶⁹

- Asymmetry;
- Borders that are irregular, scalloped, or poorly defined;
- Colours that are varying;
- Diameters that appear concerning; and
- Evolution of the mole.

3.3 Early diagnosis

Early diagnosis interventions aim to reduce the number of patients with late cancer diagnoses through increased identification of the first signs and symptoms of cancer (or “red flag” symptoms) and through improved accessibility and affordability of investigational, treatment, and referral services.⁴⁸ In other words, the objective of such measures is to ensure prompt referral, investigations and treatment at the occurrence of the first signs and symptoms of cancer. Early diagnosis is deemed relevant to many types of cancer, including those of the breast, cervix, mouth, larynx, colon, rectum and skin.⁴⁸

As front-line healthcare professionals, pharmacists are often consulted and trusted for advice beyond medicines use, including counselling on a variety of health conditions and minor ailments. Pharmacists therefore have an important role to play in ensuring patients who present with any concerning or “red flag” signs and symptoms are adequately referred for further investigations. This could occur, for example, during counselling on non-prescription or traditional, complementary or alternative medicines. Pharmacists should continue to rely on their academic and professional development to recognise any signs or symptoms that would warrant additional testing and investigations. Reference documents, such as the [NICE guidelines on suspected cancer recognition and referral](#), may also assist pharmacists in contributing to early diagnosis measures.⁷⁰

3.4 Pharmacist involvement

Pharmacists play a pivotal role in early cancer detection through involvement in screening and early detection programmes. As they frequently interact with patients and are well embedded within communities, pharmacists are well-placed to provide education to patients on early cancer detection through a variety of means, such as including tailored screening guidelines as part of prescription medicine package inserts, and

educating patients during healthy lifestyle interventions and medication counselling. Educational material, such as leaflets or audio-visual campaigns on display in pharmacy waiting areas, could also be provided.

Pharmacists can also participate by contributing to the identification of eligible patients through risk assessment tools or standardised questionnaires. Owing to their proximity to patients, pharmacists can actively participate in identifying patients who would be candidates to enrol in screening initiatives and can refer them to appropriate facilities and specialties for further testing. Pharmacists should be aware of local, regional and national cancer screening programmes which could facilitate access to educational resources, testing materials and referral pathways. Recognising when patients present with signs or symptoms that warrant further investigations is a core component of pharmacists' responsibilities in early cancer detection.

Finally, cancer screening initiatives can also take place in community pharmacies if the necessary resources and conditions are in place for their ensured success. Different instances of pharmacist-led cancer screening programmes have been described. For example, in Switzerland, a community pharmacy-based colorectal cancer screening campaign was performed through the assessment of risk factors using a questionnaire.¹⁸ Candidates deemed at high risk were referred to physicians for further evaluation, whereas the remainder of candidates were provided with a FIT test along with counselling.¹⁸ Candidates with positive FIT test results were also referred to physicians.¹⁸ In Ireland, colorectal cancer screening uptake was increased when screening kits were distributed through the community pharmacy network.¹⁸ Similarly, in Spain, pharmacists are also regularly involved in colorectal cancer screening campaigns. Targeted individuals are invited on behalf of the regional governmental health authority to present themselves to their nearest participating pharmacy to obtain information regarding colorectal cancer screening as well as a testing kit.¹⁸ Once the sample has been collected at home, the kit is returned to the pharmacy, and the sample is sent off for laboratory analysis.¹⁸ The results of these campaigns have shown an increase in screening uptake as well as high patient satisfaction with regard to the pharmacy-based service.¹⁸

A community pharmacy-based skin cancer screening programme took place in Norway. Photographs of patients' skin were taken in the pharmacy consultation room and then sent to a specialist for analysis.¹⁸ Pharmacies were viewed as ideal locations to conduct such screening services due to their proximity and accessibility.

Case study

Yasmina is a community pharmacist who believes it is important to develop and maintain relationships of trust with all her patients. One morning, she is called to provide counselling for a patient started on anastrozole for the treatment of breast cancer. As she approaches the consultation booth, Yasmina sees a regular patient of hers, whom she has got to know over the years.

During the counselling session, Yasmina learns that the patient did not come to pick up the medicine for herself, but rather for her sister who was recently diagnosed with breast cancer. After providing counselling on the medication, Yasmina explores the possibility of risk assessment with her patient, now knowing that she has a first-degree relative with breast cancer. She educates the patient on different screening methods, including self-examination and mammography as well as genetic testing, and stresses their importance considering the patient's increased risk of developing breast cancer. With the consent of her patient, Yasmina drafts a letter to the patient's general practitioner, informing them that further risk assessment should be conducted. Yasmina also provides the patient with educational resources to learn more about breast cancer and screening, and she offers her availability to answer any additional questions the patient may have.

Thanks to Yasmina's proximity and relationship of trust with her patients, she was able to identify an opportunity for education on breast cancer screening in addition to utilising her role as a first-line, healthcare professional to refer the patient for additional risk assessment and screening.

4 Management of cancer

The management of cancer is intricate, often requiring assessments by different specialists and healthcare professionals and multi-modal treatments. With regard to pharmacological options, oncology remains an ever-changing field, with novel therapeutic options being regularly researched, developed and made available for use.

As medicines experts and integral parts of healthcare teams, pharmacists play pivotal roles in the management of cancer, especially with regard to optimising medicines use. Knowledge of the clinical presentation, diagnostic criteria and non-pharmacological treatment options regarding cancer remains important for pharmacists to provide optimal, patient-centred care.

4.1 Clinical presentation and diagnosis

The clinical presentation of cancer is varied, and patients will experience different signs and symptoms according to the primary site of the disease. Furthermore, these signs and symptoms are usually non-specific and may also be caused by other illnesses or injuries, highlighting the importance of noting their details, such as onset, duration and progression, to provide a history that is as accurate as possible and that complements other investigative measures.⁷¹ Infants and children may be unable to localise or specify what they are feeling or experiencing, adding a layer of complexity to the evaluation of the condition.

Some of the more common signs and symptoms of cancer include:^{71,72}

- Headaches, vision or hearing changes, or seizures;
- Fatigue or extreme tiredness that is not relieved by sleep or rest;
- Pain that does not improve or that worsens;
- Fever or night sweats for no known reason;
- Cough or hoarseness that does not improve;
- Weight gain or weight loss of at least 4.5 kg (or 10 pounds) for no known reason;
- Changes in appetite, such as loss of appetite, dysphagia, abdominal pain, nausea or vomiting;
- Changes in bowel habits (diarrhoea or constipation), melena or haematochezia;
- Sores on the tongue or mouth or bleeding, pain or numbness in the lip or mouth;
- Bladder changes, such as dysuria or haematuria;
- Lumps or swelling in the body;
- Lumps or thickening in the breast, or nipple changes or discharge from the nipple;
- Changes to skin, such as lumps that bleed or that turn scaly, new moles or changes to existing moles, sores that do not heal or jaundice; and
- Unusual bleeding or bruising for no known reason.

To diagnose cancer, different methods are used by cancer specialists and physicians. These include:⁷³

- **Laboratory tests** — of blood, urine or other bodily fluids, which may test for tumour markers that are produced at higher levels by cancer cells, such as alpha-fetoprotein, CA 19-9, carcinoembryonic antigen and prostate-specific antigen;⁷⁴
- **Imaging tests** — such as computed tomography scans, magnetic resonance imaging, single-photon emission computed tomography scans, positron emission tomography scans, nuclear and bone scans, ultrasounds and X-ray; and
- **Biopsies** — during which a physician removes a tissue sample through needle aspiration, endoscopy (such as during colonoscopies or bronchoscopies) or surgery. The tissue sample is then reviewed by a pathologist and graded.⁴

Along with this information, if a cancer is confirmed, the physician will determine the stage of the cancer which will orient the treatment plan and prognosis.⁵

4.2 Pharmacological treatment

A wide array of different treatment classes exists to treat cancer. Broadly speaking, therapies can fall under different categories. On one hand, treatments with the objective to cure cancer are considered to be of curative intent, whereas treatments aimed at maintaining an adequate quality of life are undertaken with a palliative intent. On the other hand, treatments may be considered neoadjuvant where their goal is to decrease tumour size prior to other treatments, such as surgery or radiation therapy. If the treatment goal is rather to destroy remaining cancer cells following other forms of treatment, then the treatment is referred to as adjuvant.

4.2.1 Hormonal therapy

Hormonal therapy, also known as hormone or endocrine therapy, is used to inhibit or alter hormone regulation to ultimately stop or slow cancer growth. This type of treatment is primarily used in breast and prostate cancer, but can also be used in other hormone-dependent cancers, such as endometrial and adrenal cancers. Different types of medicines are used according to cancer types (Table 1).

Table 1. Examples of hormonal agents used in cancer treatment^{75,76}

Type of cancer	Pharmacological agents	
Breast	Aromatase inhibitors	Anastrozole, exemestane, letrozole
	Selective oestrogen receptor modulators	Tamoxifen, raloxifen
	Oestrogen receptor antagonists	Fulvestrant, toremifene
	Luteinising hormone-releasing hormone (LHRH) agonists	Goserelin, buserelin, leuprolide, triptoreline
	Androgen therapy	Testosterone
Prostate	Androgen deprivation therapy (anti-androgens)	Apalutamide, enzalutamide, darolutamide, bicalutamide, flutamide, nilutamide
	Androgen biosynthesis inhibitors (CYP17 inhibitors)	Abiraterone, ketoconazole
	LHRH agonists	Goserelin, buserelin, leuprolide, triptorelin, histrelin
	LHRH antagonists	Degarelix, relugolix

Other agents used include somatostatin analogues (lanreotide, octreotide), thyrotropin stimulating hormone agonists, progestins (medroxyprogesterone, megestrol) and prolactin lowering agents (bromocriptine, cabergoline, quinagolide).

The majority of medicines used in hormonal therapy are usually administered through the oral, intramuscular or subcutaneous routes.⁷⁵ The most common adverse effects include decreased libido, hot flashes and fatigue; in women, hormonal therapy may also contribute to a higher risk of fractures, thrombosis, stroke and heart disease.⁷⁵ Tamoxifen, a selective oestrogen receptor modulator used in the treatment of hormone-dependent breast cancer, may increase the risk of endometrial cancer in a dose- and time-dependent manner.⁷⁷ However, the benefits of treatment may outweigh the risks, and routine endometrial surveillance is not recommended unless the patient is considered at high risk for endometrial cancer.⁷⁷ Tumour flares may also occur upon initiation of treatment with LHRH agonists, and the addition of anti-androgens may be required to mitigate the effects of this flare.⁷⁸

Surgical interventions to remove hormone-producing organs, such as orchiectomy or oophorectomy, may also be considered as hormonal therapy.⁷⁵

4.2.2 Chemotherapy

Chemotherapy works by inhibiting the growth and proliferation of rapidly dividing cells.⁷⁹ It is not specific to cancer cells and also affects surrounding healthy cells, justifying its potential for significant adverse effects and the necessity for precise dosing regimens, monitored administration and regular follow-ups.⁷⁹ Chemotherapy can also be used to alleviate cancer-related symptoms.⁷⁹ Chemotherapy agents can be classified in different categories (Table 2).

Table 2. Examples of chemotherapy agents used in cancer treatment⁷⁶

Category	Mechanism of action	Pharmacological agents
Alkylating agents	Inhibition of deoxyribonucleic acid (DNA), ribonucleic acid (RNA) or protein synthesis	Nitrogen mustards (cyclophosphamide, bendamustine), platinum agents (carboplatin, cisplatin, oxaliplatin), hydroxyurea
Antimetabolites	Interruption of DNA and RNA synthesis when incorporated into natural body substances due to structural resemblance to DNA and RNA pairs	Pyrimidine analogues (azacytidine, capecitabine, fluorouracil), adenosine analogues (cladribine), purine analogues (mercaptopurine), and folate analogues (methotrexate, pemetrexed)
Antimicrotubule agents	Prevention of the cell growth phase through interference with microtubule function and formation	Vinca alkaloids (vinblastine, vincristine), taxanes (docetaxel, paclitaxel, cabazitaxel)
Topoisomerase I and II inhibitors	Inhibition of the enzyme topoisomerase, which is responsible for maintenance of DNA structure	Irinotecan, topotecan, etoposide, anthracyclines (doxorubicin, daunorubicin, idarubicin)

Other chemotherapy agents include asparaginase, bleomycin, decitabine, romidepsin and vorinostat.⁷⁶

Chemotherapy is usually administered as part of a protocol in combination with other medicines on a cycle-based dosing regimen and is often part of a multi-modal treatment approach. Many chemotherapies are administered through the intravenous route, but other routes of administration are also used and include the oral, intramuscular, subcutaneous, intrathecal, intraperitoneal, intra-arterial and topical routes.⁷⁹ Some chemotherapy regimens require central venous access for their safe administration. Given their cytotoxic potential, the preparation and handling of these medicines requires special care that is usually governed by specific standards and recommendations to prevent contamination and accidental exposure.

The adverse effect profile of chemotherapeutic agents is vast and can range in incidence and severity according to the chemotherapy class and specific pharmacological agent. Measures should be pre-emptively taken to help prevent adverse events, reduce their severity and support their management for patients to be able to maintain appropriate quality of life.

4.2.3 Targeted therapy

Targeted cancer therapies work by primarily affecting specific protein mutations that would normally allow for tumour growth and replication throughout the body; this is in contrast to chemotherapy, which rather works to destroy all rapidly dividing cells, both cancerous and healthy.⁸⁰ Targeted therapy works through different mechanisms, such as supporting the immune function in destroying cancer cells, inhibiting cancer cell growth, inhibiting angiogenesis in tumour cells, delivering cytotoxic substances to targeted cells, and preventing hormone growth.⁸⁰ Targeted therapeutic agents can be classified as small molecule inhibitors, which are used for intracellular targets, or as monoclonal antibodies, which attach to target receptors found

on cell surfaces.⁸⁰ Typically, before initiation of these medicines, pharmacogenetics testing is required to confirm the presence of the target protein mutation.

A variety of targeted therapy agents, each with their own target protein mutation, is currently available on the market. These medicines target different proteins, receptors and ligands, such as HER2 (trastuzumab), CD20 (rituximab), epithelial growth factor receptor (EGFR) or tyrosine kinase (erlotinib, sunitinib, imatinib, dasatinib), mammalian target of rapamycin (mTOR) (everolimus), poly ADP-ribose polymerase (PARP) (olaparib), cyclin-dependant kinase (CDK) (palociclib, ribociclib, abemaciclib), and JAK1 and JAK 2 (ruxolitinib).^{76,81}

Another type of targeted therapy is antibody-drug conjugates, which combine an antibody with a drug. These medicines work by having the antibody bind to its target and thereafter having the conjugated drug enter the cell to exert its effect, limiting damage to surrounding cells; examples include trastuzumab emtansine and brentuximab vedotin.⁸²

Helpfully, the suffixes of medicines in this class provide information regarding its classification:⁷⁶

- -mab — monoclonal antibody
- -zomib — proteasome inhibitor
- -nib — kinase inhibitor
- -olimus — mTOR inhibitor

These medicines may be administered by the oral, intravenous or subcutaneous routes.⁸¹ Common adverse events include diarrhoea, hepatotoxicity and skin reactions.^{80,81} Resistance to the targeted therapy is also possible, and thus combination therapy along with chemotherapy or radiation therapy may lead to improved outcomes compared with targeted therapy alone.⁸⁰

4.2.4 Immunotherapy

Immunotherapy heightens the patient's own immune system to work against malignant cells. It works in different ways, such as informing the immune system to target specific cancer cells as well as boosting and enhancing the immune function and immune response.⁸³ Different types of immunotherapies are available:^{76,83}

- **Immune checkpoint inhibitors** — these block immune checkpoints, which normally prevent the over-activation of the immune response. By blocking these checkpoints, immune cells can fully exert their function and respond more strongly to cancerous cells. Currently, several different medicines target specific immune checkpoints, such as PD1 (pembrolizumab, nivolumab, cemiplimab), PDL1 (atezolizumab, avelumab, durvalumab) and CTLA4 (ipilimumab).
- **Immunomodulatory agents** — these heighten the body's immune response against cancer. These agents can be categorised as: cytokines (aldesleukin, interferon, peginterferon); vaccine therapy with bacillus Calmette-Guerin, a live, attenuated bacterium that exerts antitumour effects; and immunomodulatory medicines or biologic response modifiers (thalidomide, lenalidomide, pomalidomide). Other agents in this class include vitamin A derivatives and imiquimod.
- **Monoclonal antibodies** — as previously mentioned, can also be considered as immunotherapies.
- **T-cell transfer therapy** — specifically tumour-infiltrating lymphocyte therapy and chimeric antigen receptor (CAR) T-cell therapy, otherwise known as adoptive cell therapy, adoptive immunotherapy or immune cell therapy, also represents a form of immunotherapy, particularly for haematological cancers. Through these therapies, a patient's own immune cells are collected, then grown in large quantities *in vitro* before being administered back to the patient.

Immunotherapies are usually administered by the intravenous or oral routes, but may also be given topically or through the intravesical route.⁸³ Because immunotherapy heightens the immune response, the majority of its associated adverse effects occur as a form of inflammation.⁸³ These symptoms, named immune-related adverse events, have the potential to become quite severe or even fatal, requiring hospitalisation and administration of corticosteroids or biologic agents to attenuate the immune response.

4.3 Additional treatment options

4.3.1 Radiation therapy

Radiation therapy, also called radiotherapy, is used in both cancer treatment and cancer-associated symptom relief, usually in combination with other treatments.⁸⁴ This type of therapy works by using high doses of radiation to kill cancer cells and decrease tumour size.⁸⁴ Radiation can be administered either externally through external beam radiation therapy or internally, whereby a solid or liquid source of radiation is inserted inside the body.⁸⁴ External beam radiation therapy and internal radiation therapy with a solid source (brachytherapy) are considered local treatments, whereas internal radiation therapy with a liquid source is considered a systemic treatment.⁸⁴ Cell death occurs days or weeks following the radiation therapy session once the DNA has been sufficiently damaged.⁸⁴

Despite local effects, nearby healthy cells are also at risk of being damaged and destroyed by radiation therapy, which can cause a number of adverse effects depending on the affected area.⁸⁴ To mitigate the risk of more severe and long lasting adverse effects, lifetime dose limits dictate how much radiation therapy a specific area can safely receive.⁸⁴

4.3.2 Surgery

Surgery may be performed to remove tumours, debulk them, or alleviate cancer symptoms secondary to pain or pressure caused by the tumour.⁸⁵ Surgery may be open or minimally-invasive; at times, it may not involve cutting into the body, such as in cases of cryosurgery, laser, hyperthermia (thermal therapy) or photodynamic therapy.⁸⁵

Examples of surgeries that may be performed include breast removal (mastectomy), uterus removal (hysterectomy), ovaries and fallopian tube removal (salpingo-oophorectomy), pulmonary lobe removal (lobectomy), prostate resection, and bowel or colon resection.

Surgery is not, however, without significant risks, and a thorough analysis of the benefits and risks associated with undergoing surgery according to patient preferences and characteristics is always warranted. Pain, infection and bleeding are among the complications associated with surgery.⁸⁵

4.3.3 Haematopoietic stem cell transplant

Haematopoietic stem cell transplant (HSCT) or bone marrow transplant involves the administration of healthy haematopoietic stem cells to patients with depleted bone marrow, usually in cases of leukaemia, myeloma or lymphoma.⁸⁶ The therapy is made up of a series of different steps:^{86, 87}

1. Once a patient has been deemed a suitable candidate for HSCT, the first step is to harvest healthy stem cells for storage. These stem cells can be harvested from the blood, bone marrow (usually from the hip bone), or cord blood (from the placenta and umbilical cord of a newborn). According to the source of stem cells, the HSCT is deemed autologous (stem cells come from patients themselves), allogeneic (stem cells come from a donor), or syngeneic (stem cells come from the patient's identical twin).
2. Thereafter, the patient undergoes a conditioning treatment, usually consisting of high doses of chemotherapy with or without radiation therapy, to destroy existing bone marrow and cancer cells as well as to inhibit the immune response. Because of the decreased immune response caused by the conditioning treatment, antimicrobial (antibacterial, antifungal, antiviral) prophylaxis is administered during and following the transplant.
3. Finally, the healthy stem cells are transplanted into the patient where they will replace cells that were destroyed by the conditioning treatment and support the recovery of bone marrow function. In some cases of allogeneic transplant, the transplanted stem cells may work directly against the cancer cells through a graft-versus-tumour effect.

Complications of HSCT include myelosuppression and infection in addition to the adverse effect profile of the administered chemotherapy and radiation therapy.^{86, 87} Following allogeneic transplant, graft-versus-host disease may also occur, where the transplanted stem cells recognise the host's cells as foreign and begin attacking them, damaging organs, such as the skin, liver and intestines.⁸⁶ Identifying a donor whose stem cells

are more similar to those of the recipient and the use of immunosuppressant agents help reduce the risk of graft-versus-host disease.⁸⁶

4.3.4 Complementary or alternative treatment

There are currently no robust data to support the complementary or alternative treatment of cancer. Different measures, however, have been proposed to alleviate physical and psychological symptoms related to cancer.⁸⁸ Physical activity and exercise have been recommended and have been shown to be effective in improving quality of life.⁸⁸ Other measures, such as meditation and stress management (mindfulness), hypnosis, yoga, music therapy, cognitive behavioural therapy, relaxation, massage, acupuncture, imagery and creative outlets have also been noted.⁸⁸⁻⁹⁰

4.4 Pharmacist involvement

4.4.1 Patient assessment and medicines management

Once a treatment plan has been determined, pharmacists play important roles in patient assessment and medicines management to help ensure the treatment will be as effective and safe as possible as well as to identify, prevent and address patients' needs and concerns.

Pharmacists should utilise their proximity to patients and accessibility within communities to accompany their patients throughout their journey with cancer. Patient assessments can be performed at various points of contact with them, namely during counselling for newly prescribed medicines, education on non-prescription and complementary or alternative medicines, prescription medicine renewals and follow-up interactions. All interactions and discussions conducted with patients should be properly documented in the patient's file, and prompt referral should be made if the patient presents any alarming or red flag signs or symptoms. Themes that may be the subject of patient assessments include:

- **Effectiveness of the treatment plan** — Pharmacists are well-equipped with the knowledge and tools to comprehend indications for treatment and treatment lines. Whereas the treating team is primarily responsible for determining the treatment choice and dosing regimen, pharmacists can act as a final “safety net” and ensure that the prescribed treatment is in accordance with the patient's diagnosis, performance status, prior treatment options and prognosis. This is especially true for oral medicines or those that may be administered at home, for which pharmacists are professionally liable for their supply and dispensing.
- **Safety of the treatment plan** — Educating patients on the risk of possible adverse events as well as monitoring for them during the course of therapy are key components in pharmacists' duty in ensuring the safe and appropriate use of medicines. Monitoring for safety includes monitoring for adverse events and complications that may arise with cancer treatment, but also includes ensuring supportive measures have been put into place to prevent or manage such events should they occur. In assessing for safety, pharmacists are also responsible for referring patients to their treating team or to an appropriate healthcare professional for further management if required.
- **Risk of interactions** — Pharmacists are relied upon to monitor for the risk of drug-drug, drug-food, and drug-disease interactions. This is especially true for patients undergoing cancer treatment because the risk of adverse events and complications is significant. As such, a thorough medication review should be performed by pharmacists to identify interactions between the cancer treatment and active medicines. Verifying for interactions with non-prescription medicines as well as traditional, complementary or alternative medicines is also essential to prevent any potential medication-related harm.
- **Medication adherence** — Pharmacists play an important role in assessing for medication adherence in patients. In cancer care, many factors may come into play and affect patients' capacity to take their medicines as prescribed. Issues surrounding availability and supply, cost and complex dosing regimens may further influence medication adherence. Paediatric patients, who may not be able to wholly express their concerns, may present with further challenges in taking their medicines. Pharmacists are therefore well-positioned to assess these factors and encourage medication adherence with the ultimate aim of improving outcomes.

- **Cost and supply** — Treatment options in cancer care can be costly and difficult to obtain, representing significant barriers for patients to access and adhere to their treatment regimen. Utilising their knowledge of health systems, pharmacists are well-placed to guide patients as they navigate coverage and funding options through special access or compassionate programmes.

Patient assessments and medicines management represent key parts of pharmacists' responsibilities as first-line, accessible healthcare professionals. Cancer diagnoses and treatments in particular can place a significant toll on patients' physical and mental health and well-being; pharmacists therefore represent important allies in supporting patients with their cancer treatment and in helping them maintain their quality of life. On that note, FIP's publication "[Mental health care: A handbook for pharmacists](#)" may be a valuable resource to support patients experiencing mental distress.

4.4.2 Handling, storage and disposal

4.4.2.1 Hazardous medicines

Many medicines used in the treatment of cancer, but also for other indications, pose important health risks for those who manipulate them. Acute and chronic effects on health, ranging from skin rashes to adverse reproductive outcomes including infertility and congenital malformations, have been reported by individuals with occupational exposure to such medicines.⁹¹

Based on a previous definition conceived by the American Society of Health-System Pharmacists, the National Institute for Occupational Safety and Health (NIOSH) developed a definition of a hazardous medicine (or hazardous drug) which has served to establish education and guidance on the handling, storage and disposal of such medicines and which is widely used across health systems and establishments worldwide.⁹²

A hazardous medicine is defined as presenting one or more of the following characteristics in humans or animals:⁹²

- Carcinogenicity;
- Teratogenicity or other developmental toxicity;
- Reproductive toxicity;
- Organ toxicity at low doses;
- Genotoxicity; or
- Structure or toxicity profiles of new medicines that mimic existing medicines determined hazardous by the aforementioned criteria.

Hazardous medicines encompass those used in cancer treatment, but also include some antiviral medicines, antibiotics, hormones and bioengineered medicines which may interfere with cellular growth and function.^{38,92} Cytotoxic drugs may be considered as a subset of hazardous drugs.³⁸ They usually include chemotherapy and antineoplastic agents that affect cell growth and proliferation, typically exerting their effects on both malignant and healthy cells.³⁸

Exposure to hazardous drugs can occur through different routes, such as inhaling droplets, particulates or vapours after piercing medicine vials or ampoules, administering intravenous medicines, removing air from a syringe or infusion line, or managing leakages from tubing or syringes.³⁸ Skin contact, accidental oral ingestion and accidental needlestick injuries are other potential routes of exposure.³⁸

Whereas a number of medicines may be considered inherently dangerous based on their characteristics, additional factors, such as methods of manipulation, exposure controls and ventilation or decontamination settings, and use of personal protective equipment, also come into play when determining the risk of potential harm for individuals who manipulate them.⁹² It is, however, evident that clear policies, procedures, protocols and measures are necessary to minimise such risk of contamination and accidental exposure.

NIOSH publishes and updates a list of hazardous medicines that can be used to develop and guide safe practices regarding the handling, storage and disposal of these medicines.^{93,92} The International Agency for Research on Cancer and eviQ from the Cancer Institute of New South Wales also maintain lists of hazardous medicines.^{93,94}

4.4.2.2 Practices for health care-based settings

Clear measures should be taken to limit direct contact with hazardous drugs and reduce the risk of accidental contamination and exposure. This holds especially true for pharmacists and pharmacy personnel who are in direct and frequent contact with cytotoxic medicines and other hazardous medicines.

Bodies such as the International Society of Oncology Pharmacy Practitioners and the European Society of Oncology Pharmacy have developed a thorough series of standards with regard to the handling of cytotoxic agents.^{38,95} With regard to the handling of hazardous medicines in health establishments, measures and recommendations in the standards include:³⁸

- The use of containers to transport hazardous medicines that will resist damage resulting in leakage;
- Clear labelling and identification of containers used to transport and store hazardous medicines (such as the Yellow Hand initiative);⁹⁵
- The use of individual, disposable packaging offering protection from light and breakage;
- The implementation of procedures regarding leakage or spills of hazardous medicines, including the availability of a spill kit;
- Strict hygiene measures prohibiting eating, drinking or the wearing of jewellery when handling and preparing hazardous medicines;
- Training and education on hazardous medicines, cytotoxic risks, safe handling, aseptic techniques and use of personal protective equipment; and
- The presence of certified, controlled infrastructure, facilities and equipment for the reconstitution and preparation of hazardous medicines, including measures for appropriate temperature, ventilation, airflow and air quality.

With respect to the handling, storage, and disposal of hazardous medicines in pharmacies, different measures and precautions should be taken, such as:³⁸

- Personal protective equipment, such as masks, gloves, head coverings and gowns for personnel handling hazardous medicines;
- Dedicated and clearly identified areas to store hazardous medicines using dedicated medication cabinets, storage bins, stickers and other markers;
- Dedicated equipment to handle hazardous medicines, including dedicated pill counters, canisters and cleaning equipment;
- Dedicated equipment to dispose of hazardous medicines and organised waste management processes;
- Clearly identified, damage-resistant packaging materials for transport and dispensing;
- Spill kits or decontamination kits; and
- Training and education of pharmacy personnel on best practices surrounding the handling, storage and disposal of hazardous medicines.

4.4.2.3 Practices for home settings

Chemotherapy agents can be administered by a variety of routes, traditionally at outpatient oncology clinics and health establishments. However, self-administration of medicines through parenteral devices or orally has become more prominent. Patients should therefore be adequately educated on proper practices regarding the handling, storage and disposal of hazardous medicines at home.

At-home infusion of cancer treatment presents a series of different benefits and challenges. For some patients, at-home infusion may be preferred as it helps overcome barriers with regards to scheduling and appointment availability. Moreover, in contexts where social distancing is required, such as the COVID-19 pandemic, at-home infusion represents an attractive solution for pursuing treatment while avoiding treatment delays or interruptions.⁹⁶ Nonetheless, this method of infusion also poses important challenges, including infusion device malfunctioning and the absence of direct monitoring and management should an adverse event occur.⁹⁶

Oral cancer medicines are being increasingly used by patients in the community, and pharmacists are therefore responsible for educating patients on best practices regarding their handling, storage and disposal to avoid accidental exposure and contamination. Several international pharmacy bodies and panels have proposed recommendations, which include:^{38, 97}

- Safely store cancer medicines out of reach of children and pets, and away from areas where food and drinks are stored or consumed;
- Ensure cancer medicines are protected from light, extreme temperatures and humidity, ideally in their original packaging;
- Wear gloves when handling cancer medicines, washing hands before putting gloves on and after their removal;
- Use dedicated adherence devices or pill boxes for cancer medicines;
- Undertake precautionary hygiene measures, such as sitting when urinating, closing the toilet lid when flushing, and double flushing;
- Wash the patient's clothing and linen separately from other items; and
- Avoid disposing of cancer medicines in the toilet or garbage and instead return soiled, damaged, unused, discontinued or expired cancer medicines to the pharmacy or hospital for proper disposal.

Ensuring proper measures to avoid contamination and exposure are necessary when manipulating hazardous and cytotoxic medicines. In low- and middle-income countries, however, significant variability and gaps have been highlighted with regard to the safe handling of cytotoxic medicines.⁹⁸ Efforts should continue to be made to ensure the necessary organisational, logistical, financial and human resources are available to implement safe handling practices for both healthcare personnel and patients worldwide.⁹⁸

Case study

Nia works in a community pharmacy in a small town. An elderly woman presents herself at the pharmacy counter, stating that she has been advised that her new medicine is ready for pick up. The pharmacy assistant invites the patient to the consultation booth and notifies Nia of her arrival.

Prior to meeting with the patient, Nia reviews the patient's file and medication list. She discovers that this patient was recently diagnosed with chronic myeloid leukaemia and has been expressing many concerns and fear over her new cancer diagnosis. She has been feeling anxious while waiting to begin her new treatment with imatinib.

Nia meets with the patient and begins by reviewing her diagnosis and explaining the medication regimen, discussing the mode of administration and risk of possible adverse effects. While the patient did express some concerns about being able to swallow the tablets, Nia was able to reassure her that she would be able to dissolve them in a glass of water or juice if she had any difficulties with swallowing.

During the counselling session, Nia also notices that the patient is holding a bottle of St John's Wort in her hands. When asked about the medicine, the patient explains that her new cancer diagnosis has brought on significant distress that has impacted her quality of life. A neighbour therefore recommended the non-prescription medicine to alleviate her negative feelings.

Careful about the risk of drug-drug interactions, Nia explains to the patient that taking St John's Wort concomitantly with imatinib is not recommended due to a significant and unpredictable decrease in imatinib plasma concentrations, which could affect the treatment of her cancer. Throughout their discussion, Nia remains attentive to the patient's concerns and provides helpful suggestions, such as emphasising that pursuing regular, daily activities could help maintain quality of life. Finally, Nia organises a follow-up with the patient at her next imatinib renewal. Should she still be feeling symptoms of distress, Nia invites the patient to contact her and, if needed, she would communicate with her treating team if further management were required.

5 Treatment optimisation

Cancer treatments are complex and have evolved to include medicines utilising different mechanisms of action and modes of administration, each of them associated with various safety and tolerance profiles. As medicines experts, pharmacists are well placed to help ensure that cancer treatments, beyond their intention to treat cancer, remain manageable and tolerable for patients.

5.1 Adverse events

5.1.1 Terminology and classification

The National Cancer Institute has developed and published Common Terminology Criteria for Adverse Events (CTCAE) related to oncology.⁹⁹ The CTCAE consists of a descriptive terminology with severity grading scales for different types of adverse events:⁹⁹

- Grade 1 — mild or asymptomatic adverse event; no interventions indicated
- Grade 2 — moderate adverse event; minimal, local or non-invasive intervention indicated
- Grade 3 — severe or significant, but not immediately life-threatening; hospitalisation or prolongation of hospitalisation indicated
- Grade 4 — life-threatening consequences; urgent intervention indicated
- Grade 5 — death related to the adverse event

For example, the adverse event of oral mucositis (a disorder characterised by ulceration or inflammation of the oral mucosa) is defined in version 5 of the CTCAE as follows:⁹⁹

- Grade 1 — Asymptomatic or mild symptoms; intervention not indicated
- Grade 2 — Moderate pain or ulcer that does not interfere with oral intake; modified diet indicated
- Grade 3 — Severe pain; interfering with oral intake
- Grade 4 — Life-threatening consequences; urgent intervention indicated
- Grade 5 — Death

5.1.2 Pharmacist involvement

As medication experts, pharmacists are well placed to help prevent adverse events related to cancer therapy. For example, pharmacists can identify potential interactions between medicines, alternative, traditional, or complementary medicines, foods and disease states. Through services such as medication reviews and medicines reconciliation, pharmacists can partner with patients, analyse medicines information and mitigate the risk of medicine-related harm that may not otherwise have been identified by other healthcare professionals. Providing adequate patient education through counselling and follow-up is also a much needed step to ensure patients are able to identify and report any potential adverse effect that may be due to their cancer treatment.

Furthermore, pharmacists are accessible healthcare providers; in the community setting particularly, pharmacists are for many patients the first point of contact when discussing health concerns. Pharmacists are thus well placed to collect important data on patients' chief complaints and screen for potentially serious adverse events. As knowledgeable healthcare professionals, pharmacists can utilise information from various sources, including guidelines, reference documents and medical literature, to help patients manage their symptoms, or to refer them to a relevant healthcare professional for further management. In cases of less serious adverse events, pharmacists can recommend non-pharmacological measures and non-prescription medicines, and support patients to engage in self-care while ensuring adequate monitoring and follow-up. In some jurisdictions or through collaborative practice agreements, pharmacists may also be able to independently initiate therapies as part of supportive care to promptly help manage adverse events.

For pharmacists to exercise their complete role in cancer treatment optimisation, they must be well supported. For example, they should have access to different clinical information, including medication histories, imaging results, laboratory results and clinical documentation to help complete their data collection and support their clinical decision-making. Pharmacists should also work within interdisciplinary teams or have facilitated access to referral services, for example, to the patient's oncologist or pivot nurse (or nurse navigator), for prompt management of symptoms.

5.1.3 Examples of management of adverse events

Adverse events are to be expected with medicines used to treat cancer, and their impact on patients' well-being can be significant to the point where treatment interruption or even cessation is required. Pharmacists are key players in the management of adverse events related to oncology treatment. They play an important role in educating, identifying, referring and managing patients who experience adverse effects over the course of their treatment.

5.1.3.1 Mood changes and fatigue

Mood changes and fatigue are among the most common cancer treatment-related adverse effects.¹⁰⁰ Although fatigue can be caused by the different types of medicines used to treat the cancer, it can also be due to the effects of the cancer itself on the individual, including cancers that affect hormones, such as breast and prostate cancer.¹⁰⁰ Mood changes and fatigue may also be caused by different health conditions or states experienced by the individual with cancer, including anxiety and depression, anaemia and changes in nutritional requirements.¹⁰⁰ Such cancer treatment-related fatigue may not be fully relieved, despite adequate rest and sleep, and can significantly interfere with day-to-day activities, relationships and job attendance.¹⁰⁰

As professionals in close contact with patients, pharmacists are ideally placed to screen for and identify cancer treatment-related fatigue during pharmacy visits or follow-ups. Patients can be asked questions regarding their levels of engagement in daily activities and general feelings of fatigue. Patients' medication can also be reviewed to identify potential health conditions that may cause or contribute to fatigue; the relief of related conditions may help improve feelings of fatigue.¹⁰⁰ Referral to an appropriate cancer care team member should be made by pharmacists.

5.1.3.2 Nausea and vomiting

Nausea and vomiting is an adverse effect with the potential to significantly affect a patient's quality of life and well-being. Up to 80% of patients receiving chemotherapy will experience nausea and vomiting to a certain degree.¹⁰¹ Complications may arise if nausea and vomiting are not well controlled, including metabolic and nutritional abnormalities, anorexia, oesophageal tears and significant impacts on mental health.¹⁰¹

Different factors influence the risk of adverse effects, including factors related to the type of cancer and type of treatment.¹⁰¹ Patient risk factors include the incidence and severity of nausea and vomiting during prior chemotherapy cycles, young age, female gender and history of morning sickness during pregnancy.¹⁰¹ Different classification systems have been identified to characterise different types of nausea and vomiting, including acute, delayed (late), anticipatory, breakthrough, refractory and chronic nausea and vomiting.¹⁰¹ Treatment options vary according to the risk of different types of nausea and vomiting.

On one hand, multiple non-pharmacological interventions are under investigation to mitigate the risk of nausea and vomiting. On the other hand, a wide array of medicines are used to manage nausea and vomiting and these can be found as parts of institution-established chemotherapy protocols, including, but not limited to 5-HT₃ receptor antagonists, NK-1 receptor (or substance P) antagonists, corticosteroids and competitive dopamine (D₂) antagonists.¹⁰¹ Clinical trials are under way to explore additional treatment options.

Pharmacists are key players in managing nausea and vomiting. From an educational standpoint, pharmacists are well equipped to educate patients on their antiemetic regimens and ensure medication adherence to dosing regimens that may be complex or difficult to understand. Pharmacists can also counsel patients on their specific cancer treatment recommendations and in doing so may clarify expectations regarding the risk of nausea and vomiting. They are also able to provide close follow-ups with patients, recommend non-pharmacological measures, and refer patients when further management is required. In institution or health

care establishment settings, pharmacists can contribute to the initiation or prescription of antiemetic regimens according to collaborative practice agreements or local professional regulations. They may also participate in key committees to guide the management of these important adverse effects.

Different guidelines regarding the management of chemotherapy-induced nausea and vomiting have been published and may be useful in helping pharmacists support patients who experience these symptoms.^{102–105}

5.1.3.3 Infection prevention

Certain cancer treatments, such as chemotherapy, work by decreasing the amount of different blood cells in the body, including white blood cells, which make up the main part of the body's defence system. Therefore patients undergoing cancer treatment may be more prone to infection, with the greatest risk usually occurring between seven and 10 days following the administration of the chemotherapy.¹⁰⁶ Infection prophylaxis, including antibiotic, antiviral and antifungal agents, may be administered to patients while they are undergoing treatment and may be continued for several months following their final treatment dose. Granulocyte colony stimulating factors are used to treat neutropenia. Prompt recognition of signs and symptoms of possible infection is key to managing infections in a timely manner and preventing complications, namely hospitalisations.

With regard to infection prevention, providing quality education to patients is important. While counselling patients on the different types of infection prophylaxis that are used, pharmacists should adequately educate patients on how to recognise potential infections, including red flag signs and symptoms that would merit prompt referral to a physician for further investigations. Pharmacists can also help in ensuring antimicrobial prophylactic regimens are appropriate and taken properly by the patient.

5.1.3.4 Skin reactions

Skin and nail changes can occur as a result of different types of cancer treatments and can range in presentation and severity.¹⁰⁷ Pharmacists thus play a critical role in educating patients on non-pharmacological measures and non-prescription medicines that are available to reduce the risk and severity of these skin changes in addition to supporting the management of these adverse effects when they do occur. Adequate skin care using non-irritating, recommended products and adequate UV protection are among the interventions pharmacists can make to support patients. In some cases, especially in cases of treatment with EGFR targeted therapy, proactive prevention of skin reactions, including acneiform eruptions and skin rashes, with both antibacterial prophylaxis and a topical corticosteroid is warranted.¹⁰⁸

5.1.3.5 Additional adverse events

Additional adverse effects are possible according to the type of cancer treatment and can include hair loss, loss of appetite, mucositis, diarrhoea and constipation.¹⁰⁹ In all cases, it is important that appropriate follow-up mechanisms and communication channels are set up and made readily available so that adverse events can be monitored in patients. Should such events occur, patients should be able to easily contact their pharmacist or cancer care team member for prompt evaluation and referral if necessary.

5.2 Complications

Pharmacists play an important role in managing adverse events, but they are also integral parts of healthcare teams managing complications of cancer and cancer treatments. Such complications can cause significant morbidity and mortality if they are not promptly and appropriately managed, therefore heightening the importance of the role of the pharmacist in their management.

Different complications of cancer and cancer treatment exist. Some of the most commonly reported are as follows:

- **Tumour lysis syndrome (TLS)** — is described as the most common disease-related emergency in patients with haematological malignancies.¹¹⁰ TLS occurs when a large amount of cells die within a short time, thereby releasing a large amount of cell contents that are not sufficiently eliminated.¹¹¹

Uric acid, potassium and phosphate levels can rise with concomitant hypocalcaemia and can affect different organs, such as the kidneys, heart, muscles and central nervous system.¹¹¹ Intravenous fluids and medicines like allopurinol, rasburicase, kayexalate, and phosphate binders may be administered to treat TLS.¹¹¹

- **Febrile neutropenia** — occurs when a patient experiences fever (temperature greater than 38°C or 100.3°F) and has neutropenia (an absolute neutrophil count under 500 per microlitre of blood).¹¹² When this occurs, patients are at a greater risk of developing an infection, sometimes in a severe form. Administering a growth factor, granulocyte colony-stimulating factor or granulocyte-macrophage colony-stimulating factor to patients undergoing treatment at high risk of neutropenia will support the development of neutrophils, thereby reducing the risk and duration of the neutropenia.¹¹²
- **Cancer-related hypercalcaemia or malignancy hypercalcaemia** — is defined as an albumin-adjusted serum calcium level greater than 2.6 mmol/l (10.5 mg/dl) secondary to an imbalance in the bone formation and degradation cycle; it can occur in up to 30% of patients with cancer.^{113, 114} In mild cases, patients may be asymptomatic, but they may develop lethargy and musculoskeletal pain.¹¹³ In more severe cases, hypercalcemia can cause volume depletion and kidney injury in addition to neurocognitive dysfunction, ranging from altered mental status to coma.¹¹³ Bisphosphonates, denosumab and corticosteroids may be administered to treat hypercalcemia.¹¹³
- **Immune-related adverse events** — occur in patients undergoing immunotherapy with immune checkpoint inhibitors. In these patients, their immune system erroneously targets their healthy cells and causes inflammation in many different parts of the body in the form of a rash, pneumonitis, colitis, arthritis or hepatitis, to name a few.¹¹⁵ These adverse events occur in approximately 20% of patients receiving immunotherapy and, if necessary, can be treated with corticosteroids or other biologic agents.¹¹⁵
- **Thromboembolic events** — are a risk for patients with cancer due to a variety of factors, including increased haemostasis, vascular injury from treatment, state of hypercoagulability and release of coagulant factors by cancer cells.¹¹⁶ Patients should be adequately assessed for thromboprophylaxis according to their medical history, baseline characteristics, comorbidities, type of cancer and treatment regimens, among other factors. Predictive models and risk assessment tools, such as the Khorana score, can be used to estimate the risk of thromboembolism.¹¹⁶ Low molecular weight heparin and, in some cases, direct oral anticoagulants, have emerged as the preferred pharmacological choices in the prevention and treatment of thromboembolic events.

Complications of cancer-related treatments can cause significant harm to patients who are already undergoing overwhelming and difficult treatments. Pharmacists are therefore required to ensure patients are able to recognise any sign or symptom that may be related to their cancer treatment. Patient education is a key area in which pharmacists can help patients, for example, in preventing infection if they are at risk of developing neutropenia. Finally, in inpatient settings, pharmacists may work directly within patient care teams to appropriately manage these complications by reviewing medication as well as by monitoring the effectiveness and safety of treatments.

5.3 Treatment in specific populations

5.3.1 Obesity

Patients with obesity or morbid obesity can present challenges for optimal cancer care delivery. Data have shown that high amounts of body fat are associated with a greater risk of developing cancer.²⁶ This may be explained by different factors, including increased hormone expression, hyperinsulinaemia and insulin resistance, oxidative stress due to increased inflammation, and effects on growth and metabolic regulators.²⁶ Importantly, several oncology medicines are dosed according to body weight or body surface area, and therefore dosing strategies may be more complex for patients with extremes of weight. Pharmacists are vital in ensuring dosages are appropriate to help guarantee the effectiveness and safety of the prescribed treatment regimen. Furthermore, pharmacists, as first-line healthcare professionals, remain essential in providing education on healthy lifestyles to obese patients to reduce their potential risk of developing cancer and non-communicable diseases.

5.3.2 Fertility preservation

It is recognised that cancer treatments, such as chemotherapy and radiation therapy, may exert gonadotoxic effects.¹¹⁷ For that reason, options have been explored for fertility preservation in both men and women. Fertility-sparing surgery and cryopreservation are among strategies that have been established.^{117, 118} In these cases, pharmacists play a leading role in patient education and should readily refer patients to fertility specialists. Furthermore, pharmacists should educate patients on proper waste and disposal methods of cancer treatments as well as reinforce their importance to prevent contamination and harm.

5.3.3 Paediatric cancers

Pharmacists may encounter paediatric patients undergoing cancer treatment. In fact, it is estimated that there are approximately 400,000 new cases of cancer in children and adolescents each year, with leukaemia, brain cancer, lymphoma and certain solid tumours, such as neuroblastoma and renal Wilms tumours, being the most common types.¹¹⁹

Supporting paediatric patients in cancer care is complex, considering how childhood cancers are difficult to prevented and identify early through screening.¹¹⁹ Care is essential for their physical and cognitive growth along with the necessary support for themselves and their families.

Case study

Lee is a pharmacist working in a community pharmacy located beside a busy cancer centre. He receives a prescription for regular, cyclical antiemetic medicines for one of his patients, who will imminently begin treatment for metastatic non-small cell lung cancer. No “as needed” antiemetic medicines were prescribed. While discussing the possibility of antiemetic medicines being prescribed, Lee notes that the patient had a significant history of hyperemesis gravidarum during her pregnancies.

Concerned with the risk of nausea and vomiting in this patient, Lee obtains her consent and discusses the case with the hospital oncology pharmacist. Lee discovers the patient will be undergoing a chemotherapy regimen with high emetogenic potential, which would further increase her risk of nausea and vomiting during treatment. Fortunately, the oncology pharmacist is authorised to independently prescribe supportive care medicines through a collaborative practice agreement implemented at the health institution and therefore sends a new prescription for “as needed” antiemetic medicines to Lee’s pharmacy.

After obtaining the prescription, Lee dispenses the additional “as needed” antiemetic medicines, planning a follow-up with the patient in several days following her first chemotherapy cycle.

6 Additional considerations

6.1 Cancer prognosis and end-of-life care

Despite advances made in the detection, treatment and management of cancer, prognoses may be shortened depending on patient comorbidities, stage of cancer and presence of complications. Predicting survival times may be performed based on clinical parameters. Prediction scores, such as the Palliative Performance Scale, Palliative Prognostic Index, and Palliative Prognostic Score, may also aid in determining predictions for survival.¹²⁰ Patient and family preferences will also affect the decision to move from complete cancer care towards palliative, comfort or end-of-life care. In such times, communication, compassion and respect are of the utmost importance. Goals of care become prioritised over interventional, life-prolonging approaches, and they focus on preserving quality of life, alleviating symptom burden, addressing spiritual and psychological distress, improving disease and prognosis understanding as well as supporting patients and their close ones as they move towards the end of life.¹²¹

Terminally ill patients, especially those with cancer, have intricate physical, psychological and spiritual needs that require the coordinated efforts of multidisciplinary teams, including pharmacists. These patients are likely to experience a variety of end-of-life symptoms, including pain, terminal delirium, fatigue, nausea, dyspnoea, cough, constipation, dysphagia and secretions (death rattle).^{120, 122} These symptoms can be particularly distressing, and proper management is therefore essential to ensure patient comfort.^{120, 123} Unconventional or off-label routes of administration, dosing regimens, and medicine formulations are frequently required to ensure adequate symptom relief, placing pharmacists at the core of adapting medication therapy to the patient.^{123, 124}

Conducting medication reviews is equally important to ensure that the treatment plan is consistent with the objectives of end-of-life care. During the last moments of life, cancer therapies are usually discontinued.¹²² Pharmacists should also be mindful of deprescribing active medicines that may no longer be necessary or effective; some of these medicines may even be causing harm by contributing to end-of-life symptoms.^{120, 122, 124} Patients with terminal illness may also present with dysphagia as well as worsening renal and hepatic impairment, which may affect medication management.¹²²

Palliative care can be provided in hospitals, hospice care facilities and patients' own homes. Therefore community pharmacists have an important role to play in supporting their patients with cancer. Beyond optimising medicines use and conducting medication reviews, they play important roles in coordinating seamless transitions of care and providing appropriate symptom identification management. They also collaborate with members of the healthcare team, and support patients and their close ones on medicines use during palliative care.^{123, 124}

6.2 Transitions of care

Transitions of care represent significant junctures in a patient's healthcare journey and may carry a risk of medication-related harm, including adverse events and medication errors induced by unintentional and intentional discrepancies when prescribing. This is especially true for patients with cancer who may visit different inpatient and outpatient settings and may undergo multi-modal treatments, both non-pharmacological and pharmacological, prescribed by a number of different specialists.

Pharmacists therefore are key players in reducing medication-related harm at transitions of care through the provision of a variety of services, including medicines reconciliation, medication review, patient education and post-discharge communication. When patients transition between inpatient and outpatient settings, pharmacists are well-equipped to obtain thorough medication histories and conduct medicines reconciliation to identify and reconcile any discrepancies in treatment. Obtaining medication histories could also help pharmacists identify current and potential medicine interactions, especially those pertaining to non-prescription, traditional, complementary or alternative medicines, providing valuable information for conducting proper medication reviews. Periodic medication reviews are also essential to ensure medication therapy is appropriate and adapted to patients, who may experience changes in their symptoms and

modifications in their renal or hepatic function, warranting adjustments to their pharmacotherapy. Moreover, as patients are encouraged to visit the same pharmacy for all their medicines, pharmacists possess an accurate record of the patient's current and past medication regimens. This is important when there are several prescribers involved in the patient's treatment and places the pharmacist in an ideal position to assess medication therapy and avoid medication errors, such as duplication of therapy or the prescription of a medicine to which the patient is allergic. To provide more information on these services, FIP has published [“Medicines reconciliation: A toolkit for pharmacists”](#) and [“Medication review and medicines use review: A toolkit for pharmacists”](#).

Providing patient education and facilitating communication between inpatient and outpatient healthcare practitioners are essential for patients with cancer. These patients may be undergoing treatment with several different medicines, each with their own complex dosing regimen, and may therefore be at heightened risk of medication errors. Additional obstacles, such as limited health literacy and language barriers, can also affect patients' understanding of their cancer treatment and should be adequately addressed.¹²⁵ Pharmacists play vital roles in providing patient education, ideally prior to discharge, on medication changes that occurred during hospitalisation, including changes made to cancer treatments. Tools and aids, such as chemotherapy calendars or medication schedules, are helpful to illustrate and provide details on dosing regimens and will ultimately enhance medication adherence.¹²⁵ Finally, facilitating post-discharge communication, such as between hospital and community pharmacists, is essential to ensure seamless pharmaceutical care.

6.3 Barriers and challenges

While it is recognised that pharmacists play an important role in cancer care, several barriers and challenges exist that limit their capacity to fully take part in providing quality care.

Access to relevant information is a barrier that has been difficult to overcome and that impedes on pharmacists' role and responsibilities to ensure the optimal use of medicines. Without access to medical assessments and precise diagnoses, treatment regimens dispensed and administered outside of the pharmacy setting (such as in an outpatient clinic) and laboratory test results, it becomes difficult to perform a comprehensive patient assessment to ensure the effectiveness and safety of cancer treatments. It is therefore necessary for frameworks to be put in place that ensure access to clinically relevant information, such as through shared electronic medical records and clinical databases.

Appropriate remuneration mechanisms must be put in place to ensure pharmacists are appropriately compensated for their contributions to quality cancer care. Pharmacists are able to play leading roles in many areas of cancer care, such as prevention, screening and treatment optimisation. Adequate remuneration would not only ensure the sustainability of their services, but also serve as a form of recognition for their contributions.

As previously highlighted, multidisciplinary collaboration is a key component of ensuring the delivery of optimal cancer care, especially in the context of imminent health worker shortages and the global burden cancer places on health systems. Pharmacist integration within healthcare teams should be pursued, and their role should extend beyond the supply and dispensing of medicines. Pharmacists should be recognised for their impact in cancer prevention, screening, and treatment management and optimisation. Referral pathways and communication channels should be put in place to allow pharmacists to promptly and efficiently refer patients who require further management. Furthermore, regulations and collaborative practice agreements should be implemented to expand pharmacists' scope of practice to include acts for which they possess the adequate training and knowledge, such as, but not limited to, independent dosage adjustment, supportive care medicines initiation and laboratory tests prescribing.

Patients' perception of pharmacists' role may represent a significant challenge to fully utilising pharmacists' skills and expertise in providing optimal cancer care. Pharmacists are essential in ensuring oncology medicines are safely prepared and dispensed, but they also possess the necessary expertise, skills and availability to educate patients on various aspects of cancer, implement prevention strategies and screening measures, and optimise medicines use through treatment management and optimisation. Awareness and

acceptance of the potential pharmacists possess to engage in comprehensive, patient-centred cancer care will only contribute to improving patients' health and well-being.

6.4 Pharmacy service models in cancer care

Different service models may be proposed for pharmacists working in cancer care in a variety of settings. It is, however, important to note that local regulations, differences in professional culture, and resource and workforce availability may influence pharmacy service delivery in cancer care within different cities or countries.

In community pharmacies, the role of the pharmacist is varied. Pharmacists may organise and spearhead prevention, screening and educational clinics and structured interventions in collaboration with other healthcare professionals, such as nutritionists, dieticians, nurses and physiotherapists. Pharmacists may also develop structured monitoring plans with patients starting on cancer treatments to ensure medication reviews are conducted and follow-ups are achieved to identify potential adverse effects or complications. To ensure the safety of cancer treatments, pharmacists may be authorised to prescribe laboratory tests, and they are well-placed to keep accounts of medication histories and active medication profiles. With additional oral chemotherapeutic agents being researched and developed, the role of community pharmacists is only expected to grow.

Pharmacists in outpatient cancer settings have been more formally defined.^{12,13} In this setting, they are responsible for the preparation and dispensing of oncology medicines, they provide counselling to patients on cancer treatment, and they review laboratory test results. They work directly with physicians, nurses and other members of the multidisciplinary team to ensure the safe and effective use of cancer treatments. According to local regulations and collaborative practice agreements, they may even initiate certain therapies, such as supportive care medicines.

Pharmacists in inpatient cancer settings play a fundamental role in conducting medicines reconciliation and medication reviews for admitted patients. They liaise with pharmacists in other settings, the attending physician, and other members of the healthcare team to ensure the treatment and resolution of the patient's clinical presentation and diagnosis. Upon discharge, pharmacists can relay information to their community pharmacist colleagues to promote continuity of care.

While pharmacists are able to play various roles according to the setting in which they work, their responsibilities lie in ensuring that patients remain educated about their health conditions and medication regimens.

6.5 Training, knowledge, and skills

The delivery of optimal cancer care requires a specific set of training, knowledge and skills that take into account the complex pathophysiology and wide array of therapeutic options. Furthermore, pharmacists who do not frequently interact with patients undergoing cancer treatment may become less knowledgeable over time about cancer and its treatment. Data have shown that knowledge among community pharmacists on cancer is variable.^{17, 126, 127} Training and educational frameworks should thus be put into place to ensure proper and sustainable integration of cancer care knowledge among all pharmacists.

A [knowledge and skills guide](#) to support pharmacists in cancer care is available from FIP. Its proposed strategies go hand in hand with the contents of this handbook to support the integration of pharmacists in cancer care delivery.

6.6 Genetic testing

Genetic testing has become an important measure to determine whether a person's genes contains specific inherited changes or variants that may increase their risk of developing cancer.¹²⁸ Testing allows clinicians to

confirm whether the cancer is the result of an inherited syndrome or to determine whether family members who have not yet developed a cancer possess the same inherited variation as their relatives.¹²⁸

Between 5 and 10% of all cancers are thought to be associated with inherited genetic variants across over 50 hereditary cancer syndromes, which underscores the importance of genetic testing.¹²⁸ The expertise of a genetic counsellor is usually recommended to ensure adequate genetic cancer risk assessment as well as ensuring patients understand the risks and benefits associated with genetic testing.

Tumour DNA sequencing, where tumour markers are identified to help guide treatment options, may be considered a form of genetic testing. Therapies targeted towards these specific markers have been developed and represent a significant segment of the therapeutic arsenal against cancer.

6.7 Clinical trials and pharmacovigilance

Progress in cancer care is dependent not only on innovations in drug discovery and development, but also on novel findings with regard to clinical practice, treatment regimens and monitoring of medication therapies. Cancer care therefore represents a key area in which pharmacists can contribute to clinical trials and pharmacovigilance.

Unfortunately, several patients may not completely respond to the first few courses of recommended therapies. In those cases, where evidence-based treatment options have been exhausted, it is usually recommended to educate patients on the possibility of enrolling in clinical trials. Enrolling in a clinical trial contributes to and helps progress current knowledge about cancer treatment and detection.

Pharmacists may therefore play a key role by participating in the different steps of a clinical trial, from planning and organisation to patient enrolment, medicine distribution, and outcome measurement and analysis.

To further progress cancer care, pharmacists also play important roles in pharmacovigilance. They regularly monitor patients for potential adverse events and complications associated with cancer treatments. The therapeutic arsenal against cancer is vast and varied, and the potential for adverse events associated with these medicines is significant and expanding. As medicines experts, pharmacists are well positioned to take on leading roles in collecting data, evaluating situations and incidents, and communicating relevant information to the appropriate scientific bodies and organisations through adverse event reporting.¹²⁹

6.8 Electronic and mobile health in cancer care

Technological advances have shifted the provision of health care and services, especially in light of restrictions due to the COVID-19 pandemic. Specifically with regard to cancer care, different initiatives in electronic health and mobile health have been described.

Several types of initiative have reported increased communication through electronic and mobile health. For example, electronic tablets or other devices have been used to collect routine patient reported outcomes concerning physical symptoms, psychosocial concerns and informational needs.¹³⁰ These outcomes were fed to the electronic medical record, with direct notifications sent to healthcare professionals regarding clinically relevant symptoms.^{130, 131} This was perceived to be especially important for patients with advanced stages of cancer or those undergoing treatment with a high risk of acute toxicity.¹³⁰ Some data have shown that these types of initiatives could improve survival and quality of life, and result in fewer emergency visits, fewer hospital admissions and better cost-effectiveness.¹³⁰

Other examples include the use of smartphones, tablets or other devices for the provision of educational material, self-management strategies and virtual consultations for patients experiencing cancer-related symptoms.¹³⁰ Patients in rural or underserved communities may also benefit from such initiatives where in-person access to healthcare professionals is scarce.¹³⁰

The use of electronic and mobile health could also support the promotion of healthy lifestyles and thus reduce several risk factors for cancer development. Pedometers as well as mobile and web training applications have been utilised with considerable uptake, increasing fitness levels and reducing cancer-associated symptoms, such as fatigue.¹³¹ Applications and web services regarding nutrition and weight management have also been used among patients with cancer.¹³¹

Electronic and mobile health should continue to be harnessed as communication, education, monitoring and support tools in the delivery of quality cancer care.

6.9 Resources

Different resources are currently available to guide knowledge and pharmacy practice in cancer care.

- The International Society of Oncology Pharmacy Practitioners publishes pharmacy relevant documentation in cancer care with regards to pharmacy service models and appropriate handling of cytotoxic medicines.
- The European Society of Oncology Pharmacy publishes educational and guidance documents in a variety of areas of oncology pharmacy practice, including regular updates on the Quality Standard for Oncology Pharmacy Practice.
- The National Comprehensive Cancer Network (NCCN, United States of America) develops a wealth of guidelines and practical documents, including clinical practice guidelines and patient guidelines. The NCCN has also developed a global programme through which it collaborates with scientific bodies and authorities from different regions worldwide to develop region-specific clinical practice guidelines.
- The European Society for Medical Oncology develops a robust collection of clinical practice guidelines for a variety of different types of cancers with slide sets, patient guides and regional adaptations.
- The American Society of Clinical Oncology publishes clinical practice guidelines, provisional clinical opinions and guideline endorsements.
- The International Agency for Research on Cancer by the World Health Organization publishes global data in addition to relevant documentation regarding cancer statistics and findings in research on cancer prevention.
- The World Cancer Research Fund International publishes thorough information, data and recommendations on cancer prevention with regard to nutrition, physical activity and weight management.
- OnTarget (Canada) is a resource guide for pharmacists specifically with regard to targeted therapies.
- The Multinational Association for Supportive Care in Cancer provides updated, evidence-based clinical practice guidelines on supportive care for patients undergoing treatment for cancer.

7 Conclusion

Cancer care is elaborate and complex and complicated, especially as the disease progresses or has co-morbidities, requiring the coordinated efforts of multidisciplinary teams to ensure optimal, patient-centred care. Across the continuum of cancer care, pharmacists represent an integral part of the treating team. Through lifestyle interventions, pharmacists are critical in advocating a healthy lifestyle through awareness, education and treatment, which significantly contributes to the prevention of cancer development. Furthermore, through effective pharmacist-led early detection strategies, patients can be promptly referred to appropriate testing services, increasing their chance of diagnosis, treatment tolerability and survival. Pharmacists are also important allies in supporting patients undergoing active cancer treatment by ensuring its safety and effectiveness and by actively assisting in the management of adverse events and complications.

Indeed, there is great potential for community pharmacists to provide a wide range of cancer care services, especially in deprived or low-resource settings where access to specialist care may be limited. Pharmacists are accessible, knowledgeable and well trusted by patients within their communities. They also are in frequent collaboration with various members of the healthcare team. Therefore pharmacists' potential to support patients with cancer and engage in optimising their care should be utilised to improve their well-being and quality of life, ultimately improving outcomes at both patient and health system levels.

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