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REVIEW

Scoping the barriers to influenza and pneumococcal vaccinations from the perspectives of patients with cancer: is there a role for the pharmacist?

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Abstract

Background: Routine immunisation for influenza and pneumococcal disease has the potential to reduce morbidity and mortality in patients with cancer.
Aim: This scoping review aims to determine barriers to influenza and pneumococcal vaccinations from the perspective of patients with cancer and to discuss the potential role of the pharmacist in impacting these barriers.
Design: A systematic search of seven databases, including MEDLINE (Ovid), Cochrane Library, Informit (health), PubMed, and CINAHL (complete), from database inception to 6 June 2023 was conducted. Search terms included: 'cancer', 'vaccination', 'influenza', 'pneumococcal', and 'barrier'. Articles published in English that describe barriers to receiving vaccinations from the perspectives of patients with cancers were included. Barriers were thematically analysed.
Results: Twenty-five articles met the inclusion criteria. Barriers identified in the literature were analysed into three key themes: healthcare professionals, patients, and healthcare system barriers. A key healthcare professional barrier was lack of recommendations from the treating oncologist or haematologist. Patient barriers included lack of information about the indication for vaccination as part of patients' cancer treatment and fear of side effects. Access to vaccination services was reported as a healthcare system barrier.
Conclusion: This scoping review highlights the significant barriers to influenza and pneumococcal vaccination according to patients with cancer. Healthcare professionals, patients, and health systems were identified as key barriers. Enablers to improve vaccination rates include patient education, increased healthcare professional vaccine recommendations, and improved access. Although pharmacists have a potential role to play in addressing these barriers, the feasibility and impact of their involvement requires further research.

Keywords: cancer, immunisation, pneumococcal, influenza, barriers, enablers, pharmacists' role.

INTRODUCTION

Patients diagnosed with cancer are at high risk for influenza and pneumococcal infections due to the immunosuppressive nature of cancer treatment and the disease itself. This can significantly increase morbidity and mortality associated with these common community infections. Patients with malignancies experience higher risk of influenza-related complications, such as bacterial co-infections.[1] The rate of hospitalisation for patients with cancer with influenza is higher (between 14% and 21%), as is the mortality rate (9%) compared to the general population.[2,3] Influenza infections in patients with cancer may result in admission and treatment delays, negatively affecting long-term prognosis.[4]

Immunosuppressed patients with malignancies are recommended to receive an annual influenza vaccine. Compared to a placebo, vaccination against influenza is effective at reducing 85% of laboratory-confirmed cases in immunocompromised patients.[5] Multiple organisations, including the US Centers for Disease Control and Prevention (CDC) and the Australia Technical Advisory

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Group on Immunisation (ATAGI), recommend regular influenza vaccination for patients with malignancies.[6,7] The World Health Organization (WHO) sets a target vaccination target of >75% for older patients and other vulnerable populations.[8] Internationally, influenza vaccination rates in patients with cancer are low, with only 30–59% patients achieving the recommended schedule of vaccinations.[2,3] A meta-analysis of Australian immunisation rates between 2000–2013 for patients with chronic diseases (including cancer) similarly found that the influenza vaccination rate was also low at 29.8–49.2%.[9] Multiple countries have implemented free annual influenza vaccination programs for high-risk populations, such as patients diagnosed with cancer.[6,10,11] However, <50% of patients receiving chemotherapy routinely receive the influenza vaccination.[12]

Similarly, pneumococcal disease is a significant cause of morbidity and mortality worldwide,[8] causing serious complications in patients with cancer, particularly in those with multiple myeloma, lung cancer, and lymphoma.[9] In patients receiving chemotherapy for solid tumours, the relative risk (RR) of invasive pneumococcal infection is 23 times higher compared to the general population.[10] In a systematic review, Australian coverage rates for the pneumococcal vaccine ranged between 15.4% and 72.8%,[9] and this compares poorly against the WHO target for immunisation rate against vaccine-preventable diseases (VPDs), which is 95%.[13] The Advisory Committee on Immunization Practices (ACIP) in the United States of America (USA), has suggested that the burden of invasive pneumococcal disease (IPD) and non-bacteraemia pneumococcal pneumonia in healthy and immunocompromised patients has been reduced by routine immunisation with the 13-valent pneumococcal conjugate (PCV-13) vaccine.[14] The risk of IPD is higher in oncology patients compared with the non-cancer population; therefore, the pneumococcal vaccine is recommended for all people diagnosed with cancer prior to starting intensive therapy.[15]

Pneumococcal disease and influenza are both vaccine preventable; however, uptake of both of these vaccines remains lower than national and international targets in this vulnerable patient group.[9,16,17] Increasing uptake of preventive immunisation strategies is important in protecting patients from ongoing community infection risks. Advances in cancer therapy provide superior remission rates and longer survival times. For some, cancer is now considered a chronic disease.[16,18] Despite consistent vaccination recommendations for patients receiving chemotherapy, barriers to immunisation result in lower-than-desired vaccination rates.[6,18] This scoping review aims to determine barriers to influenza and pneumococcal vaccinations from the perspective of patients with cancer and to discuss the potential role of the pharmacist in impacting these barriers.

METHOD

The review protocol was developed according to Joanna Briggs Institute Methodology for Scoping Reviews.[19] Scoping reviews are exploratory studies that aim to map the available existing knowledge on a given topic.[20] A scoping review was chosen as there is value in the examination of broader areas to identify gaps in the research knowledge base, clarify key concepts, and report on the types of evidence that inform practice. The scoping review allowed the authors to bring together the information and offer a subjective interpretation of the known literature.[21]

This scoping review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis for Scoping Reviews (PRISMA-ScR).[22] The research question to be addressed by this review is: what are the barriers from the perspectives of patients diagnosed with cancer to receiving pneumococcal and influenza vaccination? The themes identified from the modified Braun and Clarke[23] thematic analysis will be reviewed, and the potential role of pharmacists in improving vaccination rates in people with cancer will be discussed.

Search Strategy

The search strategy was developed using keywords related to the research question. Medical Subject Headings (MeSH) and keywords such, as 'cancer', 'malignancy', 'vaccination', 'immunisation', 'barrier', and 'antivaccination', were searched in MEDLINE (Ovid), EmCare, Cochrane Library, InformIT (health), Scopus, PubMed, and CINAHL (complete). Additional searches were conducted with keyword searches in Google Scholar and on government websites, and references/citations of all literature were searched for additional articles, meeting the inclusion criteria. The search was not country specific with searches conducted from database inception to 6 June 2023.

Inclusion and Exclusion Criteria

Articles were assessed for relevance to the research question, and inclusion and exclusion criteria applied. Inclusion criteria for studies were as follows: full articles published in English; adult patients with cancer or a history of cancer that have undergone anti-cancer treatment; and assessment of behaviours, attitudes, or

perceptions of immunisation with influenza and/or pneumococcal infection including barriers to immunisation. Review articles or those focusing only on immunocompromised patients from other causes except cancer, and vaccines associated with the prevention of secondary cancers such as human papillomavirus (HPV) and hepatitis B (HepB) were excluded.

Data Extraction and Thematic Analysis

Figure 1 illustrates the process of article selection for this review. The selected articles were imported into EndNote (Clarivate, Philadelphia, PA, USA), and duplicates were removed. First, the titles, abstracts, and full texts of the studies were screened by the first author, who assessed the articles for inclusion. Any discrepancies were resolved through discussion with the co-authors until a consensus was reached. The data from the included articles were charted into a table format recording the author, country, year, aim of the study year, methodology, barriers, and enablers. Barriers were themed using a modified Braun and Clarke's reflexive inductive five-step thematic analysis (TA): (1) familiarisation with barriers by reading and re-reading articles; (2) searching for themes within barriers and gathering data; (3) creating themes and subthemes; (4) reviewing themes; and (5) naming themes as patient, health professional, and healthcare systems, including frequency of occurrence of subthemes.[23]

RESULTS

Out of 495 articles found from initial searches, a total of 25 studies (Table 1) were included in this scoping review involving seventeen cross-sectional

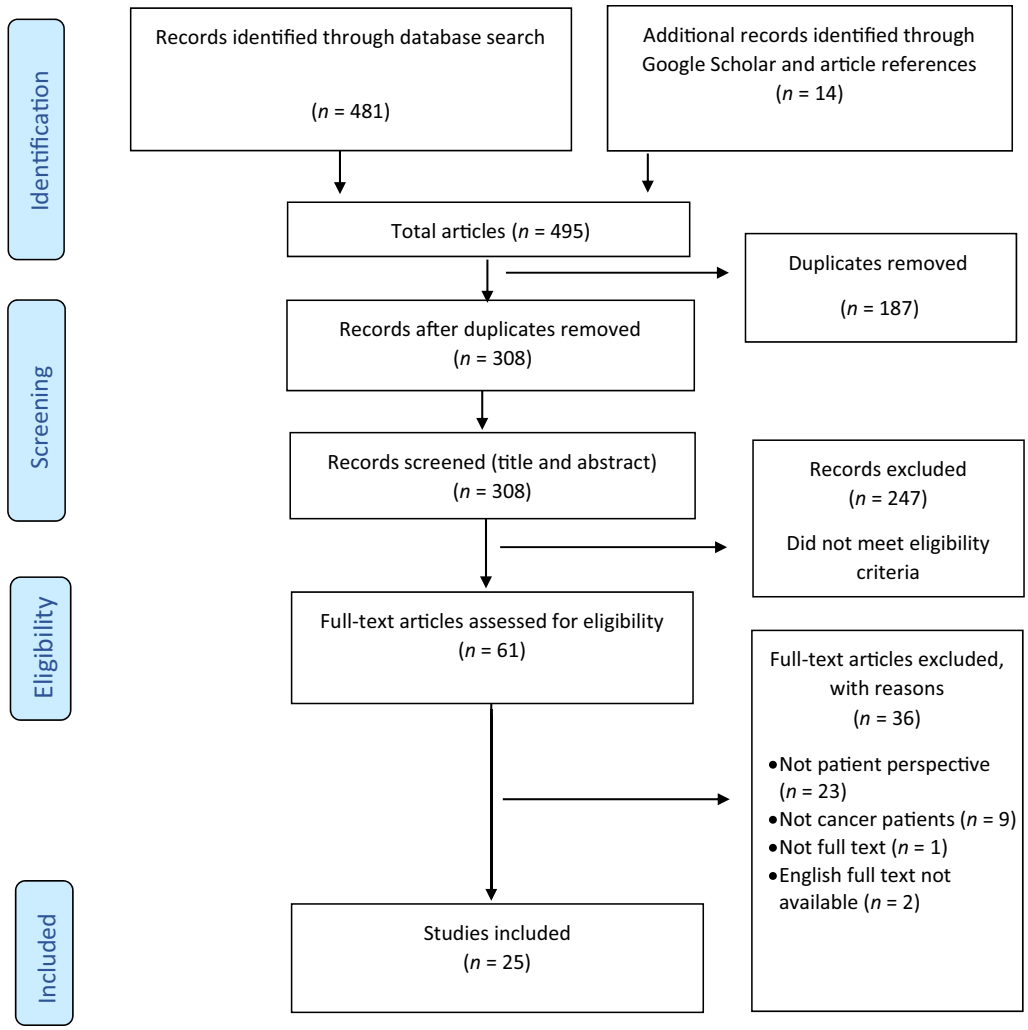

Figure 1 PRISMA-ScR-flow diagram of included studies.

Table 1 Study characteristics of included studies

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
Akin et al.[24] Turkey (2016)	Determine cancer patients' attitudes towards vaccines and acceptability or refusal to receive vaccination	Cross-sectional study Single-site cancer centre with self-completed survey of patients with cancer over age of 18 Patients (n = 229) completed survey questions related to all vaccines with focus on influenza and other preventable diseases such as pneumococcal, tetanus, hepatitis B	*Barriers* Vaccination not recommended to 93% of participants Perceived vaccination unnecessary Lack of information on vaccines Fear of adverse effects Vaccine ineffective Religious beliefs *Enabler* Strong association between doctors' advice and vaccination
Ariza-Heredia et al.[25] USA (2014)	Understand barriers to prevent cancer patients and their household contacts from influenza vaccination uptake	Cross-sectional study Patients over age of 18 with cancer and confirmed influenza microbiology (n = 154) contacted for phone survey n = 108 (70%) consented to participate	*Barriers* Oncologist recommendation to not receive influenza vaccine 61% of eligible patients incorrectly advised to not receive vaccination (misinformation) *Enablers* Healthcare provider recommendation the most significant factor in receiving vaccination Age (older patients more likely to receive vaccination) Education for healthcare providers to correctly recommend vaccination to eligible patients Household contacts recommended to receive vaccination by oncologist: patients have higher vaccination rates
Chang et al.[27] USA (2019)	Examine documented rate of influenza vaccination or refusal across three hospitals	Cross-sectional study Retrospective analysis of medical records for documentation of influenza vaccination, refusal of vaccination, or documented conversation on influenza vaccination by physicians or nursing staff within first 12 months of diagnosis of diffuse large B-cell lymphoma (DLBCL) during February 2015–October 2017 n = 114 new diagnoses of DLBCL	*Barriers* Poor documentation to determine correct vaccination status Patients refusing vaccination were not referred for education or counselling Doctors unsure about vaccinating due to conflicting information in literature about effectiveness of vaccine in DLBCL (not confident in recommending vaccine) *Enabler* Patients educated about infection risk with rituximab were more likely to receive vaccination
Chang et al.[26] USA (2021)	Determine vaccination rate with influenza from previous 12 months in patients with a diagnosis of cancer	Cross-sectional study Face-to-face interviews of 2016 and 2017 National Health Interview Survey (NHIS) with subpopulation focus on patients with self-reported cancer 64% of patients that have or had cancer received influenza vaccine in past 12 months prior to survey n = 5053 self-reported with cancer	*Barriers* Age: younger patients less likely Race/ethnicity: lower rates in Black and Hispanic patients compared to white patients No health insurance No vaccine-related information on cancer centre websites
Choi et al.[28] Korea (2014)	Determine whether cancer survivors receive influenza vaccination	Cross-sectional study Questionnaire to cancer survivor's versus non-cancer survivors during 2007–2011	*Barriers* Smoking (less likely) Two years since diagnosis (longer living with cancer less likely)

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
		n = 943 cancer survivors *n* = 41 233 non-cancer survivors	*Enablers* Chronic disease comorbidities (heart disease, diabetes mellitus, chronic obstructive pulmonary disease) Poor self-perceived health status Age (older patients more likely to received vaccination) Location/geography (rural more likely): more services provided by clinics Free vaccines: patients over 65 are entitled to preventive health, young patients are not
Church et al.[40] USA (2018)	Improve vaccination rate with electronic and posted letter reminders	Quasi-experimental Medical records screened for chronic lymphocytic leukaemia (CLL) patients and pneumococcal vaccine status Investigators place order for administration with nurse and primary physician co-signers of order and a reminder letter sent to patient *n* = 366 patients with diagnosis of CLL	*Barriers* Alert fatigue from electronic system for clinical support tools for health professionals Infrequent visits to healthcare providers Not offered by doctor Perceived contraindications (misinformation) *Enablers* Patient and clinician reminders Education for patients and healthcare providers work well to increase rates Ease of access to primary physician showed it was easier to get it from them versus specialist
Kosaka et al.[29] Japan (2021)	Uunderstand influenza awareness and influenza vaccination attitudes	Cross-sectional study Web-based questionnaire sent to Japanese cancer patients who consented to participate over a two-month period (1 September 2020–31 October 2020) *n* = 163 patients completed survey	*Barriers* Perceived reduced vaccine efficacy Fear of side effects Cost Limited to time to get injection or convenience Younger age Not concerned about influenza infection *Enablers* Vaccination with influenza in previous year predicted future vaccination Recommended by medical professionals Patients educated on benefit of influenza vaccination Vaccination in workplace (improved access) Recommended by family or friends COVID-19 pandemic made patients more receptive to vaccines Usually receives regular vaccines
Krimmel et al.[41] USA (2016)	Improve vaccination adherence rates Increase knowledge and improve attitudes Evaluate barriers and facilitator adherence	Quasi-experimental Pre and post test to determine knowledge on vaccination adherence Patients provided with information and kit on preventing influenza, including vaccine coupon, September 2015–January 2016 *n* = 48 patients after transplant that had not received the vaccination	*Barriers* Lack of doctor recommendation Fear of influenza vaccine Lack of education on vaccination Side effects of vaccines Poor access High cost *Enablers* Provider recommendation and influenza vaccination adherence was statistically significant

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
		6 months to 3 years after transplant	Coupon for free vaccination (cost), improving access, and schedule reminders was biggest impact on adherence
Lachenal et al.[43] France (2010)	Determine factors influencing vaccination in haematological patients Determine vaccine rate	Cohort study Standardised questionnaire for influenza vaccine uptake or reasons not receiving Patients were offered free vaccination, then assessed for reasons not receiving between 1 January–31 January 2008 *n* = 200 haematological patients	*Barriers* Vaccination not suggested to patients 53.7% of patients (lack of doctor recommendation) 24.2% vaccination contraindicated by haematologist doctors 50% afraid of fever 21.8% preferred homeopathy 15.5% thought there was no benefit to receive vaccine *Enabler* Elderly patients had higher vaccine rates
Lagler et al.[42] Austria (2012)	Determine seroconversion after first vaccination Determine vaccination rates	Quasi-experimental Patients were offered free vaccine then blood assay baseline, after first vaccine and second vaccine Survey on tolerability of side effects was recorded up to one month after vaccine or reason for refusal; duration November 2009–March 2010 *n* = 65 patients selected: *n* = 25 with solid tumour; *n* = 17 with haematologic malignancy; *n* = 23 healthy patients	*Barriers* Negative unproven reports on effectiveness in the media (misinformation) Timing of vaccine was reported for low uptake (poor access) Lymphoma had lower serological conversion *Enabler* Comorbidities with chronic disease
Lerchenfeldt et al.[30] USA (2013)	Determine vaccination adherence autologous versus allogeneic Determine reasons behind missed or delayed vaccinations	Quasi-experimental Electronic medical records were searched and recorded patients who received vaccination reminder cards, phone call from pharmacist for scheduled appointments, vaccination dates, and vaccinations missed or delayed *n* = 137 post-transplant patients *n* = 93 autologous *n* = 44 allogeneic	*Barriers* Autologous were referred to primary care provider or general practitioner (GP) 12 months after transplant had more missed doses due to suspected poor communication between transplant team and GP (lack of doctor recommendation) Patients delayed due to comorbidities of thrombocytopenia, anticoagulation Lack of understanding of contraindications for vaccinations by transplant team (doctor not confident in recommending) *Enablers* Allogeneic had closer follow up due to high risk of post-transplant complications (improved access) Healthcare professionals that know about coagulation and vaccination formulation (doctors educated on vaccines)
Loubet et al.[31] France (2015)	Estimate influenza and pneumococcal vaccine uptake Identify factors associated with vaccine uptake in large cohort of patients	Cross-sectional study Patients identified with diseases or treatments that cause immune deficiencies through register and sent anonymous, 40-question multiple-choice questionnaire *n* = 3653 haematological patients included in cancer group	*Barriers* Lack of awareness of pneumococcal recommendations by doctor (lack of doctor recommendation) Lower vaccination rates with biologics proposed to be due to newness of medications and limited information (doctor not confident in recommending)

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
			Lack of information on vaccines Misinformation in media Younger age *Enablers* Results show patients need to be informed more It is suggested that patients aged >65 years have higher influenza rate because it is globally offered to all patients, which is not the case with pneumococcal
Loulergue et al.[12] France (2008)	Determine rate of influenza vaccine Determine factors influencing patients to receive vaccine during treatment	Cross-sectional study All patients presenting for treatment completed self-assessment in regard to vaccine rate and factors influencing vaccine rates *n* = 112 cancer patients from single site	*Barriers* Lack of recommendation from treating physician (72%) Fear of side effects (33%) Concerns over vaccine efficacy (10%) *Enabler* Older age more likely
Miller et al.[32] England (2018)	Determine sociodemographic and psychological factors affecting intention to receive influenza vaccine	Cross-sectional study 24 questions were mapped to Health Belief Model (HBM) on 5-point Likert scale ranging from strongly agree to strongly disagree *n* = 93 patients received allogeneic haematopoietic stem cell transplantation (HSCT)	*Barriers* Older patients were more likely to have low intent Patients have lower perceived risk >12 months after transplant (lack of perceived benefit + time since diagnosis) *Enablers* Patients understand their condition and are educated about infection risk after HSCT (patients educated) Receive recommendation from a doctor for influenza More likely to consider a vaccine if HSCT team recommended it versus if their GP recommended Of low-intent group 54% prefer to receive vaccination at HSCT centre (improved access)
Monier et al.[18] France (2020)	Assess vaccination coverage and associated factors in oncology and haematology patients	Cross-sectional study Single-site French university with survey among solid cancer or blood malignancy *n* = 671 (232 haematological patients and 439 solid cancer)	*Barriers* Lack of vaccine knowledge Misinformation from French anti-vaccine lobby groups Family physicians and specialists not informed about vaccine recommendations *Enablers* Patients aged >65 years Positive opinions about vaccination Family physician and/or oncologist giving information about vaccination
Mousset et al.[33] Germany (2012)	Determine vaccination rates among patients with malignancies and household contacts	Cross-sectional study Outpatients at oncology and haematology centre completed anonymous 9-question questionnaire	*Barriers* Patient thought cancer was contraindication against vaccination (48.1%) Too busy, but willing to get vaccinated (37%) Fear of side effects (13%)

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
	Determine information status for patients and household contacts	*n* = 72 patients, 91.6% haematology patients, 8.4% solid tumours	No personal risk of contracting influenza (5.6%) No severity of influenza illness (5.6%) *Enablers* Increased awareness of benefits of influenza for GPs and oncologists Results suggest relationship between knowledge of recommendations and vaccination status among patients and contact persons
Ozdemir et al.[46] Turkey (2023)	Determine clinical pharmacists' contribution to pneumococcal vaccination rate in cancer patients	Randomised control study Vaccination Status Questionnaire (VSQ) and Vaccination Knowledge Questionnaire (VKQ) before and after pharmacist education intervention *N* = 235 patients (117 intervention arm and 118 control)	*Barriers* Anti-vaccine messages in media Negative vaccine attitudes Fear of unknown or unwanted side effects Pharmaceutical company influence or gain Preference for natural immunity Lack of family/GP doctor's recommendation to be vaccinated *Enablers* Face-to-face and phone education by clinical pharmacist about pneumococcal vaccines Vaccination with influenza had positive correlation with pneumococcal vaccine acceptance
Pierron et al.[44] France (2021)	Understand coverage and determinants of influenza, pneumococcal, and diphtheria-tetanus-poliomyelitis (dTP) in haematological patients	Cross-sectional study Haematological patients receiving chemotherapy at single site Patients completed survey assessing vaccine uptake and attitudes towards vaccines GP vaccine and knowledge and attitudes were assessed for each doctor managing patient via phone call *N* = 145 patients	*Barriers* Different recommendations to receive influenza vaccine according to published guidelines while on anti-CD20 Knowledge of vaccines in cancer by GP Lack of national vaccine registry for patients and HCP to view Fear of side effects *Enablers* Vaccination schedule letter sent to GP by haematologist (doctor educated) Vaccine information and recommendation by doctor (GP or haematologist) Age (>65 years old) Positive vaccine attitudes Previous vaccine with flu increases pneumococcal vaccine uptake
Poeppl et al.[34] Austria (2015)	Determine influenza vaccination rate in cancer patients Determine factors influencing patient decision against vaccination	Cross-sectional study 1 July–October 2013 Single-site anonymous survey of patients attending outpatient department *n* = 444 patients completed survey 54.5% solid tumours 21.9% had haematological malignancy 17.3% had no malignancy diagnosis at time of visit	*Barriers* Doubt of vaccination from information received (misinformation) Vaccination would fail due to compromised immune system (31%) (lack of perceived benefit) Fear of side effects (26%) Influenza not severe (23%) Vaccine could worsen cancer (14%) Vaccination requires another appointment (13%) Only 44% of patients were informed of influenza vaccination by doctors

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
			Enabler Patients recommended for vaccination by doctor had significantly higher rates
Price et al.[35] USA (2019)	Understand vaccination rates among patients, caregivers, and family and factors that influenced vaccination	Cross-sectional study Flu season 2013–2014: surveys administered during 6-week period, June–July 2014 *n* = 703 patients *n* = 146 caregivers and family completed survey	*Barriers* Concerns about vaccine components (misinformation) Lack of time (more common in unvaccinated family members than patients) Younger patients less likely to receive vaccination *Enablers* Patients prefer to receive information on vaccine from cancer centre Brochures and signs in cancer unit Pharmacist education on vaccines Unvaccinated family and caregivers would consider getting vaccine if free at cancer unit
Ring et al.[36] England (2003)	Determine uptake of influenza in tertiary referral hospital	Cross-sectional study Structured interview where clinicians complete questionnaire with patient when attended for treatment *n* = 110 patients were interviewed	*Barriers* Vaccination not discussed/recommended (55%) Safety concerns from family GP (17%) *Enablers* Older patients (>60 years old) Comorbidities Discussion of vaccination with oncologist GPs educated on misconceptions about effectiveness and safety of influenza vaccine
Sitte et al.[45] France (2019)	Evaluate impact of specialised infectious disease consultant on gastrointestinal cancer (GC) patient vaccine rates	Cross-sectional study Between December 2016–April 2017, all patients with GC or inflammatory bowel disease (IBD) in an outpatient gastroenterology clinic enrolled in 3-phase vaccine program: (1) initial questionnaire, (2) infectious consultation, (3) subsequent questionnaire *n* = 366 patients, 27.1% with cancer, 11.2% were colorectal *n* = 105 went to appointment, 30% of patients overall	*Barriers* Fear of potential side effects Impact on illness, worsened disease GP knowledge and confidence of vaccination in this patient group Misinformation in media about vaccine indications and safety *Enablers* More than 9 out of 10 patients got vaccine after education; about 50% changed their mind about vaccination after consult Structured, focused education improves vaccination (previous study with IBD nurse)
Stafford et al.[37] USA (2013)	Explore disparity trends among black and white cancer survivors with influenza vaccine prevalence	Cross-sectional study Random sampling of adult population with phone land line were asked questions about health behaviours and risk, where 432 607 responded, and of those 41 346 have or had cancer *N* = 41 346 cancer survivors' data analysis of survey	*Barriers* Access to doctors within 12 months for check-up had lower rates Cost was a negative indicator for receiving vaccination *Enablers* Patients with regular GP more likely to receive vaccination Patients with some college education had higher odds of vaccination Older age
Urun et al.[38] Turkey (2013)	Determine perceptions about influenza and pneumococcal vaccines	Cross-sectional study Face-to-face interview according to standardised questionnaire about	*Barriers* Do not have information on vaccines (33.5%) Influenza not serious (23.9%)

Table 1 (*continued*)

Author, Country, Year	Aim of study	Methodology (study design and study population)	Barriers and enablers
	Determine vaccine coverage among patients with malignancies and their family members	influenza and pneumococcal vaccine During 2011–2012 flu season, interviews took place 2 January–2 March 2012 *n* = 359 patients	Not appropriate during chemotherapy (22.1%) Fear of side effects (12.5%) Not recommended by doctor (5.9%) *Enabler* Higher education (graduated high school and above)
Vinograd et al.[39] Israel (2014)	Identify predictive factors for vaccination among cancer patients	Case-control study During 2010–2011 flu season personal interviews and medical records to confirm diagnosis and triggers for vaccination *n* = 806 patients	*Barrier* Higher-risk malignancy *Enabler* Strong predictor was oncologist recommendation and GP recommendation

observational studies,[18,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39] three non-randomised interventional cohort studies,[40-42] four prospective observational studies,[12,43,44,45] and one randomised interventional cohort study.[46] The countries of origin were USA,[25,26,27,30,35,37,40,41] France,[12,18,31,43,44,45] Austria,[34,42] England,[32,36] Korea,[28] Germany,[33] Turkey,[24,38,46] Japan,[29] and Israel.[39] The majority of studies were in a hospital or oncology clinic setting targeting patients with cancer,[12,18,25,27,30,32,33,34,35,36,38,39,40,41,42,43,44,45,46] with five population studies focusing on patients with cancer or cancer survivors.[26,28,29,31,37] Twenty studies were designed to assess barriers and behaviours by administering structured questionnaires to patients.[12,18,24,25,28,29,31,32,33,34,35,36,37,38,39,43,44,45,46,47] Only two studies used a structured survey based on a theoretical framework, the Health Belief Model (HBM), to link questions to specific constructs, within the framework to identify barriers.[32,46]

Data extracted and categorised into themes related to barriers are presented in Table 2, which summarises the barriers according to frequencies of occurrence in the articles mapped to the three themes identified. The most frequent barrier identified in the studies with 12 occurrences was misinformation[18,25,31,33,34,35,40,41,42,44,45,46], and second with 11 was lack of doctor recommendation[12,24,25,30,34,36,38,40,41,43,44,46] and fear of side effects.[12,24,29,33,34,38,41,43,44,45,46] Studies reported that poor access, or limited time access, to vaccines[29,33,34,35,37,40,41,42] or doctors not confidently recommending vaccines while patients are having treatment for cancer or are after transplant[27,30,31,36,42,43,45] were the next common barriers. Other identified barriers were patients perceiving a lack of benefit from vaccines,[24,29,32,33,34,43,46] patients lacking information to make decisions on receiving the vaccines,[18,24,26,31,38,41] and age,[26,29,31,32,35] with younger patients less likely to receive vaccination. Emerging from the articles, authors summarised results from their studies as enablers to receive vaccination rather than barriers. These have been entered to capture the positive and negative framing of the results, and they have been included and mapped to barrier themes in Table 3.

DISCUSSION

Vaccination rates in patients diagnosed with cancer varied between studies in relation to oncology or haematology patients and vaccine types. The documented rates of the influenza vaccination were as low as 13% in solid organ cancer[34] and as high as 89% in post-allogeneic transplant patients,[41] while the rate of pneumococcal vaccination ranged from 4% in solid cancers[38] to 37% in blood cancers.[31] There were three key barrier themes identified: healthcare professional factors, patient factors, and healthcare systems.

Healthcare provider recommendation was a significant influence on vaccination for patients with cancer. Patients were more likely to receive vaccination if their treating oncologist or haematologist recommended that they be vaccinated and detailed the benefits in their individual situation.[12,32] Patients' vaccination acceptance also increased when recommended by their general practitioner (GP), but not to the same degree as recommendations from their oncologist.[12,25] People undergoing treatment for cancer believed their oncologist/haematologist was responsible for all of their care during treatment, and only 16% thought it was a shared care model with their GP.[48] Some GPs

were not confident or were unsure about recommending vaccination to patients undergoing systemic therapy.[31] Evidence for the efficacy of influenza vaccination during chemotherapy is conflicted and inconclusive. Several studies have found patients with haematological conditions and receiving medicines that decrease B-lymphocytes (e.g. rituximab) have a reduced response to vaccination, which provides insufficient protection.[42,49,50] In contrast, other studies showed similar response rates in solid tumours and haematological malignancies compared to the general population.[5,51] Inconsistent findings on effectiveness make it difficult for GPs to feel confident in recommending vaccines to their patients and to advise timing during therapy.[36,45] Despite conflicting reports, there is consensus that there is minimal risk to patients, and the potential benefits warrant the recommendation of universal influenza vaccination to all patients diagnosed with cancer.[5,52,53] Cancer centres are getting busier due to older populations, unhealthy lifestyles, better diagnostic techniques, screening procedures, and more effective therapies.[54] The American Association of Medical Colleges (AAMC) Center for Workforce Studies demonstrated there would be a 48% increase in patient visits but only a 14% increase in the supply of oncologists and available appointments, leading to less time for patients with their doctor.[55] Lack of recommendations by treating oncologists/haematologists was identified as a significant barrier to receiving a vaccine. Closing this gap is therefore going to require a multidisciplinary team effort, including nurses and pharmacists.[55]

The main obstacle faced by patients was the spread of vaccine misinformation, which has been exacerbated by the upsurge in negative media coverage and the amplification of anti-vaccination strategies through social media. The vaccine hesitancy movement encompasses various themes rooted in conspiracy theories, a general lack of trust in government and pharmaceutical companies, belief in alternative therapies, and safety concerns.[56] Nevertheless, research has supported the idea that influenza and pneumococcal vaccines are generally well tolerated by patients with cancer and those undergoing systemic therapy. These patients did not experience higher rates of local reactions or systemic side effects compared to the general population.[16,50] Patient barriers also showed that side effects were regularly quoted as an explanation for declining influenza or pneumococcal vaccination by patients with cancer. Exploring patients' beliefs found that they thought chemotherapy could exacerbate the side effects from vaccinations and they might become unwell from the vaccination. Patients were also concerned that vaccination would worsen their cancer.[41,42]

Healthcare system barriers involved poor access and that it was an inconvenience to receive appropriate vaccinations. During cancer treatment, patients have multiple appointments within hospitals, including doctor consults, treatment chair bookings, blood tests, staging scans, and other interventions or investigations, and this may lead to fragmented care. Survey results from patients and physicians also found that chronic conditions and preventive health took a back seat during cancer treatment.[57] Interventions to improve vaccination rates have included electronic standing orders in patients' medical records in hospitals, education packs with information around indications, safety information, free vaccine vouchers, and clinic appointments with infectious disease specialists.[40,41,43,45] There is also a negative association among younger and lower income patients with the uptake of unfunded influenza vaccines.[9] Vaccine coverage rates improved following the introduction of universally funded vaccines in patients aged ≥65 years.[9] Reducing the cost barrier for all patients should improve immunisation rates for all patients.[40]

Pharmacists are among the most accessible and trusted health professionals, and as a result, they can play an important role in improving vaccination uptake.[58] Barriers that pharmacists in a cancer centre could address include healthcare professional recommendations, patient and healthcare professional education, safety and effectiveness counselling, and the delivery of a convenient and accessible vaccination service.[59,60]

Many adult patients with cancer lack the awareness of the need for appropriate vaccinations while undergoing systemic cancer therapy.[39] Patient education and addressing vaccine hesitancy have been identified as important parts of vaccination programs.[61] Despite the availability of safe and effective vaccinations, patients are still undecided on their benefit in reducing their susceptibility and ability to tolerate vaccines. Pharmacists are well placed to help address the '3 Cs' of vaccine hesitancy: confidence, complacency, and convenience. Healthcare workers, including pharmacists, remain a significant influence on vaccine-related decisions. When counselling patients about vaccines, pharmacists can address their fears of side effects and make them feel at ease by providing evidenced-based information and reading materials.[61]

Pharmacists working in cancer units are an integral part of the cancer team and have the training and experience in providing evidence-based care.[62] With the lack of available time with specialists, pharmacists have an opportunity to play a central role in identifying patients' risk of infection and evaluate an individual's vaccination

Table 2 Frequency of identified barriers

Rank	Subtheme	Frequency	Barrier
1	Misinformation	12	Patient barrier
2	Lack of doctor recommendation	11	Health professional barrier
3	Fear of side effects	11	Patient barrier
4	Doctor not confident in recommending vaccination	8	Health professional barrier
5	Poor access or time	8	Healthcare system barrier
6	Lack of perceived benefit from vaccines	7	Patient barrier
7	Patient lacks information on vaccines	8	Patient barrier
8	Age	5	Patient barrier

Table 3 Frequency of identified enablers

Rank	Subtheme	Frequency	Barrier
1	Patients educated on vaccines are more likely to be vaccinated	13	Patient barrier
2	Healthcare professional/doctor recommendation to receive vaccine improved vaccination rates	10	Health professional barrier
3	Improved access/cost of vaccines	8	Healthcare system barrier
4	Age (older patients more receptive)	7	Patient barrier
5	Doctors educated on vaccines	6	Health professional barrier
6	Vaccinated previously	4	Patient barrier

status. These pharmacists can identify vaccines that may be delivered safely or refer according to funding models.[63] Recommendations from healthcare professionals are among the most common reasons why vaccine-hesitant patients change their minds on vaccination acceptance.[64] Secondly, patients have demonstrated confidence in pharmacists' ability to identify patient risks and recommend correct vaccines, and a pharmacist's recommendation has had an impact on patient decisions to be immunised similar to that of a doctor or nurse.[65]

Pharmacists are emerging as an essential part of a multidisciplinary team caring for patients with cancer according to scoping review by Colombo et al. in 2017.[66] As front-line clinicians, pharmacists should seize opportunities to educate, facilitate, and ultimately vaccinate susceptible high-risk patients for preventable infectious diseases.[63] Pharmacists have developed competency to administer vaccinations through undergraduate training or pharmacist-specific postgraduate training programs.[67] Pharmacists have effectively and safely administered influenza vaccinations to adult patients in the community setting.[59] Community-based pharmacist immunisation services have experienced high satisfaction and adherence to recommended vaccines, including influenza.[59,68] Expanding vaccination practice into hospitals, an Australian tertiary hospital developed a partnered pharmacist charting model for influenza vaccination for eligible patients admitted through the emergency department or general medical units.[69] In this model, the pharmacist and medical officer assessed each patient for suitability for influenza immunisation, after which they were charted for nursing administration. These results have demonstrated that partnered pharmacist charting in a hospital setting is feasible and can increase vaccination rates among high-risk patients.[69] Accessibility for people with cancer to an immunisation service in a cancer unit is an easy modifiable barrier to vaccination by including immunisation provision as part of the pharmacist's role.

A strength of this study was that the included literature had clearly identified barriers that were similar and could be themed. A limitation was that the study only focused on influenza and pneumococcal vaccines, while not taking into consideration all vaccines patients require to reduce their infection risk, such as varicella and HPV. Another limitation of the study was that not all vaccines available for pharmacists to administer were reviewed. Another limitation of the study was that the study design for assessing patient vaccine beliefs and behaviours was primarily of a cross-sectional observational nature, with small cohorts of patients with cancer, and the tool used to assess patients was a self-completed anonymous survey. The surveys were also not designed to be mapped to any validated tools, such as HBM,[70] the 5C model,[71] and the vaccine hesitancy scale,[72] which made it difficult to compare findings. Further research into the barriers within a structured framework such as HBM could result in better-quality evidence to inform the development of vaccination programs in this patient cohort.

This review found influenza and pneumococcal vaccination rates were consistently low across all studies for patients diagnosed with cancer. Barriers to optimising

vaccination rates are multifactorial, including lack of education about benefits while undergoing treatment, concerns over side effects, communication between specialists and GP, convenience, and lack of healthcare professional recommendation. Vaccine programs within cancer centres demonstrated high uptake due to patients' high level of trust in their cancer care team. There is also a positive association between cancer team recommendations and vaccination adherence, so it should be the primary focus of future vaccination programs.

This review has highlighted a role for pharmacists in enhancing the uptake of immunisation services. Patients and doctors would benefit from integrating and utilising cancer care pharmacists in the assessment and education of patients to make informed decisions about vaccinations, with further research required to measure pharmacist impact on vaccine uptake in this at-risk cohort.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

AUTHORSHIP STATEMENT

Kristoffer Johnstone: conceptualisation; investigation; formal analysis; writing – original draft; writing – review and editing. **John Smithson**: conceptualisation; investigation; formal analysis; writing – review and editing. **Beverly Glass**: conceptualisation; investigation; formal analysis; writing – review and editing. **Joyce Cooper**: writing – review and editing.

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Ethical approval was not required for this scoping review as it utilised published data and did not contain human data.

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