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Evaluating Eye Health Education for Pharmacy and Dietetic Professions: Evidence From a Pre–Post Intervention Study

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Abstract

A targeted educational program was developed to address gaps in eye health knowledge among allied health professionals. The initial focus was on increasing awareness of the role of nutrition in age-related macular degeneration (AMD) among dietitians in training and professional practice. This program was later adapted and expanded to encompass broader eye health content for undergraduate pharmacy students. The initial intervention was delivered in 2019 at a national professional conference in Australia. Accredited dietitians and dietetic students attended an interactive two-hour workshop exploring nutritional strategies relevant to AMD prevention and management. Knowledge acquisition was evaluated using questionnaires administered before and after the session, with participant consent inferred through completion of both surveys. The principal outcome measure was the difference in AMD-related nutrition knowledge following the intervention. The revised intervention was subsequently implemented within a university pharmacy curriculum at an Australian institution. Second-year pharmacy students completed a four-hour learning module designed to strengthen foundational eye health knowledge and to explore the professional role of pharmacists in supporting individuals with low vision. Evaluation followed a pre–post study design, with changes in aggregate knowledge, perception, and attitude scores serving as the primary outcome measures. Participation was voluntary, and completion of both questionnaires constituted informed consent. In the dietetics cohort, comprising ten practising dietitians and five dietetic students, a statistically significant increase in overall knowledge scores was observed following the intervention (mean scores increased from 7.07 ± 1.94 to 10.8 ± 1.01; $p = 0.001$). Improvements were particularly evident in participants' understanding of evidence-based dietary recommendations, identification of food sources rich in AMD-associated nutrients, and awareness of relevant supplementation. Among the pharmacy cohort, 179 second-year Bachelor of Pharmacy students enrolled in the Pharmacy Practice unit demonstrated a modest but significant improvement in overall eye health knowledge after completing the educational module (6.25 ± 1.93 pre-intervention vs. 6.64 ± 2.00 post-intervention; $p = 0.011$). Students' perception scores regarding the role of pharmacists in eye and low vision care also increased significantly (41.54 ± 5.26 to 42.45 ± 4.95; $p = 0.004$). In contrast, no significant change was detected in overall attitude scores. The targeted educational workshop effectively enhanced nutrition-related knowledge concerning AMD among practising and student dietitians. When adapted for pharmacy education, the intervention similarly resulted in measurable gains in general eye health knowledge and improved perceptions of pharmacists' professional involvement in low vision care, although attitudes remained unchanged.

Keywords: Eye health, Age-related macular degeneration, Dietitian, Pharmacist

Introduction

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High-quality eye care is best delivered through an integrated, multidisciplinary model [1, 2]. Such collaboration is well established in the management of diabetic retinopathy, where patients commonly receive coordinated care involving eyecare professionals, general practitioners, and a range of allied health practitioners, including podiatrists, endocrinologists, and nutrition specialists [2, 3]. In contrast, management pathways for many other ocular conditions remain

largely confined to referrals between eyecare providers and low vision rehabilitation services [2].

There is growing recognition of the need to involve a broader range of health professionals, particularly allied health practitioners, to address preventable lifestyle-related risk factors associated with eye disease and ocular injury [1]. Age-related macular degeneration (AMD), a major contributor to irreversible vision loss worldwide, provides a clear example where such interdisciplinary involvement is beneficial [4]. Evidence from research studies and clinical guidelines highlights the importance of modifiable behaviours in AMD prevention and management, including smoking cessation and dietary modification [5]. Recommended dietary strategies include increased intake of dark green leafy vegetables [6], low glycaemic index foods [6–8], and fish [4, 6, 9], alongside the appropriate use of nutritional supplements formulated according to the Age-Related Eye Disease Study (AREDS) [10, 11].

The original AREDS supplement formulation contained vitamin C (500 mg), vitamin E (400 IU), beta carotene (15 mg), zinc oxide (80 mg), and cupric oxide (2 mg). Due to concerns regarding elevated lung cancer risk associated with high-dose beta carotene, the AREDS 2 formulation replaced beta carotene with lutein (10 mg) and zeaxanthin (2 mg) [10, 11]. Given these nutritional considerations, dietitians—who specialise in dietary counselling—and pharmacists—who supply and advise on nutritional supplements—are well positioned to contribute meaningfully to AMD care.

Pharmacists, in particular, frequently interact with a wide spectrum of consumers, including those seeking AREDS supplements, over-the-counter eye products such as lubricating eye drops, and medications unrelated to eye care. Many of these individuals may nevertheless experience visual impairment or blindness, highlighting the relevance of pharmacists' involvement in eye health support.

Despite this potential role, evidence suggests that pharmacists may be inadequately prepared to engage effectively with people who are visually impaired. A study conducted in Korea reported that fewer than half of pharmacists used recommended communication strategies, such as repeating key information or confirming patient understanding, while just over one-third employed assistive communication technologies [12]. Among visually impaired consumers surveyed in the same study, a majority expressed unmet needs for more comprehensive medication counselling, with 62% indicating a desire for additional information and 68% reporting that they did not receive any tailored support from their pharmacist [12].

As the pharmacy profession continues to shift from a predominantly medication supply function toward the delivery of expanded clinical and patient-centred services, it is increasingly important for pharmacists to possess the skills and knowledge required to support individuals with visual impairment and disability more broadly [13]. Addressing existing gaps in pharmacist-delivered care necessitates the inclusion of targeted training at the pre-registration stage, prior to entry into professional practice. However, there remains a paucity of published research examining educational interventions designed to prepare pharmacists for this role.

In response to this gap, the present study aims to assess the effectiveness of a modified educational intervention in enhancing general eye health knowledge and shaping pharmacy students' perceptions and attitudes regarding the pharmacist's role in low vision care. This objective is pursued through two phases: first, by evaluating a pilot intervention focused on nutrition and AMD knowledge among practising and student dietitians; and second, by adapting and broadening this intervention to include general eye health content and clinical communication training for pharmacy students at the University of Sydney.

Materials and Methods

Study overview

Two sequential educational interventions were implemented in 2019. The first was a pilot study delivered to dietetics professionals and students at a national conference. This session was held on 12 August 2019 at the Dietitians Australia National Conference on the Gold Coast, Australia, and consisted of a two-hour, facilitated small-group workshop examining the relationship between dietary factors and age-related macular degeneration (AMD). Prior to participation, attendees were given written information describing the study, and it was clearly communicated that participation was voluntary. Completion of anonymous questionnaires administered before and after the workshop was taken as implied consent. Participants were also invited to complete a post-intervention evaluation survey.

The second intervention was an expanded and curriculum-integrated program developed for

undergraduate pharmacy students. Content from the pilot workshop was revised and extended to align with learning objectives within the Pharmacy Practice 2 (PHAR2822) Unit of Study. Additional material addressed broader eye health concepts and included structured training in clinical communication to support interactions with both sighted individuals and those with visual impairment. This intervention, named LOOKSHARP, was delivered at the Sydney Pharmacy School, University of Sydney, beginning in Week 6 of Semester 2 (12 September 2019).

LOOKSHARP was delivered in two stages: an initial two-hour lecture covering general eye health and AMD, followed by a two-hour interactive workshop conducted one week later. Recruitment was managed by a member of the research team who had no teaching or assessment role within the unit to minimise potential coercion. All second-year students enrolled in Pharmacy Practice 2 were eligible and invited to participate voluntarily. Students received a Participant Information Statement at the start of the workshop and were advised that consent was inferred through completion of both the baseline and follow-up questionnaires. Only responses from students who returned both surveys were included in the analysis. Data were collected immediately prior to the workshop and again approximately one month later. The follow-up questionnaire also included items seeking feedback on the educational experience.

To protect confidentiality, questionnaires were linked using unique identification codes known only to the administering researcher. These identifiers were permanently destroyed once post-intervention data collection was completed. A schematic representation of the study timeline is provided in **Figure 1**. All procedures complied with the principles outlined in the Declaration of Helsinki and were approved by the University of Sydney Human Research Ethics Committee (HREC2019/573 and HREC2019/575).

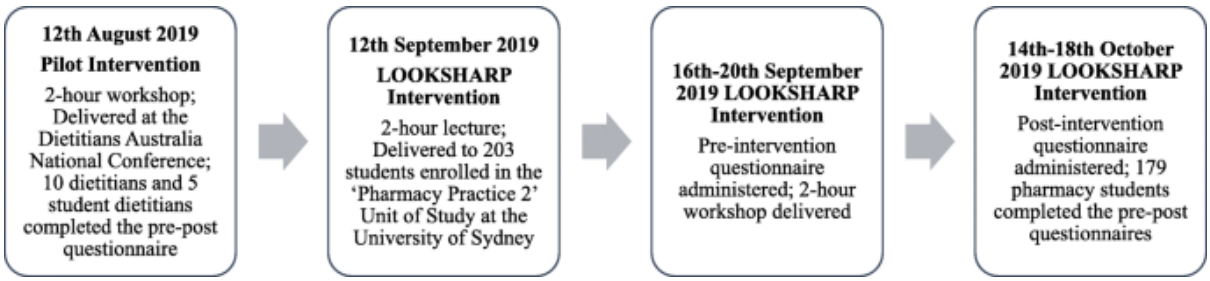

Figure 1. Sequence of the pilot study and the subsequent LOOKSHARP program

The preliminary study was undertaken to test whether a structured educational session could measurably strengthen understanding of nutrition-related contributors to age-related macular degeneration (AMD) among individuals with formal training in nutrition. Demonstrated gains in knowledge were used as a benchmark to determine whether the same educational framework could be adapted for use with other health professional groups. Pharmacy students were selected as a priority population due to their regular involvement in supplying ocular nutritional products, despite not having specialist training in nutrition.

Description of the pilot program

The pilot workshop was developed through collaboration between Accredited Practising Dietitians, ophthalmology clinicians, and researchers with expertise in AMD. Core content centred on contemporary evidence linking dietary factors with AMD risk and progression, supplemented by interactive components designed to promote engagement and practical understanding.

To introduce the lived experience of central vision loss, participants completed an activity that reproduced visual distortions characteristic of AMD. Specialised simulation eyewear sourced from Vision Australia was used while attendees attempted to interpret nutrition labels presented in varying font sizes, thereby illustrating challenges encountered during routine daily tasks.

Knowledge of key carotenoids was explored in a second activity focused on lutein and zeaxanthin. Participants were shown images of nine commonly consumed foods, each paired with a defined portion size, and were asked to rank these foods according to carotenoid content. Facilitators then reviewed the correct ordering using data from the United States Department of Agriculture (USDA) National Nutrient Database [14], followed by discussion of the biological functions of these nutrients and factors affecting their absorption.

Application of learning to clinical contexts formed the final component of the program. Participants worked in small groups on one of three randomly assigned case scenarios, each requiring dietary evaluation, formulation of behaviour modification strategies, and development of a one-day meal plan. The scenarios represented diverse patient profiles: an individual with early AMD who smoked, a person with no current ocular disease but a family history of AMD, and an older adult with unilateral neovascular AMD. Group outcomes were subsequently shared with all workshop participants.

To reinforce key messages beyond the workshop, attendees received a range of supporting materials. These included educational resources produced by the Macular Disease Foundation Australia, such as a professional information brochure on nutrients and supplementation and a recipe collection featuring foods relevant to AMD management. Additional resources created by the research team were also distributed, including a one-week sample meal plan consistent with Australian Dietary Guidelines and current AMD evidence, along with an explanatory handout addressing the roles of lutein and zeaxanthin.

LOOKSHARP intervention

The LOOKSHARP program was delivered to undergraduate pharmacy students enrolled at the Sydney Pharmacy School, University of Sydney. The Bachelor of Pharmacy curriculum spans four years, with the initial two years dedicated to foundational sciences, including human physiology, pharmaceutical sciences, professional communication skills, and introductory clinical content relevant to primary health care, including eye health. The latter half of the program places greater emphasis on system-based disease management, advanced clinical practice skills, and supervised experiential learning through clinical placements.

LOOKSHARP was embedded within the Pharmacy Practice 2 Unit of Study, which is undertaken in the second semester of the second year. This unit concentrates on effective communication of medicines-related information to consumers, particularly in relation to over-the-counter and complementary products [15]. Pharmacy Practice 2 builds upon competencies introduced in Pharmacy Practice 1 (PHAR1821), where students are initially exposed to patient-centred communication, non-prescription therapeutics, clinical reasoning, and the principles of pharmaceutical care.

Details of the LOOKSHARP educational content and delivery format are outlined in **Table 1**. Material addressing the relationship between nutrition and age-related macular degeneration (AMD), including the interactive workshop components, was adapted from the earlier pilot intervention. The instructional design of LOOKSHARP followed the three-stage educational framework described by Wilson and Lieberman [16], while the associated learning objectives and expected outcomes were structured according to the Structure of the Observed Learning Outcome (SOLO) taxonomy **(Table 1)** [17].

Table 1. Overview of the LOOKSHARP intervention, illustrating how educational activities and learning objectives were progressively developed using the three-level method [16] and the SOLO taxonomy [17].

Wilson & Lieberman three-level method [16]	SOLO taxonomy level [17]	Implementation within the LOOKSHARP intervention	Learning objectives
Level I (Exposure) Designed to familiarise pharmacy students with common eye conditions, including AMD, to promote foundational understanding and acceptance of individuals living with visual impairment [16].	**Unistructural:** acquisition of discrete elements of knowledge [17].**Multistructural:** organisation of individual knowledge components into coherent concepts [17].	A two-hour expert-led lecture was delivered in Week 6 of Semester 2 (2019), one week prior to the workshop. The session, facilitated by a dietitian, an optometrist, and members of the research team, introduced key concepts in general eye health and AMD. This preparatory session enabled students to build baseline knowledge and identify questions in advance of the experiential workshop.	Improve students' awareness of visual impairment as a disability and enhance understanding of the functional challenges experienced by individuals with vision loss.

Level II (Experience) Provides opportunities for learners to directly engage with and experience challenges commonly faced by people with vision loss [16].	**Relational:** integration and connection of multiple concepts to form a meaningful whole [17].	A two-hour interactive workshop was conducted in Week 7 of Semester 2 (2019) and facilitated by a registered pharmacist affiliated with the University of Sydney. The workshop incorporated experiential activities designed to simulate living with an eye condition. These included use of AMD simulation glasses, exercises to identify foods rich in key macular carotenoids (lutein and zeaxanthin), and role-play scenarios demonstrating appropriate eye drop counselling techniques.	Develop empathetic, patient-centred communication skills for counselling individuals with eye conditions, including guidance on evidence-based AMD-related products, and apply practical strategies to support people living with vision impairment.
Level III (Ownership) Encourages learners to assume professional responsibility for promoting equitable care for individuals with vision loss [16].	**Extended abstract:** application of learning to real-world contexts and generation of reflective or novel insights [17].	Case-based learning activities focusing on eye conditions, including AMD, were incorporated into the workshop to prompt consideration of individual patient circumstances and professional responsibilities, such as providing tailored counselling on nutritional supplements. A structured reflection task concluded the workshop. In addition, the Unit of Study coordinator scheduled a summative assessment requiring submission of a reflective essay in Week 13 (the final week of semester), addressing themes explored across workshops, including LOOKSHARP.	Critically reflect on the evolving role of pharmacists in extending inclusive and equitable care to people living with vision loss.

Outcome measures

For the pilot workshop, changes in participant knowledge were evaluated using questionnaires administered before and after the session. The survey included six items covering multiple domains. These comprised one clinical multiple-choice question related to age-related macular degeneration (AMD); three multiple-choice questions assessing knowledge of dietary sources relevant to AMD; one binary (yes/no) item examining awareness of Age-Related Eye Disease Study (AREDS) supplements, accompanied by an open-text field for respondents who answered affirmatively to provide details regarding supplement brands or formulations; and a final item collecting demographic information, including professional role (accredited dietitian, dietetic student, or other) and length of professional practice where applicable.

Responses from the pre- and post-intervention questionnaires were scored to quantify overall knowledge change. Correct answers were awarded one point, while incorrect responses received zero points. For items allowing multiple correct responses, participants received one point for each correct option selected. An additional point was awarded for Question 2 if participants provided appropriate dietary advice within the "other" response option. For the AREDS awareness item, one point was allocated when participants correctly identified or described AREDS supplementation. The maximum possible score per question was as follows: Question 1 (1 point), Question 2 (5 points), Question 3 (3 points), Question 4 (3 points), and Question 5 (1 point), resulting in a total achievable score of 13.

Participant satisfaction with the pilot workshop was evaluated using a feedback survey incorporating a five-point Likert scale ranging from "very dissatisfied" to "very satisfied." Additional items included a dichotomous question asking whether participants would recommend the workshop to others, as well as an open-

ended section for qualitative comments and suggestions. The knowledge questionnaires and feedback survey were compiled into a single booklet to enable matching of pre- and post-intervention responses for each participant. A coversheet was included to preserve anonymity by concealing questionnaire completion status from the research team at the time of collection. Submission of both pre- and post-intervention questionnaires was taken as evidence of consent to participate.

Assessment of the LOOKSHARP intervention followed a comparable pre–post evaluation approach. The baseline questionnaire administered prior to the workshop consisted of four distinct sections:

a) Section 1: participant characteristics

This section comprised seven items using either binary (yes/no) responses or brief written answers. Information collected included age, gender, country of birth and duration of residence in Australia, current employment status, prior awareness of vision-related conditions, and any known family history of visual impairment.

b) Section 2: clinical judgement and decision-making

The second section consisted of 12 fixed-response questions assessing students' ability to make appropriate clinical decisions related to age-related macular degeneration (AMD). Topics covered included nutritional supplements, dietary recommendations, preventive strategies, symptom recognition, risk factors, and general knowledge related to AMD. The items were derived from a previously published survey used to evaluate dietary and lifestyle counselling practices among eye care professionals in the United Kingdom [18]. These questions were revised and refined based on an extensive review of the literature and the subject-matter expertise of the research team. Each response was scored dichotomously (1 for correct, 0 for incorrect), with individual item scores summed to produce a total score ranging from 0 to 12.

iii) Section 3: pharmacists' professional role in AMD and vision impairment

This section comprised 12 statements designed to capture students' views on the responsibilities and contributions of pharmacists when supporting individuals with vision impairment or vision loss. Responses were recorded using a five-point Likert scale. As with earlier sections, items were adapted from a previously published instrument [18]. Participants rated their agreement with each statement from 1 ("strongly disagree") to 5 ("strongly agree"), producing a cumulative score ranging from 12 to 60, with higher scores reflecting more positive perceptions of the pharmacist's role.

iv) Section 4: attitudes toward communication with people living with disability

Students' approaches to interacting with individuals who have a disability were assessed using 20 items drawn from the validated Interaction with Disabled Persons Scale (IDPS) [19]. This scale employs a six-point Likert response format, with options spanning from −3 ("disagree very much") to 3 ("agree very much"). Total scores could range between −60 and 60. Minor wording adjustments were made to the original IDPS to incorporate person-first terminology (for example, replacing "disabled" with "a person living with a disability"), while maintaining the scale's original intent and structure.

Analysis

All data collected from the two educational interventions were coded and analysed using SPSS® software (version 25). In the pilot study, participant characteristics and workshop evaluation responses were summarised using descriptive statistical methods. For the knowledge assessment items (Questions 1–5), score distributions were examined by calculating mean values and score ranges. Evaluation of responses to Question 5 was based on participants' written answers, with credit awarded for accurately identifying or describing the AREDS supplement formulation. Pre- and post-intervention score differences were assessed using Wilcoxon's signed-rank test, as the data did not meet assumptions of normality.

For the LOOKSHARP intervention, demographic variables were analysed descriptively in the same manner. Aggregate scores for knowledge (Section 2), perceptions (Section 3), and attitudes (Section 4) were computed by summing item responses within each section. Changes between baseline and follow-up scores were examined using Wilcoxon's signed-rank test, again selected due to non-normal score distributions. Internal consistency of Sections 2, 3, and 4 was evaluated through reliability testing using Cronbach's alpha.

Results and Discussion

Pilot intervention

Fifteen participants (10 registered dietitians and 5 dietetic students; 87% female) attended the educational workshop focusing on nutrition and age-related macular degeneration (AMD). Among the qualified dietitians, professional experience ranged from newly graduated to 30 years in practice. All attendees consented to take part in the pilot intervention, yielding a 100% response rate.

Mean pre- and post-intervention questionnaire scores and their ranges are presented in **Table 2**. Following the workshop, all participants demonstrated awareness that AMD primarily affects central vision (Question 1) and were able to provide appropriate dietary recommendations (Question 2), with several also identifying correct additional advice. Knowledge gains were also evident regarding food sources of lutein and zeaxanthin (Question 3) and awareness of AREDS supplementation (Question 5). Changes in individual question scores, as well as overall knowledge scores, were statistically significant ($p < 0.05$). In contrast, knowledge related to omega-3 content in fish (Question 4) showed no change.

Table 2. Nutrition and AMD knowledge scores pre- and post-intervention

Knowledge item	Post-intervention mean ± SD (observed range)	Pre-intervention mean ± SD (observed range)	p-value
1. Visual field affected by AMD (possible score: 0–1)	1.00 ± 0.00 (1–1)	0.66 ± 0.49 (0–1)	0.025
2. Dietary recommendations for AMD (possible score: 0–5)	4.20 ± 0.41 (4–5)	2.73 ± 1.22 (0–4)	0.002
3. Knowledge of food sources of lutein and zeaxanthin (possible score: 0–3)	2.93 ± 0.26 (2–3)	1.47 ± 0.99 (0–3)	0.002
4. Knowledge of omega-3 fatty acid content in fish (possible score: 0–3)	2.13 ± 0.52 (1–3)	2.13 ± 0.52 (1–3)	1.000
5. Awareness of AMD-related supplements (possible score: 0–1)	0.93 ± 0.26 (0–1)	0.47 ± 0.52 (0–1)	0.008
Overall knowledge score (possible score: 0–13)	**10.8 ± 1.01 (8–12)**	**7.07 ± 1.94 (3–10)**	**0.001**

Participant evaluations of the workshop indicated a high level of acceptability. Attendees particularly valued the participatory design of the session and the practical materials supplied. Satisfaction ratings were received from 12 of the 15 participants, with 80% indicating they were either “satisfied” or “very satisfied”; three participants did not return evaluation forms. All respondents stated that they would recommend the workshop to peers.

LOOKSHARP intervention

The LOOKSHARP program was incorporated into the Pharmacy Practice curriculum and delivered to a cohort of 203 students during Weeks 6 and 7 of Semester 2, 2019. The intervention was implemented across ten tutorial classes in Week 7. Paired pre- and post-intervention questionnaires were completed by 179 students, resulting in a response rate of 88.2%. Participant demographics showed that most students were women (n = 120, 67%) and aged between 18 and 34 years (n = 170, 95%). Over half were Australian-born (n = 99, 55.3%), and nearly two-thirds were employed in a pharmacy at the time of the study (n = 112, 62.6%). Although more than half of the cohort (n = 102) reported personal familiarity with vision impairment through a family member or friend, the majority (n = 152, 84.9%) had not previously received any formal education relating to eye or vision conditions.

Following participation in the intervention, students demonstrated a significant increase in total knowledge scores related to age-related macular degeneration (AMD) ($p = 0.011$). The largest gains were observed in understanding of clinically supported supplementation, as reflected across three knowledge items ($p = 0.005$) **(Table 3).** Students’ views regarding the professional responsibilities of pharmacists in assisting people with vision impairment also shifted positively, with a significant improvement in overall perception scores ($p = 0.004$). Improvements were most evident in competencies related to instructing patients in eye-drop administration ($p = 0.028$), applying assistive technologies ($p = 0.028$), supporting self-care practices

(p = 0.050), delivering specialised services (p = 0.006), and recognising indicators of visual impairment (p = 0.001) **(Table 4)**. While aggregate attitude scores did not change significantly (p = 0.578), students reported reduced unease when engaging with individuals with disabilities, as measured by a single item (p = 0.043) **(Table 5)**. Reliability testing of the questionnaire demonstrated moderate to acceptable internal consistency, with Cronbach's alpha coefficients of 0.50 for knowledge, 0.70 for perceptions, and 0.70 for attitudes.

Table 3. Overall knowledge scores of pharmacy students regarding age-related macular degeneration (Section 2)

AMD knowledge domain (12 items)	Post-intervention mean ± SD (percentage score)	Pre-intervention mean ± SD (percentage score)	p-value
Knowledge of evidence-based supplementation (3 items; possible score: 0–3)	1.03 ± 0.88 (34 ± 29%)	0.81 ± 0.84 (27 ± 28%)	0.005
General nutrition recommendations (3 items; possible score: 0–3)	2.59 ± 0.69 (86 ± 23%)	2.58 ± 0.66 (86 ± 22%)	0.866
Risk factors and preventive strategies (2 items; possible score: 0–2)	1.10 ± 0.73 (37 ± 24%)	1.03 ± 0.78 (34 ± 26%)	0.309
Disease mechanisms and clinical presentation (2 items; possible score: 0–2)	0.90 ± 0.60 (30 ± 20%)	0.80 ± 0.62 (27 ± 21%)	0.059
Pharmacological management options (2 items; possible score: 0–2)	1.08 ± 0.81 (36 ± 27%)	1.08 ± 0.63 (36 ± 21%)	0.959
Overall AMD knowledge score (possible score: 0–12)	**6.64 ± 2.00**	**6.25 ± 1.93**	**0.011**

Table 4. Pharmacy students' perceptions of professional pharmacist roles in the care of individuals with vision impairment (Section 3)

Pharmacist role domain (12 items)	Post-intervention mean ± SD	Pre-intervention mean ± SD	p-value
Monitoring			
Supporting patient self-management	4.07 ± 0.83	3.95 ± 0.77	0.050
Conducting screening activities	4.16 ± 0.82	4.07 ± 0.90	0.278
Information provision			
Directing counselling primarily to the carer[a]	3.46 ± 1.01	3.59 ± 0.94	0.195
Demonstrating correct eye drop technique	4.48 ± 0.65	4.61 ± 0.61	0.028
Adapting counselling approaches	4.46 ± 0.74	4.36 ± 0.88	0.102
Supporting use of assistive technologies	4.24 ± 0.73	4.10 ± 0.84	0.028
Using simplified language[a]	3.68 ± 1.17	3.67 ± 1.15	0.802
Vigilance			
Perceiving people with vision impairment as difficult to engage with[a]	3.52 ± 0.96	3.63 ± 0.99	0.228
Identifying vision impairment based on obvious indicators (e.g. guide dog)[a]	2.99 ± 1.10	3.30 ± 1.05	0.001
Management			
Belief that pharmacists should not deliver specialised assistance[a]	3.89 ± 1.00	4.13 ± 0.80	0.006
Ensuring accessible service interfaces	4.51 ± 0.64	4.50 ± 0.66	0.918
Providing staff education and training	4.32 ± 0.71	4.30 ± 0.88	0.853
Overall perception score (possible range: 12–60)	**42.45 ± 4.95**	**41.54 ± 5.26**	**0.004**

[a]Items phrased in a negative direction were recoded prior to analysis, with response options scored from 1 (strongly agree) to 5 (strongly disagree).

Table 5. Pharmacy students' attitudes toward communication with people with disabilities, by thematic domain (Section 4)

Attitudinal domain (20 items)	Post-intervention mean ± SD	Pre-intervention mean ± SD	p-value
Social unease			
Feeling overwhelmed[a]	0.95 ± 1.75	1.08 ± 1.69	0.834
Feeling uncomfortable[a]	0.86 ± 1.73	0.84 ± 1.76	0.916
Looking or staring[a]	1.30 ± 1.58	1.44 ± 1.58	0.536
Uncertainty about appropriate behaviour[a]	0.66 ± 1.71	0.42 ± 1.75	0.184
Limiting interactions to brief contact[a]	1.53 ± 1.61	1.81 ± 1.38	0.043
Fear-related responses			
Avoidance of direct eye contact	1.54 ± 1.61	1.75 ± 1.48	0.368
Anxiety about acquiring a disability[a]	−0.76 ± 1.81	−0.57 ± 1.82	0.593
Relief at not having a disability[a]	−2.25 ± 1.20	−2.43 ± 1.08	0.307
Empathy			
Open discussion about disability	1.04 ± 1.64	1.05 ± 1.59	0.775
Absence of pity	−0.32 ± 1.81	−0.66 ± 1.80	0.075
Focusing on the individual rather than the disability	1.47 ± 1.51	1.53 ± 1.51	0.964
Behaving normally and disregarding the disability	0.93 ± 1.87	0.97 ± 1.77	0.826
Perceived knowledge level			
Awareness of challenges faced	1.21 ± 1.52	1.15 ± 1.46	0.833
Feeling uninformed[a]	0.88 ± 1.88	1.04 ± 1.87	0.714
Sense of vulnerability			
Curiosity about living with a disability	1.30 ± 1.64	1.32 ± 1.64	0.990
Emotional discomfort when seeing disability	1.89 ± 1.29	2.10 ± 1.18	0.061
Frustration when unable to help	1.83 ± 1.33	2.03 ± 1.16	0.072
Reminder of personal vulnerability	0.45 ± 1.87	0.34 ± 1.94	0.671
Positive enrichment			
Admiration for coping ability	2.09 ± 1.15	2.09 ± 1.12	0.942
Finding assistance rewarding	2.29 ± 1.67	2.43 ± 0.90	0.248
Overall attitude score (possible range: −60 to 60)	18.57 ± 11.20	19.18 ± 10.19	0.578

[a]Items worded in a negative direction were recoded prior to statistical analysis, with responses scored from −3 (agree very much) to +3 (disagree very much).

This study represents the first evaluation of an educational program addressing the relationship between nutrition and age-related macular degeneration (AMD) for practising and student dietitians, which was subsequently broadened to include a general eye health intervention for pharmacy students. Both educational initiatives were effective in enhancing AMD-related and eye health knowledge within their respective participant groups.

Among dietitians, the pilot workshop resulted in a significant improvement in awareness of appropriate dietary recommendations for individuals with AMD. Beyond strengthening understanding of key food groups relevant to AMD management, participants also demonstrated marked gains in recognising dietary sources of lutein and zeaxanthin, as well as improved awareness of supplements associated with optimal macular health. In contrast, knowledge regarding the omega-3 fatty acid content of different fish species remained moderate and unchanged following the intervention. This outcome is likely attributable to the limited emphasis placed on omega-3 fatty acids during the workshop, where the topic was only briefly addressed in the introductory presentation due to time limitations. Conversely, lutein and zeaxanthin were explored in greater depth through targeted small-group activities

followed by whole-group discussions. Similarly, education surrounding AREDS supplementation was a prominent component of the workshop, incorporated into both the overview presentation and applied case-study exercises that required participants to translate knowledge into practical patient scenarios. These interactive and applied learning approaches are consistent with principles of authentic learning, which are associated with deeper and more durable knowledge acquisition [20].

The LOOKSHARP intervention delivered to pharmacy students also produced a significant improvement in overall AMD knowledge, particularly in relation to evidence-based supplementation. Although increases were observed across knowledge domains related to AMD risk factors, disease mechanisms, and general dietary guidance, these changes did not reach statistical significance. Selective improvements may reflect students' tendency to prioritise content perceived as examinable based on the unit of study outline [15, 21], or content with immediate relevance to practice, given that 62.6% of participants were employed in a pharmacy setting where eye health knowledge could be directly applied. In addition, limited change in some areas may be explained by high baseline knowledge levels, particularly within the general dietary advice domain, where pre-intervention scores were already close to the maximum achievable score.

The LOOKSHARP program also resulted in a significant positive shift in students' perceptions of pharmacists' professional responsibilities when supporting individuals with vision impairment. In particular, increased agreement regarding the use of assistive technologies during patient counselling suggests greater recognition of their role in facilitating effective communication. Importantly, movement toward neutral or disagreement responses for the belief that individuals using visual aids do not require additional assistance indicates that the intervention helped challenge prevailing stereotypes and encouraged more inclusive perspectives. Interestingly, agreement with pharmacists' role in demonstrating eye-drop technique decreased significantly after the intervention. This shift may reflect students' exposure to practical skill-based activities, including self-administration, peer feedback, and observation of demonstrations by the facilitating tutor and registered pharmacist. These experiences may have prompted participants to reassess and recalibrate their perceived competence, suggesting that confidence in this skill may have been overestimated prior to the intervention.

Despite improvements in knowledge and perceptions among pharmacy students, no significant change was detected in overall attitude scores. This finding may be influenced by the use of the Interaction with Disabled Persons Scale (IDPS), developed in 1997, which may lack sensitivity for detecting attitudinal change in contemporary student cohorts who are already exposed to evolving societal norms around equity, inclusion, and accessibility [19]. Furthermore, the intensity of the intervention itself may have been insufficient to produce measurable changes in attitudes. Previous research using the IDPS among psychology undergraduates reported similar baseline scores but demonstrated positive attitude shifts following ten hours of service-learning involving direct engagement with individuals with disabilities [19, 22]. Direct interpersonal contact has been shown to promote less prejudicial attitudes by providing personal insight into the lived experiences and challenges faced by people with disabilities [23, 24]. However, it is likely that both sustained training and exposure to a diverse range of vision impairments are required, as exposure alone may be insufficient to alter deeply embedded attitudes. Supporting this notion, a comparable educational intervention involving pharmacy students and simulated patients with lived experience of suicide improved counselling confidence but failed to significantly change attitudes toward suicide [25].

Overall, the knowledge gains achieved in the pilot intervention for practising and student dietitians were successfully translated into a broader educational framework for pharmacy students, yielding comparable outcomes. Nonetheless, several limitations should be acknowledged. First, the pre–post study design lacked a control group and is susceptible to response-shift bias [26], although this approach is commonly employed in educational intervention research [27]. Future studies may consider the use of a retrospective pre-test design to mitigate this limitation [26]. Second, some questionnaire items were not validated, as they were purpose-designed based on the combined expertise of the research team. Third, the study did not assess the impact of the interventions on professional practice, highlighting the need for longitudinal follow-up to determine effects on the clinical behaviours of dietitians and pharmacists. Additional limitations were specific to each intervention. The pilot workshop involved a small sample size, limiting generalisability to the broader population of

Australian dietitians. Moreover, as multiple workshops were delivered concurrently at the Dietitians Australia conference, participants who selected the nutrition and AMD workshop may have had a pre-existing interest in the topic, introducing potential selection bias. In the LOOKSHARP intervention, reliability analysis of Section 2 (clinical decision-making) yielded a Cronbach's alpha of 0.5, below the commonly cited threshold of 0.7 for acceptable internal consistency [28]. Despite these limitations, the demonstrated knowledge improvements associated with the LOOKSHARP intervention have supported the continued integration of this module into the Pharmacy Practice unit of study at the University of Sydney, Australia.

Conclusion

Targeted educational programs are effective in strengthening understanding of nutrition-related aspects of age-related macular degeneration among both practising and student dietitians, while also improving eye health knowledge and shaping more informed perceptions of pharmacists' responsibilities in low-vision care among pharmacy students. As a result of its demonstrated impact, the LOOKSHARP program has been formally embedded within the Pharmacy Practice unit of study at the University of Sydney. Further investigation is warranted to explore adaptation of this intervention for other healthcare disciplines, including general practice.

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