Prescribing oral medicines by optometrists

A mapping of current education programs and professional practice standards to demonstrate the preparation of optometrists to prescribe medicines for oral administration

A report commissioned by the Optometry Board of Australia

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Abbreviations and Terminology

Acronym, Term	Meaning
ASPRINH Project	Assessment of Prescribing in Health Project (2015-2017). This multi-site project reviewed the curricula for ten separate health professions to identify how prescribing is taught and assessed.
Competencies	The knowledge, skills and behaviours needed to adequately perform the function. (1)
Core Competency (CC)	Competencies considered essential to safe prescribing. (2)
Learning Outcome (LO)	Expected outcomes of the learning process undertaken during completion of a unit of study.
OBA	Optometry Board of Australia.
OCANZ	Optometry Council of Australia and New Zealand.
Prescribing Competencies Framework (PCF)	Prescribing expectations defined for the Australian context.
Program of Study	A course of study encompassing multiple units of study.
Unit of Study	A discrete component of a program of study, comprised of multiple learning sessions e.g. lectures, tutorials, practicals and associated assessments.

Executive Summary

Appropriately trained and authorised Australian optometrists have prescribed medicines, according to a defined formulary of topical medicines, for many years (two decades in Victoria; less in other states and territories). During this time, optometrists have contributed to patient care by ensuring efficient access to medicines according to their recognised scope of practice. This project considered the preparation, and practice expectations, of endorsed Australian optometrists to prescribe medicines in the context of expanding the prescriptive authority to include medicines for oral administration.

The project consisted of a series of detailed reviews focused on the professional practice expectations of optometrists and the education and training programs that lead to an endorsement to prescribe medicines. Four key questions were posed.

Key Question 1: Is there evidence in the curricula (entry level and post entry level ocular therapeutics programs) that students are required to demonstrate competence to apply current evidence to decisions that involve medicines management?

The project response to this question involved two separate reviews of the learning outcomes and assessments for all accredited optometry programs in Australia (seven curricula). Evidence suggests that optometrists undergoing both entry level and post entry level ocular therapeutics programs in Australia develop the skills and knowledge required to prescribe medicines, including oral medicines, according to reliable evidence.

Key Question 2: What medicines are included in each program and in what context are medicines taught?

The details of medicines included in the curricula for participating sites identified all medicines/classes included in, but not limited to, the current OBA approved list of scheduled medicines. Medicines were discussed in the context of foundational (basic pharmacology) knowledge, the application of medicines to relevant case material and the application to patient care, such as in the clinic setting. There is evidence that programs include orally-administered medicines.

Key Question 3: Do the current professional practice standards describe an expectation that registrants will seek and incorporate current evidence in their prescribing decisions?

The project reviewed the professional practice standards for optometry (Entry Level Competency Standards for Optometry, OBA Guidelines for Use of Scheduled Medicines and the OBA Code of Conduct for Optometrists) and identified that all prescribing competencies considered relevant to the project are included.

Key Question 4: Do the current accreditation standards align with an expectation that students will be taught and assessed on their ability to incorporate current evidence in their prescribing decisions?

The current accreditation standards for optometry programs align with the expected prescribing competencies reviewed in the project.

In the context of prescribing, therapeutic decision-making requires consideration of many factors focused on the clinical needs and preferences of the patient. The optimal medicine, dose, frequency, route of administration, likely duration and expected outcomes of treatment must be considered according to reliable and relevant evidence. The ability to source, appraise and apply evidence is therefore critical to inform the decision-making process. This project identified evidence that the education programs reviewed support the development of the skills required to undertake this process, including those required for oral prescribing. The review also identified clear professional expectations that optometrists remain aware of, and practice according to, their recognised scope of practice. Australian optometrists are well prepared to prescribe medicines according to appropriate and reliable sources of evidence.

1. Introduction

The OBA Code of Conduct describes the need for optometrists to practice within their recognised scope of practice. (3) Health professions in Australia define scope of practice according to the practice components considered essential to their practice. (4-6) Commonly, definitions include the elements of competence (which comprises required, and demonstrated, knowledge, skills and associated behaviours), authority (legislative and professional) and accountability (professional responsibility supported by an appropriate governance system and professional standards), as summarised in Figure 1. In order to modify a profession's scope of practice, consideration should be given to each element.

Scope of practice = competence* + authorisation + accountability

**where competence comprises demonstrated knowledge, skills and behaviours.*

Figure 1 The key components of practice scope

While a formal definition of practice scope is difficult to identify for the Australian optometrist, Kiely et al. suggest that scope is partly determined by the authorisation to prescribe medicines. (7) Appropriately trained Australian optometrists have been eligible to obtain authorisation to prescribe medicines for some years (since 2000 in Victoria and subsequently in other states). Since 2014, successful graduates of all Australian optometry programs of study have achieved automatic authority to prescribe medicines from an approved list, comprising relevant topical medicines. (8) Optometrists demonstrate their *competence* to prescribe medicines as part of the required education and training (either at the entry or post entry level). The *authority* to prescribe medicines, provided by state and territory-based legislation, currently requires optometrists to prescribe according to a formulary of approved topical medicines. The *accountability* for prescribing is indicated in the professional standards.

Prescribing competence requires the application of essential knowledge (e.g. pharmacology, biomedical sciences) and skills (e.g. communication, the ability to source and appraise appropriate literature, clinical decision-making) to the needs of a unique patient. In this context, the most appropriate prescribing decision should be guided by the best available evidence relevant to the patient and their needs. In some instances, the best evidence may indicate that the most appropriate prescribing decision is to *not* prescribe medicines. Equally, evidence may indicate that an oral medicine is the most appropriate. Currently, Australian optometrists are not authorised to prescribe medicines for oral administration. A survey conducted by Kiely et al. indicates that, excluding the treatment of glaucoma, the most common reason for an optometrist with prescribing rights to refer a patient is where the 'best medication is an oral medicine'. (7)

This project reviewed the current education and training undertaken by Australian trained optometrists, and the professional expectations described in relevant professional practice standards, for evidence of competence and accountability to prescribe medicines according to evidence, including for oral administration.

The report comprises two sections: section 1 describes the project aim and scope and summarises the methodology; section 2 summarises the findings and provides a conclusion. Separate appendices provide additional detail regarding the project methodology (including its limitations) and challenges. Supplementary tables provide the data collection templates and full details of the data generated by the project.

Section 1: Project aim, methodology and scope

2. Project Aim

The project was commissioned to review the education and training provided by Australian optometry schools in the context of prescribing medicines for oral administration. Specifically, the Optometry Board of Australia (OBA) requested a mapping exercise that would investigate alignment between approved programs of study and the NPS MedicineWise Competencies Required to Prescribe Medicines (the Prescribing Competencies Framework).(1) However, the Prescribing Competencies Framework does not include the route of administration as a specific prescribing competency, focusing instead on prescribing medicines according to reliable evidence (including evidence to support the most appropriate route of administration). The project team therefore focused the review on the preparation of optometrists to make appropriate prescribing decisions based on the best available evidence, including decisions regarding the optimal route of administration.

Given that Australian optometrists have prescribed medicines for some years, prescribing competence per se was not under investigation. The review considered the application of competence to the prescribing process, including consideration of the patient's specific needs, the best available evidence and an awareness of professional and personal limits.

2.1 Key Questions

1. Is there evidence in the curricula (entry level and post entry level ocular therapeutics programs) that students are required to demonstrate competence to apply current evidence to decisions that involve medicines management?
2. What medicines are included in each program and in what context are medicines taught?
3. Do the current professional practice standards describe an expectation that registrants will seek and incorporate current evidence in their prescribing decisions?
4. Do the current accreditation standards align with an expectation that students will be taught and assessed on their ability to incorporate current evidence in their prescribing decisions?

3. Project Methodology

The project commenced in March 2020 and will conclude in December 2020. The following summarises the project methodology (full details are available in the separate appendices).

3.1 Project establishment

The project team met virtually in March 2020 to discuss and agree on the project deliverables and proposed method, including the programs of study to be reviewed. For each program, a site contact was identified and invited to attend an online meeting held on 28th April, 2020, to discuss the project aims, method, timeframe and the required contributions from each site. Seven sites agreed to participate in the review, providing details of nine programs of study (Table 1). This represents all of the accredited optometry programs offered in Australia.

Table 1 Project participating sites

Site	Program
Australian College of Optometry	Certificate in Ocular Therapeutics
Deakin University	Bachelor of Vision Science, Master of Optometry
Flinders University	Bachelor of Medical Science (Vision Science), Master of Optometry
Queensland University of Technology	Bachelor of Vision Science, Master of Optometry
The University of Canberra	Bachelor of Vision Science, Master of Optometry
The University of Melbourne	Doctor of Optometry
The University of New South Wales	Bachelor of Vision Science, Bachelor of Optometry
The University of New South Wales	Bachelor of Vision Science, Master of Clinical Optometry
The University of New South Wales	Graduate Certificate in Ocular Therapeutics

The following details were requested from each site:

- A program outline or overview.
- The name of each unit of study and associated learning outcomes and assessments.
- Details of the medicines/medicine classes included in the program, what year level and in what context medicines are included.

Given the project commenced at the height of the COVID-19 pandemic, many programs had modified their processes to accommodate students learning from home. Sites were requested to provide the details of their regular program, rather than detailing program modifications designed to accommodate COVID-19, which primarily impacted assessment processes without affecting learning outcomes.

3.2 Method

In order to meet the project aims, 5 reviews were undertaken (reviews A-E). The method used for each review is described in Appendix 1. Review findings are summarised in section 2, full details are available in the annexed Supplementary tables.

3.2.1 Summary of reviews undertaken for the project

Table 2 Project review summary

Review	Aim	Method
A	Identify prescribing competencies in program learning outcomes.	Comparison of all unit learning outcomes with relevant prescribing competencies sourced from the Prescribing Competencies Framework. (1)
B	Identify prescribing competencies in program learning outcomes.	Comparison of all unit learning outcomes with relevant prescribing competencies sourced from Lum et al. 12 core competencies for prescribing. (2)
C	Identify medicines and/or medicine classes included in the reviewed programs of study.	Details provided by sites indicating where medicines/classes were included and the context in which medicines/classes were studied.
D	Identify the presence of prescribing competencies in optometry professional practice standards	Comparison of professional practice standards (3, 8, 9) with relevant prescribing competencies sourced from the Prescribing Competencies Framework. (1)
E	Identify prescribing relevant expectations in the OCANZ Accreditation Standards for Optometry programs of study.	Review of the accreditation standards (10, 11) to identify aspects relevant to the development of prescribing decision-making skills.

4. Project Scope

The project considered the preparation of Australian optometrists to prescribe medicines for oral administration.

4.1 In scope

The following tasks were considered important to the project achieving its aims:

(a) A review of Australian optometry curricula (both entry level and post entry level ocular therapeutics programs) and accreditation standards to identify teaching relevant to optometrist prescribing medicines.

(b) A review of the current optometry professional practice standards to identify expectations consistent with optometrist prescribing medicines according to the best available evidence.

4.2 Out of scope

The following were considered outside the project scope:

(a) Review of the international literature relevant to optometrist prescribing of medicines for oral administration.

(b) Evidence that optometrists are competent to undertake tasks essential to prescribing but not specific to prescribing medicines for a particular route of administration. This includes the ability to accurately diagnose ocular disease, to monitor prescribed therapy, to communicate the prescribing decision with the patient and other health professionals. These factors are considered as part of the accreditation process for all optometry programs and were therefore not reviewed as part of the project.

(c) The professional requirements for the maintenance of prescribing competence after initial endorsement e.g. the completion of required relevant continuing professional development. These requirements were not reviewed as part of the project.

Section 2: Project findings, summary and recommendations

5. Review A. Prescribing competencies identified in program learning outcomes

5.1 Key messages

- Relevant foundational knowledge and skills were identified in all reviewed programs.
- Specific prescribing competencies were identified in all reviewed programs.
- Consideration could be given to strengthening how the following topics are addressed in program learning outcomes:
  (a) The implications to the wider community of prescribing medicines e.g. specific reference to the concept of antimicrobial stewardship.
  (b) The critical appraisal of medicines-specific literature with particular focus on medicines for oral route of administration. Although it is clear that current programs emphasise the skill of sourcing and appraising literature, the inclusion of a medicines-specific focus in this context could be emphasised in program learning outcomes.
  (c) Recognised contributors to, and strategies to prevent, medicines related error and prescribing error in particular.

5.2 Aim

To review current optometry programs of study (entry level and post entry level ocular therapeutics programs) for the presence of learning outcomes that reflect relevant prescribing competencies as defined in the Prescribing Competencies Framework. (1)

5.3 Summary of method

The sites detailed in Table 1 contributed to this review by providing relevant program details.

5.3.1 Program details

Details were received from 7 sites for 9 programs of study (7 entry level programs; 2 post entry level ocular therapeutics programs). For 3 sites, assessment details were provided, but not

linked to specific learning outcomes. For 1 site, no learning outcomes were provided for the experiential component of the program.

Each site was asked to provide the following details for review:

- The learning outcomes for all program units of study.
- The method of assessment for all learning outcomes.
- An outline or overview of the program.

Program details were obtained in a variety of formats and manually entered into a separate Microsoft Excel® spreadsheet for each site.

5.3.2 Review

Learning outcomes were reviewed to identify those that developed (or required students to demonstrate):

(a) foundational knowledge and/or skills important for prescribing competence, or
(b) knowledge and/or skills considered specifically relevant to the chosen prescribing competencies.

For this review, the Prescribing Competencies Framework was used as the reference for relevant competencies and underpinning knowledge and skills, further detailed in Appendix 1, Table 1.

A coding system was used to identify learning outcomes that provided relevant foundational knowledge and/or skills (coded '1') and those that either provided or required the student to demonstrate specifically relevant knowledge and/or skills (coded '2'). Learning outcomes not viewed as relevant were assigned a code of '0'.

5.3.3 Analysis

For each site, a summary of the proportion of all program learning outcomes that were coded 0, 1 or 2 was compiled to indicate the proportion of the program that provided knowledge and skills relevant to the review. This process was replicated for the grouped data to provide an overall view of the reviewed programs of study.

Example analysis (refer also Supplementary Tables, Table 2.1)

149 Learning outcomes (LO) were reviewed for Site A. Of the 149 LO, 20 (13.4%) provided underpinning knowledge relevant to UKN2.4 (Pharmacology of relevant medicines) and were coded 1. Of the 149 LO, 15 (10.1%) were specifically relevant to competency 2.2.1 (Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicine suitable for treating the person) and coded 2.

When all sites were combined, a total of 1298 LO were reviewed. Of these, 161 (12.4%) provided underpinning knowledge relevant to UKN2.4 (coded 1) and 102 (7.9%) were specifically relevant to competency 2.2.1 and coded 2.

Comparison of the two post entry level ocular therapeutics programs and the entry level programs was undertaken to identify any possible differences relevant to the preparation of prescribing skills relevant to the project.

An overview of the assessments used to assess learning outcomes identified as providing relevant content was undertaken to ensure processes consistent with relevant literature were identified.

5.4 Findings

Tables 3 and 4 (pages 19, 20) provide a summary of the proportion of learning outcomes identified as reflecting the chosen prescribing competencies, for all sites combined, either specifically (Table 3) or by in the context of developing required underpinning knowledge and/or skill (Table 4). These tables summarise the data for all programs, including both entry level and post entry level ocular therapeutics programs, which are discussed separately below. Further details are provided in Supplementary Table 2.1.

Entry level optometry programs

Combined data identified learning outcomes considered specifically relevant for all reviewed prescribing competencies. However, individual sites varied in the proportion of learning outcomes identified as relevant to the competencies. These differences may reflect institutional procedures and requirements and/or differences in program structure (e.g. undergraduate or graduate entry).

Findings are reported as a proportion of the entire program learning outcomes identified as relevant to the review.

For the entry level programs, the highest proportion of learning outcomes identified as **specifically relevant** were for competencies 2.2.1 *(Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition)* [overall average proportion 7%; range 5% - 10%] and H1.2.1 *(Demonstrates knowledge of and complies with: professional standards, codes of conduct, scope of practice statements or guidelines)* [overall average proportion 4%; range 1% - 7%].

The lowest proportion of specifically relevant learning outcomes was identified for competency 2.2.5 *(Considers the implications to the wider community of using a particular medicine to treat the person)* [overall average proportion less than 1%; range 0% - 1%].

Learning outcomes that provided the **foundational knowledge and skills** required to develop prescribing competencies were identified for all foundational areas included in the review. Similar to the learning outcomes identified as specific to prescribing, however, variability in the proportion of learning outcomes identified as relevant was observed between sites.

The highest proportion of learning outcomes identified as providing required foundational *knowledge* related to UKNH1.2 *(Relevant practice guidelines, protocols and scope definitions)* [overall average proportion 11%; range 7% - 14%]. Learning outcomes relevant to the development of *skill* USKH2.2 *(Ability to communicate effectively with the person and other health professionals)* were most commonly identified [overall average proportion 10%; range 3% - 16%].

The only area of foundational *knowledge* that was difficult to identify in the learning outcomes related to medicine errors *(UKNH1.3 Awareness of the types, causes, and risks of medicines errors, and where they are most likely to happen e.g. due to prescribing the wrong route, dose, time or dosing frequency for the medicines)*. For 2 entry level programs, no relevant learning outcomes could be identified that aligned with this knowledge, and for the remainder either 1 or 2 learning outcomes were identified across the entire program.

Learning outcomes relevant to the development of foundational *skills* were identified for all areas.

Post entry level ocular therapeutics programs

Two programs that deliver post entry level education and training specific to prescribing medicines were reviewed. For one site, learning outcomes relevant to the period of experiential learning were not provided. One site provided learning outcomes for each unit of study, the other for each lecture session. As a consequence, the proportion of relevant learning outcomes appears much higher in one program than the other. Regardless, the review provides an indication of the focus of teaching content for the programs. Findings are reported as a proportion of the entire program learning outcomes identified as relevant to the review.

Within these programs, and consistent with the entry level programs, the highest proportion of learning outcomes specifically relevant to prescribing competencies was identified for competency 2.2.1 *(Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition). [Site F 50%; Site G 8%].*

For competencies 2.2.5 *(Considers the implications to the wider community of using a particular medicine to treat the person)* and H1.4.4 *(Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice)*, no learning outcomes appeared specifically relevant in the two programs.

The highest proportion of learning outcomes identified as providing required foundational knowledge was for UKN2.4 *(Pharmacology of relevant medicines)*. [Site F 56%; Site G 29%]. Learning outcomes relevant to the development of foundational skill USK2.2 *(Consider medicine effectiveness e.g. pharmacodynamic and pharmacokinetic properties of medicines)* was most commonly identified [Site F 56%; Site G 28%].

Foundational knowledge relevant to an understanding of medicine errors *(UKNH1.3 Awareness of the types, causes, and risks of medicines errors, and where they are most likely to happen e.g. due to prescribing the wrong route, dose, time or dosing frequency for the*

medicines) was identified infrequently in the 2 post entry level ocular therapeutics programs. Learning outcomes relevant to the development of skills needed to appraise literature *(USKH1.1 Ability to source and critically appraise medicines related information)* and communicate *(USKH2.2 Ability to communicate effectively with the person and other health professionals)* were least commonly identified.

Assessment of relevant learning outcomes

Five entry level programs and one post entry level ocular therapeutics program provided adequate detail to directly link program learning outcomes with assessments. For each of these sites, the learning outcomes identified as relevant to the review were clearly assessed, frequently using multiple methods of assessment. For the other three sites, the details of assessments were provided for each unit of study, rather than for individual learning outcomes. Therefore, although it is apparent that learning outcomes identified as relevant to prescribing are assessed, it is not possible to identify a clear link between specific learning outcomes and assessments.

The details provided by all sites indicated that a range of assessment methods were applied to assuring student achievement of the learning outcomes considered relevant to prescribing. Written examinations and assignments were commonly used early in the programs, while standardised assessments such as the objective structured clinical examination (OSCE), case presentations and observed performance assessments were more common later in the programs. Practical examinations, particularly those that examined diagnostic ability were frequently identified across all programs.

Table 3 Review A: Proportion of learning outcomes identified as **specifically relevant** to prescribing competencies

Prescribing specific competencies (all sites combined)	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the person	Considers the implications to the wider community of using a particular medicine to treat the person	Refers the person for further assessment or treatment when the suitable treatment options are outside the health professional's own scope of practice	Demonstrates knowledge of and complies with: professional standards; codes of conduct; scope of practice statements or guidelines	Practices within the limits of the health professional's own education, training, and scope of practice	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines or modifying existing treatment plans
	2.2.1	2.2.5	2.2.9	H1.2.1	H1.2.2	H1.4.4	H2.5.4
Total LO Reviewed (all sites combined)	1298	1298	1298	1298	1298	1298	1298
Number LO specifically relevant to the competency	102	2	27	60	51	34	43
Proportion of all LO reviewed (%)	7.9%	0.2%	2.1%	4.6%	3.9%	2.6%	3.3%
Notes	LO = Learning outcome Findings are reported as a proportion all learning outcomes reviewed across all programs of study, including both entry level and post entry level ocular therapeutics programs.						

Table 4 Review A: Proportion of learning outcomes identified as developing **underpinning knowledge and/or skill** relevant to prescribing competencies

Underpinning knowledge and skills	Pharmacology of relevant medicines	Awareness of issues relevant to medicines safety	Consider medicine effectiveness e.g. pharmaco-dynamic and pharmaco-kinetic properties of medicines	Awareness of medicines-related legislation requirements e.g. relevant poisons legislation, TGA, PBS, MBS	Relevant practice guidelines, protocols and scope definitions	Awareness of the types, causes, and risks of medicines errors, and where they are most likely to happen, for example due to: prescribing the wrong route, dose, time, or dosing frequency for the medicine	Ability to source and critically appraise medicines related information	Commitment to respecting the contribution of other health professionals to collaborative care	Ability to communicate effectively with the person and other health professionals
	UKN2.4	UKN2.5	USK2.2	UKNH1.1	UKNH1.2	UKNH1.3	USKH1.1	USKH2.1	USKH2.2
Total LO Reviewed (all sites combined)	1298	1298	1298	1298	1298	1298	1298	1298	1298
Number LO providing underpinning knowledge/skill relevant to the competency	161	123	151	128	163	10	101	102	114
Proportion of all LO reviewed (%)	12.4%	9.5%	11.6%	9.9%	12.6%	0.8%	7.8%	7.9%	8.8%
Notes	LO = Learning outcome Findings are reported as a proportion all learning outcomes reviewed across all programs of study, including entry level and post entry level ocular therapeutics programs								

5.5 Discussion

The findings indicate **entry level optometry programs** provide students with the foundational knowledge and skills required to prescribe medicines and meet prescribing specific competencies. Learning outcomes that describe foundational pharmacology knowledge; an awareness of medicines safety and medicines legislation; and the boundaries of the optometrist scope of practice were clearly evident in the reviewed programs.

The reviewed programs, which were developed to focus on topical medicines in accordance with the scope of practice for Australian optometrists, could strengthen the description of some aspects of prescribing practice in the program learning outcomes. For example, a broader understanding of the risks of, and strategies to reduce, prescribing error in the context of prescribing oral medicines and the social obligations specifically related to the prescription of oral medicines.

Post entry level ocular therapeutics programs emphasised foundational pharmacology, medicines legislation and scope of practice/guidelines knowledge as well as the skills required to make a prescribing decision and practice within recognised optometric scope. These programs focused less on the critical appraisal of the literature and skills relevant to professional communication. This emphasis is understandable given that the basis for these skills are developed in the entry level programs and this may explain the lack of emphasis in the post entry level context. It is also important to note that many of these skills will likely be enhanced and further developed during the experiential learning period. Learning outcomes may not explicitly reflect this period of development and for one program learning outcomes applicable to the practical component of the program were not obtained.

The principles of effective assessment suggest that multiple assessment methods, utilised on multiple occasions and, ideally, in varying relevant contexts are required to adequately assess the development of prescribing relevant skills. (12, 13) The information provided for review suggests that these principles are adhered to across the reviewed programs.

The inability to identify learning outcomes that specifically address aspects of prescribing practice, and the associated variation between programs, likely reflects differences in the ways that programs are required to construct their learning outcomes, by their institutions, rather than the absence of teaching material.

5.6 Challenges

Curricular review of this type is challenging, largely because it involves a comparison of a set of competencies designed to define the practice of a registered health professional with a set of learning outcomes designed to develop required professional knowledge and skills. Clearly there are many steps along the path from first year student to graduate. The progression of student learning is reflected in the detail of the learning outcomes, particularly the verb used to describe the expected outcome. For example, the 'demonstration of ability to…' describes an expectation that the student has developed the skill and can show the assessor their abilities. On the other hand, 'become familiar with…' indicates the early part of the process and the provision of knowledge more specifically. Comparing these different types of learning outcomes with the expectations of a registered professional is, at times, challenging. The decision to review the underpinning knowledge and skills was taken to augment the information available to the review.

There is no specific guidance for the *number* of learning outcomes required to adequately develop the knowledge and skills required to prescribe medicines. In the context of this review, the proportion of the entire program of study has been used as an indicator of the volume of teaching dedicated to the development of a particular skill or acquisition of knowledge. However, in one area of practice a single learning outcome may be adequate, while for others reinforcement may be required across the program and evidenced by multiple relevant learning outcomes. This review made no judgement regarding this, but rather sought to identify the presence of relevant teaching considered essential to prescribing decision-making. The number of relevant learning outcomes will also be influenced by institutional policy and approval processes that govern the number of learning outcomes that can be expressed at a course, graduate outcome and individual unit of study level. Where restrictions are placed on the number of learning outcomes applicable to each unit,

the expression will be broad in nature and may not explicitly capture the level of detail required for this review.

For the purposes of context, a comparison can be made with other prescribing professions. The ASPRINH (Assessment of Prescribing in Health) Project compared the curricula for 10 health professions (including 1 optometry program) with the Prescribing Competencies Framework to identify learning outcomes specifically relevant to each element. While this review was less detailed than the current review, it provides a comparative indication of the volume of learning outcomes identified as relevant to prescribing in each curriculum. Data adapted from the ASPRINH Project (14) indicates that optometry curricula are comparable to other professions in the proportion of program learning outcomes identified as specifically relevant to prescribing elements (Table 5).

Table 5 Proportion of learning outcomes identified as specifically relevant to the elements of the Prescribing Competencies Framework

Prescribing Competencies Framework Element	Dentistry (DDM)	Medicine (MBBS)	Nurse Practitioner (MNP)	Optometry (B VisSci MOptom)	Pharmacy (BPharm Hons)
	Proportion of LO specific to element (%)	Proportion of LO specific to element (%)	Proportion of LO specific to element (%)	Proportion of LO specific to element (%)	Proportion of LO specific to element (%)
2.2 Identifies appropriate medicines options that can be incorporated into the person's treatment plan	9.8	7.4	12.8	12.1	23.3
H1.2 Practices according to professional standards, codes of conduct, and within the health professional's own scope of practice	3.5	7.0	18.0	3.0	9.8
H1.4 Practices quality use of medicines	5.1	2.2	7.7	4.2	22.6
H2.4 Communicates effectively with the person using appropriate communication skills to enable the safe use of medicines	2.1	5.0	2.6	9.7	6.0
H2.5 Collaborates with other health professionals to achieve optimal health outcomes for the person	0.5	2.2	12.8	7.2	2.3
Notes	LO = Learning outcome Findings are reported as the proportion all learning outcomes identified as relevant to prescribing within each program of study				

Source: Data adapted from *ASPRINH Project(14)*

6. Review B. Core competencies identified in program learning outcomes

6.1 Key Messages

- All programs of study include learning outcomes that specifically align with the core prescribing competencies.
- Foundational knowledge and skills were evident in all programs.

6.2 Aim

To review current optometry programs of study (entry level programs and post entry level ocular therapeutics programs) for the presence of learning outcomes that reflect relevant prescribing competencies as defined by Lum et al. (2)

6.3 Summary of method

As for Review A, the seven sites detailed in Table 1 provided relevant program details. The method employed for this review was identical to that undertaken for Review A and described in Appendix 1. Learning outcomes for all units of study were compared to a relevant selection of core competencies described by Lum et al. (2) to identify those that align either by providing foundational knowledge and/or skills or specifically relevant teaching content. The competencies chosen for this review are detailed in Appendix 1, Table 2.

6.4 Findings

A summary of the findings for all sites combined is provided in Table 6. Full details are available in Supplementary Table 2.2.

6.4.1 Entry level optometry programs

Combined data showed that all programs include learning outcomes identified as either specifically relevant to the chosen core competencies. In addition, foundational knowledge and/or skill important to the development of the competencies were clearly evident. As identified in Review A, variability was observed

between sites in the proportion of learning outcomes identified as relevant to the competencies.

Learning outcomes (LO) considered relevant to the reviewed competencies most frequently aligned with core competency 7 *(Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment)* [Combined average proportion LO providing foundational knowledge/skill 8%; range 3% - 15%. Combined average proportion LO specifically relevant 12%; range 6% - 21%] and competency 8 *(Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications, concerns; drug-patient, drug-disease, drug-drug interactions)* [Combined average proportion LO providing foundational knowledge/skill 9%; range 4% - 14%. Combined average proportion LO specifically relevant 12%; range – 7% 17%].

6.4.2 Post entry level ocular therapeutics programs

Similar to the entry level programs, the 2 ocular therapeutics programs most commonly included learning outcomes that aligned with core competency 7 [Site F 50% LO specifically relevant and 6% provide foundational knowledge/skill; Site G 7% LO specifically relevant and 24% provide foundational knowledge/skill] and competency 8 [Site F 50% LO specifically relevant and 6% provide foundational knowledge/skill; Site G 7% LO specifically relevant and 23% provide foundational knowledge/skill].

Table 6 Review B: Proportion of learning outcomes that reflect the core prescribing competencies defined by Lum et al* (summary, all sites)

	Determine how well disease and symptoms are managed/controlled	Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment	Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions	Select drug, form, route, dose, frequency, duration of treatment
	Core Competency 6	**Core Competency 7**	**Core Competency 8**	**Core Competency 9**
Total LO Reviewed	1298	1298	1298	1298
Number (proportion of all reviewed LO) providing relevant underpinning knowledge and/or skill	26 (2.0%)	125 (9.6%)	133 (10.2%)	81 (6.2%)
Number (proportion of all reviewed LO) specifically relevant	114 (8.8%)	155 (11.9%)	154 (11.9%)	101 (7.8%)
Notes	LO = Learning outcome Findings are reported as a proportion all learning outcomes reviewed across all programs of study, including entry level and post entry level ocular therapeutics programs			

**Lum E, Mitchell C, Coombes I. The competent prescriber: 12 core competencies for safe prescribing. Austr Prescr 2013;36(1):13-6.*

6.5 Discussion

Review A provided detailed information regarding the foundational knowledge and skills required to develop individual prescribing competencies and the program content viewed as specifically relevant to the competencies. This review (Review B) considered the core prescribing competencies, which describe a more consolidated view of prescribing competence. For example, core competency 8 describes the need to consider 'ideal' therapy, inclusive of both pharmacological and non-pharmacological therapies. This competency is very relevant to optometry practice, reflecting the need to consider the optimal prescribing decision in the context of the specific patient's needs and available treatment modalities. Core competency 9 describes the selection of an appropriate drug, including consideration of the most appropriate drug, form, route, dose, frequency and duration of treatment. All of these factors require consideration based on available evidence and all programs of study provide both foundational and specific content relevant to this competency.

7 Review C. Medicines specifically included in reviewed programs

7.1 Key messages

- OBA approved medicines are included in all programs.
- Teaching content specifically focused on oral medicines was apparent for all programs.
- The project did not have access to the specifics of the fuller detail of components of individual assessment items within programs to determine where assessment relating to prescribing medicines occurred.

7.2 Aim

To review the medicines included in the reviewed programs and the context in which students are exposed to relevant medicines.

7.3 Summary of method

7.3.1 Data

The details of medicines included in the reviewed programs were provided by each site. A template developed by the project team (Supplementary Table 1.2) was provided by OCANZ to site contacts with a request to populate and return reflective of current program details. Details of all medicines currently specified in the OBA approved list of scheduled medicines from which endorsed optometrists are qualified to administer, obtain, possess, prescribe and supply within their practice (8) were requested. In addition, a description of the oral medicines included in each program was requested.

7.3.2 Analysis of the data

For each site, details provided were reviewed to determine:

- Confirm that all OBA approved topical medicines were included and in what context the medicines were studied. For the purposes of this review, sites were asked to identify teaching content that provided:
    - foundational knowledge (e.g. basic pharmacology);

- the application of knowledge (e.g. the use of a medicine in the context of a specific disease state); and
- the application of knowledge in a clinical context (e.g. the medicine is considered by the student in the context of a prescribing decision for a patient). This would be expected to occur in the supervised clinic/private practice setting.

- Oral medicines included in the program and the context in which these were included.

7.4 Findings

7.4.1 General comments regarding the data

All sites used the template provided by the project team, however, the detail recorded varied. Sites were instructed to describe medicines that were included in the program (for the purposes of the review an indication of content relevant to medicine classes was considered adequate). Some sites provided detail regarding individual medicines, however most indicated where medicine classes were included. Generally, it was difficult to establish the depth to which medicines (or medicine classes) were discussed e.g. whether the medicine was mentioned for relevance to a broader topic or discussed in detail. Two sites provided clear details of where oral medicines were included, for the remainder this information was implied but not specified.

Evidence of medicines included in the program was received from 6 of the 9 sites reviewed. Supplementary Table 2.3 provides full details of the information supplied by each site.

7.4.2 Evidence of the inclusion of OBA approved medicines in the reviewed programs

Review of curricula to identify approved medicines

Notwithstanding the above comments related to data variability, all medicine classes included in the OBA approved medicines list were evident in each program. There were no exclusions or omissions in the detail provided.

Teaching context

(a) Foundational teaching

Programs included foundational pharmacology content (as evidenced in greater detail in Review A) and used multiple teaching methods to facilitate learning including lectures, webinars, tutorials and case-based teaching. For most programs, there was clear evidence that pharmacological principles were discussed in the context of both ocular and broader systemic medicines.

(b) Application of pharmacological knowledge

Pharmacological principles were applied to specific disease states, including infectious, inflammatory and allergic ocular diseases and glaucoma, on which a significant proportion of medicines teaching was focused (as evidenced by the number of lectures, tutorials, webinars and other teaching sessions). In addition, medicines were discussed in the context of systemic diseases such as hypertension, thyroid disease and analgesia.

(c) Application of pharmacological knowledge in the clinical context

For all sites, the clinical placement experience was highlighted as providing the opportunity for students to apply their medicines knowledge to the clinical context. Students work in a variety of practice settings during this period of learning and would be expected to encounter the prescribing process, including the clinical decision-making, during that period. While OCANZ specifies that the practice of therapeutics is a requirement for students on clinical placements and requires providers to submit annual information on the minimum, median and maximum number of encounters involving therapeutics to which students on placement are exposed, the processes of clinical decision-making in the context of prescribing specific medicines is not externally reported. It is therefore difficult to quantify the exact contribution of the clinical placement experience to the development of prescribing knowledge and skills, although this is known to be significant.

Assessment

All sites required students to demonstrate their knowledge and skills using logged patient encounters, case reports and performance evaluations. However, it was unclear from the information provided whether there was a requirement for

assessments to include (e.g. for case reports) or assess (e.g. for performance evaluations), the prescribing process (or for a proportion of the assessments to do so). Therefore, although it is expected that students undertake therapeutic decision-making during the course of their clinical experience, it is unclear exactly how frequently this occurs and whether the ability to do so is formally assessed (and if it is, how many encounters and which disease states are assessed).

Teaching content specific to oral medicines

All sites indicated that oral medicines were included in the current program. For most sites the teaching content described according to each medicine class was noted to include both topical and oral medicines. For 2 sites, additional detail was provided to confirm that oral medicines were included in the context of relevant disease states and as part of the foundational pharmacology units.

Examples

The following examples describe the additional detail provided by 2 sites, to further expand on the teaching relevant to medicines and therapeutic decision-making.

Site A curriculum detail

Foundational knowledge relevant to prescribing

- Cellular biology, pathological processes, systemic disease, microbiology.
- Pharmacological principles.

Applied prescribing knowledge

- Foundational knowledge supports the development of more detailed knowledge and competencies in ocular anatomy and physiology, visual science and the specific study of ocular pharmacology and ocular disease. The clinical applications of foundational knowledge are relevant to these units of study.
- Case-based scenarios are used to illustrate the aetiology, signs and symptoms, differential diagnoses, clinical progression and prognosis of ocular conditions.

Prescribing in the clinical setting

- Experience gained in the university-based clinic, external practices, ophthalmology practices and international clinical placements provide practical exposure to the management of ocular conditions, including those requiring medicines management.
- Case-based scenarios are used to supplement clinical exposure for less common conditions requiring therapeutic management.
- Oral medicines used in the management of ocular disease, including co-management of disease in collaboration with medical practitioners according to current legislation and possible new roles for optometrists are discussed in relation to specific cases.

Figure 2 describes the above in the context of learning to prescribe antibacterial agents.

Figure 2: Teaching and Assessment of the use of antibacterials in the management of ocular disease

Teaching & Learning

❖ **Foundational knowledge** Ocular defence mechanisms to infection, including anti-microbial agents in tear film, beta-lysin in tears and aqueous, immune responses and tear immunoglobulins. Common ocular pathogens, antibacterial resistance, cross-resistance.

❖ **Pharmacology** of relevant antibacterial drugs including their mechanisms of action e.g. cell wall structure, cell membranes, protein synthesis, cellular metabolism, DNA synthesis.

❖ **Therapeutic application of antibacterials** including aminoglycosides, macrolides, Fluoroquinolones. Indications, contraindications, adverse effects, precautions.

❖ **Case examples reinforce the application of knowledge.** Two examples illustrate this: the use of guanine analogues in the management of *herpes simplex and herpes zoster* keratitis; where oral antibiotics are necessary e.g. doxycycline for meibomian gland disease. Adverse effects, contraindications, precautions and possible interactions.

Assessment

Format

Lecture, case-based learning.

Experiential learning (university clinic, external placements), personal experiences recorded.

Application of understanding to the clinical context via case presentations, logged experiences, performance review.

Site B curriculum detail

Foundational knowledge relevant to prescribing

- Evidence-based prescribing, patient-centred care.
- The ability to access, interpret and utilise appropriate literature to inform clinical decision-making (regarding both topical and oral medicines) in the context of specific case studies.
- Study design and how to interpret evidence to inform clinical decision-making e.g. how to identify study strengths and weaknesses. Studies that inform drug selection and route of administration are included.
- Principles of pharmacology and related concepts, including the anatomical and physiological basis of pharmacology; drug delivery, distribution & clearance; receptors & drug actions, including those relevant to oral medicines. Case- and problem-based learning strategies allow students to apply and reinforce these concepts.
- Mechanisms of infection, inflammation, microorganisms, non-infective inflammatory processes. Mechanisms of action and the spectrum of activity of antimicrobial (focus on antibacterial and antiviral) and anti-inflammatory medicines.
- The prescribing process, including the principles of quality use of medicines, national prescribing competencies, antimicrobial stewardship. In addition, the concept of therapeutic dosing and the therapeutic range is introduced for both topical and systemic drug delivery.

Applied prescribing knowledge

- The diagnosis of, and prescribing process for, a range of ocular conditions, including meibomian gland dysfunction and the use of doxycycline; dacryocystitis and the use of penicillins and cephalosporins; scleritis, episcleritis and the use of ibuprofen and prednisolone; acute angle closure and the use of acetazolamide.

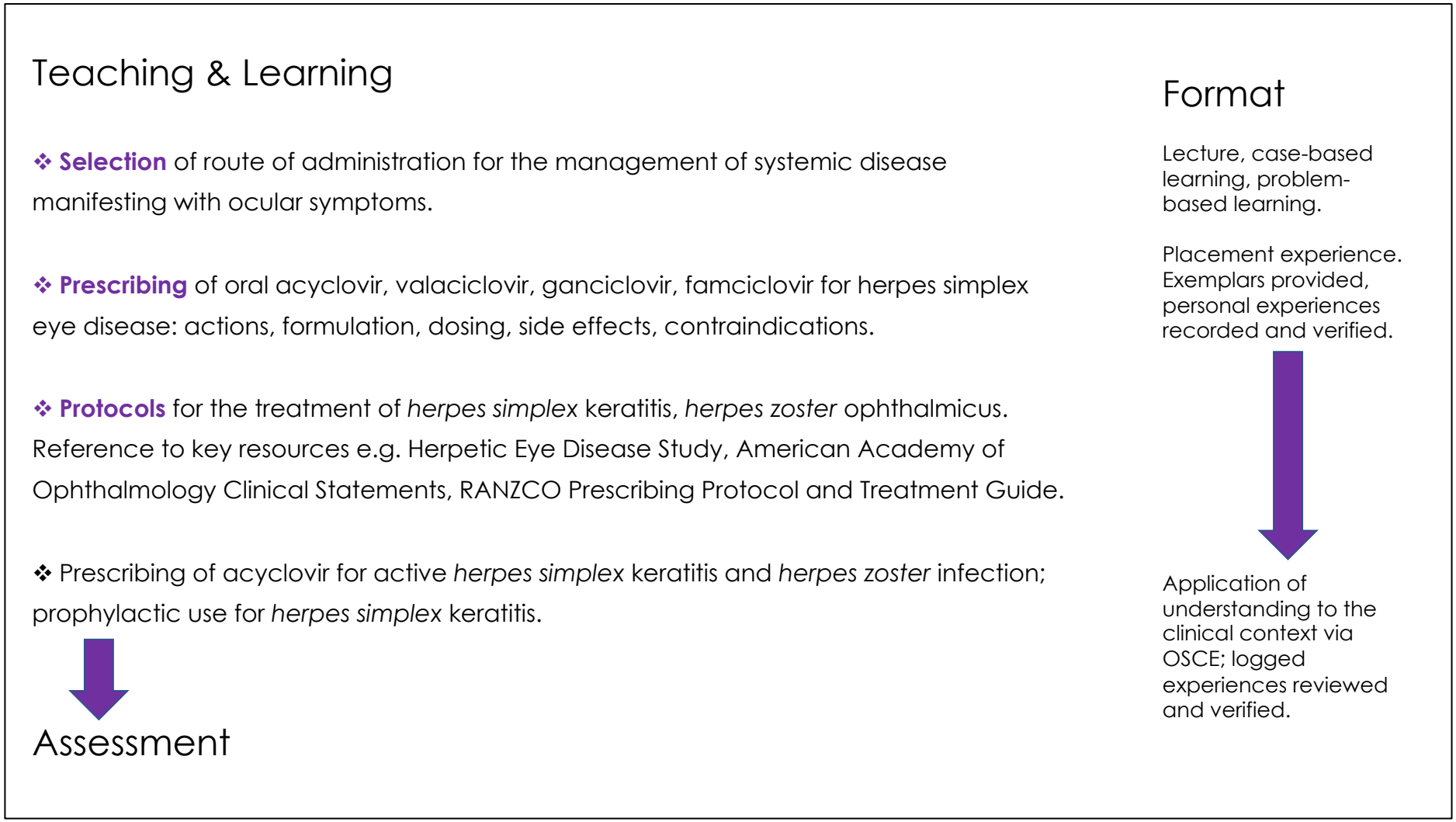
Prescribing in the clinical setting

- Full spectrum of ocular conditions that may require oral medicines.
- Safety considerations in oral prescribing (pregnancy, indications and contraindications to prescribing oral medicines).

- Potential interaction of key oral and topical medicines used in the management of eye disease.
- Ocular and systemic adverse reactions to topical and oral medicines.
- Medication errors. Sources of error, extent, consequences and strategies for avoiding.
- Protocols for the systemic administration of a range of oral medicines with a focus on the prescription of oral antibacterials, antivirals and anti-inflammatories in the management of conditions such as hordeolum, dacryocystitis, preseptal cellulitis, *herpes simplex* eye disease, *herpes zoster* ophthalmicus, uveitis, scleritis, episcleritis, ocular allergy and dry eye disease.
- Quality use of medicines, key medicines, specific dosing strategies, adverse reactions, contraindications.
- Use of current and reliable medicines references and relevant studies to inform prescribing decision-making.
- Assessment: range of written assessments, OSCEs that assess the capacity to make prescribing decisions, the ability to detect prescribing error and the ability to respond to unexpected responses.

Figure 3 describes the above in the context of learning to prescribe acyclovir.

Figure 3: Teaching and Assessment of the use of acyclovir in the management of herpetic eye disease



8 Review D. Prescribing competencies reflected in professional practice standards

8.1 Key Messages

> All reviewed prescribing competencies are clearly evident in the documents that describe professional practice expectations for endorsed optometrists.

8.2 Aim

To identify the chosen prescribing competencies in the professional practice standards for Australian optometrists.

8.3 Summary of method

Professional practice standards were reviewed for alignment with the prescribing competencies considered relevant to the project (Appendix 1, Table 1). Three documents that describe professional practice expectations relevant to the project were reviewed:

- Entry Level Competency Standards for Optometry (Kiely & Slater, 2014) (9)
- OBA Guidelines for Use of Scheduled Medicines (2018) (8)
- OBA Code of Conduct for Optometrists (2016) (3)

The data was analysed descriptively.

8.4 Findings

The review findings are summarised in Table 7. Full details are provided in the Supplementary Table 2.4.

When considered together, the documents clearly describe an expectation that endorsed optometrists will meet the competencies defined in the Prescribing Competencies Framework and identified as relevant to this review.

The **Entry level Competency Standards** reflected all reviewed competencies, with an emphasis on the collaborative nature of prescribing. Competency 2.2.9, which describes the need for prescribers to recognise when a patient should be referred to another professional, is described in detail in the standards with a particular emphasis on prescribing arrangements for glaucoma. Competency H2.5.4, which describes the communication of relevant prescribing information to other health professionals, is also clearly evident in the standards. The standards indicate that optometrists should be aware of, and practice according to, their scope of practice.

With reference to the choice of medicine, indicators describe the need for optometrists to evaluate evidence, use clinical expertise, consider patient preferences and context and prescribe medicines according to the recognised principles of quality use of medicines, including accepted guidelines and protocols. The need to understand when oral medicines may be more appropriate than topical is specifically included in the indicators. In summary, the standards expect endorsed optometrists to demonstrate all prescribing competencies reviewed as part of the project.

The **Guidelines for Use of Scheduled Medicines** focuses on the clinical decision-making processes relevant to prescribing, including the important factors to consider and the possible implications of the choice (with an emphasis on antimicrobial resistance). The guidelines also describe the responsibility optometrists have to effectively communicate with other health professionals, including referral where appropriate, particularly in relation to glaucoma management and shared care arrangements.

The **Code of Conduct** describes the professional aspects of practice, that can be applied to the context of prescribing medicines. These include: the recognition of personal limits and scope of practice descriptions; the expectation that practice will reflect the best available evidence and hold the patient central to the decision-making process; the need to consider and manage potential and actual conflicts of interest; and the need to practice collaboratively.

Table 7 Review D. Prescribing competencies identified in professional practice standards (summary)

	Competency Area 2 Relevant Prescribing Competencies		Competency Area H1 Relevant Prescribing Competencies		Competency Area 2 Relevant Prescribing Competencies	
	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition	Considers the implications to the wider community of using a particular medicine to treat the person	Refers the person for further assessment or treatment when the suitable treatment options are outside the health professional's own scope of practice	Demonstrates knowledge of and complies with: professional standards; codes of conduct; scope of practice statements or guidelines	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines or modifying existing treatment plans
	2.2.1	**2.2.5**	**2.2.9**	**H1.2.1**	**H1.4.4**	**H2.5.4**
Optometry competency standards (source: Entry Level Competency Standards for Optometry, 2014) **that reflect the relevant prescribing competencies***	4.9.1	4.9.1	1.3.3	1.3.3	4.9.1	1.5.1
			1.4.1	1.4.4	1.2.1	1.5.3
			1.5.2	1.3.1		4.11.2
			4.3.1			4.11.3
			4.9.1			
			4.11.1			
			4.11.2			
Optometry guidelines (source: OBA Guidelines for Use of Scheduled Medicines, 2018) **that reflect relevant prescribing competencies***	2.1 (b)	2.1 (b)	5			6.1
		4.1	7.1			7.2
			7.4			

	Competency Area 2 Relevant Prescribing Competencies		Competency Area H1 Relevant Prescribing Competencies		Competency Area 2 Relevant Prescribing Competencies	
	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition	Considers the implications to the wider community of using a particular medicine to treat the person	Refers the person for further assessment or treatment when the suitable treatment options are outside the health professional's own scope of practice	Demonstrates knowledge of and complies with: professional standards; codes of conduct; scope of practice statements or guidelines	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines or modifying existing treatment plans
	2.2.1	**2.2.5**	**2.2.9**	**H1.2.1**	**H1.4.4**	**H2.5.4**
Practice descriptions (source: OBA Code of Conduct for Optometrists, 2016)			1.1 (d)	1.2 (a)	1.2 (g)	3.5
that reflect relevant prescribing competencies*			7.11 (b)	7.11 (d), (e)		
**Source: NPS MedicineWise Prescribing Competencies Framework*						

By way of comparison the ASPRINH Project reviewed the professional practice standards for multiple health professions with the Prescribing Competencies Framework to identify where standards reflected the competencies, either completely or in part. In this review, the proportion of the prescribing competency element (which comprises multiple performance criteria) that was identified in the practice standards was calculated. As shown in Table 8, these data indicate that the optometry entry level competency standards accurately reflect the prescribing competency elements chosen for review in this project.

Table 8 Proportion of prescribing competencies specifically identified in professional practice standards (comparison of professions)

Prescribing Competencies Framework Element	Dentistry	Medicine	Nurse Practitioner	Optometry	Pharmacy
	Proportion (%) of this element identified in practice standards*	Proportion (%) of this element identified in practice standards*	Proportion (%) of this element identified in practice standards*	Proportion (%) of this element identified in practice standards*	Proportion (%) of this element identified in practice standards*
2.2 Identifies appropriate medicines options that can be incorporated into the person's treatment plan	66.7	88.9	55.6	100.0	100.0
H1.2 Practices according to professional standards, codes of conduct, and within the health professional's own scope of practice	100.0	100.0	100.0	100.0	100.0
H1.4 Practices quality use of medicines	75.0	100.0	100.0	100.0	100.0
H2.4 Communicates effectively with the person using appropriate communication skills to enable the safe use of medicines	100.0	50.0	50.0	100.0	100.0
H2.5 Collaborates with other health professionals to achieve optimal health outcomes for the person	50.0	50.0	25.0	100.0	25.0
**The professional practice standards reviewed for each profession as part of the ASPRINH Project are provided in Appendix 1 Table 3.*					

Source: Data adapted from *ASPRINH Project (14)*

9 Review E. Prescribing competencies identified in accreditation Standards

9.1 Key Messages

Accredited entry level optometry programs and post entry level ocular therapeutics programs are required to address (in the learning outcomes and assessment matrix) the prescribing competencies considered relevant to this project. Graduates of these programs are therefore equipped to prescribe medicines according to evidence, which may include medicines to be administered orally.

9.2 Aim

To review the current accreditation standards for alignment with relevant prescribing competencies as detailed in the NPS MedicineWise Prescribing Competencies Framework. (1)

9.3 Summary of method

Accreditation standards pertaining to both entry level optometry programs (9) and post entry level ocular therapeutics programs (11) were reviewed to identify standards specifically relevant to the prescribing competencies chosen for the project (Appendix 1, Table 1).

9.4 Findings

Program accreditation is noted in the standards to signify that graduates of the program "…have the knowledge, skills and other professional attributes and competencies that are necessary for the entry level practice of optometry/the practice of ocular therapeutics in Australia or New Zealand." [Preamble] As such, programs must demonstrate appropriate outcomes consistent with professional practice standards, which includes the prescription of medicines within accepted practice scope.

9.4.1 Accreditation standards for entry level optometry programs

Entry level optometry programs must ensure that all graduates are prepared for therapeutic practice. Standards 3 and 5 are applicable to this review.

Accreditation Standard 3 (Program design, delivery and resourcing enable students to achieve the required professional competencies) Criteria 3.1 indicates that program learning outcomes should address all professional competencies endorsed by OCANZ (i.e. the Entry level Competency Standards for Optometry, 2014 (9)). As described in Review D, the competency standards specifically include competencies relevant to prescribing medicines.

In meeting the relevant standards, programs must achieve the minimum discipline knowledge, skills and capabilities as described in the Threshold Learning Outcomes Health, Medicine and Veterinary Science. (15) Learning Outcomes described in the Threshold descriptions include the ability to formulate a management plan, identify and treat ocular disease within recognised practice scope and the ability to obtain and interpret relevant evidence.

Accreditation Standard 5 (Assessment is fair, valid and reliable) describes the need for a comprehensive assessment program that assures graduates meet the endorsed competency standards. Specifically, all learning outcomes are to be mapped to the required competencies and assessed (Criteria 5.6); the assessment program should address all learning outcomes relevant to the required competencies (Criteria 5.2); and include multiple assessment methods (including direct observation in the clinical setting) used across multiple sampling points (Criteria 5.3).

9.4.2 Accreditation standards for post entry level ocular therapeutics programs

Post entry level programs are designed to upskill optometrists who were not trained to prescribe scheduled medicines as part of their entry level training. Programs delivering post entry level ocular therapeutics qualifications are expected to demonstrate alignment with professional and national prescribing competencies. Specifically, learning outcomes are expected to map to both the endorsed professional standards and the NPS MedicineWise Prescribing Competencies Framework. Graduates are expected to meet all standards required of the Registration Board and to practice according to their personal and professional practice limits.

As for the entry level programs, standards 3 and 5 are most relevant to this review.

Accreditation Standard 3 (Program design, delivery and resourcing enable students to achieve the required professional competencies) specifically addresses the need for learning outcomes to align with all OCANZ endorsed professional competencies relevant to ocular therapeutics (Criteria 3.2).

Guidance for this section specifically includes a requirement that:

- Programs demonstrate alignment with the NPS MedicineWise Prescribing Competencies Framework;
- Graduates are competent to prescribe oral medicines, regardless of their jurisdictional authority to do so.
- Programs demonstrate an integrated curriculum that provides a strong foundation in prescribing skills, including the principles of quality use of medicines, safe prescribing practices, adverse event reporting and collaborative and inter-professional prescribing practices.

Accreditation Standard 5 (Assessment is fair, valid and reliable) includes a requirement that the assessment program covers all learning outcomes relevant to the competencies for ocular therapeutics (Criteria 5.2) and that all learning outcomes, mapped to the required competencies, are assessed (Criteria 5.6). As for the entry level programs, the use of multiple assessment tools (including direct observation in the clinical setting) and sampling opportunities is expected (Criteria 5.3).

Graduates are expected to be competent in their ability to discuss medicines with patients and other health professionals, engage with patients and relevant carers/family members to arrive at decisions regarding medicines, to communicate regarding prescribed medicines and treatments with other health professionals at transitions of care and to identify opportunities to enhance the care of patients by co-ordinating medicines prescribed by other health professionals. In addition, graduates are expected to evaluate evidence relevant to prescribing decisions.

The accreditation standards also indicate that graduates assess and maintain their competence to prescribe.

9.5 Discussion

Accreditation standards explicitly require all programs to address the OCANZ endorsed professional competence standards. As illustrated in Review D, these standards include all aspects of the Prescribing Competencies Framework that are relevant to the aspects of prescribing practice included in this project (i.e. decision-making and practice according to scope definitions).

Given that all programs of study reviewed in this project hold current OCANZ accreditation, the readiness of graduates to prescribe medicines according to evidence is assured.

10 Summary of findings and recommendations

This project reviewed the optometry professional practice standards and the education and training provided to endorsed optometrists to explore the foundations of evidence-based decision-making in the context of prescribing medicines. Seven programs of study contributed to the review, including 5 entry level programs and 2 post entry level ocular therapeutics programs.

10.1 Key messages

The reviews undertaken as part of this project indicate the following:

- Current entry level optometry programs and post entry level ocular therapeutics programs are required to demonstrate alignment with prescribing competencies in order to meet accreditation standards.
- Prescribing competencies are explicitly included in the current professional practice standards, which align closely with the NPS MedicineWise Prescribing Competencies Framework.
- Education and training programs include learning outcomes and assessments that clearly reflect the prescribing competencies reviewed in the project.
- The proportion of learning outcomes specifically relevant to prescribing is comparable to other prescribing professions.

10.2 Summary of findings in response to key questions

Key Question 1: review of education and training programs

Is there evidence in the curricula (both entry level and post entry level ocular therapeutics programs) that students are required to apply current evidence to decisions that involve medicines management?

The review of **entry level optometry programs** identified that an average of 7% (range 5% - 10%) of all learning outcomes were specifically relevant to competency 2.2.1, which describes the clinical decision-making process required to choose a suitable medicine according to patient need. An average of 3% (range 0% - 8%) of learning outcomes were specifically relevant to the process of evaluating evidence and making an evidence-based decision regarding medicines (competency H1.4.4). Learning outcomes specifically relevant to practice within the limits of education, training and practice scope (competency H1.2.2) were identified, on average, in 3% of the learning outcomes reviewed for entry level programs (range 1% - 5%).

This teaching was supported by additional learning outcomes and assessments that focused on required foundational knowledge (e.g. pharmacology) and skills (e.g. recognition of practice scope, communication).

Post entry level ocular therapeutics programs similarly included learning outcomes specifically relevant to the clinical decision-making process (competency 2.2.1) with 50% of learning outcomes in one site and 8% in the other site identified as relevant to this competency. The ocular therapeutics programs emphasised practice according to competence and scope definitions in their learning outcomes, with 44% at one site and 4% at the other site identified as specifically relevant to this competency (H1.2.2). Ocular therapeutics programs included less learning outcomes specifically relevant to the evaluation of evidence. This may be due to the assumption of prior learning relevant to this competency.

Foundational knowledge in pharmacology and the consideration of medicines effectiveness (including pharmacodynamic and pharmacokinetic properties of a medicine) were clearly visible in the learning outcomes for both programs.

All program learning outcomes were additionally reviewed against the core competencies for safe prescribing, as defined by Lum et al. (2) The findings of this review indicated that 12% of all reviewed learning outcomes for the entry level programs were specifically relevant to core competency 7 (Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment) [range 6% - 21%] and a similar proportion were specifically relevant to core competency 8 (Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions) [range 7% - 17%]. This review also highlighted that 8% of reviewed learning outcomes for the entry level programs were specifically relevant to core competency 9, which describes the selection of drug, form, route, dose, frequency and duration of treatment [range 5% - 11%]. Core competencies were also evident in the post entry level ocular therapeutics programs.

All relevant learning outcomes were assessed, using a variety of assessment methods including standardised (e.g. OSCE) and performance-based assessments, in addition to case presentations, written examinations and written assignments, consistent with the accepted literature guiding assessment practices.

In summary, all programs include learning outcomes that align with the clinical decision-making process relevant to prescribing and support this by foundational knowledge and skills relevant to this competency. Entry level programs include outcomes that require students to appraise evidence and make evidence-based decisions. However, this is emphasised less in the post entry ocular therapeutics programs.

Key Question 2: Medicines included in programs

What medicines are specifically discussed in each program and in what context?

Review C indicated that all medicines included in the OBA list of approved medicines were included in the reviewed programs, in the context of foundational knowledge, applied knowledge (for example to cases) and in the practice setting. All sites indicated that oral medicines were included in the program. The review was unable to determine the depth to which medicines were discussed or whether performance-based assessments were specifically tailored to include therapeutic decision-making focused on medicines use, or whether this occurred by chance.

Key Question 3: Professional practice standards expectations regarding prescribing

Do the current professional practice standards describe an expectation that registrants will seek and incorporate current evidence in their prescribing decisions?

A review of the professional practice standards (Entry level Competency Standards, Guidelines for Use of Scheduled Medicines and Code of Conduct) indicated that all prescribing competencies relevant to the project were clearly expressed in these professional practice descriptions.

Key Question 4: Accreditation standards

Do the current accreditation standards align with an expectation that students will be taught and assessed on their ability to incorporate current evidence in their prescribing decisions?

Entry level and ocular therapeutics programs must demonstrate alignment with the Entry level Competency Standards, which specifically includes the aspects of prescribing reviewed as part of this project. In addition, ocular therapeutics programs must demonstrate alignment with the Prescribing Competencies Framework. All of the reviewed programs hold current accreditation status, thereby ensuring delivery of teaching and assessment specifically relevant to the prescribing of medicines according to evidence.

10.3 Conclusions

Notwithstanding the limitations of the review methodology described in Appendix 3, it is evident that optometrists are well prepared to prescribe medicines safely and effectively. Review details that support this conclusion include: the professional expectations within which optometrists practise, the accreditation processes that govern program development and the specific detail included in the education and training programs. Optometrists who complete either entry level programs or post entry level ocular therapeutics programs are equipped with:

- the required foundational pharmacology and therapeutics knowledge, including specific knowledge of the medicines and medicine classes relevant to optometric practice, the impact of systemic medicines on the eye and of ocular medicines on other body systems;

- the skills to make a prescribing decision, including sourcing and analysing relevant literature to support that decision, an important component of which will include the optimal route of medicines administration; and
- an awareness of competence and practice scope boundaries.

Moving forward, consideration should be given to strengthening program learning outcomes that specifically focus on the following aspects of prescribing medicines:

- The risks of error associated with medicines use, broadly, and the prescribing process specifically, with an emphasis on recognised practical strategies that may prevent and/or limit error.
- The implications of a prescribing decision in the social context, with particular reference to the prescribing of oral antibiotics.
- The appraisal of medicines specific evidence in post entry level ocular therapeutics programs (this was not apparent in the learning outcomes reviewed, however may be included in additional content).
- Where possible, the specific assessment of prescribing skills and knowledge in final assessments.

These suggestions do not detract from the reviewed programs of study, which clearly provide students with both the foundational and specific knowledge and skills necessary to prescribe medicines. Identification of evidence to support one element of the prescribing decision, such as the route of administration, in program learning outcomes is challenging due to the requirement for these outcomes to reflect the global intention of each unit of study, rather than the specific detail that supports these outcomes.

Optometrists have proven prescribing skills, evidenced by their successful contribution to the Australian prescribing workforce for many years. This review supports optometrists' ability to make an evidence-based decision regarding medicines use, including the most appropriate medicine and optimal route of administration based on available evidence.

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Prescribing oral medicines by optometrists

A mapping of current education programs and professional practice standards to demonstrate the preparation of optometrists to prescribe medicines for oral administration

Report Appendices

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Appendix 1: Review methodology

1.1 Prescribing Competency References

Two references were used to provide descriptions of prescribing competencies relevant to the Australian context:

1. The NPS MedicineWise Prescribing Competencies Framework (2012) (1)
2. Lum et al. The competent prescriber: 12 core competencies for safe prescribing (2013) (2)

Coombes et al. describe the four stages of prescribing: information gathering, clinical decision-making, communication and monitoring/review. (3) Each of these stages are reflected in the references chosen for the review, which describe multiple competencies. For the purposes of this project, competencies that focus on the clinical decision-making process were considered most relevant, given that the clinical skills of information gathering (including establishing a diagnosis), communication (including the generation of a prescription) and monitoring of prescribed therapy were not within project scope. The competencies specifically reviewed are provided in Appendix 1, Tables 1 and 2.

Reference 1: The NPS MedicineWise Prescribing Competencies Framework (1)

The Prescribing Competencies Framework (the Framework) defines the competencies required to prescribe medicines and the knowledge, skills and behaviours that support the development of these competencies. For the purposes of this review, competencies relevant to the therapeutic decision-making process were included, as well as the knowledge, skills and attributes required to achieve these competencies. In one instance, two relevant skills were combined for the purposes of the review (USKH2.2). The following were chosen by the project team as most relevant to the project and used to review the curricula content.

Appendix 1 Table 1 Prescribing competencies relevant to Reviews A, D, E

Competency		Comment
Code	Detail	
UKN2.4	Pharmacology of relevant medicines	Competency Area 2 Underpinning knowledge
UKN2.5	Awareness of issues relevant to medicines safety	Competency Area 2 Underpinning knowledge
USK2.2	Consider medicines effectiveness e.g. pharmacodynamic and pharmacokinetic properties of medicines	Competency Area 2 Underpinning skill
2.2.1#	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition	Competency Area 2 required competency
2.2.5#	Considers the implications to the wider community of using a particular medicine to treat the person	Competency Area 2 required competency
2.2.9#	Refers the person for further assessment or treatment when the suitable treatment options are outside the professional's own scope of practice	Competency Area 2 required competency
UKNH1.1	Awareness of medicines-related legislation requirements e.g. relevant poisons legislation, TGA, PBS, MBS	Competency Area H1 Underpinning knowledge
UKNH1.2	Awareness of relevant practice guidelines, protocols and scope definitions	Competency Area H1 Underpinning knowledge
UKNH1.3	Awareness of the types, causes and risks of medicines errors, and where they are most likely to happen, for example due to: prescribing the wrong route, dose, time, or dosing frequency for the medicine	Competency Area H1 Underpinning knowledge
USKH1.1	Ability to source and critically appraise medicines related information	Competency Area H1 Underpinning skill
H1.2.1#	Demonstrates knowledge of and complies with: professional standards, codes of conduct, scope of practice statements or guidelines	Competency Area H1 required competency

Competency		Comment
Code	Detail	
H1.2.2	Practices within the limits of the health professional's own education, training, and scope of practice	Competency Area H1 required competency
H1.4.4#	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Competency Area H1 required competency
USKH2.1	Commitment to respecting the contribution of other health professionals to collaborative care	Competency Area H2 Underpinning skill
USKH2.2	Ability to communicate effectively with the person and other health professionals	Competency Area H2 Underpinning skill (combines H2.4* and H2.5*)
H2.5.4#	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines or modifying existing treatment plans	Competency Area H2 required competency

**H2.4 Communicates effectively with the person using appropriate communication skills to enable the safe use of medicines.*

**H2.5 Collaborates with other health professionals to achieve optimal health outcomes for the person.*

 # Competencies included also in Reviews D and E.

Source: Prescribing Competencies Framework (1)

Reference 2: The competent prescriber: 12 core competencies for safe prescribing (Lum et al.) (2)

This article describes the competencies considered central, or core, to the prescribing process according to the four stages of prescribing. Focusing on those most relevant to the therapeutic decision-making process, competencies 5-9 were considered most relevant to the project. However, when included, competency 5 *(Identify key health and/or medication related issues with the patient, including making or reviewing the diagnosis)* highlighted predominately learning outcomes that described the diagnostic process, which was not under review as part of the project. For this reason, competencies 6-9 only were included (Appendix 1, Table 2).

Appendix 1 Table 2 Core competencies used in Review B

Competency Code	Detail
CC6	Determine how well disease and symptoms are managed/controlled
CC7	Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment
CC8	Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions
CC9	Select drug, form, route, dose, frequency, duration of treatment

Source: The competent prescriber:12 core competencies for safe prescribing (Lum et al.) (2)

1.2 Reviews A and B – education and training programs

The review of current education and training programs for endorsed Australian optometrists was conducted to explore the presence of learning outcomes that reflected accepted national prescribing competencies with a focus on those relevant to therapeutic decision-making.

Review method

The process used to undertake the reviews was based on the work undertaken as part of the ASPRINH (Assessment of Prescribing in Health) Project. (4) Learning outcomes detail the curriculum content that is viewed as sufficiently important to assess and were chosen as the indicator of program content for the purposes of this review. Learning outcomes were reviewed for alignment with the prescribing competencies detailed in Appendix 1, Tables 1 and 2.

Data collection templates were developed, and an initial review undertaken using the learning outcomes obtained for one site. The review process and templates were refined according to the outcome of this process. For each site, the following steps were undertaken:

1. Learning outcomes and assessments for all units of study were entered into a Microsoft Excel® spreadsheet.
2. Relevant prescribing competencies were entered into the spreadsheet.

3. Learning outcomes were reviewed for alignment with the competencies and coded according to the following criteria:
    a. Learning outcomes not relevant to the competency (coded '0');
    b. Learning outcomes that provide foundational knowledge and/or skills relevant to the competency (coded '1'); or
    c. Learning outcomes that either provide or require the student to demonstrate knowledge and/or skills specifically relevant to the competency (coded '2').
4. Data was checked to ensure consistency across all sites. The checking process involved confirming the program details against the original information provided by each site and ensuring the review was conducted consistent with the assumptions and general principles (detailed below) across all sites.
5. A summary of each site was prepared.
6. Descriptive analysis included the following:
    a. For each site, the proportion of learning outcomes that provided and/or required either foundational (coded '1') or specifically relevant (coded '2') knowledge and/or skills was calculated as a proportion of all learning outcomes for that site.
    b. Data for each site was combined to calculate the proportion of all learning outcomes reviewed (for all sites) that provided teaching either specifically relevant to the competencies or relevant foundational knowledge and/or skills.
    c. Entry level programs and post entry level ocular therapeutics programs were reviewed separately.

Review A and B Assumptions and General Principles

The following assumptions and principles were applied to the review process:

Principle 1: Consistent with accreditation requirements, all programs provide foundational level knowledge in biomedical sciences (e.g. anatomy, physiology, chemistry, molecular/cellular biology) sufficient to support the development of diagnostic skills and an understanding of basic pharmacology.

Principle 2: The ability of an optometrist to accurately diagnose optometric illness was not under review. As such, this aspect of prescribing was not reviewed.

Assumption 1: Given that prescribing is one aspect of optometric practice, professional practice skills described in broad terms were assumed to apply to prescribing practice

specifically e.g. the application of ethical behaviour to practice is taken to include application to prescribing practice.

Assumption 2: Learning outcomes that describe the student formulating and/or revising management or treatment plans were taken to include pharmacological therapies as part of the plan, where appropriate to the patient and consistent with practice scope.

Assumption 3: In order to formulate and revise management plans that include medicines, an awareness of relevant legislation is understood e.g. medicines scheduling, Pharmaceutical Benefits Scheme requirements.

Assumption 4: Shared care is assumed to require communication of care arrangements with both the patient/carer and relevant health professional colleagues.

Assumption 5: The development of skills relevant to contribution to teamwork is taken to include the development of communication skills.

1.3 Review C – review of the medicines included in each program

This review investigated the medicines and/or medicine classes included in the programs of study. A template was developed using Microsoft Excel® and provided to each site to record the details of where medicines were included in the program (Year, Semester, Unit). The template included all OBA approved medicines. In order to understand the teaching context and review the development of decision-making skills critical to the prescribing process, sites were asked to indicate the context in which the medicine and/or medicine class was discussed, according to the following categories:

- Foundational knowledge e.g. basic pharmacology.
- Application of knowledge e.g. to a disease state.
- Application of knowledge in the clinical context e.g. the inclusion of the medicine/class in clinical decision-making process in the context of managing a patient.

Sites were instructed to indicate details for the medicine class, where teaching details were common to all medicines in the class.

Descriptive analysis of the data included:

- Identification of the medicines/classes that were *unable* to be identified in the information provided.

- The context in which medicines were included in the reviewed programs.
- Oral medicines included in the program and the context in which these were studied.

1.4 Review D – Review of Professional Practice Standards

This review explored the presence of prescribing competencies in the Entry Level Competency Standards for Optometry (Kiely & Slater, 2014). (5) Given that competency standards describe the expectations of graduates, this review sought to identify relevant prescribing expectations in the standards. In addition to the competency standards, the OBA Guidelines for Use of Scheduled Medicines (2018) (6) and Code of Conduct for Optometrists (2016) (7) were also reviewed for the presence of practice expectations that reflect the prescribing competencies.

For this review, the prescribing competencies identified as relevant to the project in the Prescribing Competencies Framework, as detailed in Appendix 1, Table 2 above, were included. For each relevant prescribing competency, reflective practice standards were identified.

Descriptive analysis of this data was undertaken to identify prescribing competencies that were identified in the practice standards and those that were unable to be identified.

In the report, Review D Table 8 summarises work undertaken by the ASPRINH Project in which the professional practice standards for a range of health professions were reviewed for their alignment with the NPS MedicineWise Prescribing Competencies Framework. A subset of the data generated by the ASPRINH Project is provided in Review D to compare the alignment of the optometry standards with those from other professions. The following table details the standards included in this review.

Appendix 1 Table 3 Professional Practice Standards/Competencies included in the ASPRINH Project

Profession	Professional Practice Standards Reviewed
Dentistry	▪ Professional Attributes and Competencies of the Newly Qualified Dentist Version 1.0 June 2010 (Australian Dental Council) ▪ Code of Conduct for Registered Health Practitioners 2014 (Dental Board of Australia) ▪ Code of Ethics for Dentists Policy Statement 6.5.1 August 2012 (Australian Dental Association) ▪ Policy Statement 6.23 Prescribing Medications in Dentistry November 2012, amended April 2016 (Australian Dental Association)
Medicine	▪ Intern Training Outcome Statements 2013 (Australian Medical Council, Medical Board of Australia) ▪ Standards for Assessment and Accreditation of Primary Medical Programs by the Australian Medical Council 2012 ▪ Australian Curriculum Framework for Junior Doctors v2.2 2009 (Confederation of Postgraduate Medical Education Councils)
Nurse Practitioner	▪ Nurse Practitioner Standards for Practice January 2014 (Nursing and Midwifery Board of Australia) ▪ Code of Professional Conduct for Nurses 2013 (Nursing and Midwifery Board of Australia) ▪ Code of Ethics for Nurses May 2013 (Nursing and Midwifery Board of Australia) ▪ A Nurse's Guide to Professional Boundaries February 2010 (Nursing and Midwifery Board of Australia)
Optometry	▪ Entry Level Competency Standards for Optometry 2014 (Optometry Australia) ▪ Guidelines for Use of Scheduled Medicines December 2014 (Optometry Board of Australia) ▪ Code of Conduct for Optometrists (Optometry Board of Australia)
Pharmacy	▪ National Competency Framework for Pharmacists in Australia 2010 (Pharmaceutical Society of Australia) ▪ Code of Conduct for Pharmacists March 2014 (Pharmacy Board of Australia) ▪ Code of Ethics for Pharmacists September 2011 (Pharmaceutical Society of Australia)

1.5 Review E – Review of Accreditation Standards

Accreditation standards pertaining to both entry level (5) and post entry level ocular therapeutics programs (8) were reviewed to identify those specifically relevant to the prescribing competencies chosen for the project (Appendix 1, Table 1). This review was undertaken to identify the specific expectations of programs of study designed to develop prescribing skills and knowledge and, in particular, the accreditation standards relevant to the prescription of medicines according to evidence.

Appendix 2: Project Challenges

Challenges to completing this work included:

- Global pandemic. The project commenced in April 2020, when universities were under extreme pressure to overhaul how they deliver their programs according to a timeframe that was necessarily tight. In essence, the timing of the project challenged the ability to efficiently obtain the necessary data to complete the work.

- Data. Sites were asked to provide 3 things for review: an overview of the program, the learning outcomes and assessments for all units of study and the medicines/medicine classes taught at a foundational, applied or performance-based level. Perhaps due to the pressures of the pandemic, this information was not provided for all sites, challenging the review and analysis process. Relevant data deficiencies are described for each review.

- Differences in program structure. The reviewed programs varied in their structure, from integrated case-based to traditional program structures. In addition, post entry level programs in ocular therapeutics fulfill the role of both reviewing previously provided information (e.g. pathophysiology) and linking this with the new concept of prescribing and associated relevant topics. These differences were considered as part of the project methodology.

Appendix 3: Limitations of the methodology

As described in Appendix 1, learning outcomes were chosen as a surrogate indicator of teaching content on the basis that the learning outcome describes what is considered sufficiently important to assess within the program. While providing a fair indicator of teaching content, use of the learning outcome is, however, somewhat constrained based on the following:

- Although the learning outcome provides a good indication of student learning, it may not completely define the extent and depth of learning within the program. For example, existing knowledge and skills may be augmented (or reinforced) by the process of experiential learning. Given the contextual nature of this type of learning, it is not possible to capture the totality of learning in the learning outcome, however this may be significant to the development of prescribing skills.

- Differences in how learning outcomes are written make program comparisons difficult. University policy, for example, may restrict the number of learning outcomes expressed per unit of study. As a consequence, multiple outcomes may be combined in a single learning outcome. This can be compared to the site for which learning outcomes are produced for each lecture/practical session rather than for the unit as a whole. In this situation, outcomes are more likely to be succinct and specific, but much greater in number. For this reason, analysis of reviewed data was expressed as a proportion of the learning outcomes for each site and overall, rather than the number of relevant learning outcomes.

- Learning outcomes necessarily change throughout the program. As the student acquires foundational knowledge and skills, learning outcomes reflect this and move from a description of the basic knowledge that must initially be obtained (e.g. understand the principles of pharmacokinetics) to an expectation of the knowledge and skills the student will use to accomplish a required task (e.g. formulate evidence-based management plans consistent with the role of an optometrist). This second example requires an understanding of evidence-based management, the ability to formulate a plan, an understanding of the role of an optometrist etc. Comparison of

these varied outcomes with competencies designed to articulate professional expectation is challenging.

- For some programs, learning outcomes that describe the acquisition of generic skills, such as communication, may be included in the unit-specific learning outcomes. This results in a greater number of learning outcomes for the unit with the potential to dilute the proportion of prescribing relevant learning outcomes identified across the program.

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Prescribing oral medicines by optometrists

A mapping of current education programs and professional practice standards to demonstrate the preparation of optometrists to prescribe medicines for oral administration

Supplementary Tables to the Report

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Supplementary Tables 1: Data collection instruments

Supplementary Table 1.1 Reviews A and B: Example (mock) data collection illustrating data collection template

Program Details										
Program	Bachelor of Vision Science, Master of Optometry	Site	L	Structure	UG, 5 years FT	Year Mapp	2019	Assessment Detail		
Program section	Unit Title	Unit Code	Abbreviated Unit Code	Unit summary & possible relevance	Abbreviated LO Number	Learning Outcome Number	Learning Outcome Detail	Assessment 1	Assessment 2	Assessment 3
Bachelor	Anatomy and Histology	AH086	L_A	Foundational anatomy and histology, including lab techniques.	L_A_1	1	Describe the structure, location and relationships of cells organs of the human body using accurate anatomical terminology.	FORM/SUM: PRAC_WA 20% Completion of weekly activities & worksheets	SUM: PRAC 30% Identify anatomical structures	SUM: WE (NFD) 50%
	Anatomy and Histology	AH086	L_A		L_A_2	2	Demonstrate proficiency in the application of light microscopy to the analysis of organ histology.	SUM: PRAC_WA 20% Completion of weekly activities & worksheets	SUM: PRAC 30% Identify histological features	SUM: WE (NFD) 50%
Masters	Optometry in practice	OP308	L_B	Clinical placement in community setting.	L_B_1	1	Design and conduct a patient-focused optometric examination demonstrating competence in the synthesis of findings to inform patient management.	FORM/SUM: CBD_REF_PF 20% Review of performance; self reflection; log of patient encounters	FORM/SUM: WE (MCQ_LAQ) 35%	SUM: OSCE 45% 10 station
	Optometry in practice	OP308	L_B		L_B_S	2	Evaluate clinical information to arrive at an accurate diagnosis, develop an appropriate treatment and management plan and provide clear and appropriate advice to patients presenting for optometric care.	FORM/SUM: CBD_REF_PF 20% Review of performance; self reflection; log of patient encounters	FORM/SUM: WE (MCQ_LAQ) 35%	SUM: OSCE 45% 10 station

	Competency area 2: Treatment options						Competency area H1 : Professional							Competency area H2: Communicates							
	rpinning knowledge (UKN) and skills/be			Relevant prescribing competencies			Relevant underpinning knowledge (UKN) and skills/behaviours (USK)				Relevant prescribing competencies			Relevant underpinning skills/behaviours (USK)		Relevant presribing competencies		The 12 core competencies (CC) for effective prescribing (relevant to decision making) Lum et al.			
	Pharmacology of relevant medicines	Awareness of issues relevent to medicines safety	Consider medicine effectiveness e.g. pharmacodynamic and pharmacokinetic properties of medicines, route of administration	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for	Considers the implications to the wider community of using a particular medicine to treat the person	Refers the person for further assessment or treatment when the suitable treatment options are outside the health professional's	Awareness of medicines-related legislation requirements e.g relevant poisons legislation; TGA; PBS; MBS	Relevant practice guidelines, protocols and scope definitions	Awareness of the types, causes, and risks of medicines errors, and where they are most likely to happen, for example due to: prescribing the wrong route,	Ability to source and critically appraise medicines related information	Demonstrates knowledge of and complies with: professional standards; codes of conduct; scope of practice statements or guidelines	Practices within the limits of the health professional's own education, training, and scope of practice	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Commitment to respecting the contribution of other health professionals to collaborative care	Ability to communicate effectively with the person and other health professionals	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines		Determine how well disease and symptoms are managed/controlled	Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment	Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions	Select drug, form, route, dose, frequency, duration of treatment
Abbreviated LO Number	UKN2.4	UKN2.5	USK2.2	2.2.1	2.2.5	2.2.9	UKNH1.1	UKNH1.2	UKNH1.3	USKH1.1	H1.2.1	H1.2.2	H1.4.4	USKH2.1	USKH2.2	H2.5.4	Comments	CC6	CC7	CC8	CC9
L_A_1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Assumed knowledge out of project scope.	0	0	0	0
L_A_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
L_B_1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Synthesis of findings required to determine how well symptoms are managed. More than arriving at a diagnosis.	2	0	0	0
L_B_S	1	1	1	2	0	0	1	1	0	1	2	2	2	0	2	0		2	2	2	2

Supplementary Table1.2 Review C: Data collection template (medicines included in programs)

Summary of medicines included in programs: context and unit details					
Class	Examples	Schedule	Foundational knowledge*	Knowledge application*	Application in clinical context*
Anti-infectives	Dibromopropamidine Propamidine Chloramphenicol Aciclovir Azithromycin Bacitracin Cephazolin Ciprofloxacin Framycetin Gentamicin Gramicidin Neomycin Ofloxacin Polymyxin Tetracycline Tobramycin	2 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4			
Oral anti-infectives	e.g. cephalexin, doxycycline, acyclovir, macrolides e.g. azithromycin	4			
Other					
Anti-inflammatories	Antazoline Azelastine Ketotifen Levocabastine Cyclosporin Dexamethasone Diclofenac Fluorometholone Flurbiprofen Hydrocortisone Ketorolac Loteprednol Prednisolone	2 2 2 2 4 4 4 4 4 4 4 4 4			
Oran Anti-inflammatories	e.g. Prednisolone	4			
Other					
Decongestants, anti-allergics	Lodoxamide Naphazoline Pheniramine Sodium cromoglycate Olopatadine	2 2 2 2 4			
Miotics, mydriatics, cycloplegics	Phenylephrine <1% Atropine Cyclopentolate Homatripine Pilocarpine Phenylephrine Tropicamide	2 4 4 4 4 4 4			

Summary of medicines included in programs: context and unit details					
Class	Examples	Schedule	Foundational knowledge*	Knowledge application*	Application in clinical context*
Anti-glaucoma medicines	Apraclonidine Betaxolol Bimatoprost Brimonidine Brinzolamide Dorzolamide Latanoprost Pilocarpine Tafluprost Timolol Travoprost	4 4 4 4 4 4 4 4 4 4 4			
Oral anti-glaucoma medicines	e.g. Acetazolamide	4			
Local anaesthetics	Amethocaine Lignocaine Oxybuprocaine Proxymetacaine	4 4 4 4			
Oral analgesics					
Other					

*The following provides an indication of the context in which medicines were included:

Foundational knowledge e.g. basic pharmacology
Knowledge application e.g. use in specific disease states
Application in clinical context e.g. medicine is considered as part of prescribing decision.

The template used for collecting data during Review D is illustrated in the example provided in Table 2.4 (below).

Supplementary Tables 2: Findings in detail

Supplementary Table 2.1 Review A: Curriculum learning outcomes compared to prescribing competencies (Prescribing Competencies Framework)

		Foundational knowledge/skills			Prescribing competencies			Foundational knowledge/skills		Prescribing competencies		Foundational knowledge/skills			Prescribing competency		
		UKN2.4	UKN2.5	USK2.2	2.2.1	2.2.5	2.2.9	UKNH1.1	UKNH1.2	UKNH1.3	USKH1.1	H1.2.1	H1.2.2	H1.4.4	USKH2.1	USKH2.2	H2.5.4
Site A	*Number LO Reviewed*	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149	149
	Proportion of all LO reviewed (%) - UKN, USK	13.4%	11.4%	13.4%	0.0%	0.0%	0.0%	12.1%	14.1%	1.3%	16.8%	0.0%	0.0%	0.0%	6.7%	9.4%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	10.1%	0.7%	2.0%	0.0%	0.0%	0.0%	0.0%	5.4%	4.0%	8.1%	0.0%	12.1%	4.7%
Site B	*Number LO Reviewed*	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	Proportion of all LO reviewed (%) - UKN, USK	11.2%	10.4%	11.2%	0.0%	0.0%	0.0%	7.2%	12.0%	0.0%	20.0%	0.0%	0.0%	0.0%	13.6%	16.0%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	10.4%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	7.2%	4.8%	3.2%	1.6%	8.0%	3.2%
Site C	*Number LO Reviewed*	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147
	Proportion of all LO reviewed (%) - UKN, USK	10.9%	8.8%	10.2%	0.0%	0.0%	0.0%	10.9%	12.9%	1.4%	4.8%	0.0%	0.0%	0.0%	4.1%	3.4%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	8.2%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	4.8%	2.0%	2.7%	0.0%	6.8%	2.0%
Site D	*Number LO Reviewed*	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188
	Proportion of all LO reviewed (%) - UKN, USK	8.5%	7.4%	7.4%	0.0%	0.0%	0.0%	6.4%	7.4%	0.5%	4.3%	0.0%	0.0%	0.0%	6.4%	12.2%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	4.8%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%	0.0%	0.0%	3.7%	2.1%
Site E	*Number LO Reviewed*	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
	Proportion of all LO reviewed (%) - UKN, USK	5.1%	5.1%	5.1%	0.0%	0.0%	0.0%	6.1%	11.2%	0.0%	12.2%	0.0%	0.0%	0.0%	8.2%	16.3%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	5.1%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	3.1%	3.1%	1.0%	0.0%	6.1%	2.0%

		Foundational knowledge/skills			Prescribing competencies			Foundational knowledge/skills		Prescribing competencies		Foundational knowledge/skills			Prescribing competency		
		UKN2.4	UKN2.5	USK2.2	2.2.1	2.2.5	2.2.9	UKNH1.1	UKNH1.2	UKNH1.3	USKH1.1	H1.2.1	H1.2.2	H1.4.4	USKH2.1	USKH2.2	H2.5.4
Site F	*Number LO Reviewed*	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
	Proportion of all LO reviewed (%) - UKN, USK	55.6%	55.6%	55.6%	0.0%	0.0%	0.0%	44.4%	61.1%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	11.1%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	50.0%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	50.0%	44.4%	0.0%	0.0%	16.7%	16.7%
Site G	*Number LO Reviewed*	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138	138
	Proportion of all LO reviewed (%) - UKN, USK	29.0%	13.8%	27.5%	0.0%	0.0%	0.0%	19.6%	21.7%	0.7%	0.0%	0.0%	0.0%	0.0%	7.2%	0.0%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	8.0%	0.0%	3.6%	0.0%	0.0%	0.0%	0.0%	4.3%	4.3%	0.0%	0.0%	1.4%	1.4%
Site H	*Number LO Reviewed*	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219	219
	Proportion of all LO reviewed (%) - UKN, USK	8.7%	7.3%	7.3%	0.0%	0.0%	0.0%	7.8%	10.0%	0.9%	5.5%	0.0%	0.0%	0.0%	7.3%	7.8%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	6.8%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	4.1%	4.6%	3.2%	0.9%	5.5%	3.7%
Site I	*Number LO Reviewed*	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
	Proportion of all LO reviewed (%) - UKN, USK	9.7%	7.4%	8.8%	0.0%	0.0%	0.0%	6.9%	9.3%	0.9%	5.6%	0.0%	0.0%	0.0%	7.9%	7.9%	0.0%
	Proportion of all LO reviewed (%) - Specific	0.0%	0.0%	0.0%	6.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	3.7%	3.7%	2.8%	0.0%	6.0%	4.6%
COMBINED	*Total LO Reviewed*	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298
	Proportion of all LO reviewed (%) - UKN, USK	12.40%	9.48%	11.63%	0.00%	0.00%	0.00%	9.86%	12.56%	0.77%	7.78%	0.00%	0.00%	0.00%	7.86%	8.78%	0.00%
	Proportion of all LO reviewed (%) - Specific	0.00%	0.00%	0.00%	7.86%	0.15%	2.08%	0.00%	0.00%	0.00%	0.00%	4.62%	3.93%	2.62%	0.31%	6.24%	3.31%

LO – Learning Outcome **UKN** – Underpinning knowledge **USK** – Underpinning skills Shading Indicates a postgraduate program in ocular therapeutics

Supplementary Table 2.2 Review B: Curriculum learning outcomes compared to prescribing competencies (Lum et al.)

		Core Competency 6 Determine how well disease and symptoms are managed/controlled	**Core Competency 7** Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment	**Core Competency 8** Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions	**Core Competency 9** Select drug, form, route, dose, frequency, duration of treatment
Site A	*Number LO Reviewed*	149	149	149	149
	Proportion of all LO reviewed (%) that provide UKN or USK	3.4%	10.7%	12.8%	8.7%
	Proportion of all LO reviewed (%) that are specifically relevant	19.5%	20.8%	17.4%	10.7%
Site B	*Number LO Reviewed*	125	125	125	125
	Proportion of all LO reviewed (%) that provide UKN or USK	2.4%	15.2%	13.6%	10.4%
	Proportion of all LO reviewed (%) that are specifically relevant	14.4%	11.2%	10.4%	9.6%
Site C	*Number LO Reviewed*	147	147	147	147
	Proportion of all LO reviewed (%) that provide UKN or USK	3.4%	7.5%	8.2%	2.7%
	Proportion of all LO reviewed (%) that are specifically relevant	8.2%	10.2%	10.9%	8.2%
Site D	*Number LO Reviewed*	188	188	188	188
	Proportion of all LO reviewed (%) that provide UKN or USK	1.6%	8.0%	8.0%	5.3%
	Proportion of all LO reviewed (%) that are specifically relevant	5.3%	9.6%	10.1%	4.8%
Site E	*Number LO Reviewed*	98	98	98	98
	Proportion of all LO reviewed (%) that provide UKN or USK	1.0%	11.2%	10.2%	9.2%
	Proportion of all LO reviewed (%) that are specifically relevant	8.2%	6.1%	7.1%	5.1%
Site F	*Number LO Reviewed*	18	18	18	18
	Proportion of all LO reviewed (%) that provide UKN or USK	0.0%	5.6%	5.6%	5.6%
	Proportion of all LO reviewed (%) that are specifically relevant	38.9%	50.0%	50.0%	50.0%
Site G	*Number LO Reviewed*	138	138	138	138
	Proportion of all LO reviewed (%) that provide UKN or USK	3.6%	23.9%	23.2%	13.0%
	Proportion of all LO reviewed (%) that are specifically relevant	3.6%	7.2%	6.5%	4.3%
Site H	*Number LO Reviewed*	219	219	219	219

		Core Competency 6 Determine how well disease and symptoms are managed/controlled	Core Competency 7 Determine whether current symptoms are modifiable by symptomatic treatment or disease modifying treatment	Core Competency 8 Consider ideal therapy (drug and non-drug), taking into account actual and potential contraindications/concerns: drug-patient, drug-disease, drug-drug interactions	Core Competency 9 Select drug, form, route, dose, frequency, duration of treatment
	Proportion of all LO reviewed (%) that provide UKN or USK	0.0%	3.2%	3.7%	1.8%
	Proportion of all LO reviewed (%) that are specifically relevant	5.5%	12.3%	13.7%	7.8%
Site I	*Number LO Reviewed*	216	216	216	216
	Proportion of all LO reviewed (%) that provide UKN or USK	1.9%	5.6%	8.8%	4.2%
	Proportion of all LO reviewed (%) that are specifically relevant	6.0%	11.6%	11.6%	6.9%
COMBINED	*Total LO Reviewed*	1298	1298	1298	1298
	Proportion of all LO reviewed (%) that provide UKN or USK	2.0%	9.6%	10.2%	6.2%
	Proportion of all LO reviewed (%) that are specifically relevant	8.8%	11.9%	11.9%	7.8%

LO – Learning Outcome **UKN** – Underpinning knowledge **USK** – Underpinning skills Shading Indicates a postgraduate program in ocular therapeutics

Supplementary Table 2.3 Review C: Medicines included in the reviewed programs

Site A		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
Anti-infective medicines: Y3 S1: 4 x Lectures and assessment on antibiotics, antiviral and antifungal agents, assessment includes both assignments and exam questions. Y4 S2: 2 x Lectures and assessment on medications for eye disease, assessment includes slide exam on cases and exam questions. 1 x Lecture and assessment on oral anti-infective agents.	***Anti-infective medicines:*** Y4 S2: 8 x Lectures and 12 hours tutorials management of anterior disorders including use of oral agents where applicable (keratitis, conjunctivitis, inflammation). Assessment includes slide exam on cases and exam questions.	***Y5 S1, Y5 S2*** 40 hours logged therapeutic practical hours in clinical setting.
Anti-inflammatory medicines: Y3 S1: 4 x Lectures and assessment on allergy and inflammation, antihistamines, NSAIDs, steroids, immune modifying agents, assessment includes both assignments and exam questions. Y4 S2: 2 x Lectures and assessment on medications for eye disease, 1 lecture and assessment on oral anti-inflammatories. Includes oral anti-inflammatories. Assessment includes slide exam on cases and exam questions.	***Anti-inflammatory medicines:*** Y4 S2: 8 x Lectures and 12 hours tutorials management of anterior disorders, including use of oral agents where applicable (keratitis, conjunctivitis, inflammation). Assessment includes slide exam on cases and exam questions.	
Decongestants and antihistamines: Y3 S1: 2 x Lectures and assessment on allergy and inflammation, decongestants, mast cell stabilisers. Assessment includes both assignments and exam questions. Y4 S2: 2 x Lectures and assessment on medications for eye disease, assessment includes slide exam on cases and exam questions.	***Decongestants and antihistamines:*** Y4 S2: 8 x Lectures and 12 hours tutorials management of anterior disorders (keratitis, conjunctivitis, inflammation). Assessment includes slide exam on cases and exam questions.	
Miotics, mydriatics, cycloplegics: Y3 S1: 4 x Lectures, 4x hands on practicals and assessment on use of diagnostic agents, assessment includes both assignments and exam questions. Y4 S2: 1 x Lecture and assessment on uveitis principles, assessment includes slide exam on cases and exam questions.	***Miotics, mydriatics, cycloplegics:*** Y4 S2: 8 x Lectures and 12 hours tutorials management of anterior disorders (keratitis, conjunctivitis, inflammation). Assessment includes slide exam on cases and exam questions.	
Glaucoma medicines: Y3 S1: 4 x Lectures and assessment on use of glaucoma agents, including oral. Assessment includes both assignments and exam questions. Y4 S2: 2 x Lectures and assessment on use of glaucoma agents, assessment includes both slide exam and exam questions. Local anaesthetics: Y3 S1: 4 x Lectures, 4x hands on practicals and assessment on use of diagnostic agents, assessment includes both assignments and exam questions.	***Glaucoma medicines:*** Y4 S2: Therapeutic Management of Eye Disease (4 x Lectures and 4 hours tutorials glaucoma. Assessment includes slide exam on cases and exam questions).	
Local anaesthetics: Y3 S1: 4 x Lectures, 4x hands on practicals and assessment on use of diagnostic agents, assessment includes both assignments and exam questions.		
Oral analgesics: OPB654 Y3 S1: 1 x lecture assessment on options for ocular pain, exam questions.		

Site B		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
Anti-infective medicines: Case 3 *Corneal abraision*. Includes basic pharmacological principles , Case 6 *Infective conjunctivitis and pterygium* (includes mechanisms of antibiotic action & side effects, concepts of prophylactic vs therapeutic management, referral), Case 12 *Meibomian gland dysfunction and dry eye* (includes oral agents), Case 13 *Dry eye with chronic dacryocystitis (includes oral antibiotics),* Case 14 *Blepharitis and BCC* with subsequent trichiasis, Case 24 *Cataracts*, Case 36 HIV+ with CMV retinitis (includes ocular antiviral medicine, infection control), Case 40 *Orbital cellulitis* (includes oral antibiotics), Case 42 *Chlamydial conjunctivitis* (includes oral antibiotics, pharmacology of tetracyclines, azithromycin, administration of oral antibiotics and the optometric drug list), Case 43 *Microbial keratitis* , Case 46 *HS keratitis* .	***Anti-infective medicines:*** Case 3 *Corneal abraision*. Includes basic pharmacological principles , Case 6 *Infective conjunctivitis and pterygium* (includes mechanisms of antibiotic action & side effects, concepts of prophylactic vs therapeutic management, referral), Case 12 *Meibomian gland dysfunction and dry eye* (includes oral agents), Case 13 *Dry eye with chronic dacryocystitis* (includes oral antibiotics), Case 14 *Blepharitis and BCC* with subsequent trichiasis, Case 24 *Cataracts*, Case 36 *HIV+ with CMV retinitis* (includes ocular antiviral medicine, infection control), Case 40 *Orbital cellulitis* (includes oral antibiotics), Case 42 *Chlamydial conjunctivitis* (includes oral antibiotics, pharmacology of tetracyclines, azithromycin, administration of oral antibiotics and the optometric drug list), Case 43 Microbial keratitis, Case 46 *HS keratitis*.	***Y4 Relevant cases:*** *1 (corneal trauma),* 3 (corneal abraision), 4 (hypermetropia), 6 (infective conjunctivitis, pterygium), 7 (acute angle glaucoma), 12 (meibomian gland dysfunction and dry eye), 13 (dry eye with chronic dacryocystitis), 14 (blepharitis, BCC with subsequent trichiasis), 15 (episcleritis), 17 (primary open angle glaucoma), 24 (cataracts), 29 (age related macular degeneration, 32 (migraine), 34 (anterior uveitis with HLA B27 related disease), 35 (giant papillary conjunctivitis with atopic dermatitis), 36 (HIV+ with CMV retinitis), 40 (orbital cellulitis), 41 (thyroid eye disease), 42 (chlamydial conjunctivitis), 43 (microbial keratitis), 46 (herpes simplex keratitis), 47 (pseudoexfoliative glaucoma), 49 (posterior uveitis). ***Use of miotics, mydriatics, cycloplegics*** discussed in cases 9 (cortical/nuclear cataract with floaters), 10 (Floaters and retinal detachment), 16 (sympathetic neuropathy & metastatic carcinoma), 21 (accommodative esotropia with anisometropia), 34 (anterior uveitis with HLS B27 related disease. This case discusses atropine poisoning). ***In addition to the cases described, students commence patient contact from year 3 and will therefore be applying their medicines knowledge to the decision-making process, where appropriate, from that point.***
Anti-inflammatory medicines: Case 3 *Corneal abraision*. Includes basic pharmacological principles. Case 4 *Hypermetropia, pingeuculum*, Case 12 *Meibomian gland dysfunction and dry eye*, Case 15 *Episcleritis* (includes oral NSAIDs), Case 24 *Cataracts*, Case 34 *Anterior Uveitis with HLA B27-related disease* (includes steroid tapering), Case 35 *Giant papillary conjunctivitis with atopic dermatitis* (steroids, mast cell stabilisers), Case 41 *Thyroid eye disease* (includes oral steroids), Case 46 *Herpes simplex keratitis*, Case 49 *Posterior Uveitis* (includes oral steroids).	***Anti-inflammatory medicines:*** Case 3 *Corneal abraision*. Includes basic pharmacological principles. Case 4 *Hypermetropia, pingeuculum*, Case 12 *Meibomian gland dysfunction and dry eye*, Case 15 *Episcleritis* (includes oral NSAIDs), Case 24 *Cataracts,* Case 34 *Anterior Uveitis with HLA B27-related disease* (includes steroid tapering), Case 35 *Giant papillary conjunctivitis with atopic dermatitis* (steroids, mast cell stabilisers), Case 41 *Thyroid eye disease* (includes oral steroids), Case 46 *Herpes simplex keratitis*, Case 49 *Posterior Uveitis* (includes oral steroids).	
Decongestants, anti-allergics: Case 35 *Giant papillary conjunctivitis with atopic dermatitis.*	***Decongestants, anti-allergics:*** Case 35 *Giant papillary conjunctivitis with atopic dermatitis.*	
Miotics, mydriatics, cycloplegics: Case 9 *Cortical/nuclear cataract with floaters,* Case 10 *Floaters and retinal detachment*, Case 16 *Sympathetic neuropathy & metastatic carcinoma*, Case 21 *Accommodative Esotropia with Anisometropia*, Case 34 *Anterior Uveitis with HLS B27- related disease* (includes atropine poisoning).	***Miotics, mydriatics, cycloplegics:*** Case 9 *Cortical/nuclear cataract with floaters*, Case 10 *Floaters and retinal detachment*, Case 16 *Sympathetic neuropathy & metastatic carcinoma*, Case 21 *Accommodative Esotropia with Anisometropia*, Case 34 *Anterior Uveitis with HLS B27-related disease* (includes atropine poisoning).	
Glaucoma medicines: Case 7 *Acute angle closure* (includes oral diuretics), Case 17 *Primary open angle glaucoma*, Case 47 *Pseudoexfoliative glaucoma* (includes therapeutic strategies, drug compliance).	***Glaucoma medicines:*** Case 7 *Acute angle closure* (includes oral diuretics), Case 17 *Primary open angle glaucoma*, Case 47 *Pseudoexfoliative glaucoma* (includes therapeutic strategies, drug compliance).	
Local anaesthetics: Case 3 *Corneal abraision*, Case 14 *Blepharitis and BCC* with subsequent trichiasis, Case 24 *Cataracts.*	***Local anaesthetics:*** Case 3 *Corneal abraision*, Case 14 *Blepharitis and BCC* with subsequent trichiasis, Case 24 *Cataracts.*	
Oral analgesics: Case 32 *Migraine.*	***Oral analgesics:*** Case 32 *Migraine.*	

Site D		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
All medicine classes: **Y3 S1** Foundational Pharmacology, **Y3 S2** Management of systemic disease, ocular pharmacology**, Y3 S2, Y4 S1** PBL cases (x32) all of which include pharmacological therapies.	***All medicine classes:*** **Y2 S2** Immunology, infectious diseases, auto- immune disease, microbes and mechanism of antibiotics. **Y3 S1** Pharmacology, **Y3 S2** ocular pharmacology, **Y2 S2, Y4 S1** PBL cases (x32) all of which include pharmacological therapies. **Y4 S2** topical, systemic antibiotics and steroids, **Y4 S2** clinical placements, **Y5 S1** clinical placements and first therapeutic case report, 4 debrief cases (may have therapeutic content), **Y5 S2** 36 hours lectures on therapeutic cases, analysis, prescribing and 2 case reports. Clinical placements and case reports.	***Y4 S2*** clinical placements, ***Y5 S1*** clinical placements, therapeutic case report, 4 debrief cases (may have therapeutic content), ***Y5 S2*** 2 case reports, clinical placement.

Site E		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
Anti-infective medicines: **OD2** foundational pharmacology, infection (2 lectures), anterior eye disease (computer assisted learning tutorial).	***Anti-infective medicines:*** OD2 antibacterials and microbial keratitis in AED, CBL & tutorial cornea, 1 lecture antivirals; OD3 2 lectures cornea/conjunctiva (medicines use not specifically described), OD4 ZCS, corneal ulcer case study.	***Clinical placements:*** In a variety of settings, including rural and metropolitan Australian practices and overseas. Private practice including ophthalmology practice. Specific exposure via **uni based clinics** to: corneal disease & glaucoma. OSCE to demonstrate competence in management of glaucoma, cornea, uveitic and allergy cases.
Anti-inflammatory medicines: pharmacology of anti-inflammatory drugs (general and specific to eye disease), 2 lectures on inflammation and immunopathology, anterior eye disease (computer assisted learning tutorial).	***Anti-inflammatory medicines:*** OD2 1 lecture AED and anti- inflammatory medicines; OD3 8 lectures uveitis, scleritis, episcleritis, CBL and tutorial uveitis. OD4 ICS study uveitis, ZCS.	
Decongestants and anti-allergics: 2 lectures immunology, 1 lecture & 1 CAL tutorial on allergy in AED, 1 lecture on ocular medicine for allergy.	***Decongestants, anti-allergics:*** OD3 CBL allergy, ICS study on allergy.	
Miotics, mydriatics, cycloplegics: OD2 pharmacology, practical class on miotic/mydriatic drugs.	***Miotics, mydriatics, cycloplegics:*** OD2 use of mydriatic drugs; OD3 use of cycloplegia in paediatrics.	
Glaucoma medicines: OD2 pharmacology.	***Glaucoma medicines:*** OD2 introduction to drugs for glaucoma (1 hr); OD3 8 hours lectures plus 5 tutorials plus 4 CBL; 4 lectures on glaucoma and medicines including clinical audit; 2 interactive case studies on glaucoma, 1 lecture POAG, 1 lecture ACG; OD4 ICS study on POAG and ICS study on ACG; OD5 ZCS.	
Local anaesthetics: OD2 pharmacology of general anaesthetics and ocular anaesthetics.	Nil	
Oral analgesics: OD2 oral medicines including analgesics. OD2 also includes the effect of systemic medicines on the eye.	Nil	

Site F		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
General: 8 lectures basics of pharmacology (introduction, terms, pharmacokinetics, ocular pharmacokinetics, pharmacodynamics, medicine classes), 1 lecture special populations, 1 lecture ADR reporting, poisons schedule, generics, 4 lectures legislation (NZ and Australia), 1 lecture prescription writing, 1 lecture PBS. ***Anti- infective medicines:*** Y1 S1 5 lectures on microbiology (including vaccination, antibiotics), 4 live webinars (microbiology, immunology, inflammation; biochemistry; pharmacology; legislation and prescribing).	***Anti-infective medicines:*** **Y1S1**: 2 lectures ocular anti-infective drugs and application, 1 lecture management of conjunctivitis, 1 lecture management of viral infections, 3 lectures management of microbial keratitis, 1 lecture management of lid infections, 1 live webinar (management of infection). Y1S2 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	**Clinical placements:** 35 hours private ophthalmology practice, 15 hours hospital placements, 2 case reports (1 anterior segment/red eye management; 1 glaucoma). Oral examination.
Anti-inflammatory medicines: 3 lectures inflammation and immunology (basics of inflammation, basics of immunology, ocular inflammation and immunology).	***Anti-inflammatory medicines:*** Y1S1 2 lectures ocular anti-inflammatory drugs and application, 1 lecture management of episcleritis, scleritis and lid disorders, 2 lectures management of anterior segment inflammation, 1 lecture management non-infectious CL complications, 4 lectures uveitis (pathophysiology, clinical evaluation, aetiology, management), 1 lecture anti-allergy drugs and application, 1 lecture orbital and lacrimal disorders, 2 lectures management of allergy, 2 lectures management of emergencies, 1 lecture dry eye management, 2 lectures surgical co-management, 4 live webinars (management of inflammation, management of emergencies and allergy, management of uveitis, management of dry eye and co-management). Y1S2: 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	
Decongestants, anti-allergics: 3 lectures inflammation and immunology (basics of inflammation, basics of immunology, ocular inflammation and immunology).	***Decongestants, anti-allergics:*** 1 lecture anti-allergy drugs and application, 2 lectures management of allergy, 1 live webinar (management of emergencies and allergy). Y1S2: 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	
Miotics, mydriatics, cycloplegics: covered in basic pharmacology & prescribing lecture series.	***Miotics, mydriatics, cycloplegics:*** Y1S1: 2 lectures autonomic nervous system drugs and application, 1 lecture management of episcleritis, scleritis and lid disorders, 4 lectures uveitis (pathophysiology, clinical evaluation, aetiology, management), 2 lectures management of emergencies, 2 lectures surgical co-management, 3 live webinars (management of emergencies and allergy, management of uveitis, management of dry eye and co-management). Y1S2: 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	
Glaucoma medicines: 5 live webinars: pharmacology, legislation and prescribing, foundations of glaucoma, glaucoma therapy.	***Glaucoma medicines:*** Y1S1: 7 lectures glaucoma drugs and therapies (drugs, clinical trials, treating glaucoma, follow up, glaucoma surgery, ocular therapy update, NHMRC guidelines, glaucoma case studies) 2 live webinars (Foundations of Glaucoma, Glaucoma Therapy). Y1S2: 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	
Local anaesthetics: covered in basic pharmacology & prescribing lecture series.	***Local anaesthetics:*** Y1S1: 2 lectures management of emergencies, 2 lectures surgical co-management, 1 lecture gonioscopy techniques, 1 lecture dilation and irrigation techniques, 1 live webinar (management of emergencies and allergy). Y1S2: 35 hours private ophthalmology placements, 15 hours hospital placements, 2 case reports, oral examination.	

Site G		
Context 1 Foundational knowledge	Context 2 Knowledge application	Context 3 Prescribing decision
Foundational ocular pharmacology unit includes basic pharmacological principles, the mechanism of action for drugs affecting the nervous system, inflammatory processes, cyclosporin. Individual drugs are noted to be mentioned where applicable in specific units as part of lecture series and/or webinars. ***Specific lectures and webinars identified include:*** 1 lecture infectious and allergic conjunctivitis, 1 lecture eye trauma and chemical injuries, 1 lecture cataract surgery, 1 lecture HSV/HZO/corneal neovascularisation, 1 lecture dry eye, 1 lecture immunology and abnormalities in the immune function, 1 lecture complications of contact lens use, 1 lecture laser refractive surgery, 1 lecture on lid, lacrima and adnexa, 1 lecture cataract surgery, 1 lecture episcleritis/scleritis, 1 lecture uveitis, 1 lecture posterior inflammation, 1 lecture anterior inflammation, 1 lecture medical treatment of glaucoma, 1 lecture PAC and PACG treatment. ; multiple webinars (covering topics including: red eye, microbial keratitis, conjunctivitis, topical NSAIDs, case study in systemic hypersensitivity reaction, uveitis, ocular pharmacology).	Individual drugs discussed in relevant contexts, including: ***Anti-infective medicines:*** Treatment of conjunctivitis (including chlamydial), recurrent corneal erosion syndrome, corneal abraision, microbial keratitis, corneal chemical burn, post-operative management, meibomian gland dysfunction, blepharitis, penetrating eye injuries, CLAK therapy, acne, rosacea, fungal keratitis, neisseria gonorrhoea, atopic keratoconjunctivitis, dacryocystitis, HZO, endophthalmitis.	Practical experience comprising a minimum of 50 hours supervised practice. Assessment includes a log of clinical encounters and submission of 3 case reports describing therapeutic management.
	Anti-inflammatory medicines: allergic rhinoconjunctivitis, giant papillary conjunctivitis, atopic keratoconjunctivitis, rheumatoid arthritis, dry eye syndrome, chronic inflammation/autoimmune disease, vernal keratoconjunctivitis, chemical corneal burns, adenovirus, blepharitis, thygesons keratitis, HZO, episcleritis, scleritis, anterior uveitis, post-operative management, diffuse lamellar keratitis post op, hyphema, sarcoidosis, analgesia, headache, ocular pain, acute/chronic pain.	
	Decongestants/anti-allergics: allergic conjunctivitis, management of systemic symptoms of allergy.	
	Miotics, mydriatics, cycloplegics: anterior uveitis, post-operative management, corneal abraision, hyphema, corneal chemical burns, differentiation between scleritis and episcleritis.	
	Glaucoma medicines: Post-operative management with IOP, possible adverse effects.	
	Local anaesthetics use in chemical injury prior to irrigation; contraindication in corneal abraision.	

Sites C H, I *provided no details for this review*

Supplementary Table 2.4 Review D: Professional Practice Standards (reference: Prescribing Competencies Framework)

	Competency Area 2 Relevant Prescribing Competencies		Competency Area H1 Relevant Prescribing Competencies		Competency Area 2 Relevant Prescribing Competencies	
	Integrates knowledge of pharmacology, other biomedical sciences, clinical medicine, and therapeutics and identifies medicines suitable for treating the condition	Considers the implications to the wider community of using a particular medicine to treat the person	Refers the person for further assessment or treatment when the suitable treatment options are outside the health professional's own scope of practice	Demonstrates knowledge of and complies with: professional standards; codes of conduct; scope of practice statements or guidelines	Critically evaluates information about medicines and makes evidence-based decisions about medicines in the health professional's own practice	Provides clear verbal and written information to other health professionals by secure means when implementing new treatments with medicines or modifying existing treatment plans
	2.2.1	**2.2.5**	**2.2.9**	**H1.2.1**	**H1.4.4**	**H2.5.4**
Relevant Competency Standard	4.9.1 Pharmacological agents are selected and recommended	4.9.1 Pharmacological agents are selected and recommended	1.3.3 Advice is sought from other optometrists and professionals when it is deemed that a further opinion is required	1.3.3 Advice is sought from other optometrists and professionals when it is deemed that a further opinion is required	4.9.1 Pharmacological agents are selected and recommended	1.5.1 Information is clearly communicated to patients, staff and other professionals
Comment	*Indicators describe pharmacological knowledge (including understanding when oral medicines are more suitable than topical); medicines availability; ability to source, interpret, appraise and apply research evidence, guidelines, protocols; to select medicines; QUM; consideration of patient access.*	*Indicators describe pharmacological knowledge (including understanding when oral medicines are more suitable than topical); QUM (including judicious prescribing); consideration of the immediate and non-immediate implications of prescribing therapeutic agents to the wider community.*	*Indicators include an understanding of the scope of practice of other health professionals; recognition of when to seek information/refer and the ability to appraise information and advice in the context of the patient.*	*Indicators discuss the need to understand the expertise and scope of practice of other health professionals and determine when to seek information or refer the patient.*	*Indicators describe the ability to critically evaluate practice based on the best available research evidence, clinical expertise, the patient's preferences, perspective and circumstances and the practice context.*	*Indicators describe the need to understand when to provide information regarding the details of medicines (and other treatments) and the treatment plan to other health professionals. The provision of advice regarding allergies and adverse events to the patient and other health professionals involved in care is also described.*
Relevant Competency Standard			1.4.1 Patient needs and interests are held paramount	1.4.4 The ethical standards of the profession are maintained	1.2.1 Clinical expertise is integrated with the best available evidence, the patient's perspective and the practice context when making clinical decisions	1.5.3 Significant or unusual clinical presentations can be recognised and findings communicated to other practitioners involved in the patient's care or to government bodies

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Comment			*Indicators describe the need to ensure referrals are made on the basis of patient need.*	*Indicators describe adherence to codes of conduct, codes of ethics, standards of practice.*	*General competency applicable to all areas of practice. Indicators describe the ability to critically evaluate practice based on the best available research evidence, clinical expertise, the patient's preferences, perspective and circumstances and the practice context. The ability to obtain, interpret, appraise and apply research evidence, guidelines/protocols in support of clinical decision making is also included.*	*Indicators describe the importance of understanding when side effects of drugs may require further investigation and/or appropriate reporting.*
Relevant Competency Standard			1.5.2 Liaison with other care providers and external agencies is maintained			4.11.2 Timely referral, with supporting documentation, is made to other professionals
Comment			*Indicators describe the need to understand what information should be included in a referral/report to another professional.*			*Indicators describe the need to convey appropriate information, via an appropriate route, to other health professionals when referrals made.*
Relevant Competency Standard			4.3.1 Pertinent signs and symptoms found during the ocular examination are identified and their relevance for further management is determined	1.3.1 Professional independence in optometric decision-making and conduct is maintained		4.11.3 Patients can be jointly managed with other health-care practitioners

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Comment			*Indicators describe the ability to recognise significant signs and symptoms and determine when referral is appropriate.*	*Indicators describe adherence with professional codes of conduct and the need to audit and manage potential bias/external influences specifically relevant to prescribing decision making.*		*Indicators describe the need for effective communication as part of shared care arrangements, including engagement in open, interactive discussions; provision of accurate and timely information; medicines information and the provision of verbal and written information by secure means regarding new treatments with medicines and/or modifications to existing treatments.*
Relevant Competency Standard			4.9.1 Pharmacological agents are selected and recommended			
Comment			*Indicators describe the knowledge of medicines prescribed by other health professionals and the ability to recognise the need to consider whether referral is in the best interest of the patient e.g. where access to medicines is subsidised when prescribed by a colleague.*			

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Relevant Competency Standard			4.11.1 The need for referral to other professionals or rehabilitative services for assessment and/or treatment is recognised, discussed with the patient and a suitable professional or service is recommended.			
Comment			*Indicators describe the need to recognise emergencies; personal limits; recognise the need to refer; consider scope of practice (self and others); understand the need to refer patients for whom oral medicines is the best therapy.*			
Relevant Competency Standard			4.11.2 Timely referral, with supporting documentation, is made to other professionals			
OBA Guidelines for Use of Scheduled Medicines (September 2018)	2.1 Quality use of medicines (b) choosing suitable medicines (if a medicine is considered necessary) so that the best available option is selected, taking into account: the individual, the clinical condition, risks and benefits, dosage	2.1 Quality use of medicines (b) choosing suitable medicines (if a medicine is considered necessary) so that the best available option is selected, taking into account: the individual, the clinical condition, risks and benefits,	5. Guidelines for the use of topical steroidal preparations. Optometrists should consider referral for a specialist opinion for those patients who may need long-term steroid use.			6.1 Role, responsibilities and communication in collaborative care of patients. Communication is the linchpin of effective collaborative care.

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	and length of treatment, any coexisting conditions, other therapies, monitoring considerations and costs for the individual, the community and the health system as a whole.	dosage and length of treatment, any coexisting conditions, other therapies, monitoring considerations and costs for the individual, the community and the health system as a whole.				
		4.1 Antimicrobial resistance. Optometrists using antimicrobial preparations should understand all issues relating to the emergence of resistance by pathogenic organisms and mechanisms for limiting this. Selection of an antimicrobial should always involve consideration of the risk that microbial resistance could develop.	7. Guidelines for care of patients with, or at high risk of developing, chronic glaucoma. When an initial diagnosis of chronic glaucoma is made, or a patient is at high risk of developing the disease, optometrists whose registration is endorsed for scheduled medicines must: refer the patient for specialist assessment and advice about confirmation of diagnosis and ongoing management. 7.1 The optometrist must provide a referral for ophthalmological assessment and advice after making an initial diagnosis and initiating			7.2 Communication. The Board expects that optometrists managing patients with glaucoma will maintain regular communication with the patient's general practitioner, ophthalmologist, physician or other health care practitioner.

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			treatment for chronic glaucoma in defined circumstances.			
			7.4 Emergency management of acute primary angle closure. The standard management of such a patient is emergency referral to an ophthalmologist or hospital.			
OBA Code of Conduct for optometrists			1. Providing Good Care 1.1 Introduction (d) referring a patient to another practitioner when this is in the best interests of the patient.	1.2 Good care (a) recognising and working within the limits of an optometrist's competence and scope of practice.	1.2 Good care. Good practice involves: (g) providing treatment options based on the best available information.	3.5 Coordinating care with other practitioners. Good practice involves communicating all the relevant information in a timely way.
			7.11 Conflicts of interest. Good practice involves (b) acting in the best interests of patients when making referrals, and when providing or arranging treatment or care.	7.11 Conflicts of interest. Good practice involves: (d) recognising that pharmaceutical and other marketing may influence optometrists and being aware of ways in which		

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				practice may be influenced; (e) not asking for or accepting any inducement, gift or hospitality of more than trivial value from companies that sell or market drugs or other products that may affect or be seen to affect the way optometrists prescribe for, treat or refer patients.		