Pharmacy Education, 2020; 20 (1) 1 - 12

RESEARCH ARTICLE

Relationships between academic performance of pharmacy students and their postgraduate competence during internship

JAMES M. WINDLE[1*] https://orcid.org/0000-0002-9226-7655
RACHEL A. SPRONKEN-SMITH[2] https://orcid.org/0000-0002-0630-8909
JEFFREY K. SMITH[3] https://orcid.org/0000-0003-3188-2045
IAN G. TUCKER[1] https://orcid.org/0000-0002-3304-6377

[1]*School of School Of Pharmacy, University Of Otago, Dunedin 9054, New Zealand*
[2]*Graduate Research School, University Of Otago, Dunedin 9054, New Zealand*
[3]*College Of Education, University Of Otago, Dunedin 9054, New Zealand*

Abstract

Background: The pharmacy internship provides opportunity for first year graduates to demonstrate competence following undergraduate success in a Bachelor of Pharmacy (B.Pharm.) programme of study

Aim: To determine the extent to which undergraduate academic performances, including academic risk, were predictive of postgraduate competence appraised by workplace preceptors.

Method: A longitudinal, multi-cohort study was undertaken of 563 interns who graduated from a pharmacy undergraduate programme in New Zealand (NZ). Demographic variables, undergraduate performances, examination resits and delayed progression, were predictively modelled against intern competence.

Results: Full model predictions for successful intern competence were most influenced by delayed progression as an undergraduate (OR 0.18, CI 0.05 – 0.72, p=0.015) and achievement across combined professional pharmacy courses (OR 1.12, CI 1.01 – 1.24, p=0.037) with 22.4% of variance explained.

Conclusions: Undergraduate assessment measures and academic deficit occurrences show a useful, but limited, contribution to the prediction of gaining competence for a pharmacy intern.

Keywords: *Academic Performance, Competence, New Zealand, Pharmacy Internship, Workplace*

Introduction

Pharmacy training institutions across countries differ with respect to requiring their graduates to be either 'practice-ready' i.e. with full registration to independently practice pharmacy at the time of graduation (Robinson & Speedie, 2015), or requiring their graduates to further undertake pre-registration (internship) training and assessment in the workplace (Gallagher, 2010). Although pharmacy education programmes show diversity in their approach to preparing and assessing their undergraduates, there needs to be an alignment between the achievements from the professional degree and workplace performance of first year graduates. Criticism remains however, in both systems whether or not fresh graduates are able to perform successfully in practice and what success looks like (Kairuz *et al*., 2010; Hester *et al*., 2014; Robinson & Speedie, 2015).

Like other health professionals, the registration of pharmacists is dependent on their ability to prove competence to practice (Nash *et al*., 2015). Since their introduction in the 1960's, competency standards have played an increasingly significant role in the initial and ongoing registration of the practising health professional (Nash *et al*., 2015). Both pharmacy educators and professional bodies place importance on students being aware of the progressive stages in developing competence, from university to entry into the profession

*Correspondence: James Windle, *School of Pharmacy, University of Otago, PO Box 56, Dunedin 9054, New Zealand. Tel: +64 3 4795280; Fax: +64 3 479 7034. E-mail: james.windle@otago.ac.nz*

ISSN 1447-2701 online

(Nash *et al*., 2016). There is support for pharmacy educational programmes to be mapped against the competency standards of pharmacists in any given country so that graduates are ready to deliver health services at the earliest opportunity (Bruno *et al*., 2010).

There are many definitions of the terms 'competency', 'competencies' and 'competence' (Epstein & Hundert, 2002; Pijl-Zieber *et al*., 2014; Nash *et al*., 2015), which often lead to confusion and problems with their application (Garavan & McGuire, 2001; Nash *et al*., 2015; Waterfield, 2017). For the purposes of this paper, the terms 'competency', 'competencies', and 'competence' are defined in Table I.

Table I: Definitions of competency-based terminology

Term	Definition
Competency	Single item of knowledge, skill or professional value (Brown, Gilbert, & Bruno, 2012; Nash, Chalmers, Brown, Jackson, & Peterson, 2015).
Competencies	Knowledge, skills, behaviours and attitudes that an individual accumulates, develops, and acquires through education, training and work experience. (Brown *et al*., 2012; Pharmacy Council of New Zealand [PCNZ], 2015).
Competence	Full repertoire of competencies (Brown *et al*., 2012; Nash et al., 2015).
Professional competence (PCNZ)	The habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served (Epstein & Hundert, 2002; PCNZ, 2015).
Competency framework	Complete collection of competencies that are thought to be essential to performance (Brown *et al*., 2012). Providing a blueprint for describing the competencies and behaviours of pharmacists in their daily practice. Sufficiently broad-based to allow for universal applicability across all practice settings, but also sufficiently focused to allow the particular competencies specific to pharmacists to emerge (PCNZ, 2015).

The Pharmacy Council of New Zealand (PCNZ) developed a set of competence standards that were ratified in 2001 (Kairuz *et al*., 2010), revised in 2010, and again in 2015. The framework (Appendix A) now comprises six broad areas of professional endeavour (Domains), each with a number of competencies (PCNZ, 2015). The application for this framework is intended to be broad to suit a variety of stakeholders including universities to inform curricula for educational programmes and intern training providers to assist in developing course curricula and a link between training and practice (PCNZ, 2015).

Pharmacy curriculum and internship in New Zealand

New Zealand (NZ) has two schools of pharmacy (University of Otago [UoO] and University of Auckland), both offering a three year, six semester, undergraduate baccalaureate (B.Pharm.). Student intake into both schools occurs predominantly by competitive entry from their respective university foundational health science first year programmes. Regarded as a traditional curriculum (Gallagher, 2010), the UoO School of Pharmacy B.Pharm. programme at the time of this research comprised the first three semesters of pharmaceutical, biomedical sciences and pharmacy practice, and the last three semesters of courses in which clinical, social and pharmaceutical sciences were integrated into system-based patient-care.

New Zealand B.Pharm. graduates do not register as pharmacists upon graduation. Graduates seek employment, through application and interview, at approved community and hospital pharmacies for their internship (pre-registration training). The programme responsible for delivering training, assessment and support while in the internship is known as the EVOLVE Intern Programme provided by the Pharmaceutical Society of New Zealand (PSNZ) and accredited by the PCNZ. Content is delivered online along with face-to-face training days. Interns must be employed a minimum of 40 hours and maximum of 84 hours per fortnight and undertake supervised practice under an approved pharmacist preceptor in a community or hospital site from February to November (EVOLVE, 2019). Interns are assessed against the PCNZ Competence Standards. Assessments during the year are based on evidence that the intern was achieving competence against the Standards and include three on-the-job appraisals, written assignments and portfolios. Interns passed as competent after their third appraisal are then required to attend and pass objective structured clinical examinations (OSCEs) at an Assessment Centre to progress to registration as a pharmacist.

The PCNZ accredits pharmacy education providers with the expectation that programmes prepare pharmacists to practise in accordance with the Competence Standards for the pharmacy profession. The Accreditation Standards are not prescriptive, therefore they allow for flexibility and innovation in delivery of pharmacy programmes. The diversity of educational approaches may be leading to a mismatch between measurement of undergraduate academic performance and workplace performance of first year graduates, as reported in other disciplines (Carr *et al*., 2014). Difficulties of both assessment constructs and time intervals between evaluations under the continuum of professional education have been acknowledged previously, from testing knowledge through to determining clinical performance (Hojat *et al*., 1996; Wilkinson & Frampton, 2004; Carr *et al*., 2014).

The overall aim of this paper is to explore the relationships between pharmacy undergraduate academic performance and postgraduate competence as interns. The specific research questions are firstly, to determine whether undergraduate academic performance can predict pharmacy intern competence as assessed by pharmacist preceptors; and secondly, to examine the extent of such differences amongst various demographic variables of interest including sex, age, ethnicity and residency.

Methods

Sample

A six-year longitudinal study was conducted with students from the final year of a four-year undergraduate pharmacy programme at the UoO being asked to consent to the collection of data about their undergraduate and first-year postgraduate (internship) assessment performance. Only those students who were registered as interns the following year (2010-2015) with the EVOLVE Intern Programme and had undertaken three appraisals were included in the study (n=563).

Variables of interest

Statistical analysis, including multiple regression modelling, was used to test how predictor variables including demographic, undergraduate academic performance and academic risk indicators were related to final intern competence appraisal in the workplace.

Demographic

Demographic variables were chosen based on available data recorded in the UoO centralised student data management system. Age was as at January 1st for the year entering internship. Student ethnicity was categorised into: (i) NZ European/Māori; (ii) Chinese; (iii) Korean; (iv) Indian; (v) Asian (other); and (vi) other ethnicity. Where a student had recorded more than one ethnicity, prioritisation of first ethnicity was made for the purpose of this study. Those recording Māori as their ethnicity (n=11) or secondary to NZ European (n=10) were combined into NZ European/Māori given small numbers for analysis and no significant differences between student Māori and NZ European being found for any of the performance measures used in this study. Asian (other) included Malaysian, Vietnamese, Cambodian, Filipino, and Japanese. Other ethnicity included Australian, African, Middle Eastern and British. Citizenship status was categorised into: (i) NZ citizen; (ii) NZ Permanent Resident (in which case the student has remained within New Zealand for a majority of time over a period of at least two years preceding residency application); or (iii) international. Students holding Australian citizenship (n=2) were combined with NZ citizens given they have the same effective rights including free education at NZ state-run primary and secondary schools.

Academic performance

Undergraduate variables chosen as measures of sustained academic performance were across two subject domains. Firstly, student grade average (weighted by course credits) across three professional pharmacy courses were calculated and designated 'GAprof'. These courses commonly contained content and assessments relating to law, ethics and pharmacy placement activities. Secondly, student grade averages (weighted) across three clinical courses were similarly calculated and designated 'GAclin'. Clinical courses integrate the drug, disease and patient factors involved in the pharmacotherapeutic management of various human body systems. Grade averages were reported as a percentage (0-100%) to improve the comparability across institutions where common measures such as grade point average (GPA) scales or letter grades can have differing ranges applied (Salvatori, 2001).

Academic risk indicators

Ideally, a student would have progressed through their programme of study having achieved high grades, not undertaken remedial examinations, and completed their degree in the minimum time. Sub-optimal completion outcomes were recorded to identify students who may have required remediation, or who showed sustained low academic performance. Resitting one or more final examinations (Yes/No), repeating one or more years in B.Pharm. programme (Yes/No), or ranked in lowest class quartile for overall B.Pharm. grade average (Yes/No), were variables of interest indicating sub-optimal completion of their undergraduate studies. Remedial examinations (resits) were offered to students achieving an equivalent final examination 'D' grade (40-49%) provided they had not failed half or more of the points comprising the programme for that year. Students that failed their resit examination or failed first-sit and were not eligible to resit, were required to repeat the subject the following year, thereby delaying their completion time beyond the three years. Student grade averages (weighted by course points) across the B.Pharm. programme were calculated to determine ranking for B.Pharm. quartiles amongst their graduating year. Grade average across the entire programme was used to indicate sustained underperformance, since a student can perform poorly on a single examination for any number of reasons, e.g. acute illness, and therefore subsequent improvement might be simply a result of regression back to the mean (Kinder & Knecht, 2011).

Internship competence appraisals

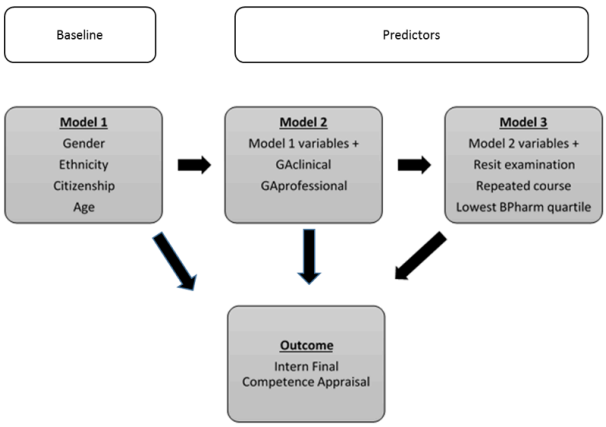
Intern overall competence (Achieved/Not yet achieved) against the PCNZ Competence Standards were recorded as outcomes for the three appraisals assessed by their preceptors in the workplace. First-time preceptors received a one-day workshop specifically addressing intern assessment supported by pre- and post- course work. Assessment refresher courses are required three- or six-yearly depending on frequency of taking interns. Of

the three intern appraisals during the year, the first two are formative, helping guide the focus of future learning and they are the basis for feedback to the intern on how they are progressing. The final appraisal is summative for which all elements need to be met/demonstrated at a level of competence to enable the intern to be eligible to sit the PCNZ OSCEs at the end of the year. Failure to pass this third appraisal results in the intern being required to continue practice under their internship scope of practice for a further six months before being eligible to resit the OSCE. The EVOLVE Intern Programme had categorised intern appraisal outcomes into four competence levels (not yet competent; borderline; competent; competent with merit) until 2013, then three levels (not yet competent; competent but not yet consistent; competent) from 2013. Competence levels described the intern's ability to perform the activity to the required standard repeatedly with or without assistance, therefore being deemed 'ready' or 'not yet ready' to be assessed at the Assessment Centre. For cohort consistency across time and detail of data supplied, it was necessary to collapse appraisal categories into binomial outcomes (Competent/Not yet competent).

Data collection methods

Demographic and academic grades as pharmacy students were collected from eVision (the UoO web-based centralised student data management system). Course results that included examination resits or repeating any year were obtained from the School of Pharmacy's internal databases. Intern pharmacist performance data from competency appraisals were supplied directly from EVOLVE each year following their internship. The data had not been previously collected and collated for analysis by any organisation prior to this study. Data were entered, coded and de-identified initially on Excel spreadsheets, then transferred into SPSS v.22 and analysed statistically.

Figure 1: Multiple regression analysis plan including a baseline (Model 1) and the sequential inclusion of additional predictor variables (Model 2 & 3)



Analysis

Continuous variables were summarised descriptively, reporting their mean and standard deviation. Differences in appraisal outcomes for continuous variables of interest were examined using independent-samples *t*-tests. Categorical variables were presented as frequencies, and percentages with appraisal outcome distributions examined for differences using *chi*-square test for contingency tables. Since neither the magnitude of the test values nor the statistical significance level can reveal the practical significance of the group differences, the standardised effect size was calculated for each result. Hojat and colleagues have published on calculating and reporting effect size estimates for both *t*-tests and *chi*-square tests based on the work of Cohen (Hojat *et al*., 1996; Hojat & Xu, 2004) For this study, effect size values having a magnitude ≥ 0.50 (*chi*-square) or 0.80 (*t*-test) are considered of practical importance. Effect size values around 0.30 (*chi*-square) or 0.50 (*t*-test) are considered moderately important, with smaller values around 0.10 (*chi*-square) or 0.20 (*t*-test) considered of no practical significance (Hojat & Xu, 2004). A statistical modelling plan was then developed that incorporated key predictor variables and the categorical dependent variable (competence achieved in the final appraisal) using multiple regression analysis (Figure 1).

Three models successively incorporated demographic and undergraduate predictor variables of interest using a three-block forced entry logistic regression analysis. Demographic variables served as the baseline model (Model 1), then two academic grade averages were added (Model 2) and lastly, three academic risk factors were further added (Model 3). Cases that might be influencing the logistic regression models were examined within standardised residuals and values of Cook's distance (Field, 2013). A single outlier was identified, then removed, of an intern who had been recorded as not yet competent across all three appraisals, yet had withdrawn from the EVOLVE Intern Programme prior to a second appraisal occurring. The possibility of multicollinearity between variables in the models was examined using variance inflation factor (VIF) and its reciprocal tolerance statistics (1/VIF) (Field, 2013). Values calculated suggest no multicollinearity biasing of the regression models. Odds ratio and 95% confidence intervals were reported with associated *p*-values. The *alpha* level was 0.05.

Ethics

Ethical approval for this research was granted from the UoO Human Ethics Committee (Ref D10/106) for an initial three years with a study extension permitted. As per ethics protocol, written informed consent was attained from final year students for accessing administrative and performance data retrospectively from the University and prospectively from EVOLVE. Datasets were de-identified for analysis using a coding system.

Results

Of the five hundred and sixty three interns included in this study, 64.7% were female, 36.8% were of NZ European and/or Māori ethnicity, 72.2% had NZ citizenship, and the median age was 22.5 years (range 21.7-47.0 years) at the commencement of their internship. The majority (83.7%) had undertaken their internship in a community pharmacy setting. The predictive impact of demographic, academic and academic risk factors on intern competence are reported below.

Competence outcomes

Descriptive findings for the three intern appraisal performances are reported in Table II. A combined total of 84.7% (n=477) interns were competent from their first appraisal, which increased to 94.3% (n=531) by the third appraisal. Rates achieved in the final competence appraisal (Appraisal 3) varied between 75% for those who had delayed academic progression to 98.9% for those who had undertaken their internship in a hospital site. Appraisal 2 competence rates in 2015 were only 21.6% (n=22,) contrasting significantly to the 90% (n=415) of intern cohorts between 2010-2014 and were separately summarised (Table II)

Table II: Descriptive summary for all variables by competence outcomes for intern appraisals

	Appraisal 1 (2010-2015) (n= 563)		**Appraisal 2 (2010-2014) (n= 461)**		**Appraisal 2 (2015) (n= 102)**		**Appraisal 3 (2010-2015) (n= 563)**	
Competent	*n*	%	*n*	%	*n*	%	*n*	%
Categorical variables								
Gender								
Female	323	88.7	274	92.3	12	17.9	351	94.3
Male	154	77.4	141	86.0	10	28.6	180	90.5
Ethnicity								
NZEuropean/Māori	190	91.8	164	97.0	8	21.1	202	97.6
Chinese	110	79.7	93	86.1	3	10.0	124	89.9
Korean	44	80.0	36	83.7	4	33.3	48	87.3
Indian	39	83.0	37	90.2	2	33.3	46	97.9
Asian(other)	47	77.0	43	82.7	3	33.3	59	96.7
Other	47	85.5	42	87.5	2	28.6	52	94.5
Citizenship Status								
NZ	354	87.2	304	92.1	18	23.7	390	96.1
NZ Permanent Resident	102	81.6	90	85.7	3	15.0	114	91.2
Non NZ Resident	21	65.6	21	80.8	1	16.7	27	84.4
Year of internship								
2010	64	80.0	73	91.3			74	92.5
2011	71	87.7	72	88.9			78	96.3
2012	86	81.9	94	89.5			97	92.4
2013	86	92.5	86	92.5			88	94.6
2014	88	86.3	90	88.2			98	96.1
2015	82	80.4			22	21.6	96	94.1
Combined	**477**	**84.7**	**415**	**90.0**	**22**	**21.6**	**531**	**94.3**
Resit one or more course final examinations	107	82.3	85	83.3	7	25.0	117	90.0
Repeated course(s) (delayed progression)	21	65.5	16	61.5	1	16.7	24	75.0
B.Pharm. Grade Av. 25th percentile	93	78.2	75	78.9	9	37.5	105	88.2
Worksite								
Community pharmacy	395	83.9	339	88.5	22	25.0	440	93.4
Hospital pharmacy	82	89.1	76	97.4	0	0	91	98.9
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Continuous variables								
Age at internship	23.2	2.8	23.0	1.9	23.7	4.1	23.2	2.6
GAclin (%)	78.4	5.7	78.1	5.7	77.3	4.8	78.2	5.8
GAprof (5)	77.3	6.0	77.3	5.9	75.3	6.1	77.2	5.9

Differences between rates of interns being assessed competent or not-yet competent were found amongst most variables of interest for each of the three appraisals (Table III).

Independent sample *t*-tests and *chi*-square tests all showed statistical significance in differences amongst all variables in the second (2010-2014) and third (2010-2015) appraisals. The only variable found to show significant difference with competence rates in Appraisal 2 (2015) was being academically ranked in the bottom quartile across the B.Pharm. programme. Competency rate differences achieved amongst interns in Appraisal 3, when considering undergraduate GAprof and GAclin performances, were considered to show Cohen's effect sizes of crucial practical importance (t= 5.57, $p<0.001$, ES=0.99; $t=4.58$, $p<0.001$, ES=0.85). Small to medium levels of practical importance were found for differences amongst most demographic and academic risk variables (Table III).

The predictive impact of demographic, academic performance, and academic risk variables on competency in the third appraisal using forced three-step logistic regression is reported in Table IV and summarised below.

Demographic effects on competence

The odds of gaining competence in their final appraisal were 65% lower for males than female interns in the simple univariate (involving just one independent variable and the outcome) and baseline models; however, gender became non-significant when adjusting for academic performance (Model 2) and academic risk (Model 3) pathway variables.

Interns identifying as Chinese or Korean were 71% and 80% lower than NZ Europeans/Māori in their odds of gaining competence in the simple univariate models respectively (OR 0.29, CI 0.11 - 0.77, $p=0.014$; OR 0.20, CI 0.07 - 0.64, $p=0.006$), but these differences were accounted for by other pathway variables introduced in each of the multivariate models. No significant predictive differences in competence were found in ethnic Asian (other), Indian and other ethnicity compared to NZ European/Māori in simple univariate or combined models.

The odds of competence in Appraisal 3 were significantly lower for those interns with NZ Permanent Residency or non-NZ residency (international), compared with those holding NZ citizenship in the simple univariate models (OR 0.42, CI 0.19 - 0.94, $p=0.035$; OR 0.22, CI 0.07 - 0.65, $p=0.006$). However, only non-residency status remained significantly lower (OR 0.26, CI 0.08 - 0.86, $p=0.027$) than NZ citizens in competence achieved when controlling for other demographic variables (Model 1) and was found not significant when adjusting for other predictor variables (Model 2 & 3).

A small predictive difference in favour of younger interns achieving competence was found in the simple univariate model (OR 0.91, CI 0.84 - 0.99, $p=0.026$). Differences in age was not found to be a significant contributing predictor to achieving competence when adjusting for pathway variables (Models 1, 2 & 3).

Table III: Significant differences of intern competence in 1st, 2nd, and 3rd appraisals according to variables of interest

	First Appraisal†		**Second Appraisal†**				**Third Appraisal†**	
	Interns (2010-2015) *n*= 563	Effect Size	Interns (2010-2014) *n*= 461	Effect Size	Interns (2015) *n*= 102	Effect Size	Interns (2010-2015) *n*= 563	Effect Size
GAclin	$t= 4.55^{***}$	0.51	$t= 4.74^{***}$	0.71			$t= 4.58^{***}$	0.85
GAprof	$t= 4.60^{***}$	0.54	$t= 4.52^{***}$	0.71			$t= 5.57^{***}$	0.99
Age at internship			$t= -2.73^{**}$	0.31				
Gender (Female/Male)	$X^2= 12.80^{***}$	*0.15*	$X^2= 4.64^{*}$	0.10			$X^2= 8.57^{**}$	*0.12*
Citizenship Status (NZ citizen, NZ Perm Res, International)	$X^2= 11.87^{**}$	*0.15*	$X^2= 6.27^{*}$	0.11			$X^2= 10.46^{**}$	*0.14*
Ethnicity (NZ Eur/ Māori, Chinese, Korean, Indian, Asian (other), Other)	$X^2= 14.52^{*}$	*0.16*	$X^2= 16.46^{**}$	*0.19*			$X^2=16.11^{**}$	*0.17*
Resit Course Examination (No/Yes)			$X^2= 6.52^{*}$	0.12			$X^2= 5.87^{*}$	*0.10*
B.Pharm. Completion Time (3 years, >3 years)	$X^2= 9.56^{**}$	*0.12*	$X^2= 24.89^{***}$	0.23			$X^2= 23.61^{***}$	*0.20*
B.Pharm. Bottom Quartile (No/Yes)	$X^2= 5.04^{*}$	*0.06*	$X^2= 16.34^{***}$	*0.19*	$X^2= 4.71^{*}$	*0.21*	$X^2= 10.41^{**}$	*0.13*

† Competent in comparison to not yet competent

$^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$ Significance levels

Effect sizes: Independent Samples *t*-test ≅ 0.20 small, ≅0.50 medium, ≅0.80 large; X^2≅0.10 small, ≅0.30 medium, ≅0.50 large (Hojat, 2004)

Table IV: Multiple regression analysis of predictors of competence at final (third) intern appraisal

		Simple Univariate			Model 1			Model 2			Model 3		
Predictor Variables (ref)	Comparison	OR	95% CI	Predictor *p*-value	OR	95% CI	Predictor *p*-value	OR	95% CI	Predictor *p*-value	OR	95% CI	Predictor *p*-value
Gender													
(female)	male	**0.35**	(0.17,0.73)	**0.005**	**0.35**	(0.17,0.76)	**0.007**	0.55	(0.25,1.24)	0.152	0.67	(0.29,1.56)	0.353
Ethnicity													
(NZ Euro/ Māori)	Chinese	**0.29**	(0.11,0.77)	**0.014**	0.53	(0.17,1.62)	0.267	0.70	(0.22,2.19)	0.538	0.72	(0.22,2.29)	0.575
	Korean	**0.20**	(0.07,0.64)	**0.006**	0.36	(0.10,1.26)	0.111	0.99	(0.24,4.08)	0.993	1.03	(0.23,4.55)	0.964
	Asian (other)	0.88	(0.17,4.48)	0.878	1.57	0.27,9.02)	0.614	1.97	(0.33,11.65)	0.455	2.33	(0.38,14.41)	0.363
	Indian	1.37	(0.16,11.68)	0.772	2.87	(0.30,27.11)	0.357	3.94	(0.42,37.40)	0.232	5.34	(0.52,55.00)	0.159
	Other ethnicity	0.52	(0.12,2.14)	0.363	0.99	(0.21,4.68)	0.999	1.39	(0.29,6.68)	0.684	1.45	(0.30,7.01)	0.646
Citizenship Status													
(NZ citizen)	NZ Perm Resident	**0.42**	(0.19,0.94)	**0.035**	0.48	(0.19,1.19)	0.114	0.51	(0.20,1.31)	0.163	0.58	(0.22,1.52)	0.268
	International	**0.22**	(0.07,0.65)	**0.006**	**0.26**	(0.08,0.86)	**0.027**	0.37	(0.11,1.29)	0.120	0.39	(0.11,1.37)	0.140
Age		**0.91**	(0.84,0.99)	**0.026**	0.91	(0.83,1.00)	0.058	0.95	(0.85,1.05)	0.301	0.95	(0.85,1.06)	0.382
Grade Av Clinical		**1.15**	(1.08,1.22)	**<0.001**				1.05	(0.95,1.15)	0.336	1.06	(0.94,1.19)	0.316
Grade Av Professional		**1.16**	(1.10,1.24)	**<0.001**				1.10	(0.99, 1.20)	0.055	**1.12**	(1.01,1.24)	**0.037**
Resit course final(s)													
(no)	yes	**0.41**	(0.20,0.86)	**0.018**							2.03	(0.59,7.03)	0.263
Delayed progression													
(no)	yes	**0.14**	(0.06,0.35)	**<0.001**							**0.18**	(0.05,0.72)	**0.015**
B.Pharm. lowest quartile													
(no)	yes	**0.32**	(0.15,0.66)	**0.002**							1.65	(0.46,5.87)	0.439
Nagelkerke R Square						13.7%			19.4%			22.4%	

Values of significance ($p<0.05$) have been bolded

Nominal logistic regression was performed with competence as the outcome variable of interest. Pre-defined predictors were added using a three step forced block entry. Model-adjusted estimates of odds ratios (OR) compared to reference groups, 95% confidence intervals (CI) and associated individual significance values (*p*) were reported

Academic performance effects on competence

Achievement grades across both clinical and professional courses were significant predictors for competence in simple univariate models (OR 1.15, CI 1.08 - 1.22, p=<0.001; OR 1.16, CI 1.10 -1.24, p=<0.001), however only academic performance across GAprof persisted in predictive significance when controlling for all pathway variables (Model 3). Interns successful in achieving competence in Appraisal 3 achieved grades that were on average 1.12 times higher (CI 1.01 - 1.24, p=0.037) with every 1-point increase in GAprof, compared to interns not yet competent when adjusting for all predictor variables.

Academic risk effects on competence

Graduates who had been required to resit final course examinations during their B.Pharm. programme were found to have lower odds of gaining competence compared to those who did not resit final examinations in simple univariate analysis (OR 0.41, CI 0.20 - 0.86, p=0.018). Differences were no longer significant after adjustment including all other predictor variables (Model 3).

Simple univariate analysis shows interns who had delayed progression of their B.Pharm. programme beyond three years (by repeating one or more courses), were 86% lower in their odds of gaining competence relative to interns who progressed in minimum time (OR

0.14, CI 0.06 - 0.35, p=<0.001). The importance of this predictor continued into Model 3 when controlling for all predictor variables (OR 0.18, CI 0.05 - 0.72, p=0.015).

Students remaining within the lowest quartile group across the B.Pharm. programme were significantly less likely to have gained intern competence compared to students achieving amongst mid to high quartiles (OR 0.32, CI 0.15 - 0.66, p=0.002) in simple univariate analysis. However there was no significance to quartile standings once other predictor variables of interest had been included (Model 3).

Model performance

Gender, ethnicity, citizenship status, and age on commencing the internship explained 13.7% of the variance in the final intern competence appraisal (Model 1). Model 2 adds the academic performance averages across clinical and professional courses in the B.Pharm. programme, which increased the explanatory power of the model to account for 19.4% of the variance. The inclusion of the three academic risk indicators (Model 3) further increased the explanatory power 1.6 fold compared to the base model, to 22.4% of variance explained. The logistic regression analyses correctly classified 94.3% of the student sample when all variables were included (p<0.001).

Discussion

This six-year longitudinal study has identified statistically significant demographic and undergraduate variables for differences amongst, and predictions for, intern pharmacists attaining professional competence as appraised by preceptors over one year. Such results identified students most able to successfully complete the internship appraisals based on undergraduate performances and risks.

This study found that deficiencies in knowledge observed during pharmacy school continue as a detrimental factor beyond graduation into their professional workplace. Univariate findings identified that students who required examination resits, had delayed graduation, or were ranked in the lowest academic quartile group over their B.Pharm., were less likely to be appraised competent against PCNZ standards. The largest individual contribution to variance explained within the prediction models came from undergraduate on-time completion. Students who had delayed progression (repeated one or more courses) were significantly less likely to demonstrate competence at the end of their internship (OR 0.18, CI 0.05 - 0.72, p=0.015). Several studies have demonstrated the ability to predict ongoing academic difficulty during passage through pharmacy undergraduate programmes, based on GPA or subject performance (Houglum *et al*., 2005; Kinder & Knecht, 2011; Schlesselman & Coleman, 2011; Alston *et al*., 2014) and has been previously reported for this undergraduate cohort (Windle *et al*., 2018). Studies that continue to track poor undergraduate performance indicators into professional competence outcomes are sparse. This research suggests predictions for postgraduate performance are influenced by prior difficulty experienced as an undergraduate, particularly when delayed graduation has occurred, however only small effect sizes for variances could be found to explain past performance difficulties. It is argued that competency has no time limits: individuals develop and acquire them at their own pace and hence interns are considered to be 'not yet competent', rather than incompetent (Garavan & McGuire, 2001). If knowledge, skills, judgements and attributes needed for competency develop over time at different rates, then the outcomes of this study suggest deficits in knowledge that required more time to correct as undergraduates, may be being carried forward into internships, but the sample size was too small to draw firm conclusions.

This study identified undergraduate performance accumulated across professional subject matter including law, ethics and placements, over the final two undergraduate years (GAprof), were predictive of intern competence when controlling for other variables. This correlation was modest but stronger than that found from undergraduate clinical performances (GAclin). The decision to compare performances across similar subject domains rather than yearly grade average performance helped refine the identification of the subject matter that more closely predicts future competency. The literature suggests weak to at best moderate relationships between undergraduate grades and postgraduate performance, and little if any correlation if such measures were methodologically or conceptually dissimilar (Wilkinson & Frampton, 2004; Carr *et al*., 2014). There is value combining various assessments to produce the strongest predictive validity, since no single assessment method provides enough data for predicting competence across integrated attributes, knowledge and skills; however non-discriminant GPA performance still remains a dominant academic comparator used in many studies (Kenny *et al*., 2013; Carr *et al*., 2014; Feemster *et al*., 2017). Weak associations for academic predictors in this study could be explained by the inherent difficulty in the extrapolation of undergraduate summative assessments as indicators of professional competence (Terry, 2017), the effect of gaining experience in the intervening period after graduation, and student characteristics not identified in entry selection but are significant for successful performance in the work environment such as work ethic, motivation and personality traits (Wilkinson & Frampton, 2004).

Health professional training programmes are increasingly encouraging greater student population diversity to address a changing health workforce that better mirrors society that they serve amongst (Crampton *et al*., 2018). Using simple univariate models, this study found that competency could be predicted from a student's sex, age, ethnicity or residency status. Being male, of older age, Chinese or Korean ethnicity, and NZ Permanent or international residency led to a higher risk of not meeting

competency. While contributing to the explained variance, these demographic variables were however, not significant once academic performance and risk factors were controlled for in successive multivariate models. Doing well in professional and clinical assessments, and not repeating any programme of study carried greater ability to predict success in internship competence than demographic differences. However, given only 22.4% of the variance in intern competence had been explained by the predictive variables, it was possible that other student characteristics not measured here, such as communication ability, may be of importance. English is New Zealand's most widely spoken official language, yet student cohorts had wide and diverse cultures and languages. At this institution, Green (2015) previously tracked the performance for 297 students across the B.Pharm. programme. Regression models using grade averages, unsatisfactory academic progression and demographic predictors found that having weak English, and being a permanent resident or international student were all predictive of weaker undergraduate academic performances. Green (2015), surmised that although students starting with weaker English may improve their language skills, they do not make up the necessary ground in time particularly as the curriculum moves into communication of clinical content. Lack of proficiency in oral or written communication skills identified in undergraduate performance may have lasting influence on professional competence in the workplace. Kairuz *et al*., (2010) found that a cohort of 77 NZ interns self-expressed greater preparedness to enter practice based on effective English and interpersonal communication skills than reported by their preceptors at the same time. These findings suggest educators continue to be challenged to provide the necessary scaffolding to support students with non-local nationality and lower English proficiency navigate increasing demands for communication skills, which ultimately determine their competence as health professionals.

For the 2015 interns, the dramatic reduction in competence in their second appraisal compared with other year cohorts, was not apparent in their first or third appraisals (Table II). This unexpected reduction can be explained by the 2015 use of a revised set of Competence Standards. These Competence Standards introduced a new structure, expansion, and revised terminology for statements and behaviours relating to competency that all pharmacists had to become familiar with. At the same time, EVOLVE communicated with all 2015 preceptors highlighting appraisal requirements based on revised Competence Standards, emphasising the need for accurate assessments across competencies It is evident from this research that the combination of revised, and therefore somewhat unfamiliar, Competence Standards and further instruction addressing appraisal assessment requirements from EVOLVE, caused preceptors to apply a more cautious interpretation of the competencies that had been achieved.

UoO pharmacy graduates are not deemed 'ready' by way of competence for independent practice on the day of graduation, nor was the undergraduate curriculum derived from a competency-based education model. Evidence is growing of institutions now using competency-based education models to drive programme design and assessments (Hirsh *et al*., 2014; Pijl-Zieber *et al*., 2014; Nash *et al*., 2015; Frank *et al*., 2017), with correlations to competency in practice still to be largely determined. The UoO School of Pharmacy has since undertaken a full curriculum review and is implementing changes including the use of entrustable professional activities (EPAs). These EPAs are derived from a summation of discreet competencies that together compose a professional task (ten Cate *et al*., 2015; Jarrett *et al*., 2017), which is increasingly being discussed and applied in pharmacy education (Pittenger *et al*., 2016; Rhodes *et al*., 2019) as well as other health professions (Chen, van den Broek & ten Cate, 2015; Bargagliotti & Davenport, 2017; Chesbro *et al*., 2017). This study will prove useful to educators as a comparator for assessing student performance through to registration once EPAs have been implemented into an undergraduate programme.

Limitations

In selecting independent and outcome variables of interest, choices were limited by the availability of data from both the UoO and EVOLVE. Intern appraisal outcomes were not detailed as to reasons for not-yet competent decisions. However, this study presented the first opportunity to combine data from NZ undergraduate and postgraduate pharmacy education providers and will further inform stakeholders and educational researchers on quality assurance outcomes.

Validity and reliability of these appraisals remains undetermined and was outside the scope for this study. Reliability (and validity) of competency is dependent on the number of assessments carried out, the number of evaluators involved and the presence of biasing confounders within the workplace setting such as gender differences (McGill, 2011). Three competence appraisals over the year will improve assessment reliability, but judgement of this kind is likely to be based on the opinion of the preceptor. Despite the fact that preceptors would be regarded as 'experts' in their profession, single evaluators run the risk of the 'halo' effect whereby distorted high or low ratings of an intern's performance assessment may manifest itself from the overall general feelings, favourable or unfavourable, a preceptor might have for the intern (Wolf, 2015; Jackson, 2018). Reliable judgements on competence were likely to improve from measuring Appraisal 3 outcomes for model predictions given it is a high-stakes summative decision that determines if the intern would sit PCNZ OSCEs for pharmacist registration.

The undergraduate and intern progression have very low failure rates. Success through the programme is expected for the vast majority of students (Windle *et al*., 2018). What is not identified in this study is the extent to which these mostly successful outcomes continued to identify competent registered pharmacists.

Conclusion

This paper has shown that both undergraduate assessment measures and academic deficit occurrences are useful in the prediction of pharmacy intern competence. The proportion of variance explained for competence performance by these measures is small to moderate. This study highlights the importance of bridging differences between the narrow subject assessment measures for pharmacy students, and the broader integrated competence expectations for the graduate intern. There will be benefit to the student if pharmacy educators continue to evaluate the assessment techniques used within their curriculum, so they are both reflective of tasks encountered in the workplace, and are explicitly relevant to competencies expected by the profession and public. Further collaboration between schools of pharmacy and postgraduate training providers can recognise lower performing students who are more likely to struggle in their first postgraduate year of training, and could better consider how tracking, support and remediation steps would assist them in achieving competence as pharmacists, rather than just becoming a neglected statistic of the conventional educational model.

Acknowledgments

The authors would like to thank EVOLVE (PSNZ) and the Pharmacy Council of New Zealand (PCNZ) for their supportive contributions and generous time over six years in ensuing cohort data continued to be extracted and reported.

References

Alston, G.L., Lane, D. & Wright, N.J. (2014). The methodology for the early identification of students at risk for failure in a professional degree program. *Currents in Pharmacy Teaching and Learning*, **6**(6), 798-806. doi: 10.1016/j.cptl.2014.07.006

Bargagliotti, L.A. & Davenport, D. (2017). Entrustables and Entrustment: Through the Looking Glass at the Clinical Making of a Nurse Practitioner. *The Journal for Nurse Practitioners*, **13**(8), e367-e374. doi:10.1016/j.nurpra.2017.05.018

Brown, A.N., Gilbert, B.J. & Bruno, A.F. (2012). Validated Competency Framework for Delivery of Pharmacy Services in Pacific−Island Countries. *Journal of Pharmacy Practice and Research*, **42**(4), 268-272. doi:10.1002/j.2055-2335.2012.tb00186.x

Bruno, A., Bates, I., Brock, T. & Anderson, C. (2010). Towards a global competency framework. *American Journal of Pharmaceutical Education*, **74**(3), Art.56

Carr, S.E., Celenza, A., Puddey, I.B. & Lake, F. (2014). Relationships between academic performance of medical students and their workplace performance as junior doctors. *BMC Medical Education*, **14**(1), 157. doi: 10.1186/1472-6920-14-157

Chen, H.C., van den Broek, W.S. & ten Cate, O. (2015). The case for use of entrustable professional activities in undergraduate medical education. *Academic Medicine*, **90**(4), 431-436. doi:10.1097/ACM.0000000000000586

Chesbro, S.B., Jensen, G.M. & Boissonnault, W.G. (2017). Entrustable Professional Activities as a Framework for Continued Professional Competence: Is Now the Time? *Physical therapy*, **98**(1), 3-7. doi:10.1093/ptj/pzx100

Crampton, P., Weaver, N. & Howard, A. (2018). Holding a mirror to society? Progression towards achieving better sociodemographic representation among the University of Otago's health professional students. *New Zealand Medical Journal*, **131**(1476), 59-69

Epstein, R.M. & Hundert, E.M. (2002). Defining and assessing professional competence. JAMA, **287**(2), 226-235

EVOLVE. (2019). Pharmaceutical Society of New Zealand EVOLVE programme overview (online). Available at: https://www.psnz.org.nz/Category?Action=View&Category_id=255 . Accessed 24th June, 2019

Feemster, A., Calabrese, M., Gaitonde, P. & Shaya, F. (2017). Characteristics of Pharmacy Students Associated with a Successful PGY1 Residency Match. *Medical Science Educator*, **27**(4), 607-611

Field, A. (2013). Discovering statistics using IBM SPSS statistics: Sage Publications Ltd.

Frank, J.R., Snell, L., Englander, R., Holmboe, E.S. & Collaborators, I. (2017). Implementing competency-based medical education: Moving forward. *Medical Teacher*, **39**(6), 568-573. doi:10.1080/0142159X.2017.1315069

Gallagher, H.C. (2010). New fitness-to-practice requirements for pharmacists in Ireland: Implications for undergraduate pharmacy education. *Medical Teacher*, **32**(2), e71-e77. doi:10.3109/01421590903199635

Garavan, T.N. & McGuire, D. (2001). Competencies and workplace learning: some reflections on the rhetoric and the reality. *Journal of Workplace Learning*, 13(4), 144-164. doi: 10.1108/13665620110391097

Green, J.A. (2015). The effect of English proficiency and ethnicity on academic performance and progress. *Advances in Health Sciences Education*, **20**(1), 219-228. doi:10.1007/s10459-014-9523-7

Hester, E.K., McBane, S.E., Bottorff, M.B., Carnes, T.A., Dell, K., Gonyeau, M.J. & Trujillo. (2014). Educational outcomes necessary to enter pharmacy residency training. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, **34**(4), e22-e25. doi:10.1002/phar.1411

Hirsh, D.A., Holmboe, E.S. & ten Cate, O. (2014). Time to trust: longitudinal integrated clerkships and entrustable professional activities. *Academic Medicine*, **89**(2), 201-204. doi:10.1097/ACM.0000000000000111

Hojat, M., Gonnella, J.S., Erdmann, J.B. & Veloski, J.J. (1996). The fate of medical students with different levels of knowledge: Are the basic medical sciences relevant to physician competence? *Advances in Health Sciences Education*, **1**(3), 179-196

Hojat, M. & Xu, G. (2004). A visitor's guide to effect sizes–statistical significance versus practical (clinical) importance of research findings. *Advances in Health Sciences Education*, **9**(3), 241-249

Houglum, J.E., Aparasu, R.R. & Delfinis, T.M. (2005). Predictors of academic success and failure in a pharmacy professional program. *American Journal of Pharmaceutical Education*, **69**(3), Art.43.

Jarrett, J.B., Berenbrok, L.A., Goliak, K.L., Meyer, S.M. & Shaughnessy, A.F. (2017). Entrustable Professional Activities: A Novel Framework for Pharmacy Education. *American Journal of Pharmaceutical Education*, **82**(5), Art. 6256. doi:10.5688/ajpe6256

Kairuz, T., Noble, C. & Shaw, J. (2010). Preceptors, interns, and newly registered pharmacists' perceptions of new zealand pharmacy graduates' preparedness to practice. *American Journal of Pharmaceutical Education*, **74**(6), Art. 108.

Kane, M.T. (1992). The assessment of professional competence. *Evaluation & the health professions*, **15**(2), 163-182

Kenny, S., McInnes, M. & Singh, V. (2013). Associations between residency selection strategies and doctor performance: a meta−analysis. *Medical Education*, **47**(8), 790-800. doi:10.1111/medu.12234

Kinder, D.H. & Knecht, K.T. (2011). Impact of non-passing grades and academic retention on subsequent academic performance in a cohort of pharmacy students. *Currents in Pharmacy Teaching and Learning*, **3**(2), 92-100. doi: 10.1016/j.cptl.2011.01.003

McGill, D., Van der Vleuten, C. & Clarke, M. (2011). Supervisor assessment of clinical and professional competence of medical trainees: a reliability study using workplace data and a focused analytical literature review. *Advances in Health Sciences Education*, **16**(3), 405-425. doi:10.1007/s10459-011-9296-1

Nash, R.E., Chalmers, L., Brown, N., Jackson, S. & Peterson, G. (2015). An international review of the use of competency standards in undergraduate pharmacy education. *Pharmacy Education*, **15**(1), 131-141

Nash, R.E., Chalmers, L., Stupans, I. & Brown, N. (2016). Knowledge, use and perceived relevance of a profession's Competency Standards; implications for Pharmacy Education. *International Journal of Pharmacy Practice*, **24**(6), 390-402. doi:10.1111/ijpp.12267

Nisbett, R.E. & Wilson, T.D. (1977). The halo effect: Evidence for unconscious alteration of judgments. *Journal of Personality and Social Psychology*, **35**(4), 250-256. doi: 10.1037/0022-3514.35.4.250

Noble, C., Coombes, I., Nissen, L., Shaw, P.N. & Clavarino, A. (2015). Making the transition from pharmacy student to pharmacist: Australian interns' perceptions of professional identity formation. *International Journal of Pharmacy Practice*, **23**(4), 292-304. doi:10.1111/ijpp.12155

Pijl-Zieber, E.M., Barton, S., Konkin, J., Awosoga, O. & Caine, V. (2014). Competence and competency-based nursing education: finding our way through the issues. *Nurse Education Today*, **34**(5), 676-678. doi:10.1016/j.nedt. 2013.09.007

Pittenger, A.L., Chapman, S.A., Frail, C.K., Moon, J.Y., Undeberg, M.R. & Orzoff, J.H. (2016). Entrustable professional activities for pharmacy practice. *American Journal of Pharmaceutical Education*, **80**(4), Art.57. doi: 10.5688/ajpe80457

PCNZ [Pharmacy Council of New Zealand]. (2015). Competence Standards for the Pharmacy Profession. Available at http://www.pharmacycouncil.org.nz/Portals/12/Documents/standardsguidelines/CompStds2015Web. pdf?ver=2017-02-20-104344-177. Accessed 11th November, 2017

Rhodes, L.A., Marciniak, M.W., McLaughlin, J., Melendez, C.R., Leadon, K.I. & Pinelli, N.R. (2019). Exploratory Analysis of Entrustable Professional Activities as a Performance Measure During Early Practice Experiences. *American Journal of Pharmaceutical Education*, **83**(2), Art. 6517. doi: 10.5688/ajpe6517

Robinson, D. & Speedie, M. (2015). Is Post−Graduate Training Essential for Practice Readiness? *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, **35**(12), 1096-1099. doi:10.1002/phar.1654

Salvatori, P. (2001). Reliability and validity of admissions tools used to select students for the health professions. *Advances in Health Sciences Education*, **6**(2), 159-175

Schlesselman, L.S. & Coleman, C.I. (2011). Predictors of poor student performance at a single, Accreditation Council for Pharmacy Education–accredited school of pharmacy. *Currents in Pharmacy Teaching and Learning*, **3**(2), 101-105. doi:10.1016/j.cptl.2011.01.002

Shaw, J., Kennedy, J., Jensen, M. & Sheridan, J. (2015). An international perspective on pharmacy student selection policies and processes. *American Journal of Pharmaceutical Education*, **79**(8), Art.115. doi:10.5688/ajpe798115

Stupans, I. (2012). Qualitative interviews of pharmacy interns: Determining curricular preparedness for work life. *Pharmacy Practice*, **10**(1), 52-56

ten Cate, O., Chen, H.C., Hoff, R.G., Peters, H., Bok, H. & van der Schaaf, M. (2015). Curriculum development for the workplace using Entrustable Professional Activities (EPAs): AMEE Guide No. 99. *Medical Teacher*, **37**(11), 983-1002. doi:10.3109/0142159X.2015.1060308

Terry, R., Hing, W., Orr, R. & Milne, N. (2017). Do coursework summative assessments predict clinical performance? A systematic review. *BMC Medical Education*, **17**(1), 40. doi:10.1186/s12909-017-0878-3

Waterfield, J. (2017). How is the term 'competence' defined by the pharmacy educator? A qualitative study of science-based and practice-based pharmacy educators. *Pharmacy Education*, **17**(1), 350-356

Wilkinson, T.J. & Frampton, C.M. (2004). Comprehensive undergraduate medical assessments improve prediction of clinical performance. *Medical Education*, **38**(10), 1111-1116

Windle, J.M., Spronken-Smith, R.A., Smith, J.K. & Tucker, I.G. (2018). Preadmission predictors of academic performance in a pharmacy program: A longitudinal, multi-cohort study. *Currents in Pharmacy Teaching and Learning*, **10**(7), 842-853. doi:10.1016/j.cptl.2018.04.018

Appendix A:

Domains and Competencies for New Zealand registered interns and pharmacists

Framework Structure: The framework contains six domains, each with a number of competencies (see below). There are additional behavioural statements for each competency (refer to source) indicating how individuals working in that competency will be behaving in practice. Mandatory Domains (M1-M2) allow for academic or non-traditional role pharmacists to retain an Annual Practising Certificate (APC) without having to maintain competence in areas not relevant to their practice. Pharmacists are able to select single competencies amongst optional domains (O1-O4) relevant to their areas of practice.	
Domain (Mandatory)	Competency
M1: Professionalism in Pharmacy	M1.1 Demonstrate personal and professional integrity M1.2 Comply with ethical and legal requirements M1.3 Contribute to quality improvement M1.4 Practice pharmacy within New Zealand's culturally diverse environment M1.5 Understand Hauora Māori M1.6 Make effective decisions
M2: Communication and collaboration	M2.1 Communicate effectively M2.2 Establish and maintain collaborative working relationships M2.3 Resolve conflict M2.4 Supervise and support colleagues M2.5 Facilitate education of colleagues
Domain (Options)	
O1: Health and medicine management	O1.1 Consult with the patient O1.2 Provide healthcare O1.3 Review and manage patient's medicine therapy O1.4 Deliver quality and safe services O1.5 Access, evaluate and provide medicines information
O2: Public healthcare	O2.1 Contribute to community health O2.2 Health promotion
O3: Supply and administration of medicines	O3.1 Assess prescriptions O3.2 Dispense medicines O3.3 Compound pharmaceutical products O3.4 Administer medicines O3.5 Provide patient counselling
O4: Leadership and organisational management	O4.1 Provide leadership O4.2 Manage quality improvement and safety O4.3 Manage and develop personnel O4.4 Provide safe working environment
[a]Source: Pharmacy Council of New Zealand Competence Standards for the Pharmacy Profession (2015)	