

Optometry Workforce and Education in California

INTRODUCTION

Optometrists are health care professionals who have earned a Doctor of Optometry (OD) degree. Common tasks performed by optometrists include conducting eye examinations, diagnosing vision problems (such as nearsightedness or farsightedness), addressing binocular vision issues, diagnosing and treating eye diseases, prescribing eyeglasses or contact lenses and prescribing vision treatments such as vision therapy or low vision aids. Optometrists may also use therapeutic pharmaceutical agents to diagnose and treat certain eye conditions, such as ocular infections, inflammations and glaucoma.

Optometrists are distinct from ophthalmologists. Ophthalmologists are graduates of medical school (MDs or DOs) who specialize in eye health and vision care. Unlike optometrists, ophthalmologists can perform surgeries, such as cataract surgery and strabismus surgery.

SUMMARY

- California optometrists make up the largest share of the nation's optometrists.
- California's OD workforce has greater shares of female and minority ODs than national averages.
- Most optometry school applicants and graduates are women.
- Although completion of a residency program is not required to practice optometry, optometry residency programs and positions have expanded in recent years, reflecting the increasing demand for additional experience in specialty areas.
- Demand for optometrists will likely increase due to California's growing and aging population.

CURRENT SUPPLY

There were approximately 43,000 optometrists working in the United States in 2019.¹ The ratio of optometrists per 100,000 population nationwide increased from 11.06 to 16.16 per 100,000 population between 1990 and 2017.²

California has the most optometrists employed in the profession of any state in the United States, accounting for over 10% of the nation's working optometrists. There were 6,826 licensed optometrists in California in August 2018.³

According to the California Department of Consumer Affairs' most recent occupational analysis report, nearly half (46.8%) of California optometrists work at least 40 hours per week.⁴

Practice Settings and Types

Optometrists work in a variety of clinical settings. As shown in **Table 1**, over two-thirds (69.5%) of optometrists in California work in private practice, a group practice or partnership. Of these optometrists, 40.1% are sole owners of their practice. Other common clinical settings include corporate practices (12.1%), other healthcare facilities, including health maintenance organizations, community clinics, and Veterans Affairs facilities (11.3%) and educational facilities (3.6%).⁵

Most California optometrists provide general practice optometry (73.7%). Other primary areas of practice include pathology assessment and patient management (6.4%), prescribing and dispensing contact lenses (4.4%) and co-management with medical specialists (2.8%).⁶

Table 1. Primary Work Setting of California Optometrists

Work Setting	Percent
Private Practice	54.4%
Corporation	12.1%
Group Practice	11.5%
HMO Facility	7.6%
Educational Facility	3.6%
Partnership	3.6%
Federal Facility (nonmilitary)	1.1%
County Facility	0.9%
Military/veterans Hospital or Clinic	0.9%
State Facility	0.4%
Municipal Facility	0.2%
Private Hospital	0.2%
Other	3.7%

Source: California Department of Consumer Affairs (2019)

Certification to Provide Expanded Services

Following graduation and licensure, optometrists who meet the necessary training requirements may apply for certifications that allow them to provide expanded optometric procedures and services. The highest level and most commonly held certification for optometrists in California is the TLG certification, which allows optometrists to use **therapeutic** pharmaceutical agents to diagnose and treat certain conditions of the

human eye and its appendages (e.g., eyelids, eyebrows, lacrimal apparatus, conjunctiva); perform certain procedures (e.g., corneal scraping with cultures, debridement of corneal epithelia, and mechanical epilation); perform **lacrimal** irrigation and dilation procedures for patients over age 12; and diagnose and treat primary open angle **glaucoma** in adult patients. As **Table 2** illustrates, nearly half (46.9%) of California optometrists hold the TLG certification.^{7,8}

All optometrists who have graduated from an accredited California optometry school on or after May 2008 are eligible to apply for the TLG certification without completing additional training.⁹ Licensed optometrists who graduated prior to this date may obtain the TLG (or other certifications) through a combination of additional didactic courses, self-directed study, exams and preceptorships. For instance, optometrists who graduated between 1996 and 2008 can become certified to use therapeutic pharmaceutical agents (TPA) if they obtain a California OD license and if an accredited school of optometry has certified that they are competent in the diagnosis, treatment and management of ocular, systemic disease and have completed 10 hours of experience with an ophthalmologist.¹⁰

Table 2. Share of California ODs Certified to Provide Additional Procedures or Services, 2018

	Use therapeutic pharmaceutical agents to treat certain eye conditions	Perform certain procedures on eye	Diagnose and treat open angle glaucoma in patients over age 18	Perform lacrimal irrigation and dilation procedures for patients over age 12	Share of CA ODs
TLG	X	X	X	X	46.9%
TPA	X	X			29.1%
TPG	X	X	X		14.9%
TPL	X	X		X	7.1%
DPA	X				0.9%
Unknown	*	*	*	*	1.1%
Share of CA ODs who can perform this service	98.90%	98.0%	61.8%	54.0%	

Source: California Department of Consumer Affairs (2019)

Geographic Distribution

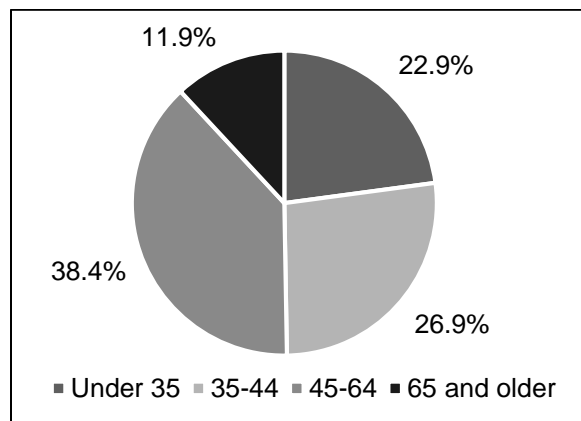
The majority (90.4%) of California optometrists work in urban locations (defined as having populations greater than 50,000 people).¹¹

Demographic Characteristics

The majority (57.5%) of optometrists in the United States are male. U.S. optometrists are 80.3% white, 15.8% Asian, 1.4% Black, 0.3% American Indian, 1.7% multiracial and 0.5% of other racial or ethnic backgrounds. The majority (55.4%) are over age 45.¹²

California's optometry workforce, in contrast, is majority female (57.7%), more ethnically diverse, and younger. California optometrists are 46.3% Asian, 42.8% white, 3.7% Hispanic/Latino, 3.1% Filipino, 0.4% Black, 2.3% multiracial and 1.5% of other racial or ethnic backgrounds. The average age of California optometrists is 46.7 years. As shown in **Figure 1**, in California similar percentages of optometrists are below age 45 and 45 years or older.¹³ The percentage of optometrists in California who are age 45 or older is lower than the percentage in the United States overall (50.3% vs. 55.4%).

Figure 1. Age Distribution of California Optometrists



Source: U.S. Census Bureau (2018). Public Use Microdata Sample, 2013-2017 American Community Survey 5-year estimates.

EDUCATION

Optometry Schools

Optometrists must complete a Doctor of Optometry (OD) degree program (typically four years in length) and obtain a license to practice in a specific state. There are 23 optometry schools in the United States, five of which have opened since 2009.¹⁴

The number of applicants to U.S. OD programs rose from 2,503 to 2,812 applicants between 2010 and 2016, and subsequently decreased to 2,472 applicants for Fall 2019 entrance.¹⁵ During this time, the number of students enrolled in OD programs grew 19.5%, from 6,060 students in Fall 2010 to 7,244 in Fall 2019.^{16,17} From Spring 2010 to Spring 2019, the number of OD graduates increased by 27%, from 1,356 to 1,722 graduates.^{18,19}

Since 2010, approximately two-thirds of U.S. optometry students and graduates have been women. The majority (53.5%) of graduates in Spring 2019 were white; the remaining new graduates were 29.0% Asian, 6.2% Hispanic/Latino, 2.0% Black or African American, 0.6% American Indian/Alaska Native, 0.2% Native Hawaiian/Pacific Islander, 1.7% multiracial and 6.9% of unknown race.²⁰

California has three optometry schools accredited by the Accreditation Council on Optometric Education. The University of California, Berkeley School of Optometry is the state's only public optometry program. The Southern California College of Optometry at Marshall B. Ketchum University and Western University of Health Sciences, College of Optometry are private, not-for-profit programs. Western University of Health Sciences enrolled its first class in Fall 2009 and graduated its first class in Spring 2013.

The number of students enrolled in California OD programs increased by over 22.2% between Fall 2010 and Fall 2018, from 819 to 1,001 students. The number of graduates of California OD programs increased by 45.5% between Spring 2010 and Spring 2018, from 154 to 224 graduates, and peaked in Spring 2013 with 237 graduates.²¹ Students and graduates from

Western University of Health Sciences likely accounted for much of these increases.

Women made up 73.4% of California OD program enrollees and 78.6% of OD graduates in 2019. New California ODs graduating in Spring 2019 were 50.6% Asian, 28.4% White, 8.2% Hispanic/Latino, 0.8% Black, 4.1% multiracial, and 7.8% of unknown race.²²

Residency

In May 2012, the Association of Schools and Colleges of Optometry (ASCO) established the Optometry Residency Match (ORMatch) to help graduates of schools or colleges of optometry that are accredited by the Accreditation Council on Optometric Education (ACOE) obtain residency positions (this includes two Canadian schools of optometry).²³ Graduates are also able to match with unfilled residency positions outside the ORMatch if they do not match with a residency program initially. ASCO officially recognizes 11 clinical subject areas of residency: family practice optometry, primary eye care, cornea and contact lenses, geriatric optometry, pediatric optometry, low vision rehabilitation, vision therapy and rehabilitation, ocular disease, refractive and ocular surgery, community health optometry and brain injury vision rehabilitation.²⁴ Most residencies are 12 months long.

Since the first ORMatch in 2013, between 480 and 567 OD graduates annually have participated in ORMatch. As seen in **Table 3**, the number of residency programs participating in ORMatch grew 30.2% between 2013 and 2019, from 199 programs in 2013 to 259 programs in 2019. During this time, the number of positions offered grew 22.2%, from 383 to 468 positions. Most optometry residency applicants were women, making up between 70 to 80% of applicants each year.

The number of applicants matched to residencies through ORMatch has remained relatively stable since the first ORMatch in 2013, ranging from 331 to 364 applicants (**Table 3**).²⁵ A significant number of applicants fill unmatched positions outside of the ORMatch. In 2019, 450 of 468 residency positions were ultimately filled, 87 of which were filled outside the ORMatch.²⁶

There are several possible explanations for why only a minority of new OD graduates choose to apply to a residency. First, differences in practice interests may drive graduates' decisions to pursue residencies. Completing a residency is only a requirement for new ODs interested in pursuing careers in academia or research.²⁷ Following graduation and licensure, new ODs who are interested in non-academic, office-based practice can begin practicing optometry without completing a residency program.

Table 3. Optometry Residency Match Statistics, United States and Canada, 2013-2019

	2013	2014	2015	2016	2017	2018	2019
# of residency programs	199	210	217	231	236	248	259
# of residency positions	383	400	411	429	443	456	468
# of applicants participating in ORMatch	567	489	483	479	480	517	487
# of applicants matched to residencies	331	348	352	347	355	364	363
% of applicants matched to residencies	62.9%	71.2%	72.9%	72.4%	74%	70.4%	74.5%
% of residency positions filled through ORMatch	86.4%	87%	85.6%	80.9%	80.1%	79.8%	77.6%

Sources: National Matching Services Inc. (2019). ORMatch Statistics, Association of Schools and Colleges of Optometry. (2019).

A 2012 survey of fourth-year students, residents and alumni from the New England College of Optometry supports the inference that career plans influence the decision to pursue residency. The survey found that 50% of student respondents did not perceive residency training to be advantageous for the geographic location where they planned to practice.²⁸

The survey's results also suggest that financial considerations affect the decision to pursue residency. Nearly three-fourths (71%) of students felt that the financial burden of residency training exceeded the increase in compensation associated with completing a residency program. A similar share (70%) of students indicated that they would be more likely to complete a residency if residents received higher compensation.²⁹ Pay for OD residents is significantly lower than the starting salary for ODs who go directly into practice. The average annual stipend for an OD residency in the 2018-2019 school year was \$37,751.³⁰ The interquartile range (middle 50%) of annual salaries for California ODs in 2018 was \$94,731 to \$130,361.³¹

FUTURE SUPPLY AND DEMAND

According to the California Employment Development Department (EDD), the number of jobs for ODs is expected to increase by 19% (approximately 800 jobs) between 2016 and 2026, which is faster than the average growth rate for all occupations in the state. Most job openings will result from the need to replace ODs who retire or leave the field for other reasons.³² At the time of this writing, there are no publicly available analyses about whether California's optometrist supply will be sufficient to meet future demand. Consequently, the authors are unable to provide predictions about the likelihood of future shortages. Additionally, although the number of graduates of OD programs has increased during the last decade, the lack of available data on the interstate mobility of California's optometrists makes it difficult to conclude whether there will be enough new optometrists to replace retiring optometrists or those leaving the state.

The EDD predicts that demand for optometrists in California will increase due to the vision care needs of the state's growing and aging population. An aging population will likely result in a greater prevalence of age-related eye diseases, such as glaucoma, cataracts, macular degeneration and diabetic and hypertensive retinopathy. This is especially significant as over half of California adults are estimated to have prediabetes or diabetes.^{33,34} Optometrists stand at the front line in diagnosis and management responsibilities for patients with age-related eye diseases.

Insurance coverage expansion may also result in greater demand for optometrists, especially among adult Medi-Cal beneficiaries. According to the California Optometric Association, approximately 2 million Medi-Cal enrollees between the ages of 21 and 64 (nearly 15% of the program's enrollees) need glasses or other forms of vision aid.³⁵ Vision benefits were eliminated for all Medi-Cal enrollees in 2009 (during the Great Recession) except for those under age 21, seniors in nursing homes and pregnant women. The state budget passed for the 2019-2020 fiscal year restored benefits for optical services for all adult Medi-Cal beneficiaries, which is likely to increase their demand for these services. The state budget for 2020-2021 contains funds to continue optical benefits, but the future of these benefits is uncertain due to the impact of the COVID-19 pandemic on state tax revenue.³⁶ Data about the share of California ODs who treat Medi-Cal patients is not available.

At the same time, new eye care workforce models could mitigate or reduce demand for optometrists, as well as increase access to eye care. For example, the EDD predicts that California optician jobs will grow by 17.6% (approximately 1,500 jobs) between 2016 and 2026. Opticians may take on lower-skill tasks in optometry/ophthalmology practices, such as evaluating and filling prescriptions, assisting customers in selecting and fitting eyewear and instructing clients on how to wear and care for eyewear.^{37,38} Likewise, optometric technicians/assistants or medical assistants working in optometry practices could increasingly play complementary roles to

optometrists. One study conducted in the Veterans Affairs Health Care System found that an increase in the ratio of optometric technicians to optometrists was associated with increased visits to optometric clinics.³⁹ Additionally, integrating vision care into primary care at community health centers has been proposed as a solution to increasing access to vision care services for underserved populations.⁴⁰

Ultimately, meeting the future demand for vision care in California will depend on having an

adequately skilled workforce that can address the vision care needs of a growing and aging population. If demand for specialized care or treatment of more complex vision conditions grows, more OD graduates may choose to enter residencies or pursue additional certification. Vision care delivery models that utilize other professions such as opticians, optometric technicians/assistants, or medical assistants for lower-skill vision care tasks may also help increase access to vision care for all.

¹ US Bureau of Labor Statistics. (2020, January 22). Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity. Retrieved May 13, 2020 from

<https://www.bls.gov/cps/cpsaat11.htm>

² Feng, P.W., Ahluwalia, A. Feng, H., & Adelman, R.A. (2020). National Trends in the United States Eye Care Workforce From 1995 to 2017. *American Journal of Ophthalmology*. May 20;S0002-9394 (20)30248-8. doi: 10.1016/j.ajo.2020.05.018.

³ Lincer, H., Kumar, G., & Morris, M. R. (2019). *Occupational Analysis of the Optometrist Profession*. Office of Professional Examination Services, California Department of Consumer Affairs. Retrieved from https://www.optometry.ca.gov/formspubs/occup_analysis_2019_02.pdf

⁴ Lincer, H., Kumar, G., & Morris, M. R. (2019). *Occupational Analysis of the Optometrist Profession*. Office of Professional Examination Services, California Department of Consumer Affairs. Retrieved from https://www.optometry.ca.gov/formspubs/occup_analysis_2019_02.pdf

⁵ Employment Development Department, State of California. (n.d.). Occupation Profile: Optometrists. Retrieved from <https://www.labormarketinfo.edd.ca.gov/cgi/databrowsing/occExplorerQSDetails.asp?searchCriteria=optometrist&careerID=&menuChoice=&geogArea=0601000000&socode=291041&search=Explore+Occupation>

⁶ Lincer, H., Kumar, G., & Morris, M. R. (2019). *Occupational Analysis of the Optometrist Profession*. Office of Professional Examination Services, California Department of Consumer Affairs. Retrieved from

https://www.optometry.ca.gov/formspubs/occup_analysis_2019_02.pdf

⁷ Lincer, H., Kumar, G., & Morris, M. R. (2019). *Occupational Analysis of the Optometrist Profession*. Office of Professional Examination Services, California Department of Consumer Affairs. Retrieved from https://www.optometry.ca.gov/formspubs/occup_analysis_2019_02.pdf

⁸ California State Board of Optometry. (2012, July 5). Fact Sheet - Board of Optometry. Retrieved from <https://www.optometry.ca.gov/formspubs/fs19.shtml>

⁹ California Business and Professions Codem Division 2, Chapter 7, Section 3041. Retrieved from https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=BPC&division=2.&title=&part=&chapter=7.&article=3

¹⁰ California Code of Regulations 16 CCR § 1568/ Retrieved from [https://govt.westlaw.com/calregs/Document/ICEB5A970D48E11DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/calregs/Document/ICEB5A970D48E11DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default))

¹¹ Lincer, H., Kumar, G., & Morris, M. R. (2019). *Occupational Analysis of the Optometrist Profession*. Office of Professional Examination Services, California Department of Consumer Affairs. Retrieved from <https://www.labormarketinfo.edd.ca.gov/cgi/databrowsing/occExplorerQSDetails.asp?searchCriteria=optometrist&careerID=&menuChoice=&geogArea=0601000000&socode=291041&search=Explore+Occupation>

¹² US. Census Bureau (2018). Public Use Microdata Sample, 2013-2017 American Community Survey 5-year estimates.

¹³ US. Census Bureau (2018). Public Use Microdata Sample, 2013-2017 American Community Survey 5-year estimates.

¹⁴ Zadnik, K. & Reich, L.N. (2019). An Analysis of the Optometric Applicant Pool Relative to Matriculants. *Optometry Vision Science*. Sep;96(9):637-646.
doi: 10.1097/OPX.0000000000001424

¹⁵ Association of Schools and Colleges of Optometry. (2019). *Gender of Doctor of Optometry Applicants: U.S. Schools and Colleges of Optometry Including Puerto Rico 2008-2020* Retrieved from <https://optometriceducation.org/wp-content/uploads/2020/05/Applicant-Gender-pdf>

¹⁶ Association of Schools and Colleges of Optometry. (2019). Annual Student Data Report Academic Year 2018-2019. Retrieved from <https://optometriceducation.org/wp-content/uploads/2019/11/ASCO-Student-Data-Report-2018-19-updated-11-18-19.pdf>

¹⁷ Association of Schools and Colleges of Optometry. (2020). Annual Student Data Report Academic Year 2019-2020. Retrieved from <https://optometriceducation.org/wp-content/uploads/2020/05/ASCO-Student-Data-Report-2019-2020.pdf>

¹⁸ Association of Schools and Colleges of Optometry. (2019). Annual Student Data Report Academic Year 2018-2019. Retrieved from <https://optometriceducation.org/wp-content/uploads/2019/11/ASCO-Student-Data-Report-2018-19-updated-11-18-19.pdf>

¹⁹ Association of Schools and Colleges of Optometry. (2020). Annual Student Data Report Academic Year 2019-2020. Retrieved from <https://optometriceducation.org/wp-content/uploads/2020/05/ASCO-Student-Data-Report-2019-2020.pdf>

²⁰ Association of Schools and Colleges of Optometry. (2020). Annual Student Data Report Academic Year 2019-2020. Retrieved from <https://optometriceducation.org/wp-content/uploads/2020/05/ASCO-Student-Data-Report-2019-2020.pdf>

²¹ Association of Schools and Colleges of Optometry. (2019). Annual Student Data Report. Retrieved from

<https://optometriceducation.org/student-data-reports/>

²² Association of Schools and Colleges of Optometry. (2020). Annual Student Data Report Academic Year 2019-2020. Retrieved from <https://optometriceducation.org/wp-content/uploads/2020/05/ASCO-Student-Data-Report-2019-2020.pdf>

²³ Overview of ORMatch. (2020, March 15). Retrieved July 02, 2020, from <https://natmatch.com/ormatch/overview.html>

²⁴ American Society of Colleges of Optometry. (n.d.). FAQs about Residencies. Retrieved December 3, 2019, from <https://optometriceducation.org/students-future-students/residency-programs/faqs-about-residencies/>

²⁵ National Matching Services Inc. (2019, November 21). ORMatch Statistics. Retrieved from <https://natmatch.com/ormatch/statistics.html>

²⁶ Association of Schools and Colleges of Optometry. Optometry Residency Programs in AY 2019-2020. Retrieved from <https://optometriceducation.org/wp-content/uploads/2019/10/Optometry-Residency-Programs-2019-20.pdf>

²⁷ FAQs about Residencies. (n.d.). Retrieved December 10, 2019, from <https://optometriceducation.org/students-future-students/residency-programs/faqs-about-residencies/>

²⁸ Quinn, N., Keppol, S., Bligdon, S., & Lyons, S. (2015). Impact of Optometric Residency Training on Future Career Paths: A Survey of Perceptions of Optometry Students, Residents and Alumni. *Optometric Education*, 40(2), 94–103. Retrieved from

https://journal.opted.org/articles/Volume40_Number2_WinterSpring2015-Article4.pdf

²⁹ Quinn, N., Keppol, S., Bligdon, S., & Lyons, S. (2015). Impact of Optometric Residency Training on Future Career Paths: A Survey of Perceptions of Optometry Students, Residents and Alumni. *Optometric Education*, 40(2), 94–103. Retrieved from

https://journal.opted.org/articles/Volume40_Number2_WinterSpring2015-Article4.pdf

³⁰ Association of Schools and Colleges of

Optometry. (2019, January). Optometry Residency Programs and Stipends. Retrieved from <https://optometriceducation.org/wp-content/uploads/2019/05/Residency-Stipend-Trends-2016-2019.pdf>

³¹ Employment Development Department, State of California. (n.d.). Occupation Profile: Optometrists. Retrieved November 25, 2019, from <https://www.labormarketinfo.edd.ca.gov/cgi/databrowsing/occExplorerQSDetails.asp?searchCriteria=optometrist&careerID=&menuChoice=&geogArea=0601000000&soccode=291041&search=Explore+Occupation>

³² Employment Development Department, State of California. (n.d.). Detailed Guide for Optometrists in California. Retrieved December 3, 2019, from <https://www.labormarketinfo.edd.ca.gov/OccGuides/Detail.aspx?Soccode=291041&Geography=0601000000>

³³ Cha, A. E., Villarroel, M. A., & Vahratian, A. (2019). *Eye Disorders and Vision Loss Among U.S. Adults Aged 45 and Over With Diagnosed Diabetes, 2016–2017*. National Center for Health Statistics. Retrieved from <https://www.cdc.gov/nchs/products/databriefs/db344.htm#Data>

³⁴ Babey, S. H., Wolstein, J., Diamant, A. L., & Goldstein, H. (2016). *Prediabetes in California: Nearly Half of California Adults on Path to Diabetes*. UCLA Center for Health Policy Research. Retrieved

from <http://healthpolicy.ucla.edu/publications/Documents/PDF/2016/prediabetes-brief-mar2016.pdf>

³⁵ Newsom, G., Ghaly, M. A., & Kent, J. (2019). *2019-20 Governor's May Revision Highlights*. California Department of Health Care Services. Retrieved from https://www.dhcs.ca.gov/Documents/Budget_Highlights/FY_2019-20_MR_Highlights.pdf

³⁶ California State Budget 2020-21. <http://www.ebudget.ca.gov/FullBudgetSummary.pdf>

³⁷ Employment Development Department, State of California. (n.d.). Detailed Guide for Opticians, Dispensing in California. Retrieved December 10, 2019, from <https://www.labormarketinfo.edd.ca.gov/OccGuides/Detail.aspx?Soccode=292081&Geography=0601000000>

³⁸ CA Business and Professions Code § 2550 - 2569

³⁹ Lynch, M. G., Maa, A., Delaune, W., Chasan, J., & Cockerham, G. C. (2017). Eye Care Productivity and Access in the Veterans Affairs Health Care System. *Military Medicine*, 182(1-2), e1631–e163. doi: 10.7205/milmed-d-16-00103

⁴⁰ Mcnamara, N. A., & Polse, K. A. (2019). Community Health Centers. *Optometry and Vision Science*, 96(12), 905-909. doi:10.1097/opx.0000000000001458