



Program Review - Overall Report

Instructional: Biology

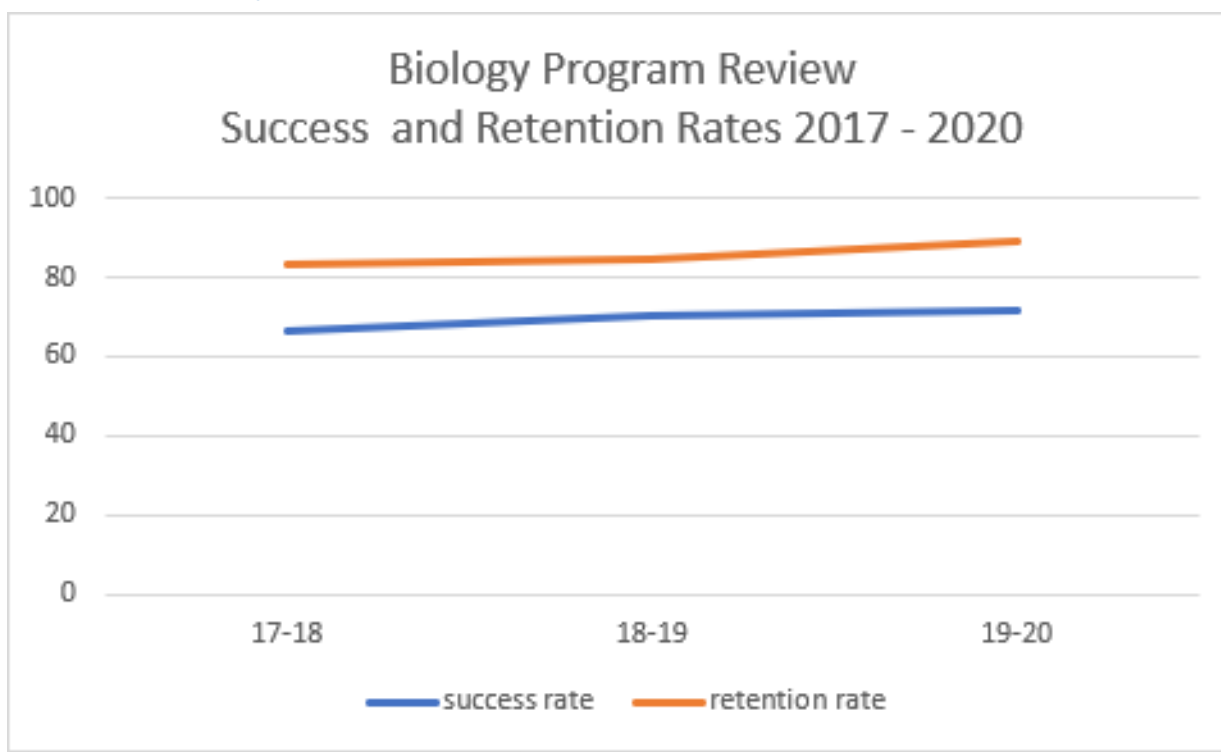
Data Review

2021 - 2024

Overall Trends

What overall trends do you see in success, retention, program of study, educational planning, and awards over the past 3 or more years?

Overall, students in AMY, BIO, HES and MIC courses have been increasing from 66.6 % to 71.6% in success and remaining about the same from 83% to 83.9 % in retention over the past 3 years.



The students in AMY, Bio, HES, and Micro courses have decreased in their rate of receiving less than passing (DF) grades during this time.

For the following programs of study: Biology and Math & Science the percentage of students developing a comprehensive credit education plan decreased from 12.22% to 10.55% in 3 years and the number of program awards granted over the past 3 years remained the same from 233 awards to 200 awards.

The number of students who have completed a degree or certificate in Biology and Math & Science programs went from 233 to 200 in 3 years. This represents no growth for these programs. In the most recent year 2019-2020, 200 students graduated. The

Data Review

expected number of students who should get a degree would be approximately (200/3744) 5.3% of Program of Study in 2019-2020. The gap in the pipeline is approximately 3544 more students to graduate with a degree or certificate. This number is large since the majority of our students transfer to programs or universities without the necessity of the program award.

Disaggregated Student Subgroups

Look at the disaggregated student subgroups in success, retention, program of study, educational planning, and awards for your area. Are there any equity gaps that you will address in the next 3 years?

In terms of student subgroups in AMY, BIO, HES, and MIC courses, only hispanic female and male student groups are showing gaps in success. Only hispanic females are showing equity gaps in retention that are concerning.

Equity gaps in program of study, educational planning, and awards are not shown on the tables for these areas.

We should take steps to address equity gaps for female and male hispanic success and female hispanic retention.

If there are any concerning trends over the past 3 or more years, or if equity gaps exist, what is your action plan to address them?

We address equity gaps for females and minorities by hosting STEM Seminar Series where female and/or minority speakers are invited to share their current research and ignite interest in STEM.

We are recruiting local high school students for a Forensics for Women competition which introduces students to the basic methods of science and the scientific method.

Dr. Monica Gutierrez shares her personal experience as a hispanic female in STEM to our Puente students.

We are increasing offering of Human Biology (BIO-4) as a pre-requisite for Anatomy and Physiology (BIO-50A/B) to address preparation gaps in students from underserved populations.

Is there a resource request associated with this Data Review? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

Assessment Review

2021 - 2024

Section 1: SLO Assessment Status (Based on Dashboard - Assessment Status)

Which Disciplines are included in this Assessment?

BIO and HES

What percent of SLOs in the disciplines you identified above have been assessed?

97.6%

Which SLOs have not been assessed and why? Identify both the Course and the associated SLO(s).

Bio-21 (SLO1 and 2) due to this being a new course

Section 2: Mapping Status (Based on Dashboard - Mapping Status)

Are all SLOs mapped to at least one PLO?

Yes

If all SLOs are not mapped to at least one PLOs, please explain why.

All of the SLOs are mapped to at least one PLO

Are the appropriate SLOs mapped to GELOs? (If you have a course that is listed in any general education area, it should have at least one SLO mapped to at least one GELO)

Yes

If the appropriate SLOs are not mapped to GELOs, please explain why.

Appropriate SLOs are mapped to GELOs

Section 3: PLO Analysis (Based on Dashboard - Analysis: PLO Direct Assessment)

Which Programs are included in this Assessment?

ADT- Biology, ADT-BIO Environmental Science, ADT-KIN Kinesiology, AOE-MAT: Math and Science

Please identify the PLO(s) - and name the associated Program(s) - that achieved benchmarks.

All PLOs for ADT-Biology, ADT-BIO Environmental Science, ADT-KIN Kinesiology achieved benchmarks above 70%. AOE-MAT: Math and Science PLO 3 achieved a benchmark above 70%.

To what do you attribute this success?

Hiring of more full-time faculty has supported achieving these benchmarks

Please identify the PLO(s) - and name the associated Program(s) - that did not achieve benchmarks.

AOE-MAT: Math and Science PLOs 1 & 2 did not achieve a benchmark of 70%

If there are PLOs that did not achieve benchmarks, what do you plan on doing to improve benchmark attainment?

Our unit is not responsible for PLO 1 in AOE-MAT. Our unit intends to improve assessment of PLO 2 in AOE-MAT with the instructional supplies and personnel requests to increase student learning of the scientific method.

Assessment Review

Section 4: Alignment to Career and Transfer

Describe the process used in this area to ensure programs (PLOs) align with career and transfer needs.

ADTs and courses are aligned to the C-ID system to improve transfer to CSUs. All courses are transferable to CSUs and UCs, as well as many other regional colleges and universities.

Describe the activities, projects, and opportunities this program offers to support experiential learning and alignment of programs to career and transfer (e.g. capstone projects, portfolios, service-learning opportunities).

Our programs provide students with labs and field trips to support experiential learning and laboratory experiences vital for transfer requirements.

Without looking at your current PLOs, describe some program outcomes which would best help your students continue on the path towards their workforce and transfer goals (e.g. subject matter expertise, hands on experience, partnerships, etc.).

Laboratory and field skills, critical thinking skills, ability to apply the scientific method

Review current PLOs. Do the outcomes listed above align with the current program outcomes?

Yes

Program Review: Part 1

EMP GOAL 1. Expand college access by increasing both headcount and full-time equivalent students (FTES).

GOALS AND ACTIVITIES

What are you doing now in support of this goal?

We have hired two new full time faculty (one is a replacement for a retiree), we have expanded course offerings, and we have maximized our laboratory and lecture spaces.

What are your plans/goals (3-year) regarding this goal?

We would like to offer more sections of impacted courses. To support this goal, we need more lab and lecture space to offer more sections, we need another full-time faculty member in Biology to teach more sections, and we need another full-time laboratory technician to support current courses offerings in the sciences and support future growth in course offerings.

<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>
3	Faculty	Full-time Biology Instructor	\$150,000.00
4	Staff	Full-time Lab Technician	\$85,000.00

In the distant future, we hope that a Science building will be built with a prep room in the middle of all of the laboratory spaces, and with laboratories designated for particular courses, as is done at many colleges and universities around the country. This layout reduces the need to have multiple laboratory technicians in multiple locations at that same time.

EVIDENCE

Do you have assessment data or other evidence that relates to this goal?

We have numerous courses in Biology that are impacted with full waitlists, in particular BIO-1, BIO-50A, BIO-50B, and BIO-55. Most of our courses are taught by part-time faculty, for example, in Fall 2021 there are 42 sections in Biology with 28 sections taught by part-time faculty or as overload for full-time faculty. The current arrangement of laboratory spaces in multiple buildings, and lack of laboratories designated for the same course means that our laboratory technicians must completely change the laboratory set-up between courses and must move laboratory supplies and equipment between buildings.

Kevin Eagan, M., & Jaeger, A. (2009). Effects of Exposure to Part-time Faculty on Community College Transfer. *Research in Higher Education*, 50(2), 168–188. Results: The researchers found a strong correlation between students' exposure to part-time faculty instruction and the likelihood that these students would not transfer to four-year institutions. Article attached in the document repository for this submission.

Program Review: Part 1

RESOURCES

Is there a resource request associated with this EMP Goal? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

EMP GOAL 3. Close all student equity gaps.

GOALS AND ACTIVITIES

What are you doing now in support of this goal?

The science department is working to close equity gaps by collaborating with other departments and committees to address equity gaps in our department. One way we are addressing this is by increasing the offering of alternative pre-requisite classes that help prepare student for the upper level coursework. The increase in sections of Human Biology (BIO-4) for allied health pre-professionals is one example.

What are your plans/goals (3-year) regarding this goal?

We plan on increasing the offering of Human Biology (BIO-4) as a pre-requisite, as an alternative to General Biology (BIO-1), for students pursuing nursing and other allied health fields. BIO-4 is a survey course of the human body that provides a step between high school life science and the Anatomy and Physiology series (BIO-50A and BIO-50B). BIO-4 has demonstrated the ability to close the equity gap by providing students a solid background for Anatomy and Physiology needed by many of our students in underserved populations.

<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>
5	Instructional Supplies	Bio 4 Human Body Models	\$6,623.60
7	Technology	Replacement laptop computers for IT 128	\$38,400.00
8	Furniture	Replacement of all lab benches in IT 128	\$18,560.00
9	Technology	JoVE science education subscription for the library (renewed annually)	\$15,000.00
11	Instructional Supplies	Bio 4 Human Organ models	\$6,677.20

Program Review: Part 1

14	Instructional Supplies	Replacement microscope slides	\$700.00
16	Instructional Supplies	Bio 4 Physio Equipment	\$536.14
17	Instructional Supplies	Bio 4 Posters	\$61.75

EVIDENCE

Do you have assessment data or other evidence that relates to this goal?

We do not have assessment data at this time, due to the fact that BIO-4 has had limited offerings. There is evidence from other districts that support the working hypothesis that Human Biology courses increase success rates and close equity gaps in higher level courses for students pursuing nursing and other allied health fields. Anderton, R.S., Evans, T., & Chivers, P. (2016). Predicting Academic Success of Health Science Students for First Year Anatomy and Physiology. *The International Journal of Higher Education*, 5, 250-260. Results found that "Previous study of science (*human biology*, chemistry or physics) strongly predicts academic performance in BMS100 (**p < .001)." Article attached to this Program Review as a supporting document.

RESOURCES

Is there a resource request associated with this EMP Goal? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

EMP GOAL 7. Become the regional college of choice by offering a comprehensive range of programs that prepare students for the future and meet employer workforce needs.

GOALS AND ACTIVITIES

What are you doing now in support of this goal?

1. Anatomy and Physiology laboratory exercises that have not significantly changed in many years.
2. Offering of a variety Gen Ed course offerings for life science courses, including lecture only courses, lecture and lab courses, and lecture and field biology courses, all of which are transferable to CSUs and UCs. Many of these courses are using equipment and supplies that are out-of-date, broken, or non-functional.

What are your plans/goals (3-year) regarding this goal?

1. Add real-time physiology labs that mimic clinical tests such as ECG, EEG, respirometry, muscle contraction, etc. using Bio-Pac technology.
2. Increase offerings of Human Biology (BIO-4) as a prerequisite for Anatomy and Physiology courses and offering of a new field course: California Naturalist (BIO-21). To provide these increased offerings, as well as

Program Review: Part 1

maintaining current course offerings requires instructional supplies for labs. The increased offerings of BIO-4, the new course of BIO-21, and maintaining current laboratory courses all require resource requests to provide students with a comprehensive education that prepares them for transfer to 4-year universities and colleges.

3. The Biology Discipline has approved and submitted DE forms for several Biology courses, so that we can increase our offerings to become a regional college of choice. An ongoing subscription to JoVE Science Education by the library is needed to support these DE courses. This subscription will also support face-to-face classes, by providing animations of difficult content in biology.

<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>
1	Technology	Surface Pros to replace laptop computers for ST 207 to run BIO-PACs	\$93,000.00
2	Technology	BIO-PACs (basic + respirometer) - BIO-50A/B	\$28,000.00
5	Instructional Supplies	Bio 4 Human Body Models	\$6,623.60
6	Instructional Supplies	Field tools and supplies - Bio 21	\$1,400.00
7	Technology	Replacement laptop computers for IT 128	\$38,400.00
8	Furniture	Replacement of all lab benches in IT 128	\$18,560.00
9	Technology	JoVE science education subscription for the library (renewed annually)	\$15,000.00
10	Instructional Supplies	Field Guides - Bio 21	\$900.00
11	Instructional Supplies	Bio 4 Human Organ models	\$6,677.20

Program Review: Part 1

12	Instructional Supplies	Anatomy models for ST 207	\$4,000.00
13	Equipment	Replacement oxygen meters for IT 128	\$1,280.00
14	Instructional Supplies	Replacement microscope slides	\$700.00
15	Instructional Supplies	Analytical instruments and supplies - Bio 21	\$1,388.00
16	Instructional Supplies	Bio 4 Physio Equipment	\$536.14
17	Instructional Supplies	Bio 4 Posters	\$61.75
18	Technology	PCR Machine Thermo Fisher (1) - BIO-60	\$5,210.00
19	Technology	BIO-RAD UV-Visible spectrophotometers (8) - BIO-60	\$25,600.00
20	Instructional Supplies	TK6 Tissue Culture Supplies and Cell Line - BIO-60	\$2,500.00
21	Equipment	3-tiered seed sprouter - BIO-3,5,8	\$640.00
22	Safety	Autoclave maintenance contract (renewed annually)	\$8,000.00

EVIDENCE

Do you have assessment data or other evidence that relates to this goal?

To become the regional college of choice by offering a comprehensive range of programs that prepare students for the future, we need up-to-date equipment and supplies to attract students to our college.

1. Published data is available of the success of using the Bio-Pac systems to support real-time physiology labs: BIOPAC SYSTEMS HELPS STARK INDUSTRIES LAUNCH VITAL VENTILATOR FOR NASA JPL [Here.](#)

Program Review: Part 1

2. Assessment data for all life science courses is available. These courses are regularly assessed with overall good student success. Once we increase the availability of Human Biology (BIO-4), we intend to compare the success of students in Anatomy and Physiology courses based on whether they took General Biology (BIO-1) as a pre-requisite or Human Biology (BIO-4) as a pre-requisite. Our working hypothesis is that students with the BIO-4 pre-requisite will have higher success and retention than students with the BIO-1 pre-requisite in Anatomy and Physiology (BIO-50A and 50B) courses. Anatomy and Physiology courses, along with Microbiology (BIO-55), are the primary courses taken by students to pursue nursing and other allied health careers. According to *The Inland Empire Regional Collaborative Health Industry Workforce Report 2017* (support documentation in this program review) there will be an increased demand for at least 55 healthcare occupations in the next 5 years. Many of these allied health occupations require the above listed courses as pre-requisites. Increasing these BIO course offerings with up to date equipment and supplies gives our students the opportunity to pursue these regionally in demand careers.

RESOURCES

Is there a resource request associated with this EMP Goal? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

EMP GOAL 9. Expand workforce to support comprehensive college and develop/sustain excellent workplace culture.

GOALS AND ACTIVITIES

What are you doing now in support of this goal?

We currently have 6 full-time faculty and 17 part-time faculty in Biology, as well as 3 full-time laboratory technicians and 1 part-time laboratory technician for Biology, Chemistry, and Physics.

What are your plans/goals (3-year) regarding this goal?

We would like to hire a new full-time faculty member in Biology and a new full-time laboratory technician to support Biology, Chemistry, and Physics laboratories.

<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>
3	Faculty	Full-time Biology Instructor	\$150,000.00
4	Staff	Full-time Lab Technician	\$85,000.00

EVIDENCE

Do you have assessment data or other evidence that relates to this goal?

Most of our courses are taught by part-time faculty, for example, in Fall 2021 there are 42 sections in Biology with 28 sections taught by part-time faculty or as overload for full-time faculty. We have expanded course offerings in Biology to maximize lecture and laboratory space, and we need full-time faculty and another laboratory technician to support these courses. The current layout of laboratories on campus and lack of labs designated

Program Review: Part 1

for single courses, means that laboratory preparation requires more work than colleges that have designated labs around a central prep room.

Kevin Eagan, M., & Jaeger, A. (2009). Effects of Exposure to Part-time Faculty on Community College Transfer. *Research in Higher Education*, 50(2), 168–188. Results: The researchers found a strong correlation between students' exposure to part-time faculty instruction and the likelihood that these students would not transfer to four-year institutions. Article attached in the document repository for this submission.

RESOURCES

Is there a resource request associated with this EMP Goal? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

EMP GOAL 12. Develop innovative and diversified resources to build and sustain a comprehensive college and achieve its visionary goals.

GOALS AND ACTIVITIES

What are you doing now in support of this goal?

We have resources to offer many diverse courses in biology, but many of the equipment and supplies are old, broken, and non-functional.

What are your plans/goals (3-year) regarding this goal?

We would like the following resources to continue to offer innovative and diversified laboratories:

<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>
1	Technology	Surface Pros to replace laptop computers for ST 207 to run BIO-PACs	\$93,000.00
2	Technology	BIO-PACs (basic + respirometer) - BIO-50A/B	\$28,000.00
5	Instructional Supplies	Bio 4 Human Body Models	\$6,623.60
6	Instructional Supplies	Field tools and supplies - Bio 21	\$1,400.00
7	Technology	Replacement laptop computers for IT 128	\$38,400.00

Program Review: Part 1

8	Furniture	Replacement of all lab benches in IT 128	\$18,560.00
9	Technology	JoVE science education subscription for the library (renewed annually)	\$15,000.00
10	Instructional Supplies	Field Guides - Bio 21	\$900.00
11	Instructional Supplies	Bio 4 Human Organ models	\$6,677.20
12	Instructional Supplies	Anatomy models for ST 207	\$4,000.00
13	Equipment	Replacement oxygen meters for IT 128	\$1,280.00
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15	Instructional Supplies	Analytical instruments and supplies - Bio 21	\$1,388.00
16	Instructional Supplies	Bio 4 Physio Equipment	\$536.14
17	Instructional Supplies	Bio 4 Posters	\$61.75
18	Technology	PCR Machine Thermo Fisher (1) - BIO-60	\$5,210.00
19	Technology	BIO-RAD UV-Visible spectrophotometers (8) - BIO-60	\$25,600.00

Program Review: Part 1

20	Instructional Supplies	TK6 Tissue Culture Supplies and Cell Line - BIO-60	\$2,500.00
21	Equipment	3-tiered seed sprouter - BIO-3,5,8	\$640.00
22	Safety	Autoclave maintenance contract (renewed annually)	\$8,000.00

EVIDENCE

Do you have assessment data or other evidence that relates to this goal?

To build and sustain a comprehensive college and achieve its visionary goals, we need to offer biology laboratories with up-to-date equipment and supplies. The addition of innovative resources such as these will help make the college competitive in the region.

1. Published data is available of the success of using the Bio-Pac systems to support real-time physiology labs: BIOPAC SYSTEMS HELPS STARK INDUSTRIES LAUNCH VITAL VENTILATOR FOR NASA JPL [Here](#).
2. Assessment data for all life science courses is available. These courses are regularly assessed with overall good student success. Once we increase the availability of Human Biology (BIO-4), we intend to compare the success of students in Anatomy and Physiology courses based on whether they took General Biology (BIO-1) as a pre-requisite or Human Biology (BIO-4) as a pre-requisite. Our working hypothesis is that students with the BIO-4 pre-requisite will have higher success and retention than students with the BIO-1 pre-requisite in Anatomy and Physiology (BIO-50A and 50B) courses. Anatomy and Physiology courses, along with Microbiology (BIO-55), are the primary courses taken by students to pursue nursing and other allied health careers. According to *The Inland Empire Regional Collaborative Health Industry Workforce Report 2017* (support documentation in this program review) there will be an increased demand for at least 55 healthcare occupations in the next 5 years. Many of these allied health occupations require the above listed courses as pre-requisites. Increasing these BIO course offerings with innovative and diversified resources gives our students the opportunity to pursue these regionally in demand careers.

RESOURCES

Is there a resource request associated with this EMP Goal? (If yes, please complete a Resource Request, which you can access from the main menu to the left)

Yes

Program Review Part 2

2021 - 2024

Curriculum

Are all your courses current (within four years)?

No

What percentage of your courses are out of date?

10% or less

If you have courses that are not current, are they in the curriculum process?

Yes

For out of date courses that are not already in progress of updating, what is your plan?

N/A

Do you have proposals in progress for all the DE courses you intend to file?

Yes

Do you require help to get your courses up to date?

No

Program Review Reflections

What would make program review meaningful and relevant for your unit?

The most meaningful and relevant component of program review is that it provides an avenue to make resource and personnel requests for Biology and Health. It is also helpful to see which courses need assessing and updating. It would be helpful if aggregated data graphs of success and retention were available, in addition to the disaggregated data graphs.

What questions do we need to ask to understand your program plans, goals, needs?

Please continue to ask what resources we need to continue to improve and grow the programs associated with our unit, and to improve student success and retention. Please provide an option to give justification for our resource requests. It would be helpful if the resources were listed by resource for review.

What types of data do you need to support your program plans, goals, needs?

As mentioned previously, it would be helpful if aggregated data graphs of success and retention were available, in addition to the disaggregated data graphs. We would like to see data that follows particular cohorts of students who take BIO-4 to see if they have higher success and retention with fewer equity gaps as students continue through Anatomy and Physiology courses, as compared with students who took BIO-1 to fulfill the pre-requisite for these courses.

If there are any supporting documents you would like to attach, please attach them here.

[Program Review Requests 2021.xlsx](#)

[Inland Empire Regional Collaborative Health Industry Workforce Report.pdf](#)

[Predicting Academic Success of Health Science Students for First Year Anatomy and Physiology.pdf](#)

[Effects of Exposure to Part-time Faculty on Community College Transfer.pdf](#)

Resource Requests

2021 - 2024

What resources do we already have?

Old laptops that no longer charge, many do not work, and none are adequate to run BIO-PACs for physiology labs.

What resources do you need?

Surface Pros to replace laptop computers in ST 207 to run BIO-PACs for physiology labs

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

93,000

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

General Fund,Lottery Instructional Supplies,Instructional Equipment Allocation

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

1

2021 - 2024

What resources do we already have?

Old laptops

What resources do you need?

BIO-PACs (basic + respirometer) to offer physiology labs in BIO-50A/B

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

28,000

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

2

Resource Requests

2021 - 2024

What resources do we already have?

6 Full-Time Faculty and 17 Part-Time Faculty in Biology

What resources do you need?

Full-Time Biology Instructor

Request related to EMP goal or Assessment?

EMP Goal 1,EMP Goal 9,EMP Goal 7

\$ Amount Requested

150,000

Resource Type

FACULTY: New Full time Faculty (Associate faculty requested through Dept. Chair and Dean)

Potential Funding Source(s)

General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

3

2021 - 2024

What resources do we already have?

3 Full-Time Laboratory Technicians and 1 Part-Time Laboratory Technician

What resources do you need?

1 Full-Time Laboratory Technician

Request related to EMP goal or Assessment?

EMP Goal 1,EMP Goal 9,EMP Goal 7

\$ Amount Requested

85,000

Resource Type

STAFF: Classified Professional, Confidential, Manager

Potential Funding Source(s)

General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

4

Resource Requests

2021 - 2024

What resources do we already have?

Histology slides shared with BIO-61, models borrowed from anatomy labs if not in use by anatomy labs

What resources do you need?

Human Body Models for Human Biology BIO-4 in IT 128

Request related to EMP goal or Assessment?

EMP Goal 3,EMP Goal 7,Achievement Data,EMP Goal 12

\$ Amount Requested

6,700

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,Equity,General Fund,Guided Pathways

The evidence to support this request can be found in:

Data Review,Program Review: Part 1

This request for my area is Priority #:

5

2021 - 2024

What resources do we already have?

6 field reel tape measures, 4 binoculars, 4 butterfly nets

What resources do you need?

Field tools and supplies to offer California Naturalist (BIO-21), a new field course

Request related to EMP goal or Assessment?

Assessment,EMP Goal 7,EMP Goal 12

\$ Amount Requested

1,400

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1,Assessment Review

This request for my area is Priority #:

6

Resource Requests

2021 - 2024

What resources do we already have?

Old laptops that no longer charge, and many of which no longer work

What resources do you need?

Replacement laptop computers for IT 128

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

38,400

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

7

2021 - 2024

What resources do we already have?

Lab benches with the benchtop separated from the legs, dangerous to use

What resources do you need?

Replacement laboratory benches in IT 128

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

18,560

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

8

Resource Requests

2021 - 2024

What resources do we already have?

The library has a 1-year subscription to JoVE Science Education to support distance education in the sciences

What resources do you need?

Ongoing annual subscription to JoVE Science Education to support DE courses in the sciences - amount requested is per year

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

15,000

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

9

2021 - 2024

What resources do we already have?

A dozen out-of-date field guides from 30 years ago

What resources do you need?

Field guides for students to use in California Naturalist BIO-21 (a new course). These guides may also be used during field trips in other courses.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

900

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Assessment Review,Program Review: Part 1

This request for my area is Priority #:

10

Resource Requests

2021 - 2024

What resources do we already have?

Borrowed models from anatomy if Anatomy and Physiology courses are not using them

What resources do you need?

Human organ models for Human Biology (BIO-4).

Request related to EMP goal or Assessment?

EMP Goal 3,EMP Goal 7,Achievement Data,EMP Goal 12

\$ Amount Requested

6,700

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund,Equity

The evidence to support this request can be found in:

Data Review,Program Review: Part 1

This request for my area is Priority #:

11

2021 - 2024

What resources do we already have?

Old anatomy models, many of which are damaged, shared between multiple anatomy labs

What resources do you need?

Anatomy models for ST 207.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

4,000

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

12

Resource Requests

2021 - 2024

What resources do we already have?

Old oxygen meters, several of which are broken

What resources do you need?

Replacement oxygen meters for IT 128.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

1,300

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

13

2021 - 2024

What resources do we already have?

Microscope slides, many of which are damaged or broken

What resources do you need?

Replacement microscope slides.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

700

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,Department Regular Funding,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

14

Resource Requests

2021 - 2024

What resources do we already have?

None - need new equipment to offer California Naturalist (BIO-21), a new course

What resources do you need?

Analytical instruments to offer California Naturalist (BIO-21), a new course.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

1,400

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

15

2021 - 2024

What resources do we already have?

Equipment borrowed from anatomy labs if they are not in use

What resources do you need?

Physiology equipment for Human Biology (BIO-4).

Request related to EMP goal or Assessment?

EMP Goal 3,Achievement Data,EMP Goal 7,EMP Goal 12

\$ Amount Requested

540

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,Department Regular Funding,Equity,General Fund,Guided Pathways

The evidence to support this request can be found in:

Data Review,Program Review: Part 1

This request for my area is Priority #:

16

Resource Requests

2021 - 2024

What resources do we already have?

Posters borrowed from anatomy labs if not in use

What resources do you need?

Anatomy posters for Human Biology (BIO-4).

Request related to EMP goal or Assessment?

EMP Goal 3,Achievement Data,EMP Goal 7,EMP Goal 12

\$ Amount Requested

65

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,Department Regular Funding,Equity,General Fund,Guided Pathways

The evidence to support this request can be found in:

Data Review,Program Review: Part 1

This request for my area is Priority #:

17

2021 - 2024

What resources do we already have?

Old PCR machine that needs replacing

What resources do you need?

PCR Machine Thermo Fisher (1) for majors' course BIO-60.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

5,200

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund,Guided Pathways

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

18

Resource Requests

2021 - 2024

What resources do we already have?

Old spectrophotometers

What resources do you need?

Replacement BIO-RAD UV-Visible spectrophotometers (8) for majors' course BIO-60.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

25,600

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

19

2021 - 2024

What resources do we already have?

None - previous cell line died

What resources do you need?

TK6 Tissue Culture Supplies and Cell Line for majors' course BIO-60.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

2,500

Resource Type

ITEM: Instructional supplies

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

20

Resource Requests

2021 - 2024

What resources do we already have?

Manual seed sprouters

What resources do you need?

3-tiered seed sprouter for BIO-3, BIO-5, and BIO-8.

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

640

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

21

2021 - 2024

What resources do we already have?

Warranty on autoclave expires in January 2022

What resources do you need?

Autoclave maintenance contract (renewed annually or other regular cycle).

Request related to EMP goal or Assessment?

EMP Goal 7,EMP Goal 12

\$ Amount Requested

8,000

Resource Type

ITEM: Equipment, Technology, Services, Software, Furniture

Potential Funding Source(s)

Instructional Equipment Allocation,Lottery Instructional Supplies,General Fund

The evidence to support this request can be found in:

Program Review: Part 1

This request for my area is Priority #:

22

Submission

2021 - 2024

All parts of my Program Review have been completed and it is ready for review

Yes

Effects of Exposure to Part-time Faculty on Community College Transfer

M. Kevin Eagan Jr. · Audrey J. Jaeger

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Abstract Over the past several decades, one of the most significant changes in the delivery of postsecondary education involves the dramatic increase in the use of contingent or part-time faculty. Although the increased use of part-time faculty within higher education makes sense from an administrative point of view, its use does not come without criticism. With community colleges representing a more convenient, affordable, and flexible educational option for a number of students, particularly those from disadvantaged backgrounds, examining how exposure to part-time faculty relates to students' academic goals represents an important area of inquiry. This study draws from social and human capital frameworks and uses hierarchical generalized linear modeling (HGLM) to examine how exposure to part-time faculty relates to community college students' likelihood of transferring to a four-year college or university. Findings suggest that students tend to be significantly less likely to transfer as their exposure to part-time faculty increases.

Keywords Part-time faculty · Community colleges · Transfer · Hierarchical generalized linear modeling · Social capital · Human capital

Introduction

Colleges and universities in the U.S. emphasize access to higher education for all individuals. Initially begun as a system of education for the elite, U.S. higher education has transitioned into a structure designed to educate the masses (Cohen 1998). Community colleges primarily have served the role of increasing access to postsecondary education, and these institutions often represent the first step for many individuals who pursue a college degree (Quigley and Bailey 2003). Community colleges feature substantial

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diversity in mission, student body, and faculty composition. These institutions have multiple purposes, serve a variety of populations, particularly disadvantaged individuals, and employ a significant proportion of part-time or contingent faculty (Cataldi et al. 2005; Cohen and Brawer 2003). With such mission complexity, community colleges face a number of challenges, including adequately staffing their diverse curricular offerings. Consequently, employment of part-time faculty by community colleges has become increasingly more common in efforts to improve institutional economic efficiency.

This paper examines recent research on the community college context, characteristics of part-time faculty, the relationship between part-time faculty and student outcomes, and community college student transfer. Framed by prior research and theories of social and human capital, the analyses utilize hierarchical generalized linear modeling to examine data from a large state system of community colleges. The analyses examine whether increased exposure to part-time faculty instruction has a negative association with community college students' likelihood of transferring to a four-year institution. The results of the study frame possible implications, such as the types of courses taught by community college instructors and the role these instructors should play in the classroom.

Significance

The transfer function of community colleges represents an important yet challenging area of research. Challenges arise when identifying those students most likely to transfer, as community colleges serve a large cross-section of the population, which has differing goals, intentions, and educational paths (Cohen and Brawer 2003). Furthermore, because many students' patterns of attendance at community colleges vary, tracking students from initial enrollment through transfer to a four-year institution has proven difficult (Adelman 2005). As Adelman (2005) indicates, information on transfer rates within individual community colleges or within community college systems often presents misleading statistics and generally underestimates the percentage of community college students who transfer to four-year institutions. Reports of transfer rates may range from 10% to 40%, depending on how scholars, institutional researchers, or other administrators decide to calculate the rate (Adelman 2005).

With these concerns in mind, researchers, administrators, and, in particular, policymakers need to garner a better understanding of the factors associated with students' likelihood of transferring from two-year to four-year institutions. Considering that higher education is seen as an avenue for social mobility, particularly for disadvantaged individuals (Bowen 1996), and that community colleges educate nearly 40% of the nation's students enrolled in higher education (National Center for Education Statistics 2007), identifying facilitators of and barriers to transferring from two-year to four-year institutions has important implications for policymakers and administrators. This study aims to offer community college stakeholders with important information regarding the relationship between part-time faculty and students' likelihood of transferring to a four-year institution by identifying transfer likely students and following them longitudinally for five years after their initial enrollment in a community college.

Literature Review

Four key areas of literature frame this study. First, any study on community colleges and their students must consider the context of these institutions and how they differ from four-

year colleges and universities. Second, an important aspect of community colleges remains their heavy reliance on part-time faculty employment; therefore, this section presents literature that provides a depiction of the part-time faculty workforce in the U.S. Third, recent studies have focused on the relationship between part-time faculty and student outcomes. Though limited research has examined specifically this relationship in community colleges, studies conducted at both four- and two-year institutions provide insight for the present study. Finally, the review concludes with an examination of the literature related to community college transfer.

The Community College Context

Characteristics of most community colleges include low tuition, flexible scheduling, comprehensive missions, and convenient locations (Cohen and Brawer 2003; Phillippe 2000). Because of these elements, community colleges represent an attractive pathway for pursuing postsecondary education for all types of students but particularly among single parents, economically and educationally disadvantaged students, and individuals who work full-time (Choy 2002; Cohen and Brawer 2003; Grubb et al. 2003). Individuals from these backgrounds and others enroll in community colleges to earn an associate's degree, accumulate academic credits that will facilitate transfer to four-year institutions, become certified in a variety of technical and vocational fields, and learn new skills through lifelong learning programs (Cohen and Brawer 2003).

Community colleges at their inception had a much stronger focus on the transfer function (Dougherty 1994). In addition to having community colleges that served as branch campuses to four-year institutions and focused on pre-baccalaureate studies, initially most states also created separate technical and vocational colleges (Bailey and Averianova 1999; Cohen 1998). Community colleges today serve an increasingly diverse student body through pre-baccalaureate studies, vocational and technical training, developmental education as well as lifelong learning programs.

Research on Part-time Faculty

As community colleges have expanded their mission complexity and diverse educational offerings, they have continued to rely heavily on employment of part-time faculty (Cohen 1998). Part-time faculty provide institutions with the ability to be more economically efficient in managing their financial resources, as part-time faculty generally are cheaper to employ than their full-time counterparts and offer greater flexibility to institutions (Bettinger and Long 2006; Gappa 1984; Leslie 1998; Liu and Zhang 2007; Schuster and Finkelstein 2006). Thus, many higher education institutions have begun hiring more part-time faculty to improve economic efficiency. Part-time faculty comprised 46.3% of all faculty appointments nationwide in 2003 (American Association of University Professors 2006). Among community colleges across the U.S. in 2003, part-time faculty held 66.7% of all faculty appointments (Cataldi et al. 2005). Comparatively, part-time faculty comprised just 27% of the total number of faculty in community colleges in 1969, and that proportion increased to 52% by 1987 (Schuster and Finkelstein 2006).

While providing an avenue for greater economic efficiency, the increased employment of part-time faculty throughout U.S. higher education institutions has drawn significant criticism from scholars, as part-time faculty are seen as threats to the level of quality in academic programs (Haeger 1998). Part of this perceived threat stems from the fact that part-time faculty generally have fewer educational credentials compared to their full-time

counterparts. Specifically, part-time faculty are more likely to have master's degrees whereas more full-time faculty tend to have their doctorates (Anderson 2002). In his analysis of faculty characteristics at all types of institutions across the U.S., Anderson (2002) found that less than 20% of part-time faculty had earned a doctorate compared to more than 65% of full-time faculty in 1998; however, Anderson did not focus specifically on community college faculty in his study. It is important to note educational differences between part-time and full-time faculty at community colleges are less substantial; 8.6% of part-time faculty and 17.9% of full-time faculty teaching at community colleges in 2004 held a doctoral degree (Eagan 2007).

As the hiring of part-time faculty has increased across all higher education institutions, particularly among community colleges, scholars have examined more closely the characteristics associated with part-time instructors at two-year colleges. Levin et al. (2006) concluded that part-time community college faculty felt a significant sense of detachment from their affiliated institution, as they generally lacked office space and remained largely uninvolved in institutional governance. In his descriptive analysis of part-time and full-time community college faculty, Eagan (2007) noted a high level of dissatisfaction with job security and employment benefits among part-time faculty, as part-timers' short-term contracts offer them little confidence for negotiating subsequent years of employment with the institution (Rhoades 1996).

Part-time Faculty and Student Outcomes

In addition to providing insight into the characteristics of part-time faculty, scholars also offer findings that illustrate how exposure to part-time faculty affects student outcomes. Much of this research, however, has focused almost entirely on students at four-year institutions and has paid little attention to individuals pursuing postsecondary education at two-year colleges. Using students as the unit of analysis, Harrington and Schibik (2004) found that students who had greater amounts of exposure to part-time faculty had a significantly reduced likelihood of persisting to the second semester. Jaeger and Hinz (2008) replicated this study at a research extensive institution and found that new students had more than 25% of their academic credits with part-time faculty. The effects of part-time faculty were consistent and negative across both studies. These research efforts focused on single institutions and utilized restrictive definitions of persistence, as the outcome measure included term-to-term persistence.

Along the same lines, Ronco and Cahill's (2004) single-institution study concluded that students with the highest level of exposure to part-time faculty were significantly less likely to persist into their second year of enrollment. Although part-time faculty exposure represented a significant and negative predictor of student retention, student background characteristics had the greatest explanatory power in predicting students' likelihood to persist (Ronco and Cahill 2004). In an analysis of institutional data, Ehrenberg and Zhang (2004) found that higher proportions of part-time faculty employed by institutions negatively affected those institutions' graduation rates.

As studies focusing on the relationship between part-time faculty exposure and student outcomes at four-year institutions continue to emerge, few researchers have examined this same phenomenon at community college. Calcagno et al. (in press) used data from the National Education Longitudinal Study of 1988 (NELS: 88) and the Integrated Postsecondary Education Data System (IPEDS) to determine the effect of institutional reliance on part-time faculty on community college students' graduation rates. Controlling for aggregated student characteristics, the authors found that the percentage of part-time

faculty employed at a community college corresponded to a reduction in that institution's graduation rate.

In a similar study, Jacoby (2006) analyzed how employment of part-time faculty affects degree completion rates at public community colleges in the U.S. Jacoby utilized data from the 2001 IPEDS database and found a significant negative relationship between the percentage of part-time faculty at community colleges and institutional graduation rates. Jacoby did not control for aggregated individual characteristics; however, his study provided controls for state-level effects on institutions' graduation rates. His use of single-level statistical techniques for multi-level data may have inappropriately biased his results, as such methods for clustered data provide less robust findings than more advanced statistical techniques (Raudenbush and Bryk 2002). Although Jacoby addressed an important gap in the literature, his research drew from institution-level data, which does not allow for meaningful interpretation regarding how exposure to part-time faculty affects students on an individual level.

Community College Transfer

No study has considered how exposure to part-time faculty affects community college students' likelihood of transferring to a four-year institution; however, a number of studies have examined other factors affecting transfer likelihood among community college students. One of the more challenging aspects of research on community college transfer is identifying the population to study (Cohen 1991), as students enrolled at a community college have varying goals, aspirations, and purposes for enrolling. Adelman (2005) used three indicators to identify transfer likely students. Adelman (2005) identified transfer likely students as individuals who were between the ages of 18 and 24, whose first post-secondary institution was a community college, and who had completed at least 10 credits at a single community college. Significant positive factors predicting transfer included the number of credits a student completed in college-level math, the number of summer-term credits a student completed, and the maintenance of continuous enrollment (Adelman 2005). Adelman concluded that students who had withdrawn from more than 20% of their attempted units or had more than 20% repeat grades were significantly less likely to transfer to a four-year institution. Entering a community college directly from high school, educational expectations, socioeconomic status, and the ratio of occupational credits to all undergraduate credits were not significant predictors of transferring to a four-year institution (Adelman 1999, 2005).

In contrast to Adelman's (2005) study, Dougherty and Kienzl (2006) found that socioeconomic status was a significant, positive predictor of transferring from a two- to a four-year institution. Dougherty and Kienzl utilized data from the Beginning Postsecondary Students database from 1990 to 1994 and the National Education Longitudinal Study of 1998–2000. Their findings suggested that high school math scores and educational aspirations were significantly and positively related to transfer, which support findings from earlier research (Cabrera et al. 2001; Lee and Frank 1990). Similarly, students without children and individuals who worked fewer than 40 hours per week were significantly more likely to transfer to four-year institutions.

Other research on community college students' transfer likelihood has focused on individuals' curricular choices and collegiate experiences. Kraemer (1995) found that students with greater levels of academic success had a stronger inclination to transfer than students who performed poorly in the classroom. Similarly, scholars have debated the role of taking remedial courses in facilitating community college student transfer. Merisotis and

Phipps (2000) emphasized the need to have remedial programs that assist the academic development of underprepared students.

Results from Cabrera et al. (2005) research suggest remedial course completion has mixed results on students' likelihood of transferring from a community college to a four-year institution. Cabrera et al. found that students who enrolled in remedial math courses were 4% more likely to transfer to a four-year college or university; however, students taking remedial reading courses reduced their transfer likelihood by 4%. Remedial reading had an even stronger negative effect for students in the lowest socioeconomic bracket, as taking remedial reading courses reduced these students' likelihood of transferring by 24%.

In addition to curricular choices, scholars have identified satisfaction and several college experiences as significant predictors of transferring from a community college to a four-year institution. Students who indicate greater satisfaction with both academic and nonacademic life at the community college tend to have a higher likelihood of transferring to a four-year institution (Nora and Rendon 1990). Lanaan (2007) concluded that community college students who successfully transferred to a four-year institution were better socially adjusted if they had joined clubs or organizations or chosen to participate in other out-of-class activities while enrolled in community college. Although Lanaan's (2007) work lends important understanding to the types of adjustments transfer students make once arriving at a four-year institution, the cross-sectional design of the study and the focus on students who have already successfully transferred do not advance our understanding of significant out-of-class predictors of transfer.

In a study looking more specifically at significant predictors of community college student transfer and degree completion, Cabrera et al. (2005) found a modest positive correlation between out-of-class experiences and students' transfer likelihood; however, the authors did not elaborate upon their measure of out-of-class experiences. Cabrera et al. also concluded that students who encountered quality instruction and interacted with counselors on campus were significantly more likely to transfer. With these factors in mind, however, Cabrera et al. concluded that students' decisions about their curriculum and their ability to find academic success represented the strongest predictors of their likelihood to transfer from a community college to a four-year institution.

Conceptual Framework

With prior literature informing this study, two theoretical perspectives also provide important insight into understanding factors that affect students' likelihood of transferring from two-year to four-year institutions. The first perspective involves social capital and students' ability to generate and utilize social capital during their time at a community college. Coleman (1988) defines social capital as the production function of social connections, as actors utilize closed network systems to generate trust, reciprocity, and information channels among other actors within the social network. The concept of social capital merges sociological and economic perspectives on social action (Coleman 1988). Sociologists posit that social norms direct individuals' behavior; in contrast, economists suggest that actors pursue self-interests and their behavior remains independent of social structures (Coleman 1988). Coleman's (1988) conception of social capital suggests that actors not only pursue self-interests but also have their interests and behaviors shaped by their surrounding social structures and norms. In essence, social capital exists within individuals' relationships and connections to other actors within a social system (Portes 1998).

While the concept of social capital implies access to trust and reciprocity, information and knowledge, and norms and sanctions, this study specifically addresses how the generation of social capital facilitates networks of information and knowledge. Although some studies have linked social capital and access to information to family networks (Perna 2004; Perna and Titus 2004), other studies have considered how students can generate social capital through their connections with institutional agents (Stanton-Salazar and Dornbusch 1995). For example, in a study of Mexican-origin high school students' access to information about college, Stanton-Salazar and Dornbusch (1995) found that students' access to information significantly improved when they developed and maintained meaningful relationships with their counselors and teachers.

In a similar manner, this study focuses on how community college students increase social capital by connecting with institutional agents. Berger and Malaney (2003) note that successful transfer decisions are directly related to how well students have been prepared for the transfer process. Community college students who develop relationships with key institutional agents, such as with academic advisors and full-time faculty, may gain access to important information about the transfer process. For instance, academic advisors and full-time faculty familiar with articulation agreements or general transferable courses may assist in guiding community college students toward transferring to four-year institutions. In contrast, students at two-year colleges who do not connect with academic advisors or are predominantly exposed to part-time, adjunct faculty may not establish networks of information that facilitate the transfer process, given that part-time faculty generally have less knowledge about and remain more disconnected from their employing institution (Schuster 2003).

Coupled with the framework of social capital is human capital theory, which posits that individuals are likely to invest in human capital development when potential benefits outweigh perceived costs (Becker 1993). Economists suggest that individuals' anticipated private return on investment in education has the strongest influence on their college-going behavior (Douglass 1997; Perna 2003). Students increase their levels of educational attainment when they anticipate that future benefits will exceed direct and opportunity costs (Douglass 1997). Oftentimes, students conceptualize these benefits in the form of future earnings, but other returns on investment may include additional skills, competencies, and intangible emotions and accomplishments often achieved during the college years (Douglass 1997).

In the community college context, students decide to transfer to a four-year college or university when they determine that the various costs of extending their educational career will provide them with substantial benefits. Students' initial degree aspirations when entering college, particularly at a two-year institution, typically do not represent a valid measure in examining their likelihood of fulfilling those degree goals (Cohen 1998). Generally, students' initial aspirations and intentions suffer from misguided expectations and poor information about the costs and benefits of pursuing a four-year degree (Cohen and Brawer 2003). To the extent that community college students tend to come from more economically depressed backgrounds and generally have less accurate information about the costs of obtaining a four-year degree (Cohen and Brawer 2003), they may demonstrate a reduced likelihood of transferring to a four-year institution to earn a baccalaureate degree. Indeed, without accurate information regarding the actual costs and potential benefits of earning a four-year degree, community college students' cost-benefit analyses may actually deter them from transferring to a four-year institution.

The interaction of social capital theory with human capital theory provides insight into how the level of exposure to part-time faculty may have a direct effect on the likelihood

that students will transfer to a four-year institution. As students experience the collegiate environment and develop their social capital through networks with faculty and staff, they may become more likely to ascertain a better understanding of the potential benefits of obtaining a four-year degree. With a more realistic idea of the potential benefits as well as the actual costs of transferring, students may be more inclined to continue their educational path by transferring to a four-year college or university. However, the utility of social capital is only as good as the information available in the social networks that students establish with institutional agents (Coleman 1998). To the extent that part-time faculty are more detached from the community college environment (Levin et al. 2006) or have limited knowledge about the transfer process at the particular institution, increased exposure to part-time faculty may inhibit community college students' access to accurate and useful information.

Methods

Research Question

Drawing from social and human capital frameworks and previous research, this study seeks to address the following research question: controlling for background characteristics, does exposure to part-time faculty in community colleges negatively relate to students' likelihood of transferring to a four-year college or university? It is hypothesized that, as students' exposure to part-time faculty increases, their likelihood of transferring decreases. A secondary research question asks: controlling for student-level characteristics, does the percent of part-time faculty employed by an institution negatively relate to institutions' average transfer rates?

Data and Sample

This study utilizes student transcript, faculty employment, and institutional data from the California community college system. This particular community college system provides postsecondary education to more than 1.5 million students each year. Drawing from two cohorts of first-time, credit-seeking students in 2000 and 2001, this study tracks the college-going behavior of the system's students over five years. The initial sample of students includes more than 700,000 cases within each cohort, which translates into an initial overall sample of nearly 1.5 million students in 107 community colleges.

Because this study focuses on transfer, we reduced the sample to reflect those students whose academic behavior indicated an intention to transfer. We limited the sample to those students who had completed at least eight transferable credits at a single institution. Adelman (2005) suggests that students most likely to transfer complete at least 10 academic units while Cohen (1991) posits this threshold is actually 15 academic credits. In a study of California community college transfer, Bahr et al. (2005) identified transfer likely students as those individuals who completed at least 12 transferable units as well as a transferable math or English course. Still another method was used by Wassmer et al. (2004), as the authors set a threshold of 12 units (not necessarily transferrable units) as well as completion of at least one transferable math or English course.

Although we use a lower threshold of academic units than ones used by previous scholars (e.g., Adelman 2005; Bahr et al. 2005; Cohen 1991; Wassmer et al. 2004), we consider only transferable units in our cutoff for students to be considered transfer likely.

Our threshold likely presents a more conservative estimate of transfer likely students, as we restrict our sample to students who earned at least eight transferable units from a *single* institution; in other words, we excluded students who accumulated transferable units at multiple institutions yet failed to achieve the threshold of eight transferable units at a single community college. We use this restriction of meeting this transferable credit threshold at a single institution because of our method of analysis, which we describe in a later section. The final analytic sample for this study included 24,865 students in 107 community colleges.

To supplement the student-level data, we merged institutional data from IPEDS into the institutional dataset. The institutional data provided a deeper understanding of the context of students' college environments. This information provided the basis for learning about the structure of opportunity, institutional size, urbanicity, and overall reliance on part-time faculty.

Variables

The student transcript and enrollment data provided information about students' background characteristics and academic behavior. The dependent variable, transfer, represented a dichotomous variable reflecting whether a student transferred within five years of initially enrolling in the system of community colleges. Demographic characteristics included gender, race/ethnicity, age, and citizenship. We dichotomously coded gender (male as the reference group), race/ethnicity (White as the reference group), and citizenship (non-citizen as the reference group). We included age as a continuous variable in the model.

Other enrollment variables included enrollment status (full-time student as the reference group), academic major, and financial aid information. Because of the dynamic nature of enrollment status, we coded students as "part-time" if they enrolled as a part-time student for at least half of their total terms of enrollment. For academic major, we controlled for undeclared and vocational studies majors with all other majors as the reference group. We measured students' academic program choice at the last term of enrollment. Financial aid information included controls for the average amount of aid students received each year in which they enrolled (continuously coded). All financial aid measures were averaged across students' years of enrollment and rescaled so that a one-unit change corresponded to a \$100 change.

To create the variable representing the percent of part-time faculty exposure each student had during their enrollment, we summed the total number of credits completed with part-time instructors and divided that total by the cumulative number of credits the students completed while enrolled. This quotient, representing students' exposure to part-time faculty, provided the proportion of credits students took with part-time faculty at the institution. The final student-level variable in the analyses controlled for students' first-year GPA.

The analyses also included a number of institution-level variables. We included the proportion of instruction done by part-time faculty at each institution as a key variable in identifying the institutional environment for students. Additionally, in separate analyses, we included the proportion of faculty employed in part-time appointments at each institution. Other institutional variables included the percent of under-represented racial minority students, the urbanicity of the institution, and the percentage of students receiving financial aid.

Analyses

Because of the clustered, multi-level nature of the data in this study (students nested within institutions), advanced statistical techniques were necessary to account for the complex sample design. The dichotomous outcome variable, transfer, warranted the use of hierarchical generalized linear modeling (HGLM) (Raudenbush and Bryk 2002). HGLM provides an efficient method to consider the interactive effects of institution- and student-level variables. HGLM takes into account the dichotomous nature of the outcome variable as well as the multi-level, clustered design of the data. Using single-level regression techniques, such as standard logistic regression, for analysis of multi-level data provides less robust results by underestimating the standard errors of parameters, which may result in a Type I statistical error by erroneously concluding a parameter is significant (Raudenbush and Bryk 2002).

Generally, to justify the use of advanced statistical analyses, the outcome variable must significantly vary across institutions (Raudenbush and Bryk 2002). Researchers can determine the extent of this variation by examining the intra-class correlation (ICC), which shows the amount of variance in the outcome variable that can be attributed to institutional differences. Because the outcome variable in this study was dichotomous, the variance of the outcome variable was heteroscedastic at the student level; therefore, the ICC was not an informative means of justifying the use of HGLM. Instead, we followed the recommendations of Raudenbush and Bryk (2002) and the example of several scholars (e.g., Hurtado et al. 2008; Rumberger and Thomas 2000; Titus 2004) by examining box plots of estimates of Empirical Bayes (EB) residuals to determine whether the transfer rates varied across institutions. These plots suggested variation across institutions in students' average likelihood of transferring; thus, we proceeded with the use of HGLM statistical analyses.

In using HGLM, we needed to give consideration to how we centered variables. Centering variables in various ways affects the interpretation of the intercept. For the analyses, we centered all variables around their grand mean, which means the intercept can be translated as the average likelihood of transferring for students with the average characteristics of the sample (Raudenbush and Bryk 2002).

Limitations

This study has several important limitations. The first limitation to this study exists in the potential lack of consistency in data collection methods across the 107 institutions in the sample. Despite the system office's efforts to standardize individual institutions' data collection methods, definitions and methods may continue to vary across institutions. Second, although HGLM provides a more robust analysis of the multi-level data in this sample, the use of HGLM has at least one constraint. Any form of regression, including HGLM, requires a substantial number of cases for every variable included in the model; Raudenbush and Bryk (2002) recommend at least 10 cases for every variable. While more than 24,000 students in the student-level sample provided for the possibility of an excessively large level-1 model, the 107 institutions constrain the level-2 model in HGLM to just 10 variables. This limitation required careful consideration of the factors included in the institutional model.

Third, as with any secondary data analysis, this study is restricted by the variables and definitions included in the community college system and IPEDS datasets. Because we primarily focused on analysis of transcript data, we were unable to control for other important predictors of community college student transfer. Our data did not offer controls for students' out-of-class experiences and engagement (Cabrera et al. 2005; Driscoll 2007;

Lanaan 2007) or students' satisfaction with the institutional environment (Nora and Rendon 1990). Likewise, transcript data did not allow us to control explicitly for students' level of social capital; instead, we suggest that students' level of exposure to part-time faculty serves as a proxy measure for social capital. We suggest that as students spend more time with part-time faculty, their ability to establish meaningful connections with their institution diminishes.

Fourth, in addition to the constraints of the dataset, our research design does not support cause-effect conclusions between exposure to part-time faculty and students' likelihood to transfer to a four-year institution. We acknowledge that we lack controls for students' course completion ratio (Calcagno et al. 2007), remedial course-taking behavior (Cabrera et al. 2005), and highest level of math completed (Adelman 1999, 2005; Calcagno et al. 2007). Although our study offers new insight into several of the issues that relate to students' likelihood to transfer, we do not presume that we have accounted for all of the complexities affecting this phenomenon.

Finally, the identification of the students included in the analytic sample features a certain level of subjectivity. This method of identifying the analytic sample may lead to a certain bias in the analyses by excluding some students who transferred but did not meet the threshold to be considered "transfer likely." While we recognize this as a limitation, we believe that having an exclusion bias provides more realistic results than having an inclusion bias, which would occur had we included all of the students in the initial population.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the student and institution-level variables included in the analyses. On average, students had 38% of their academic credits with part-time faculty during the time in which they were enrolled at their home institution. Some students in the sample had no credits with part-time faculty whereas others had all of their credits taught by part-time faculty. Students had an average first-year GPA of 3.10, and their cumulative GPA averaged 3.14.

Women composed 54% of the analytic sample, which resembles the larger population of community colleges in this state system. Asian American and Pacific Islander students accounted for 14% and 4% of the analytic sample, respectively. These percentages indicate a slight overrepresentation of Asian Americans and Pacific Islanders in the analytic sample compared to their actual proportion (13%, combined) of the entire community college population in this system of institutions. White students constituted 44% of the sample, which is slightly less than the percentage of White students enrolled in this system (46%). Comparatively, Latino and Black students made up 23% and 5% of the analytic sample, respectively.

The average age of students in the analytic sample was 24.80, which is significantly lower than the average age (28 years old) of students enrolled throughout the system. This statistic suggests that younger students may be more likely to demonstrate transfer likely behavior whereas older individuals may have other goals in mind, such as vocational retraining or lifelong learning, when they first enroll. Nearly 60% of students enrolled part-time. Approximately 38% of students in our sample did not declare a major, and 7% of students majored in vocational studies programs. The balance of students studied a variety of fields, ranging from liberal arts and humanities to science and technology.

Table 1 Descriptive statistics

	Mean	S.D.	Min.	Max.
Dependent variable				
Transferred to a four-year institution	0.36	0.48	0.00	1.00
Independent student-level variables				
Female	0.54	0.50	0.00	1.00
Black	0.05	0.34	0.00	1.00
Asian American	0.14	0.22	0.00	1.00
Pacific Islander	0.04	0.21	0.00	1.00
Latino/a	0.23	0.42	0.00	1.00
Other	0.07	0.15	0.00	1.00
White	0.44	0.50	0.00	1.00
Citizenship	0.80	0.40	0.00	1.00
Age	24.80	10.07	16.00	70.00
Vocational studies major	0.07	0.25	0.00	1.00
Undeclared major	0.38	0.49	0.00	1.00
Average loans across all years of enrollment (100)	0.16	1.75	0.00	64.36
Average grants across all years of enrollment (100)	2.80	5.98	0.00	59.53
Average fee remissions across all years of enrollment (100)	2.08	2.69	0.00	31.52
Average work study aid across all years of enrollment (100)	0.26	1.79	0.00	33.04
Average scholarships across all years of enrollment (100)	0.22	1.50	0.00	45.00
Exposure to part-time faculty (10%)	3.81	2.33	0.00	10.00
Parent income (log transformed)	2.53	4.39	0.00	12.94
Student income (log transformed)	3.42	4.43	0.00	13.64
First-Year GPA	3.10	0.73	1.00	4.00
Total GPA	3.14	0.52	1.00	4.21
Earned an associate's degree	0.26	0.44	0.00	1.00
Does not have a high school diploma	0.15	0.36	0.00	1.00
Has a high school diploma	0.78	0.42	0.00	1.00
Has a college degree	0.07	0.25	0.00	1.00
Part-time student	0.58	0.49	0.00	1.00
Independent institution-level variables				
Proportion of total faculty in part-time appointments	0.64	0.08	0.33	0.85
FTE student (hundreds)	65.48	37.55	5.63	177.41
Proportion of instruction done by part-time faculty	0.49	0.08	0.28	0.77
Percentage of students majoring in vocational studies	5.74	4.12	0.00	28.51
Urbanicity: City	0.44	0.50	0.00	1.00
Urbanicity: Suburban	0.31	0.46	0.00	1.00
Urbanicity: Rural	0.25	0.44	0.00	1.00
Percent of students receiving financial aid	0.51	0.14	0.22	0.86
Percent of students identified as URM	3.33	1.77	0.77	9.33

Among the institutional variables, part-time faculty constituted 64% of all faculty across all the institutions in the system in 2003. The average proportion of instruction offered by part-time faculty was 49%. Though the mean FTE enrollment at community colleges

within the system was 6,548 students, this variable ranged from 563 to 17,741 students. Approximately 44% of institutions were located in urban areas compared to 31% in suburban and 25% rural.

HGLM Analyses

Table 2 presents the results of the HGLM analyses on students' likelihood to transfer to a four-year institution. We include the log-odds of transfer as well as delta-p statistics. Delta-p statistics represent the change in probability of transfer associated with a one-unit change in the predictor variable. We used the method recommended by Petersen (1985) to calculate the delta-p statistics.

The findings indicate a significant and negative association between students' transfer likelihood and their exposure to part-time faculty instruction. Indeed, for every 10% increase in students' exposure to part-time faculty instruction, students tended to become almost 2% less likely to transfer. Although the strength of this association may seem small, the average student in this sample had almost 40% of his or her academic credits with part-time faculty members, which translates into being, on average, about 8% less likely to transfer compared to peers who had no exposure to part-time faculty members. Additionally, students who had all of their credits taught by part-time faculty were nearly 20% less likely to transfer than their peers who had only full-time faculty instruction. In this sample, 342 students had all of their credits with part-time faculty members while almost 2,500 had no exposure to part-time faculty instruction. Although our methodology precludes us from concluding a causal relationship between exposure to part-time faculty and students' transfer likelihood, the results suggest a significant negative association between these two variables.

The results for other academic variables in the model suggest more positive outcomes for students, as the analyses indicate that earning a higher GPA in the first year of enrollment and completing an associate's degree significantly improve students' chances of transferring to a four-year college or university. Students who earned an associate's degree increased their likelihood of transferring to a four-year college or university by almost 24% compared to their classmates who did not complete an associate's degree. Additionally, for every one-point increase in first-year GPA, students' chances of transferring to a four-year institution increased by about 7%. We ran other models, not shown in this paper, with cumulative GPA in the analysis and found similar results. Models including cumulative, rather than first-year, GPA suggested that a one-point increase in cumulative GPA improved students' chances of transferring to a four-year institution by 7.25%.

Attending part-time and majoring in vocational studies appear to have significant negative effects on transferring from a community college to a four-year institution. Vocational studies majors were 16% less likely to transfer compared to students majoring in more traditional academic disciplines. Additionally, enrolling in community colleges on a part-time basis decreased students' chances of transferring by almost 12% compared to their full-time peers. Not declaring a major appears to have no significant effect on students' likelihood of transferring.

Among the institutional characteristics, only two variables in the model emerged as significant. Students enrolled at rural institutions were 4% less likely to transfer compared to students attending suburban campuses. Attending an institution located in an urban area had no significant effect on students' likelihood to transfer. Also, the percent of students at an institution receiving financial aid had a significant negative effect on transfer. Every 10-point increase in the proportion of students at an institution receiving financial aid made students at that institution almost 2% less likely to transfer.

Table 2 Results of HGLM analyses

	Log odds	S.E. (Sig.)	Delta-P (%)	VIF	Tol.
Independent student-level variables					
Female	−0.03	0.03		0.96	1.04
Black	0.04	0.07		0.93	1.07
Asian American	0.35	0.05***	8.39	0.79	1.27
Pacific Islander	−0.02	0.07		0.95	1.06
Latino/a	−0.33	0.04***	−7.21	0.81	1.23
Citizenship	0.37	0.04		0.69	1.17
Age	−0.06	0.01***	−1.37	0.98	1.44
Vocational studies major	−0.81	0.07***	−15.99	0.95	1.06
Undeclared major	−0.04	0.03		0.94	1.07
Average loans across all years of enrollment (100)	0.01	0.01		0.97	1.03
Average grants across all years of enrollment (100)	−0.02	0.01*	−0.46	0.68	1.47
Average fee remissions across all years of enrollment (100)	−0.02	0.01*	−0.46	0.35	2.86
Average work study aid across all years of enrollment (100)	0.00	0.01		0.93	1.07
Average scholarships across all years of enrollment (100)	0.01	0.01		0.96	1.04
Exposure to part-time faculty (10%)	−0.08	0.01***	−1.82	0.97	1.03
Parent income (log transformed)	0.03	0.01***	0.69	0.66	1.51
Student income (log transformed)	0.01	0.01		0.46	2.15
First-year GPA	0.30	0.02***	7.16	0.88	1.14
Earned an associate's degree	0.97	0.03***	23.74	0.92	1.09
Does not have a high school diploma	0.11	0.04**	2.57	0.97	1.03
Has a college degree	−0.05	0.07		0.81	1.24
Part-time student	−0.56	0.03***	−11.68	0.89	1.12
Independent institution-level variables					
FTE student (hundreds)	0.00	0.01		0.75	1.33
Proportion of instruction done by part-time faculty	0.00	0.01		0.93	1.07
Percentage of students majoring in vocational studies	−0.01	0.01		0.98	1.02
Urbanicity: City	0.05	0.07		0.72	1.39
Urbanicity: Rural	−0.18	0.08*	−4.03	0.68	1.47
Percent of students receiving financial aid	−0.09	0.02***	−1.75	0.79	1.26
Percent of students identified as URM	−0.01	0.03		0.79	1.26
Model statistics					
Intercept reliability	0.69				
Chi-square	374.26				
Explained variance at level-2	0.30				
Baseline probability of transfer	0.36				

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

In the institutional model, we tested two variables representing the presence of part-time faculty. We examined how the proportion of faculty in part-time appointments, by head-count, related to students' likelihood of transferring, and we also tested whether the

proportion of instruction offered by part-time faculty significantly affect student transfer. Both variables, tested separately, showed no significant association with transfer likelihood.

Finally, Table 2 presents several statistics related to multicollinearity, model fit, and explained variance at the institutional level. With the exception of students' average fee remissions, we found no evidence of multicollinearity among the independent predictors in our model. Regarding model fit, the chi-square statistic associated with the level-2 variance component is 374.26, which suggests a substantial improvement from the same statistic in the fully unconditional model (not shown). The chi-square statistic improved by 103.73 points between the fully unconditional model and the final model reported in Table 2. The high chi-square statistic reported in Table 2 suggests that we have not accounted for the majority of the variance between institutions in students' likelihood to transfer to a four-year college or university. The institutional predictors included in the level-2 model explained approximately 30% of the variation between institutions in students' likelihood of transferring to a four-year college or university. The heteroscedasticity of the level-1 variance precludes us from making a reasonable interpretation of explained variance at level-1.

Discussion and Implications

This study examined the association between exposure to part-time faculty instruction and community college students' likelihood of transferring to a four-year college or university. HGLM analyses of the student- and institution-level data indicate a significant and negative relationship between exposure to part-time faculty instruction and students' chances of transferring. This finding is similar to prior research on the relationship between exposure to part-time faculty and persistence among students at four-year institutions (Harrington and Schibik 2004; Eagan and Jaeger 2008; Jaeger and Hinz 2008; Ronco and Cahill 2004).

Because the effect of exposure to part-time faculty becomes much more pronounced as students spend more time in the classroom with part-timers, administrators and policy-makers need to give careful attention to this issue. Prior research has found that available and engaged faculty members positively contribute to a number of student outcomes (Cejda and Rhodes 2004). At the same time, research suggests that part-time faculty remain less engaged and available (Umbach 2007) and less satisfied (Eagan 2007; Levin et al. 2006) than their full-time colleagues. Part-timers' lack of availability might be attributed to deficient resources, such as office space, provided to part-time faculty as well as poor incentives for part-time faculty to make themselves available to students outside of class. To address issues of availability and satisfaction among part-time faculty, and consequently mitigate the negative relationship between exposure to part-time faculty and students' likelihood of transferring, administrators should consider ways in which to provide incentives for part-timers to engage with the campus as well as spend time with students outside of class.

As suggested by the social and human capital frameworks used to conceptualize this study (Becker 1993; Coleman 1988), stronger connections between students and faculty, either part-time or full-time, may provide students with the information, resources, and encouragement they need to navigate the academic process and ultimately decide to transfer to a four-year institution. As prior research suggests, connecting with faculty

outside of class has a number of positive outcomes for students, such as networking and mentoring opportunities (Cejda and Rhodes 2004; Cotten and Wilson 2006). In fact, Cejda and Rhodes (2004) concluded that increased interactions with faculty positively contributed to Hispanic community college students' likelihood to complete an associate degree. If administrators provide part-timers with the necessary incentives to encourage them to connect with students outside the classroom, the negative relationship between students' likelihood to transfer and exposure to part-time faculty may be mitigated.

In addition to considering how to encourage increased engagement among part-time faculty at community colleges, administrators need to reach out to part-time students. In this study, almost 60% of transfer likely students attended part-time. Cohen and Brawer (2003) suggest that students enroll part-time at community colleges because of competing obligations, as many community college students work full-time, have family commitments, or just prefer to attend part-time. Although not explicitly tested by variables in this study, the negative relationship between enrolling part-time and the likelihood of transferring to a four-year institution may be explained partly by time. Students attending part-time, by the very nature of their part-time status, take longer to accumulate the credits necessary to transfer into a four-year college or university. The length of time it takes to become transfer eligible may discourage part-time students from wanting to continue with their education. Additionally, part-time students may have goals that do not include or do not require earning a four-year college degree.

Future research needs to examine these issues in greater depth. In cases where part-time students have an ambition to transfer, however, community college faculty and staff need to work with them to make sure they have the information necessary to navigate the transfer process. Because part-time students spend less time on campus than their full-time counterparts, they likely have fewer opportunities to connect with their peers as well as their faculty to develop information networks. If both part-time and full-time faculty as well as staff members time to reach out to these students to talk with them about the transfer process, part-time students' inclination toward transfer may become stronger.

In addition to the findings on part-time faculty and part-time students, the results suggest that students with higher first-year GPAs have significantly greater chances of transferring to four-year institutions. This finding corresponds to other research that links first-year GPA and persistence and degree completion (Eagan and Jaeger 2008; Titus 2004). Student success in the first year of college may be critical to how they view the prospect of later transferring from a community college to a four-year institution.

One finding from this study seems to contradict earlier research that examined the connection between part-time faculty and student outcomes. Using institutional data only, Jacoby (2006) concluded that the proportion of part-time faculty employed by the institution negatively affected the institutions' associate degree completion rate. While our study was distinct from Jacoby's work in sample, methodology, and the outcome of interest, our findings suggest that the negative effects associated with employment of part-time faculty actually occur more at the individual level rather than the institutional level. Our models revealed that neither the proportion of faculty employed in part-time appointments nor the proportion of instruction completed by part-time faculty had a significant relationship with students' likelihood of transferring to a four-year institution. These findings suggest that students respond less to contextual effects of their institution and more to individual factors affecting their experience. The individual effects on students of part-time faculty employment underscore the importance for individual faculty to connect with students. Additionally, this finding emphasizes the importance of institutions to consider best to utilize the part-time faculty whom they employ.

Future Research

The limitations from our study as well as its findings provide a number of opportunities and directions for future research. First, future studies should consider alternative definitions for transfer likely students. Our study restricted the sample of transfer likely students to those individuals who completed at least eight transferable units at a single institution. This restriction likely did not account for students who enroll at and earn transferable credits from multiple community colleges. Future work could use a higher threshold of transferable units but consider units cumulative across institutions; such a selection strategy may significantly increase the sample size of transfer likely students. Our data did not offer control for students' out-of-class experiences and engagement (Cabrera et al. 2005; Driscoll 2007; Lanaan 2007), students' satisfaction with the institutional environment (Nora and Rendon 1990), or a means to measure social capital. Additional research could explore these items in addition to key variables relating to exposure to part-time faculty.

Considering that students may attend more than one community college, future analyses might also use cross-classified hierarchical linear modeling (CCHGLM). CCHGLM takes into account multiple contexts, such as multiple institutions, that may affect an outcome (Raudenbush and Bryk 2002). Because of the swirling effect of community college students (de los Santos and Wright 1989), where many students simultaneously enroll and take courses at multiple institutions, students are exposed to multiple institutional contexts. These different contexts might influence their ability to navigate the transfer process.

In addition to using advanced analyses to account for this swirling effect of enrolling at more than one institution, future studies should disaggregate the data by enrollment status. In our study, part-time students were almost 12% less likely to transfer to a four-year institution than their classmates who enrolled full-time. Because this study focused specifically on the effects of exposure to part-time faculty on community college students' likelihood to transfer to a four-year college or university, examining differences between part- and full-time students was beyond the scope of this research. At the same time, by not conducting separate analyses on full- and part-time students, we may not have provided an accurate depiction of the experiences of these two distinct types of students.

Just as future research should disaggregate by enrollment status, scholars may consider providing for more specific controls for student major. Our study examined differences in undeclared and vocational studies majors compared to students in traditional academic disciplines. Thus, we were unable to determine whether students' experiences with part-time faculty are significantly different in science and mathematics fields compared to those in the humanities. More detailed analyses might provide community college administrators and policymakers with more specific information about the relationship between exposure to part-time faculty and students' likelihood of transferring.

Finally, limited research has provided community college administrators and policymakers with a cost-benefit analysis of employing part-time faculty. Research has shown part-time faculty save institutions on labor costs (Bettinger and Long 2006). At the same time, our results, as well as the findings from other research, suggests a negative relationship between exposure to part-time faculty and student outcomes. Future research might consider using econometric techniques, such as stochastic frontier analysis, to determine the extent to which community colleges become more cost efficient by relying heavily on part-time faculty employment. At the same time, such research may show how increasing employment of part-time faculty affects institutions' production efficiency, as measured in terms of community colleges' ability to produce certificates and associate degrees as well as transfer students to four-year institutions. Such analyses may provide

administrators with information on how best to utilize the skills and talents of part-time faculty so as to constrain costs while continuing to maintain or even improve their efficiency in producing well-educated individuals.

Conclusion

Anticipated expansion in enrollments within the U.S. higher education system likely will place further strain on the community college sector (Martinez 2004). At the same time, states continue to reduce appropriations to higher education institutions, and such reductions have forced institutions to identify innovative revenue-generating and cost-saving strategies. Among community colleges, increased employment of part-time faculty appears to be one of the more popular solutions to constrain costs. Thus, the trend of increasing employment of part-time faculty likely will continue for years to come; therefore, community colleges must learn to work within the system that they have perpetuated by identifying ways to tap into the talents offered by part-time faculty members. Finding ways in which to encourage part-timers to make time for students outside of class, such as by providing part-time faculty with office space or additional money to compensate them for holding office hours, may mitigate the negative relationship between part-time faculty exposure and students' likelihood to transfer. At minimum, and given our findings, policymakers and community college administrators must begin to consider the effects of increased use of part-time faculty.

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<i>Rank</i>	<i>Category</i>	<i>Request</i>	<i>Cost</i>	
1	Technology	Surface Pros to replace laptop computers for ST 207 to run BIO-PACs	\$93,000.00	7, 12
2	Technology	BIO-PACs (basic + respirometer) - BIO-50A/B	\$28,000.00	7, 12
3	Faculty	Full-time Biology Instructor	\$150,000.00	1, 7, 9
4	Staff	Full-time Lab Technician	\$85,000.00	1, 7, 9
5	Instructional Supplies	Bio 4 Human Body Models	\$6,623.60	3, 7
6	Instructional Supplies	Field tools and supplies - Bio 21	\$1,400.00	7, 12
7	Technology	Replacement laptop computers for IT 128	\$38,400.00	7, 12
8	Furniture	Replacement of all lab benches in IT 128	\$18,560.00	7, 12
9	Technology	JoVE science education subscription for the library (renewed annually)	\$15,000.00	7, 12
10	Instructional Supplies	Field Guides - Bio 21	\$900.00	7, 12
11	Instructional Supplies	Bio 4 Human Organ models	\$6,677.20	3, 7, 12
12	Instructional Supplies	Anatomy models for ST 207	\$4,000.00	7, 12
13	Equipment	Replacement oxygen meters for IT 128	\$1,280.00	7, 12
14	Instructional Supplies	Replacement microscope slides	\$700.00	7, 12
15	Instructional Supplies	Analytical instruments and supplies - Bio 21	\$1,388.00	7, 12
16	Instructional Supplies	Bio 4 Physio Equipment	\$536.14	3, 7, 12
17	Instructional Supplies	Bio 4 Posters	\$61.75	3, 7, 12
18	Technology	PCR Machine Thermo Fisher (1) - BIO-60	\$5,210.00	7, 12
19	Technology	BIO-RAD UV-Visible spectrophotometers (8) - BIO-60	\$25,600.00	7, 12
20	Instructional Supplies	TK6 Tissue Culture Supplies and Cell Line - BIO-60	\$2,500.00	7, 12
21	Equipment	3-tiered seed sprouter - BIO-3,5,8	\$640.00	7, 12
22	Safety	Autoclave maintenance contract (renewed annually)	\$8,000.00	7, 12

Predicting Academic Success of Health Science Students for First Year Anatomy and Physiology

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Abstract

Students commencing tertiary education enter through a number of traditional and alternative academic pathways. As a result, tertiary institutions encounter a broad range of students, varying in demographic, previous education, characteristics and academic achievement. In recent years, the relatively constant increase in tertiary applications in Australia has not translated to an increase in student retention or graduate numbers. The Health Sciences discipline typically falls within this paradigm, prompting various approaches to promote academic success and overall student retention. In this study, the demographic and previous education of health science students at an Australian University, were analysed along with first year science grades from a core first year anatomy and physiology unit. A generalized linear model (GLM) demonstrated statistically significant relationships between performance in the unit (measured by grade point average) and year 12 Australian Tertiary Admissions Rank (ATAR) subjects (human biology and chemistry; $p < 0.001$) and gender ($p < 0.001$). No significant performance correlation was observed with household socioeconomic status, as measured by socio-economic indexes for areas. Taken together, the results from this study facilitate estimation of academic success by some parameters prior to their commencement at University.

Keywords: Anatomy, Prediction, Academic performance, Australian

1. Introduction

Predictors of academic success or failure in the tertiary environment are pivotal in shaping curricula and support services. Students entering Australian universities particularly struggle in science, engineering and mathematic degrees (Hassan, 2008). Academic staff have found it challenging to address this issue, which is amplified by the diversity of students entering the university system. In particular, entrance via alternative pathways into Australian Universities has been enhanced (Macey, Jordan, Jackson, & Money, 2006), resulting in significant breadth in the academic abilities and prior knowledge of first year students. Identifying fixed and apparent predictors of academic performance among transitioning students is needed to tailor support to those at risk of underperforming and potentially improve student retention and ultimately graduation.

Demographic markers such as age (Sheard, 2009), socioeconomic status (Li & Dockery, 2014), gender (Sheard, 2009), high school performance (Hoffman & Lowitzki, 2005; Richardson, Abraham, & Bond, 2012) and employment (Stinebrickner & Stinebrickner, 2003) have previously been investigated as predictors for academic performance across a range of university degrees. Studies on the effect of age have been inconsistent, with both positive and negative reported correlations for academic success (Naderi, Abdullah, Aizan, Sharir, & Kumar, 2009; Sheard, 2009). However, an Australian study using input-output analysis found that a 20 year old undergraduate student has the highest probability of completing a course, and that the age of commencement is a strong indicator (Shah & Burke, 1996). These inconsistencies may relate to variations across degree, university and country; indeed this is the case for gender analyses (Harackiewicz, Barron, Tauer, & Elliot, 2002). A study of Australian university students observed no performance difference between males and females in science (McKenzie & Schweitzer, 2001) or graduate entry medicine (Puddey & Mercer, 2014). However, females performed considerably better in the majority of subject fields at Australian high schools (Fischer, Schult, & Hell, 2013). Gender disparate predictors of success identified in our analysis may shed light on these discrepancies.

The school of health sciences at this University offers undergraduate degrees in biomedical science (BMS), exercise and sports science (BESS), health and physical education (HPE), and other broad health-related degrees. A traditional entry pathway into one of these degrees involves the successful completion of year 12 and a requisite Australian Tertiary Admission Rank (ATAR) score, comprising of four or more stage 2/3 subjects. While students can enter these degrees with any combination of secondary subjects, competency in English is a prerequisite. While the majority of students enter into university study through a traditional secondary education pathway, there are several alternative university entrance pathways available to mature-age students. The addition of those entering via previous tertiary study, foundation year or technical and further education (TAFE) preliminary qualifications creates a heterogeneous pool of students with concomitant disparities of prior knowledge, learning pace, and digital literacy.

This study aims to investigate predictors of performance using three first year cohorts of health science students studying first year anatomy and physiology. We sought first to demonstrate that a core Anatomy and Physiology unit (Human Structure and Function; BMS100) score was representative of first year GPA. From this point, the study sought to ascertain whether there is a difference in the ability of first year students from BESS, HPE, and BMS degrees to successfully complete the BMS100 unit. Further we explore whether specific demographic factors would predict performance. The ability to identify subsets of students who transition poorly to health science degrees at university would provide better targeted student support aimed to improve student performance, satisfaction, retention and ultimately graduation.

2. Methods

2.1 Participants

First year students from three different health science degrees at this University were included in this study across intake years 2012 - 2014. The total student sample (n= 414) comprised three BMS100 semester cohorts spanning 2012 (n= 127), 2013 (n= 112) and 2014 (n= 175). The male to female ratio within the sample changed from 2012-2014, with female proportion progressively increasing by 10% (Table 1). Similarly, the ratio of school leavers to non-school leavers (alternative entry and mature age) enrolments shifted to favour school leaver enrolments by 10% in the same period (Table 1). School leavers were defined as students less than 20 years of age who gained entry to their Health Sciences degree employing a valid ATAR score (within two years). Mature age and/or alternative entry students were over the age of 18 years and gained entry by foundation year, tertiary enabling program, TAFE certification or previous tertiary semesters.

Table 1. Composition of BMS100 students by gender and mode of tertiary entrance

Academic Year	2012	2013	2014
Male	54.4%	49.2%	44.5%
Female	45.6%	50.8%	55.5%
Total	100.0%	100.0%	100.0%
School Leaver	52.8%	59.8%	62.8%
Mature Age	47.2%	40.2%	37.2%
Total	100.0%	100.0%	100.0%

2.2 Academic Performance Measures

Student's pre- university entrance performance measures included ATAR score, stage 3 year 12 high school subjects and mode of university entrance, which is divided into two pathways; direct school leavers (based on ATAR score) and non-direct school leaver (alternative and mature age) students. Both alternative entry and mature age students qualify on the basis of previous tertiary semester, TAFE certification or advanced standing, and/or completion of foundation year or tertiary enabling programs. Given the heterogeneous education background of these cohorts, a preliminary literacy assessment undertaken by students was also included to estimate its role in first year performance.

Academic performance in the core first year anatomy and physiology unit, Human Structure and Function (BMS100), was assessed as a specific marker for success in health science. The anatomy and physiology unit consists of a mid-semester exam (weighted 15%), online and laboratory assessments (15%), practical exam (weighted 20%) and final exam (weighted 50%). In addition, following the completion of first year, grade point averages (GPA) for full-time students were calculated as a general measure for first year performance. For GPA

calculations, student unit results were awarded a 0 (Fail, <50), 1 (Pass, 50-59), 2 (Credit, 60-69), 3 (Distinction, 70-79) or 4 (High Distinction, 80-100).

2.3 Assessment of Socioeconomic Status

Socioeconomic status (SES) was indirectly measured from socioeconomic indexes for areas (SEIFA). The listed residential postcode of students were categorised according to the 2011 Australian Bureau of Statistics' socio-economic indexes for areas (ABS, 2013). Postcodes were assigned a value of 1-10 corresponding to the Western Australian SES percentile for that postcode. For example, high SES suburbs were in the top percentile bracket (90-100) and were awarded a value of 1, with the lowest percentile bracket (1-10) awarded a value of 10.

2.4 Literacy Assessments: Reading and Writing Ability

The internal post-entrance literacy assessment (PELA) was used to determine the writing and reading abilities of students in this study. This test is delivered to all students who are commencing health science degrees at an Australian University. Briefly, the test involves a reading and comprehension section, a vocabulary test, and a final section requiring the production of an extended piece of writing. For reading, each student receives a score (1-10). This score was also converted to a tertile (low, medium and high). Writing ability was assessed by the university's Academic Enabling and Support Centre (AESC) through a structured extended piece of writing, and recorded as "sufficient" or "not sufficient."

2.5 Data Analysis and Ethics

Data were described and analysis was conducted using SPSS version 22 (IBM corporation). Group differences in academic performance were analysed using an independent t-test or one-way ANOVA with a p value of <.05 threshold considered statistically significant. A general linear model (GLM) was used to analyse the relationship between the pre-entry factors and student grade in the core first year anatomy and physiology unit from 2012-2014. The pre-entry variables used in the GLM included gender, SES, degree, literacy and high school ATAR level human biology, biology, chemistry, physics and mathematics. Non-significant factors were removed one at a time until the final model was determined. Ethical approval to obtain student demographic data, including previous high school subjects, was granted by the University's Human Research and Ethics Committee.

3. Results

3.1 Percentage Score in BMS100, A First Year Anatomy and Physiology Unit, is Representative of First Year GPA

A lasting belief in health sciences, based on anecdotal evidence, is that performance in anatomy and physiology typifies overall degree performance. We first sought to verify this in our sample, which comprised three cohorts (2012-2014) of a core anatomy and physiology unit (BMS100). Student final percentage score in BMS100 and their mean first year GPA were found to be highly concurrent (Figure 1). A student's grade in BMS100 and their first year GPA have a statistically significant ($p < .001$) positive linear relationship in 2012 ($r = .75$), 2013 ($r = .82$) and 2014 ($r = .85$). Most notably, in all three cohorts, students receiving a high distinction in BMS100 averaged a GPA greater than 3.00 (0-4 scale). Reciprocally, students who receive a pass or fail grade, average a GPA of less than 1.3 and 1.1 respectively at the completion of first year (Table 2).

Table 2. First year performance in health science (BMS100) and Mean (SD) GPA scores across years 2012-2014

Academic Year	2012	2013	2014
BMS100 Grade	1 ST Year GPA Mean (SD)	1 ST Year GPA Mean (SD)	1 ST Year GPA Mean (SD)
HD	3.16 (.69)	3.03 (.41)	3.37 (.41)
D	2.37 (.45)	2.26 (.46)	2.21 (.41)
C	1.79 (.46)	1.73 (.42)	1.65 (.32)
P	1.27 (.46)	1.10 (.36)	1.26 (.43)
F	1.04 (.45)	1.10 (.33)	0.99 (.31)

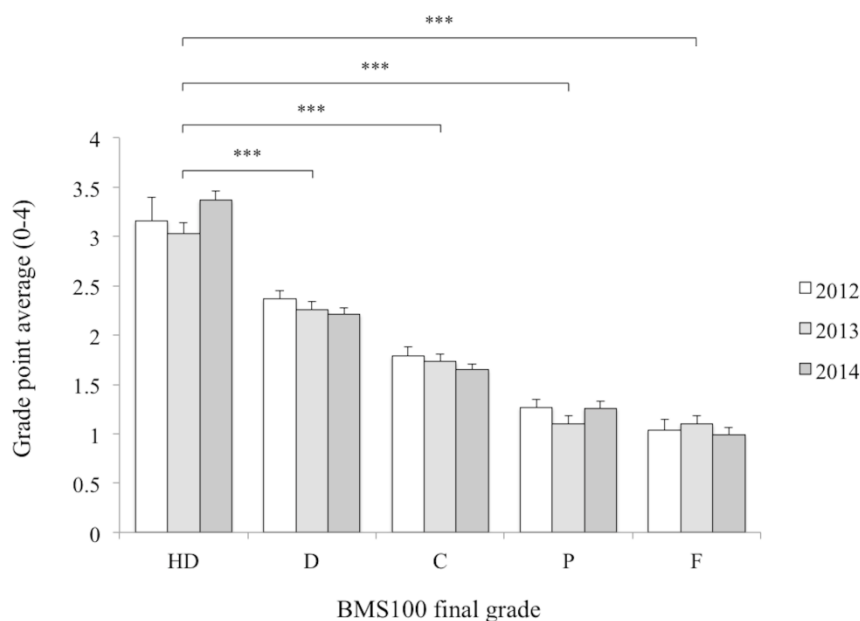


Figure 1. A student's grade in a core first year anatomy and physiology unit, BMS100, correlates to academic success in the first year of their health science degree. Student grades ranging from a high distinction (80-100), distinction (70-79), credit (60-69), pass (50-59) and fail (<50) correlate with the grade point averages (0-4) of full time health science students following the completion of first year (** $p < 0.001$).

3.2 Demographic Predictors Influencing Success in First Year Anatomy and Physiology

Having demonstrated that the BMS100 unit is a satisfactory representation of overall performance in first year health science, we next set out to determine which factors influenced our cohort's performance. Student demographic data was examined as a possible influence on BMS100 performance (Figure 2). Within the health science degree program, females performed better (2.8-7.8%) than males across years, but were only statistically significant in 2012 and 2014 (2012: $t = 2.88$, $p = .005$; 2014: $t = 2.85$, $p = .005$). Interestingly, student socioeconomic status was not associated with higher academic performance in any of the three cohorts (Figure 2b). Students who entered university via their ATAR had higher BMS100 performance scores across all three cohorts (3.7-7.8%) (2013: $t = 3.46$, $p = .001$; 2014: $t = 2.27$, $p = .024$). Due to the University recording process, data was unavailable to delineate the effect of entry pathway subsets of alternative entry and mature age students.

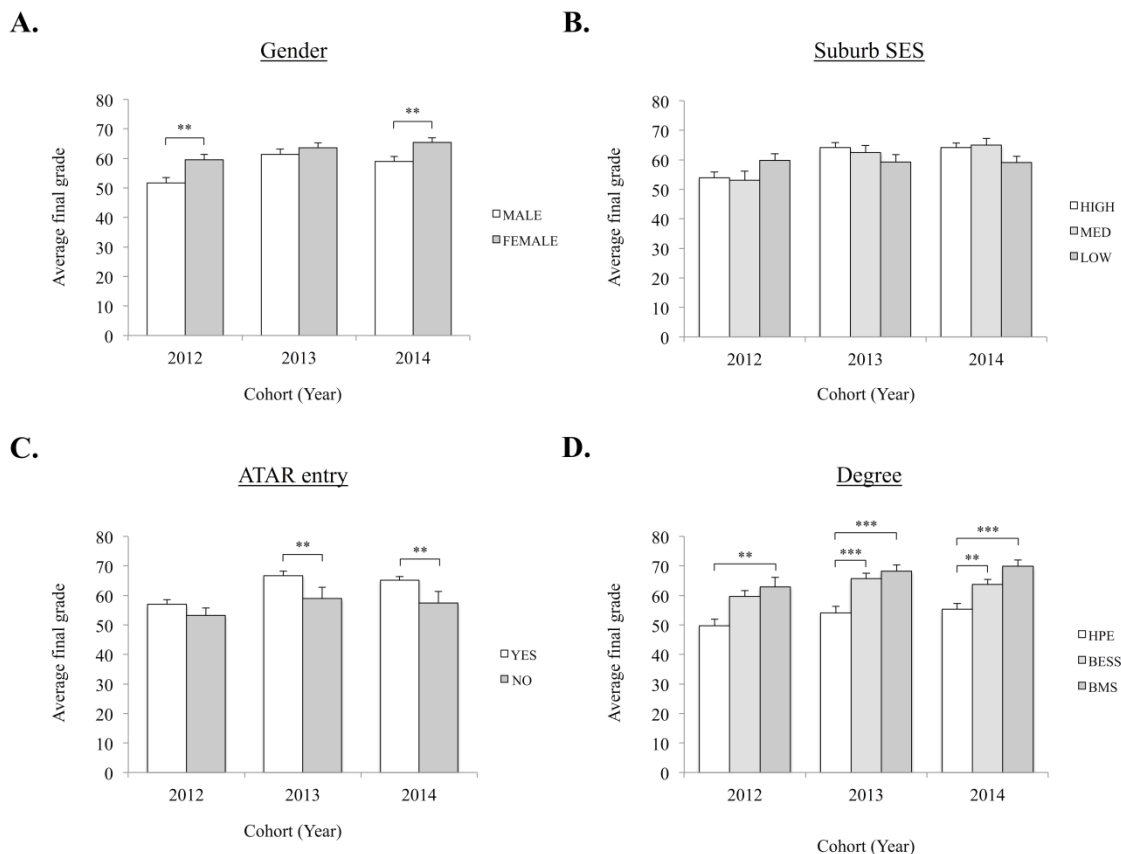


Figure 2. Demographic predictors and choice of degree effect student performance in first year anatomy and physiology. (A) The effect of student gender, (B) socioeconomic status, (C) university admission pathway, and (D) health science degree on BMS100 final grade (* $p < .05$; ** $p < .01$; *** $p < .001$).

Using a one-way ANOVA, degree program showed a significant difference between BMS and HPE students in BMS100 performance in 2012 ($F = 5.49$, $p = .004$), 2013 ($F = 12.85$, $p < .001$) and 2014 ($F = 12.15$, $p < .001$) year groups, with the former performing 13.1-14.5% better. Similarly, BESS students were significantly better performers in BMS100 in 2013 ($F = 12.85$, $p < .001$) and 2014 ($F = 12.15$, $p = .003$) when compared with students in the HPE degree (Figure 2d).

3.3 Assessment of Literacy as a Predictor for Success in First Year Anatomy and Physiology

Upon admission, students in health sciences take the post-entrance literacy assessment (PELA). Health science students who were deemed “sufficient” in writing tasks performed significantly better in 2012 ($t = 2.82$; $p = .006$) 2013 ($t = 2.41$, $p = .017$) and 2014 ($t = 2.08$, $p = .039$) than those requiring improvement (Figure 3). Strong performance on the reading portion of the PELA test showed a trend to higher performance in BMS100 across all three years. While not significant, we observed a difference in mean BMS100 grade of between 4-6% from high to low reading score tertiles (see figure 3).

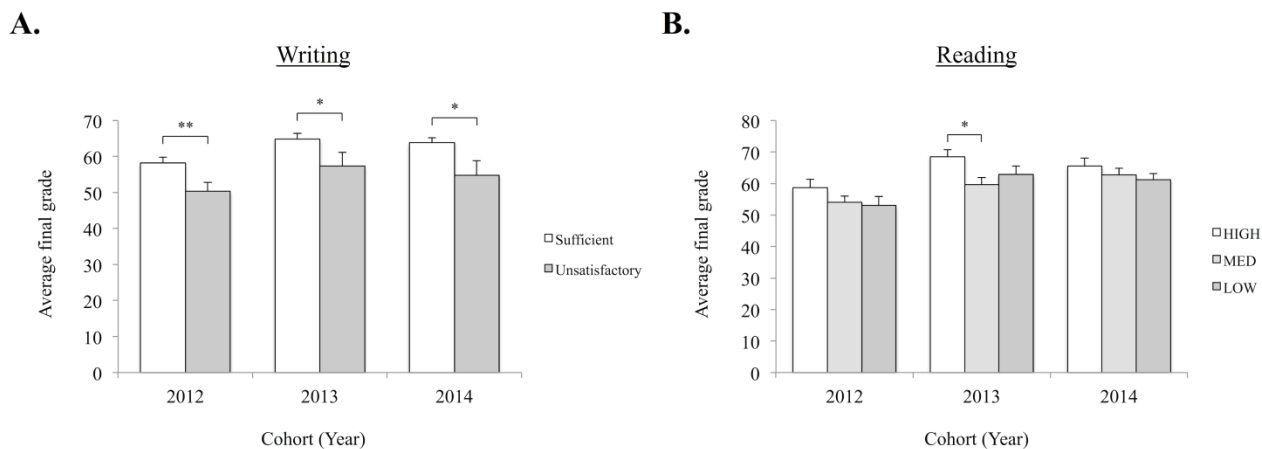


Figure 3. Literacy assessments as a predictor for student performance in first year anatomy and physiology. The effect of (A) student writing competency, and (B) reading competency on BMS100 grades, as determined by the post-entrance literacy assessment (* $p < .05$; ** $p < .01$).

3.4 Previous Science and Mathematics Exposure can Influence Student Grades in A First Year Anatomy and Physiology Unit

Differences between previous study and academic success in first year anatomy and physiology, secondary school subjects and previous tertiary degrees were compared to final BMS100 grades using independent t tests (Figure 4). Previous completion of ATAR human biology was associated with higher BMS100 grades by between 7-9% in 2012 ($t = 2.52$, $p = .013$), 2013 ($t = 2.62$, $p = .01$) and 2014 ($t = 4.32$, $p < .001$) (Figure 4a). Similarly, completion of ATAR chemistry prior to University was associated with higher BMS100 performance scores in all cohorts (2012: $t = 4.09$, $p < .001$; 2013: $t = 3.51$, $p = .001$; 2014: $t = 4.43$, $p < .001$) (Figure 4d). While prior completion of ATAR physics was associated with a higher BMS100 performance score, this was only statistically significant in 2012 ($t = 2.90$, $p = .004$) and 2014 ($t = 3.45$, $p = .001$) (Figure 4c). It should be noted that only a small number of students ($n < 25$) studied ATAR physics in each cohort year. Finally, higher-level ATAR mathematics (Western Australian 3AB/3CD) was associated with higher BMS100 grades between 5-9%, in 2012 ($t = 2.47$, $p = .015$), 2013 ($t = 2.25$, $p = .027$) and 2014 ($t = 4.18$, $p < .001$) (Figure 4). Students who previously studied biology or physical education (PE) studies did not perform any better in BMS100 than students with no prior exposure (Figure 4).

3.5 A Combination of Factors can Predict Academic Success in First Year Anatomy and Physiology

To identify what combination of factors might be associated with academic success in BMS100, multiple factors were assessed in combination. To determine if general exposure to ATAR level science (human biology, chemistry or physics) during high school sufficiently prepared and enhanced student performance in first year, independent t tests were used for each year cohort. Previous study in one or more science subjects at a year 12 standard (previous science) was associated with a significantly higher academic performance by 10-16% in all three cohorts ($p < .001$) of studying BMS100 compared to no previous science (Figure 5a). Higher BMS100 grades occurred when combining previous study of chemistry with the writing portion of the PELA literacy assessment (Figure 5). Students in all three cohorts showed a significantly higher score ($p < .001$) of between 12-18% in BMS100 grade following completion of ATAR chemistry and writing proficiency (Figure 5B).

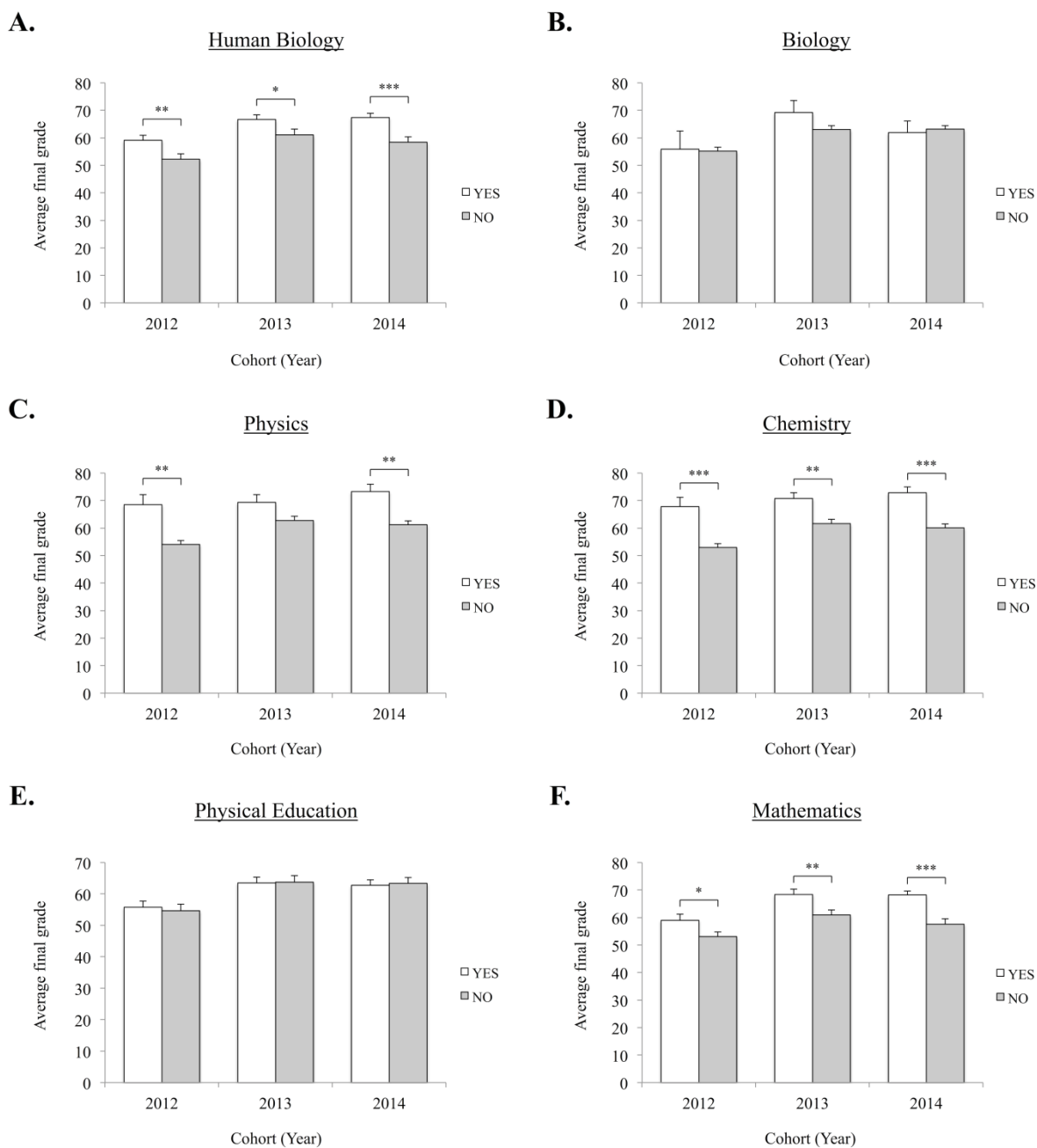


Figure 4. A student’s previous study can predict academic performance in first year health science. Previous study in (A) human biology, (B) biology, (C) physics, (D) chemistry, (E) physical education studies and (F) advanced mathematics can predict academic performance in BMS100 (* $p < .05$; ** $p < .01$; *** $p < .001$).

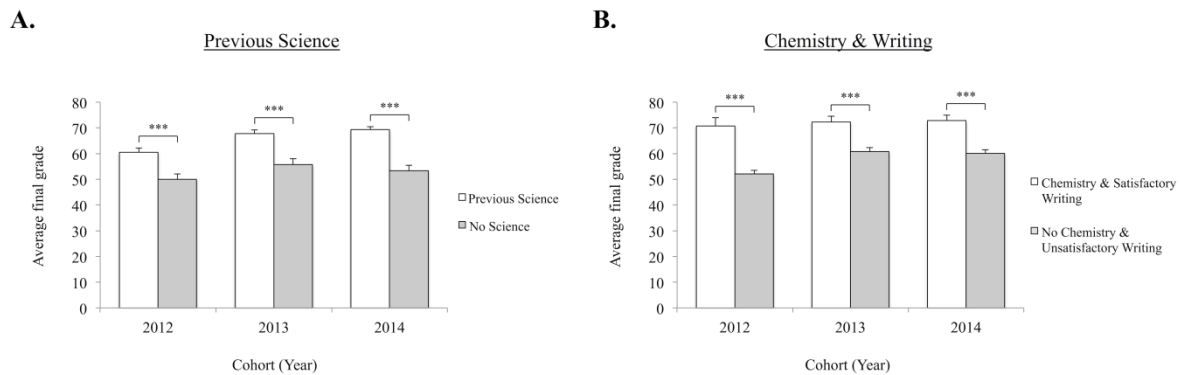


Figure 5. Combining multiple variables is associated with significantly higher academic performance in first year anatomy and physiology. (A) Previous study of science (human biology, chemistry or physics) strongly predicts academic performance in BMS100 (** $p < .001$). (B) A combination of previous chemistry study and competency in writing improves academic performance in BMS100 (** $p < .001$).

3.6 Predictors of Academic Performance Using a GLM

To clarify these results further, a GLM examined predictors of academic performance (BMS100 score). All potential academic predictors were incorporated into the GLM, and were sequentially removed until all remaining variables showed statistical significance. SES, mathematics and reading were found not to be significant predictors of BMS100 performance. The final model derived is reported in Table 3 and indicates that gender, course program, previous human biology, physics, chemistry, writing assessment and cohort year are together important predictors of academic performance. Specifically, student gender was a significant determinant of academic success, with female students scoring 4.69 points higher than males ($p < .001$). Student course was an important predictor; with HPE degree students scoring 5.68 points lower than BMS degree students ($p = .007$). Successful completion of the writing assessment in first semester increased student performance scores by 4.01 ($p = .019$). Previous study of human biology, chemistry and physics was also shown to improve performance scores by 6.41 ($p < .001$), 7.60 ($p < .001$) and 6.18 ($p = .007$) points respectively. Within the model, these improvements are additive, and therefore a female student who had completed ATAR level human biology, physics and chemistry at secondary school and passed their writing assessment would have an increased performance score of 28.88 points. Cohort year indicated that 2012 was significantly different to other years, with this year's students performing worse ($p = .003$).

Table 3. Final Model Parameter Estimates: Predictors of academic performance

	Variable	β coefficient	Std. Error	Significance
Gender	Male	-4.686	1.319	<.001
	Female	0*		
Course	HPE	-5.862	2.175	.007
	BESS	-0.241	1.9462	.901
	BMS	0*		
Previous human biology	No	-6.414	1.370	<.001
	Yes	0*		
Previous physics	No	-6.175	2.291	.007
	Yes	0*		
Previous chemistry	No	-7.603	2.033	<.001
	Yes	0*		
Writing assessment	Insufficient	-4.010	1.712	.019
	Sufficient	0*		
Cohort year	2012	-4.881	1.631	.003
	2013	1.214	1.612	.451
	2014	0*		

* Comparison category set to zero

4. Discussion

In this study we attempted to extract components of academic success or otherwise of health science students through their performance in a core first year anatomy and physiology unit, BMS100. Percentage score in this unit was highly concurrent with GPA at the completion of first year, affirming it as a suitable proxy for overall first year performance in health sciences.

While this is a novel finding for health science students, previous studies have identified a similar relationship in medical cohorts (Sitticharoon, Srisuma, Kanaviton, & Summachiwakij, 2014). Anatomy and physiology are integral components of a health science degree, indeed many anatomists believe that mastering the somewhat rote learning style of anatomy can aid students across multiple fields of study (Pandey & Zimitat, 2007). The results from this study support this notion, as high scores in BMS100 coincide with, or even translate to, an impressive overall GPA.

If the grade obtained in first year anatomy and physiology was a predictor for academic success, what variables predicted these grades? Our results indicate that mode of entrance, degree program, and gender are significant factors in our cohorts. Final BMS100 grade for school leavers versus mature age students were significantly different in years 2013 and 2014, but when considered with other factors as predictors of performance, the mode of university entry did not seem to play an important role. University entrance scores themselves correlate to academic performance in science degrees, and Australian undergraduate medical degrees (McKenzie & Schweitzer, 2001; Puddey & Mercer, 2014). In our findings, degree program was an important variable, with the BMS cohorts significantly outperforming HPE cohorts by 13-14% each year. While no ATAR or University entrance difference exists, many in the BMS cohort strive towards graduate entry medicine, possibly reflecting in their attitude towards study. Females consistently averaged higher grades over all three cohorts in BMS100, than males. As a significant variable in predicting academic success in BMS100, females would be expected to continue to perform better across the entirety of their health science degree. Given prior educational attainment is the most important predictor of academic success, and girls consistently perform better in secondary school (Duckworth & Seligman, 2005; Fischer et al., 2013), it seems this is an advantage carried to higher education (McKenzie & Schweitzer, 2001). The effect size of socioeconomic status (SES) varies in reports, but it was recently shown that SES does not influence academic performance at an Australian university (Li & Dockery, 2014). However, the demographic of the school can influence student performance, with equivalent students from less prestigious schools performing better than those from more prestigious schools in graduate medicine (Puddey & Mercer, 2014) and general university (Li & Dockery, 2014). Our data supports previous findings, with no statistical significance observed between students' SES, although the effect of secondary school demographic is of interest to further research.

The problem surrounding the decline in writing standards in health science students has previously been observed (McNaught & Hoyne, 2012). Students who lack competency in writing were more likely to struggle with academic workloads at university (Lau, 2003). Previous work has identified a weak correlation between performance in a research and writing unit and BMS100 (McNaught & Hoyne, 2012), presumably due to the distinct material differences between units. In this study we observed that writing competency, as determined by the PELA, was associated with higher academic performance in first year anatomy and physiology. However, this relationship was not observed with reading scores. It is unclear how writing proficiency translates to improved grades in BMS100, particularly as this unit requires minimal structured writing assessments. However, general literacy scores naturally relate to university entrance scores (Newell, 2012), suggesting the two variables are both important, despite an unclear connection.

Subjects studied in secondary school have previously shown to be associated with success in health science units at another Australian university (Green, Brown, & Ward, 2009). In our study, significant increases in the average BMS100 grade were observed in all three cohorts when students studied mathematics at a year 12 level. However, when analysed in a GLM, mathematics was not found to be a significant predictor of performance, suggesting that higher-level mathematics may be coincidentally chosen alongside other ATAR science subjects, or is an indicator of higher-level thinking. In contrast, physics and chemistry were associated with higher performance scores and were a significant predictor of performance using the GLM. While a previous background in physics or chemistry would not be intuitive in an anatomy and physiology unit, both predictors combined increase BMS100 grade by approximately 13%. This data supports a similar finding at La Trobe University, where high school chemistry and physics were seen to be associated with higher academic performance in several anatomy and physiology units (Green et al., 2009). The number of students entering university with higher level or intermediate mathematics, chemistry and physics is declining in Australia (Barrington, 2006; Rubinstein, 2009), which establishes an ongoing need for supporting this body of students as a collective.

Past study of biological sciences and physical education (PE) were not shown to enhance academic performance. This is a surprising finding for PE studies, as many health science students commonly have this background, and this content is a precursor for several anatomical concepts. In contrast, human biology study in high school was a significant factor in all cohorts. Human biology appears to be a common intuitive predictor for a health science degree although the teaching delivery of BMS100 may be disparate and the theory more involved. Nevertheless, student background in human biology is purportedly of help with study techniques, familiarity with terminology, and understanding anatomical concepts (Sitticharoon et al., 2014). It is well recognised in the teaching literature that previous exposure to concepts, even an awareness of the degree of depth within topics, enhances student aptitude for difficult content. Why then, does this not apply to past PE study? While both PE and human biology contain foundation concepts, students entering University with secondary human biology may be better equipped to approach familiar topics, and less bewildered by the breadth of material covered in one semester of anatomy and physiology.

5. Conclusions

When comparing the strength of each predictor, the GLM determined science subjects, specifically Human Biology, Physics and Chemistry, as the most significant predictors of academic success, where gender, course chosen, and writing proficiency were also important. The study of advanced science units, including anatomy, is becoming more difficult for continually larger groups of students with inadequate secondary school backgrounds (Green et al., 2009). It is worth noting that these characteristics are merely predictors, as a male student with lower writing proficiency and no science background is not predestined to perform poorly. Rather, unmasking these predictors of performance enables university faculties to understand what makes the university transition difficult. While universally available, support services can become increasingly customized to these student vulnerabilities, or marketed to these individuals. Existing approaches to improve writing proficiency and assist students without a previous science background have been an option prior to the commencement, and during, their undergraduate degrees. Despite offering such programs, improving attendance rates has remained challenging (McNaught & Hoyne, 2012). The authors have contemplated such a predicament, and raise the possibility of compulsory short courses for student populations predicted to be at most risk of academic failure.

This study has validated first year anatomy and physiology as an indicator of performance in health science degrees. Moreover, demographic and secondary education predictors of academic performance have been identified, warranting further study and consideration in additional disciplines. We anticipate that tailoring or targeting services to students most likely to falter will improve student's transition to university, retention and ultimately graduation.

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Inland Empire Regional Collaborative - Health Industry Workforce Report -

This report has been developed on behalf of the SlingShot Initiative in Riverside and San Bernardino Counties. The research became possible thanks to the support from San Bernardino County and Riverside County Workforce Development Boards. Reach Out provided leadership in conducting the research and developing this report.



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Introduction and Background

For over a decade, the Inland Empire has grappled with a health workforce shortage and lack of primary care capacity. The Press-Enterprise, the San Bernardino Sun, California Healthline and KPCC have reported extensively on such issues as the region's scarcity of specialists, primary care doctors, obstetricians and gynecologists, nursing assistants and residencies for medical students. Meanwhile, the health workforce shortage is only expected to become exacerbated as an aging workforce retires.

The Inland Empire has the most severe doctor shortage in California, an issue which has received much scrutiny in recent years and which resulted in the formation of the University of California, Riverside's School of Medicine. According to the Association of American Medical Colleges, there are on average 90 primary care physicians per 100,000 residents nationwide. In the Inland Empire, however, there are 34.5 primary care physicians per 100,000 residents, nearly two-thirds less than the national average, according to data provided by the California Health Care Foundation. In addition, Riverside and San Bernardino counties are designated Registered Nurse Shortage Areas according to the Office of Statewide Planning and Development.

However, nursing and physician shortages are not the only occupations facing a health workforce shortage in the Inland Empire. In 2007, indications of shortages in other areas, not only in medicine, but in dentistry and behavioral health, spurred educators and employers to develop solutions to this looming problem.

The Inland Empire's rapidly growing and diverse population, coupled with low educational attainment, the anticipated retirement of experienced Healthcare professionals, and new demands created by Healthcare reform all contributed to a growing need for regional planning on the future health workforce.

The San Bernardino and Riverside County Workforce Development Boards were not surprised that Healthcare became one of the two focus sectors for the Inland Empire Regional Collaborative (IERC), one of the 12 coalitions throughout the state chosen for the SlingShot Initiative.¹ Focusing on the two-county region, the IERC facilitated regional employer engagement by creating a model and developing a system that effectively engages the business community and directs training resources based on employer feedback.

In 2015, the IERC held several regional convenings with community and business/private industry stakeholders, designed to identify challenges, solutions, and resources for large-scale impact. Attendees included Workforce Investment Boards, K-12 Systems, universities, all regional community colleges, California Employment Development Department (EDD), economic development partners, and community-based organizations, employers from priority industry sectors, labor organizations, and Chambers of Commerce. The IERC gathered specific industry and employer feedback from the Healthcare and advanced manufacturing industries. Industry champions emerged from the group and were invited to identify specific industry priorities.

Based on the industry input, the IERC identified initial occupations of focus and started developing curriculum and funding pilot programs, such as Community Health Worker and Health Information Technology. The IERC chose four different providers: Loma Linda University Gateway College,

¹ The other focus sector for the SlingShot Initiative in the Inland Empire is manufacturing.

HealthStaff, Mt. San Jacinto College, and University of California Riverside Extension. Many participants completed training and obtained employment in the region.

In 2016, Industry Sector Experts were engaged for outreach and identification of industry needs. Goals of the Industry Sector Experts included: 1) comparing improved feedback from industry that reflects the outcomes of new hires to the initial industry feedback; 2) measuring working group engagement and motivation through attendance and involvement; 3) expanding circle of employers in targeted industry convening and doubling number of industry champions; and 4 improving employment outcomes for SlingShot training participants.

In 2017, Industry Champion Events were held. It became clear that a broader study of the labor market needs and shortages was necessary to further focus the regional efforts in Healthcare sector. On behalf of the IERC, Reach Out implemented a health workforce study on the 55 Healthcare occupations in demand, using a variety of research methods, including the data collection and analysis of traditional labor market sources, employer interviews, and geographic information systems (GIS) analyses. This report represents the summary of the findings and recommendations to address identified gaps. The goals of the recommendations are to support regional Healthcare sector, improve training, achieve better employment outcomes, and create opportunities for upward income mobility for the Inland Empire.

Methodology and Research Scope

The research team conducted the study utilizing a variety of private and public sources and data collection methods. Secondary data sources on labor market demand and education and training completions were analyzed for the Inland Empire region as a whole and its sub regions where possible. The team also interviewed local employers, analyzed job postings and surveyed Regional Occupational Programs. The following represents the research steps, data sources and research methodologies employed for this project:

Identification of occupations

The initial list of job titles was compiled by the IERC to reflect those jobs that regional employers expressed interest in. The researchers on this project matched these existing job titles with the Standard Occupational System (SOC) codes and reviewed related reports and literature. The result was the list of 63 occupations. Demand data for these SOC occupations was used to rank these by job openings and identify the 55 growing occupations that became the focus of this study. The following occupations were included in the study:

Anesthesiologists	Diagnostic Medical	Health care Social Workers
Audiologists	Sonographers	Home Health Aides
Cardiovascular Technologists and Technicians	Dietitians and Nutritionists	Licensed Vocational Nurses
Community Health Workers	Emergency Medical Technicians and Paramedics	Magnetic Resonance Imaging Technologists
Dental Assistants	Family and General Practitioners	Massage Therapists
Dental Hygienists	Health Educators	Medical and Clinical Laboratory Technicians
Dentists, General		

Medical and Clinical Laboratory Technologists	Occupational Therapists	Psychiatric Technicians
Medical and Health Services Managers	Occupational Therapy Assistants	Psychiatrists
Medical Assistants	Ophthalmic Medical Technicians	Radiologic Technologists
Medical Records and Health Information Technicians	Optometrists	Registered Nurses
Medical Secretaries	Personal Care Aides	Respiratory Therapists
Medical Transcriptionists	Pharmacists	Social and Human Service Assistants
Mental Health and Substance Abuse Social Workers	Pharmacy Aides	Speech-Language Pathologists
Mental Health Counselors	Pharmacy Technicians	Surgeons
Nuclear Medicine Technologists	Phlebotomists	Surgical Technologists
Nurse Anesthetists	Physical Therapist Aides	Veterinarians
Nurse Practitioners	Physical Therapist Assistants	Veterinary Assistants and Laboratory Animal Caretakers
Nursing Assistants	Physical Therapists	Veterinary Technologists and Technicians
	Physician Assistants	

Appendix A provides the full list of 55 occupations by educational level required, as well as related job titles and SOC codes.

Geographic scope

The analysis of available data was conducted for the Inland Empire region that consists of San Bernardino and Riverside Counties. Where possible, the data was also obtained and analyzed on the sub-regional level for the combined zip-code areas of High Desert, Eastern Deserts (i.e. Coachella Valley and Morongo Basin), West End San Bernardino County, Metro San Bernardino County, Western Riverside County, and Southwest Riverside County.

Appendix B lists zip codes included in each sub region.

Secondary data collection

First research step was to obtain accurate and reliable secondary data for 55 Healthcare occupations in the Inland Empire and its sub regions. In partnership with the California Community Colleges’ Center of Excellence for Labor Market Research (COE)², the research team collected traditional labor market data using Emsi’s Labor Market Analytics tool.³ The data were used for

² Coeccc.net

³ Emsi occupation employment data are based on final Emsi industry data and final Emsi staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level Emsi earnings by industry. www.economicmodeling.com

assessing the projected annual demand for the 55 Healthcare occupations on regional and sub-regional levels.

The research team then matched 55 occupations with educational programs using the crosswalk between SOC codes and Classification of Instructional Programs (CIP) codes. Using the CIP codes identified through the crosswalk, we accessed Integrated Postsecondary Education Data System (IPEDS) to compile data on postsecondary program completers. We also requested and received the self-reported data on the number of high school student completers in Healthcare from the Regional Occupational Programs (ROP) in the region. IPEDS and ROP completion data were used for assessing the supply of educated workforce for the 55 Healthcare occupations.

Data Disclaimer: Because not all training providers report data to IPEDS, some institutions, especially those that deliver short-term training, might be missing from the data source utilized for this report. Thus, caution should be taken when analyzing completion counts for occupations that require less than an associate degree.

Another secondary data source utilized in this research was Burning Glass. It allowed us to obtain information on the employer job postings in Health care and understand the latest trends in employer hiring in the Inland Empire.

Primary data collection

In addition to the secondary research, the team conducted primary data collection through a series of **interviews with Healthcare employers in the region**. Using County Business Service contact sheets, input from both county contacts, and Reach Out questionnaire, the team conducted employer interviews between June and December, 2017. The interviewees were asked about their current hiring needs and most difficult to fill positions. Of the 30 employers contacted for interviews, 24 employers participated. The participating Healthcare businesses included electronic medical software experts, health plan networks, community clinics, general acute care hospitals, first responders and skilled nursing facilities.

Appendix C provides the full list of employers that participated in the interviews.

GIS Mapping

The IERC partnered with the Loma Linda University to develop Geographic Information Systems (GIS) **mapping for the top 10 occupations where the shortages exist overlaid with the number of completions and the locations of education and training institutions**. The maps were developed to show training shortages or oversupply by sub-region.

Industry Growth & Trends

The Healthcare sector has been an important driver of the Inland Empire economy. It was the only sector that added employment during the recent Great Recession in 2007-2011 and continued to grow rapidly through the economic recovery thereafter. The Healthcare sector encompasses a diverse range of industries. The top 10 Healthcare industry groups in the Inland Empire region that demonstrate projected positive job growth from 2015 to 2020 include the individual and family services industry group (which is projected to grow by 47% or 22,000 positions in a 5-year span), general medical and surgical hospitals group (with 11% projected growth and almost 4,000 additional openings), nursing care facilities (12% growth and 1,400 new jobs), and others. Exhibit 1 provides projection data for all top ten industry groups.

Exhibit 1: Industry Groups in Health Care.⁴

Health Care Industry Groups (NAICS)	2015 Jobs	2015 - 2020 Change	2015 - 2020 % Change	2016 Location Quotient	2016 Establishments	Current Total Earnings
Individual and Family Services (6241)	47,470	22,087	47%	2.1	40,328	\$17,870
General Medical and Surgical Hospitals (6221)	35,741	3,928	11%	0.8	44	\$83,049
Nursing Care Facilities (Skilled Nursing Facilities) (6231)	11,969	1,388	12%	0.7	149	\$43,465
Offices of Dentists (6212)	10,939	1,066	10%	1.1	1,662	\$54,811
Home Health Care Services (6216)	9,000	810	9%	0.6	299	\$39,260
Outpatient Care Centers (6214)	6,986	8,804	126%	1.4	373	\$82,028
Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly (6233)	6,833	1,957	29%	0.8	290	\$29,943
Offices of Other Health Practitioners (6213)	6,820	1,208	18%	0.7	960	\$42,950
Residential Intellectual and Developmental Disability, Mental Health and Substance Abuse Facilities (6232)	4,822	485	10%	0.8	307	\$35,698
Medical and Diagnostic Laboratories (6215)	2,200	153	7%	0.8	184	\$53,749

Source: California Community Colleges' Centers of Excellence for Labor Market Research, coeccc.net

Note: 2016 Establishments also include sole proprietors.

The review of the data above and existing literature as well as the information from the employer interviews reveals a number of trends that are shaping the future of the Healthcare workforce landscape in the Inland Empire region:

- Of all industry groups, the **outpatient care centers industry group** presents the most opportunities. It is expected to add employment at an incredibly high rate of 126% in a five-year period. It is number two industry group by the total number of new jobs, and it is

⁴ Location Quotient is a measure of how concentrated employment of industries are in an area compared to national average. A location quotient of more than 1.0 indicates higher regional concentration of an industry, while location quotient of less than 1.0 indicates lower regional concentration. For example, a location quotient of 1.2 explains that an industry is 20% more concentrated in a region compared to the national average.

40% more concentrated in the Inland Empire compared to the national average (location quotient of 1.4). It also shows some of the highest average earnings per worker (\$82,000).

- The demand for Healthcare services and subsequent industry and employment growth continues to be driven by the **aging population** that requires more services. The number of people age 60 and older will jump 40% by 2030⁵, says the federally mandated California State Plan on Aging. Currently, two-thirds of the state's older population is concentrated in either the San Francisco Bay or Los Angeles areas. But experts predict in the next decade that concentration will spread to Orange, Riverside and San Bernardino counties. The older population in Riverside County is expected to hike by 97% by 2030 (from 353,225 to 695,017), while the growth of this population group for San Bernardino is estimated to be at 107% (from 265,699 to 550,488). This will not only drive the overall growth of the sector in the region, but also the types of Healthcare services that will be needed and the types of workers that will need to be trained to deliver such services.
- Other workforce needs of the industry are shaped by the Affordable Care Act (ACA) implementation and technology changes. Specifically, interview participants articulated the **increased need for Registered Nurse Case Managers** to ensure adherence to the Affordable Care Act (ACA) guidelines for diagnosis and care within the legislation's specified requirements and time frames (e.g. management of chronic conditions achieved within 90 days, no readmission for five discharge diagnoses within 30 days). Additionally, **Health Information Technology (HIT) professionals** are needed who can certify that the organization's electronic medical records are within the ACA's parameters for meaningful use.
- The geographic and demographic diversity of the Inland Empire creates additional needs for the Health care sector to deliver services. In San Bernardino County, there are 59 designated **medically underserved areas** in all three areas of primary care, dental care, and mental health. In Riverside County, there are 42 designated medically underserved areas in all three categories.
- Faced with the challenges of providing more care, Healthcare employers are exploring alternative ways to deliver care. For example, **physician assistants (PAs) and nurse practitioners (NPs)** are now performing some of the functions that were previously delivered only by Medical Doctors. Case in point, Kaiser Permanente recently announced a new plan to use nurse practitioners in over 30 Target stores across Southern California. These clinics will provide a wide range of health services including pediatric care, women's health and treatment of minor illnesses. CVS is now offering Minute Clinics that provide basic services such as immunizations, treatment of minor injuries, etc. They are usually staffed by NPs and PAs.

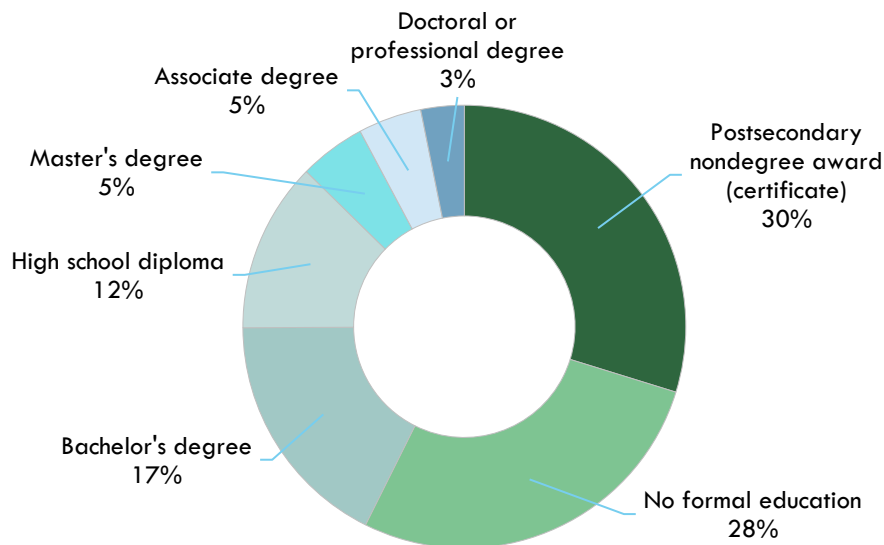
⁵ California State Plan on Aging.

- New development is also driving the need for workers. For example, Riverside University Health System is opening a new medical center in Moreno Valley. Kaiser Permanente will open a new medical facility in Murrieta. Some of the services in the new facility will include: Primary Care, OB/Gyn, Ambulatory Surgery, Urgent Care, Telemedicine, Specialty Services, Laboratory and Pharmacy. Each of these departments will need the allied health and nursing positions to support the medical facility.
- The high turnover rate within certain occupations (i.e., CNAs and LVNs) is attributable to hourly wage/salary/benefit competition among Healthcare employers. One employer reported the turnover rate of 11% for LVNs. One employer reported 18% turnover and another reported 25% for CNA's. As one employer stated, "These positions incur high turnover as wages are low and employees will leave one organization to work at another for as little as a 15 cent per hour increase." The impact of this "churning" of staff is the constant and costly need to seek and train new hires, which creates "an immediate and tremendous need" for CNAs and LVNs, as well as RNs.

Projected Demand for 55 Occupations

Collectively, the 55 Healthcare occupations chosen for this study represent over 135,000 currently employed workers in the Inland Empire. These positions are expected to grow by about 20% or 26,700 new positions in the next five years. Annually, there will be over 17,900 openings due to growth and replacement needs. A large portion of these job openings (30%) will be for occupations requiring Postsecondary non degree awards, such as certificates, followed by those requiring no formal education (28%) and those that require Bachelor's degree (17%). See Exhibit 2.

Exhibit 2 – Percent of Occupational Job Openings for the next five years by Education Requirements



Exhibits 3 through 9 provide traditional labor market projections for all 55 Healthcare occupations, grouped by minimum entry-level educational level. Annual job openings indicate the potential demand for each occupation, which includes both the new jobs created due to industry expansion and the openings created due to replacement needs, such as retirements.

Among occupations that require Doctoral education, pharmacists and physical therapists are projected to be in the highest demand. Top in-demand occupations requiring Master’s degree include Healthcare social workers, mental health counselors, and nurse practitioners. Registered nurses, health managers, mental health and substance abuse social workers are the top of the Bachelor’s degree occupational group. The largest annual openings for the Associate’s degree occupations are projected for dental hygienists, radiologic technologists, and medical and clinical laboratory technicians. Nursing assistants, medical assistants and Licensed Vocational Nurses are the highest in-demand occupations requiring a certificate.

Exhibit 3 - Demand for Occupations Requiring Doctoral or Professional Degree

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Pharmacists	2,911	3,204	293	10%	187
Physical Therapists	1,537	1,892	355	23%	139
Dentists, General	2,142	2,341	199	9%	102
Family and General Practitioners	952	1,020	68	7%	41
Veterinarians	554	618	64	12%	35
Optometrists	290	338	48	17%	20
Psychiatrists	414	449	35	8%	18
Surgeons	340	352	12	4%	12
Anesthesiologists	154	158	4	3%	6
Audiologists	49	65	16	33%	6
TOTAL	9,343	10,437	1,095	12%	567

Exhibit 4 - Demand for Occupations Requiring Master's Degree

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Health care Social Workers	1,488	1,899	411	28%	251
Mental Health Counselors	1,626	1,934	308	19%	242
Nurse Practitioners	1,184	1,486	302	26%	124
Speech-Language Pathologists	1,041	1,246	205	20%	97
Occupational Therapists	842	1,025	183	22%	81
Physician Assistants	604	750	146	24%	65
Nurse Anesthetists	82	109	27	33%	10
TOTAL	6,866	8,449	1,583	23%	869

Exhibit 5 - Demand for Occupations Requiring Bachelor's Degree

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Registered Nurses	28,884	33,357	4,473	15%	2,442
Medical and Health Services Managers	2,456	2,943	487	20%	301
Mental Health and Substance Abuse Social Workers	1,193	1,440	247	21%	180
Dietitians and Nutritionists	774	926	152	20%	81
Health Educators	461	557	96	21%	80
Medical and Clinical Laboratory Technologists	601	717	116	19%	63
TOTAL	34,368	39,940	5,572	16%	3,148

Exhibit 6 - Demand for Occupations Requiring Associate's Degree

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Dental Hygienists	1,620	1,910	290	18%	161
Radiologic Technologists	1,804	2,027	223	12%	142
Medical and Clinical Laboratory Technicians	1,078	1,271	193	18%	110
Respiratory Therapists	1,609	1,768	159	10%	109
Veterinary Technologists and Technicians	625	758	133	21%	79
Physical Therapist Assistants	362	487	125	35%	74
Diagnostic Medical Sonographers	516	611	95	18%	48
Cardiovascular Technologists and Technicians	509	587	78	15%	43
Occupational Therapy Assistants	156	219	63	40%	35
Magnetic Resonance Imaging Technologists	193	223	30	16%	17
Nuclear Medicine Technologists	194	204	10	5%	12
TOTAL	8,665	10,065	1,399	16%	831

Exhibit 7 - Demand for Occupations Requiring Postsecondary Non degree Award/Certificate

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Nursing Assistants	9,408	11,334	1,926	20%	1,529
Medical Assistants	7,779	8,827	1,048	13%	1,077
Licensed Vocational Nurses	8,265	9,394	1,129	14%	841
Dental Assistants	4,800	5,432	632	13%	676
Massage Therapists	2,615	2,971	356	14%	352

Emergency Medical Technicians and Paramedics	2,306	2,772	466	20%	241
Phlebotomists	1,191	1,353	162	14%	160
Medical Records and Health Information Technicians	1,712	1,929	217	13%	150
Psychiatric Technicians	1,203	1,309	106	9%	119
Surgical Technologists	856	1,062	206	24%	114
Medical Transcriptionists	376	410	34	9%	53
Ophthalmic Medical Technicians	225	256	31	14%	24
TOTAL	40,734	47,049	6,314	16%	5,338

Exhibit 8 - Demand for Occupations Requiring High School Diploma

Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Medical Secretaries	6,442	7,266	824	13%	888
Social and Human Service Assistants	2,888	3,574	686	24%	511
Pharmacy Technicians	3,641	4,151	510	14%	401
Veterinary Assistants and Laboratory Animal Caretakers	1,053	1,171	118	11%	191
Physical Therapist Aides	538	648	110	20%	91
Pharmacy Aides	537	581	44	8%	83
Community Health Workers	336	429	93	28%	64
TOTAL	15,436	17,819	2,383	15%	2,229

Exhibit 9 - Demand for Occupations Requiring No Formal Education

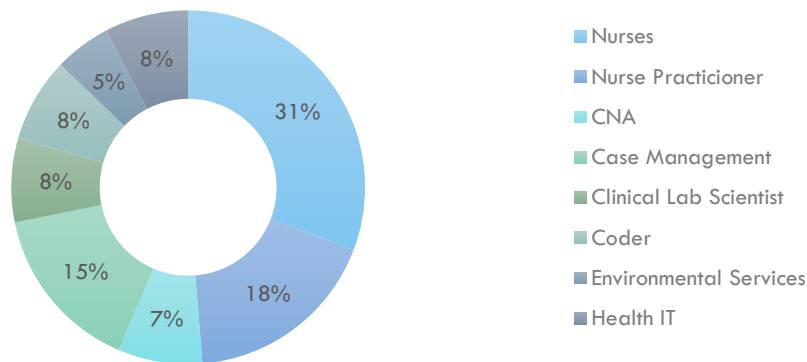
Occupation	2017 Jobs	2022 Jobs	5-year change	5-year % Change	Annual Openings
Personal Care Aides	17,102	23,761	6,659	39%	4,187
Home Health Aides	2,874	4,599	1,725	60%	759
TOTAL	19,976	28,360	8,384	42%	4,946

Employer Hiring & Training Needs

Based on the qualitative information from the interviews with 24 employers, registered nurses were the number one need expressed by the interviewees (Exhibit 10). Case managers and health information technology (HIT) professionals were also a frequently stated need, followed by speech, respiratory occupational and physical therapists. A “tremendous and immediate need” for CNAs and LVNs was also emphasized. Behavioral health specialists were also stated as a hiring need and viewed as a critical shortage in the Inland Empire. Environmental Service staff (hospital housekeeping) and Dietary staff were a need at two hospitals.

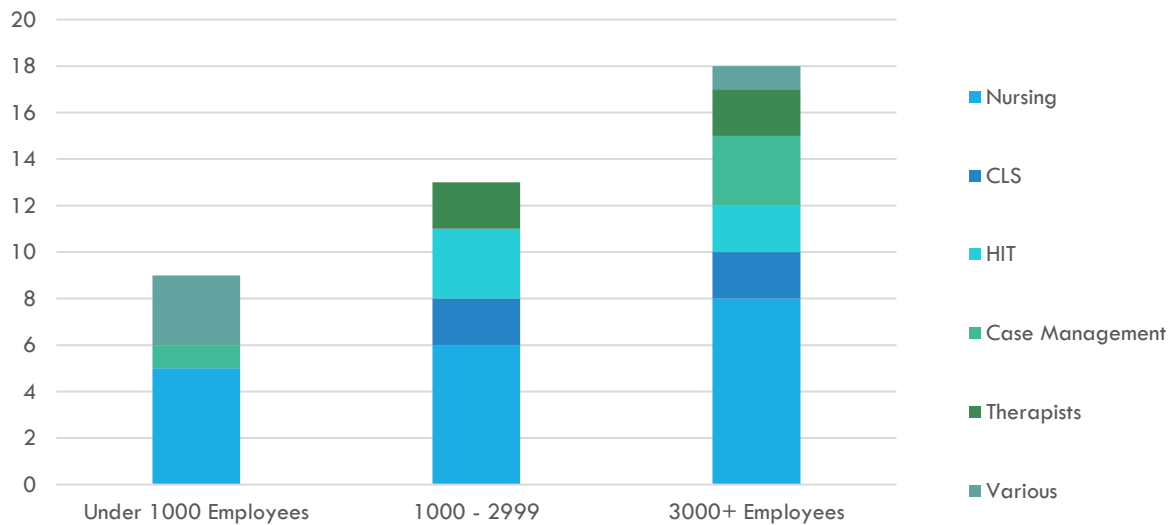
When asked about the needs in a structured questionnaire, employers indicated that all levels of nursing are the largest needs throughout the Inland Empire, particularly in regards to Nurse Practitioners, Bachelor of Science in Nursing, Registered Nurses, and Certified Nursing Assistants.

Exhibit 10 – Current Hiring Needs in the Inland Empire (n=23)



The interviews also included a follow-up question of “Why are these positions difficult to fill?” The response overwhelmingly given was a shortage in the labor market. So overwhelming was this response that out of twenty responses, seventeen respondents associated the difficulty with labor shortages. (Exhibit 11)

Exhibit 11 – Positions Most Difficult to Fill (n=22)



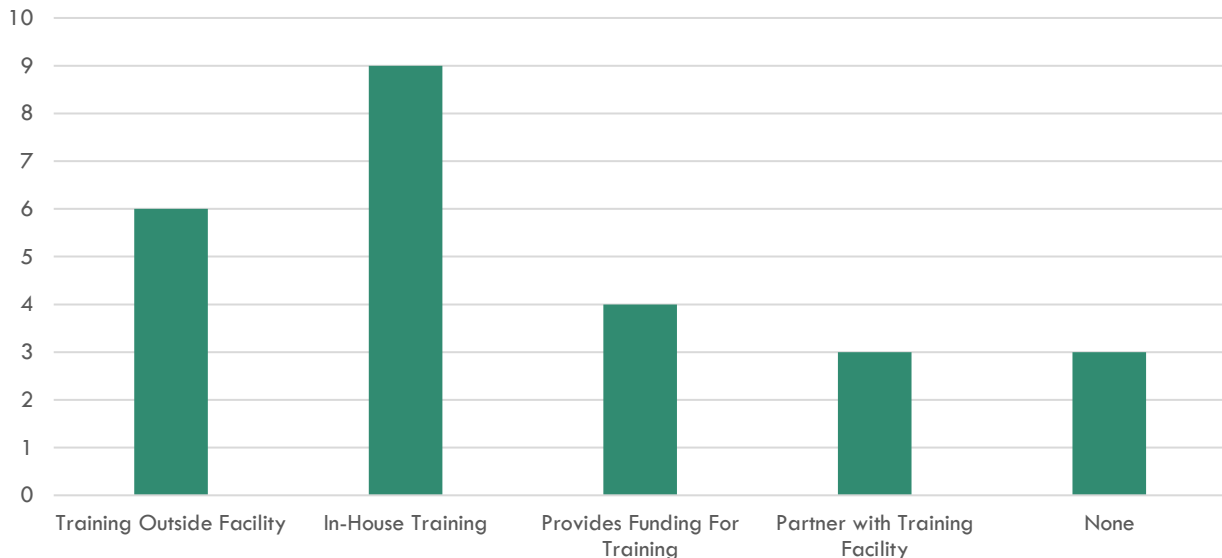
Interviews with local employers also confirmed that the trend towards Bachelor’s degrees in the health field is on the rise, especially for the occupations that are difficult to hire. Associate Degrees and Special Training programs are also still of importance in the Inland Empire medical field. (Exhibit 12)

Exhibit 12 – Highest Training Required for Positions that are Difficult to Fill



The survey explored how potential job seekers in the medical field can obtain the necessary training required to find a position. Employers were asked about the unique, responsive methods of training that are necessary for the positions. The findings indicate that many facilities train for specialized positions either in-house or in a partnership with other facilities or universities. In the Inland Empire, an example is Loma Linda University. (Exhibit 13)

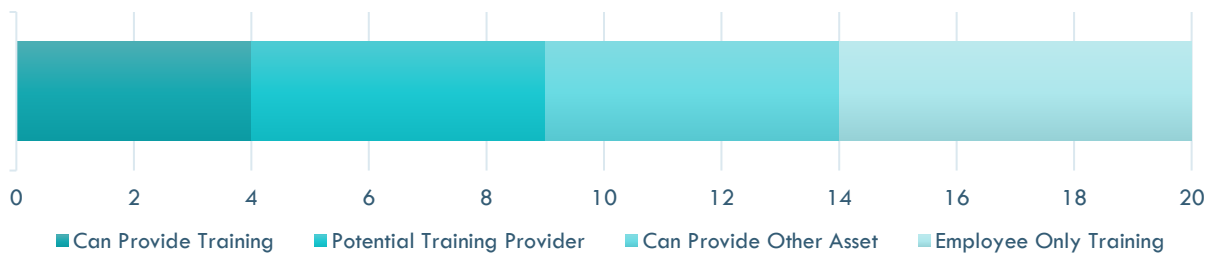
Exhibit 13 – Discrete Training Required for Needed Positions



Most of the interviewees have internal programs in place to train new hires and incumbent staff for openings within the needed occupations. For those for whom registered nurses are a critical need, strong partnerships have been forged with local nursing schools, and students in these schools participate in practicums, externships and internships with the Healthcare employers. Most of the Healthcare employers whose needs are in the HIT arena use a private HIT provider to provide proprietary training to staff. Three hospitals contract out their HIT training.

One community clinic offered to provide training resources in the form of a training location. One hospital offered a training venue. (Exhibit 14)

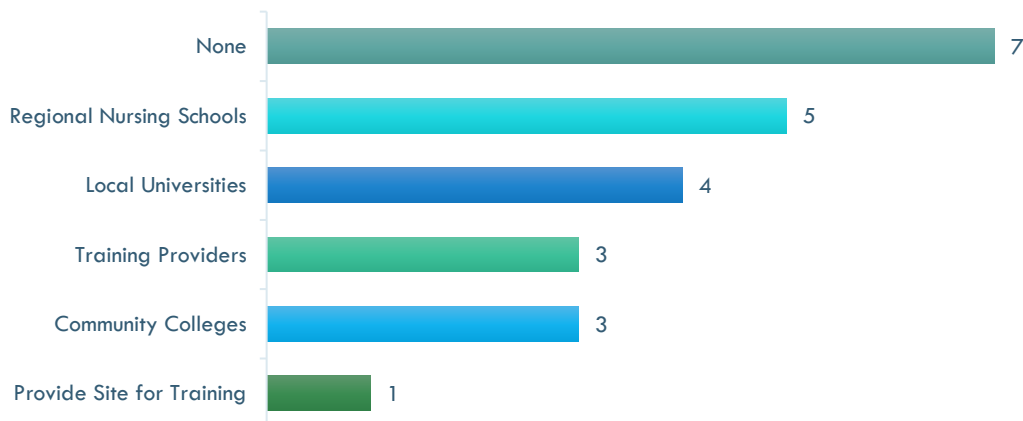
Exhibit 14 – Availability of Facilities to Provide Training



However, employers reported that they are connected to local training providers, be it universities, community colleges, or other occupational training in the area. Many of the respondents reported that they have a “close” or “very close” working relationship with many of the regional training facilities. Ten of the employers surveyed have a recruitment strategy in place from education and training programs. For smaller employers not employing medical care staff, this question was not applicable. (Exhibit 15)

Through strengthening the bridge between medical training programs and medical health facilities, the Inland Empire has a solid foundation to begin to address the medical employment needs in the area.

Exhibit 15 – Connections with Regional Training Providers



Immediate Training Needs

Many of the Healthcare employers interviewed expressed a dire need for applicants and new hires who project professionalism. Comments about applicants’ or new hires’ appearance (attire), demeanor (lack of customer service skills), attendance (calling off, tardiness) and lack of basic computer skills were frequent and expressed with a discernible amount of frustration by the Healthcare employer. As one Healthcare employer put it, “I need employees who show up, are not wearing jeans and flip flops, can smile and be kind to my patients and know how to do more than just swipe left.”

Community Health Workers (CHW)

The role of and possible need for Community Health Workers was discussed with each Healthcare business. When asked about the need for Community Health Workers, almost half of the employers (11 of 24) responded that they do not use this occupation, while seven employers already employ these workers, and four plan to employ them in the near future. One employer also reported that Community Health Worker duties are currently performed by other staff.

Two of the interviewees plan to add CHWs to their care teams. These CHWs will coach the care teams' patients on life skills that can improve the social determinants of health and use of community resources such as food banks, transportation vouchers, utility and housing assistance, and medical home identification, as well as options for health insurance through the Affordable Care Act. One Healthcare entity did employ several CHWs, but found skills to be lacking and have removed the position from their job family. No other Healthcare employer had a current or foreseeable need for CHWs.

Health Information Technology (HIT)

A need was expressed by many of the Healthcare employers for applicants that understand and can function within HIT, with one major employer defining the need as "huge." It is estimated by a training analyst for an electronic medical software vendor and a local HIT expert there are more than 10 HIT software programs in use by hospitals and clinics in the Inland Empire. These systems encompass the electronic medical record (EMR). The meaningful use of the EMR is required by the Affordable Care Act, and therefore staff that can work effectively within the HIT/EMR is a critical need.

While many different HIT software programs are available, a discussion with a software expert revealed that all HIT software products, which include the EMR, have the same basic platform of functionality. Variations among software programs occur in the specific applications of each HIT software product, but the basic workings of the software are identical.

Emerging Jobs

Traditional labor market data does not always help understand new or emerging workforce needs. In order to identify emerging occupational titles, aggregated job postings data were obtained and analyzed. Because job postings do not equal job openings, these data should only be used to observe the general trends, rather than to indicate the demand for jobs using job postings counts.

Employer job advertisements for Healthcare positions in the Inland Empire indicate that the employers have new/emerging needs. Some of the titles with the largest number of online advertisements include intensive/critical care nurses, clinical case managers, nursing managers/supervisors, health technicians, telemetry technicians, registrar/patient service representatives, nursing home administrators, sterile processing technicians, nutrition technicians, and clinical documentation specialists. The list of the top emerging titles is provided in Exhibit 16.

Exhibit 16 – Top Emerging Health care Occupations in the Inland Empire (by online job advertisements)

Emerging Occupational Titles	Job Postings (2016)
Intensive / Critical Care Nurse	2,233
Clinical Case Manager	894
Nursing Manager / Supervisor	689
Health Technician / Technologist (Other)	384
Telemetry Technician	359
Registrar / Patient Service Representative	335
Medical Biller	238
Nursing Home / Home Health Administrator	196
Sterile Processing Technician	188
Nutrition / Dietetic Technician	172
Clinical Analyst / Clinical Documentation and Improvement Spec	112
Clinical Data Systems Specialist / Manager	109
Dialysis Technician	105
Clinical Nurse Educator	81
Dietary Aide	78
Clinical Nurse Specialist	41
Emergency Room / Department Technician	36
Medical Records / Coding Supervisor	28
Histotechnologist / Histotechnician	24
Cytogenetic Technologist / Cytotechnologist	16
Endoscopy Technician	16
Neurodiagnostic Technician / Technologist	15
Patient Advocate / Navigator	13
EKG Technician	8
Hearing Screener / Technician	4
Mental Health Assistant	2

Additionally, interviews revealed two other emerging occupations:

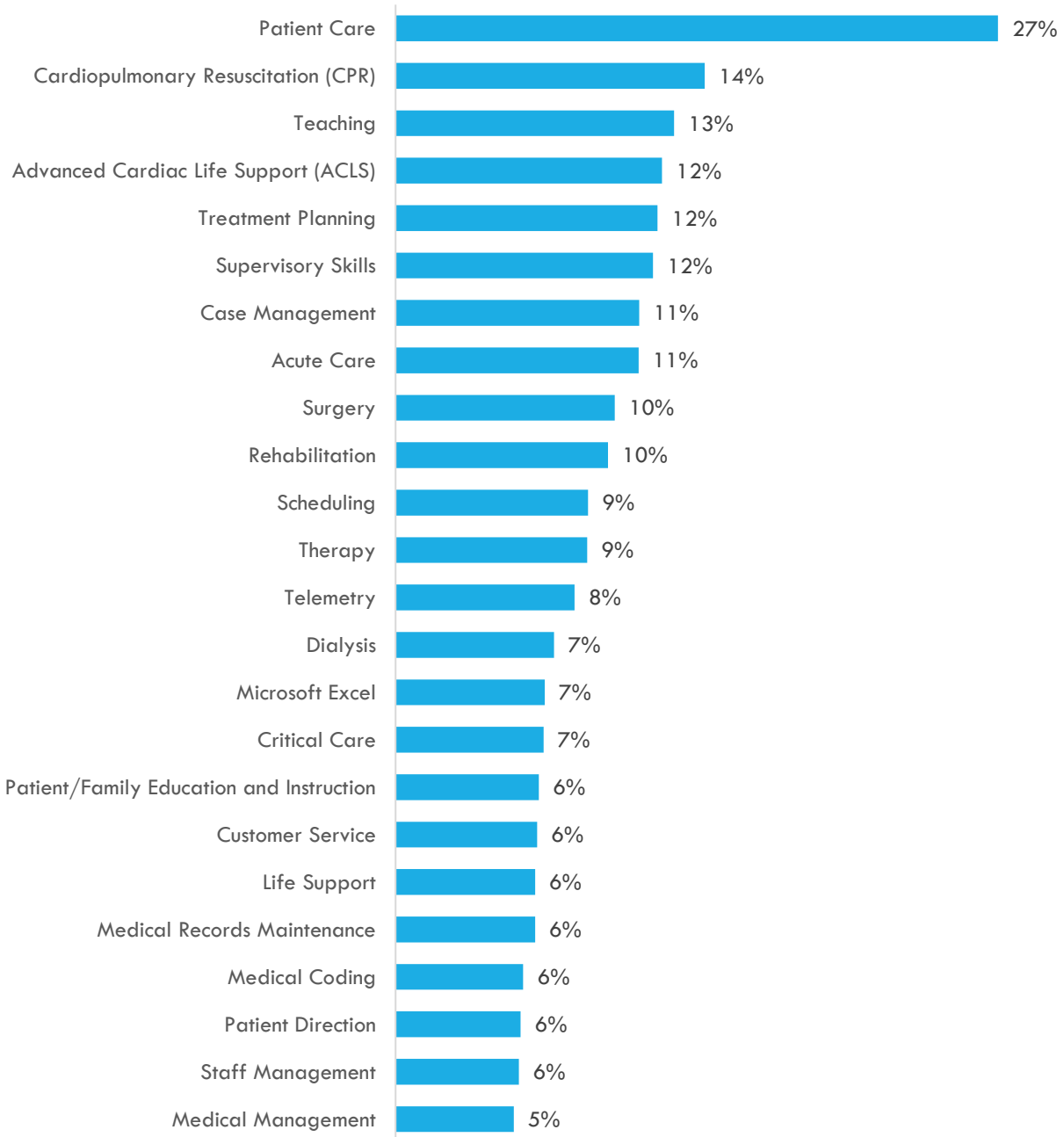
- **Medical Scribe/ Scribe Assistant:** Scribes work closely with physicians and Healthcare providers to supply real time charting of physician and patient encounters during medical exams. Scribes are responsible for a variety of clerical tasks that include retrieving medical records, documenting the results of diagnostic tests, and preparing discharge instructions, while maintaining the flow of the clinic.
- **Hybridization of existing positons,** such as medical assistant and scribe; nursing assistant and phlebotomist.



Skills in Demand

Employer job advertisements also provide an insight into the top skills that are required and preferred for Healthcare positions in the region. Patient care is the top specialized skill listed in 27% of employer job postings in the Inland Empire. Other skills in greatest demand are also shown in Exhibit 17.

Exhibit 17 – Top Specialized Skills Listed in Health care Job Ads, Percent of all postings (n= 22,151)



Education and Training Gap Analysis

The number of students completing education and training programs related to Healthcare was analyzed to determine if postsecondary institutions are supplying enough students to meet workforce demand.

Available programs and completions

There are 56 postsecondary education institutions and other training providers in the Inland Empire region with programs for the 55 Healthcare occupations identified for this study. These institutions are located primarily in the Metropolitan San Bernardino and western areas of San Bernardino and Riverside Counties. A limited number of training providers are located in the desert areas of the region. Appendix D provides the full list of the training institutions.

Collectively, these education and training institutions conferred over 11,800 program awards, ranging from occupational course credits to formal degrees. Most of these awards were given to students in Metro San Bernardino, West End San Bernardino County and Western Riverside County sub regions (Exhibit 18).

Exhibit 18 – Number of Completers of Relevant Healthcare Programs by Sub Region

Sub region	Number of Completers (2016)
Metro San Bernardino	3,625
West End San Bernardino	4,063
Western Riverside	2,251
Eastern Desert	1,334
Southwest Riverside	359
High Desert	160
Other	70
Total	11,862

Of all of the awards conferred by the educational institutions in the region, almost one-third was conferred as credits for Regional Occupational Program courses, followed by postsecondary certificate awards of at least one but less than two academic years (22%) and those of less than one academic year (16%). Exhibit 19 provides the number of completers for each award level.

Exhibit 19 – Number of Completers by Award Level

Award/Degree Level	Number of Completers (2016)
ROP Course	3,501
Award of less than 1 academic year	1,810
Award of at least 1 but less than 2 academic years	2,735
Award of at least 2 but less than 4 academic years	225
Associate degree	1,354
Bachelor's degree	1,270
Post baccalaureate certificate	11
Master's degree	395
Post-masters certificate	9
Doctoral degree	552
Total	11,862

Of the 55 occupations of study, 46 were found to have matching programs with completers in the region. The largest number of awards were conferred for medical assistants (1,719), registered nurses (1,283), and EMTs and paramedics (1,239). Other occupations with many completers included LVNs, dental assistants, medical secretaries and nursing assistants. Exhibit 20 shows the top 20 occupations with the largest number of completers in the region.

Exhibit 20 – Top 20 occupations with Education/Training Program Completers in the Region

Occupation	Number of Completers (2016)
Medical Assistants	1,719
Registered Nurses	1,283
Emergency Medical Technicians and Paramedics	1,239
Licensed Vocational Nurses	866
Dental Assistants	668
Medical Secretaries	525
Nursing Assistants	339
Pharmacy Aides	273
Medical and Health Services Managers	258
Respiratory Therapists	198
Pharmacy Technicians	191
Medical Records and Health Information Technicians	190
Massage Therapists	189
Veterinary Technologists and Technicians	181
Mental Health and Substance Abuse Social Workers	180
Surgical Technologists	173
Dentists, General	171
Dietitians and Nutritionists	138
Diagnostic Medical Sonographers	130
Physical Therapists	118

Some of the courses offered by ROPs in the region were not occupation specific but rather exploratory in nature Healthcare Occupations. These exploratory courses were completed by 1,564 students in the region providing a pipeline of high school students into the Healthcare education programs.

Identified Gaps

Upon matching of the projected 2016 annual openings with annual (2016) completion in the region, training gaps between workforce supply and workforce demand for each occupation was identified⁶. Exhibit 21 shows all Healthcare occupations that are projected to experience undersupply of education/trained workers in the region by at least 20 positions. Twenty-nine occupations are likely to have training gaps. Registered nurses and nursing assistants are projected to have the highest number of shortages, followed by social/human service assistants, medical secretaries and Healthcare social workers.

⁶ Occupations that require no formal education were excluded from the training gap analysis because completions cannot be utilized as a measure of “supply” in this case. These occupations are Personal Care Aides and Home Health Aides.

Exhibit 21 – Occupations with the Annual Training Undersupply in the Inland Empire

Description	Typical Entry Level Education	Annual Openings	Regional Completions (2016)	Undersupply
Nursing Assistants	Postsecondary non degree award	1,529	339	(1,190)
Registered Nurses	Bachelor's degree	2,442	1,283	(1,159)
Social and Human Service Assistants	High school diploma or equivalent	511	75	(436)
Medical Secretaries	High school diploma or equivalent	888	525	(363)
Health care Social Workers	Master's degree	251	3	(248)
Mental Health Counselors	Master's degree	242	25	(217)
Pharmacy Technicians	High school diploma or equivalent	401	191	(210)
Veterinary Assistants and Laboratory Animal Caretakers	High school diploma or equivalent	191	23	(168)
Massage Therapists	Postsecondary non degree award	352	189	(163)
Phlebotomists	Postsecondary non degree award	160	14	(146)
Medical and Clinical Laboratory Technicians	Associate degree	110	0	(110)
Pharmacists	Doctoral or professional degree	187	79	(108)
Family and General Practitioners	Doctoral or professional degree	307*	189**	(118)
Psychiatric Technicians	Postsecondary non degree award	119	24	(95)
Dental Hygienists	Associate degree	161	93	(68)
Community Health Workers	High school diploma or equivalent	64	0	(64)
Physical Therapist Aides	High school diploma or equivalent	91	30	(61)
Radiologic Technologists	Associate degree	142	91	(51)
Medical and Clinical Laboratory Technologists	Bachelor's degree	63	18	(45)
Cardiovascular Technologists and Technicians	Associate degree	43	0	(43)
Occupational Therapists	Master's degree	81	38	(43)
Medical and Health Services Managers	Bachelor's degree	301	258	(43)
Occupational Therapy Assistants	Associate degree	35	0	(35)
Veterinarians	Doctoral or professional degree	35	0	(35)

Physical Therapist Assistants	Associate degree	74	44	(30)
Nurse Practitioners	Master's degree	124	95	(29)
Ophthalmic Medical Technicians	Postsecondary non degree award	24	0	(24)
Physical Therapists	Doctoral or professional degree	139	118	(21)
Optometrists	Doctoral or professional degree	20	0	(20)

*Source: 2017 Burning Glass Physician Position Openings. Using traditional data sources, the demand numbers for family and general practitioners were underestimated, as job postings data indicate larger demand for the Inland Empire region and the subregions; hence, an alternative, reliable data set was utilized for this occupation.

**Source: 2017 Loma Linda University School of Medicine and University of California Riverside School of Medicine total completions

While some of the occupations with insufficient program completions require a 4-year degree and above, the majority only need a high school diploma with some on-the-job-training, certificate completion or an associate degree. Thus, opportunities exist to close these gaps quickly by expanding or initiating relevant programs through the region's Regional Occupational Programs, community colleges, and other private post-secondary institutions. The following is the list of occupations that show gaps, but require less than a Bachelor's degree:

- Nursing Assistants
- Social and Human Service Assistants
- Medical Secretaries
- Pharmacy Technicians
- Veterinary Assistants and Laboratory Animal Caretakers
- Massage Therapists
- Phlebotomists
- Medical and Clinical Laboratory Technicians
- Psychiatric Technicians
- Dental Hygienists
- Community Health Workers
- Physical Therapist Aides
- Radiologic Technologists
- Cardiovascular Technologists and Technicians
- Occupational Therapists
- Occupational Therapy Assistants
- Physical Therapist Assistants
- Ophthalmic Medical Technicians
- Veterinary Technologists and Technicians

Among the occupations that show an oversupply of the trained/educated workforce by at least 20 completers are EMTs/Paramedics, medical assistants, pharmacy aides, and veterinary technologists/technicians.

Exhibit 22 - Occupations with the Annual Training Oversupply in the Inland Empire

Description	Typical Entry Level Education	Annual Openings	Regional Completions (2016)	Oversupply
Emergency Medical Technicians and Paramedics	Postsecondary non degree award	241	1,239	998
Medical Assistants	Postsecondary non degree award	1,077	1,719	642
Pharmacy Aides	High school diploma or equivalent	83	273	190
Veterinary Technologists and Technicians	Associate degree	79	181	102
Respiratory Therapists	Associate degree	109	198	89
Diagnostic Medical Sonographers	Associate degree	48	130	82
Dentists, General	Doctoral or professional degree	102	171	69
Audiologists	Doctoral or professional degree	6	70	64
Surgical Technologists	Postsecondary non degree award	114	173	59
Dietitians and Nutritionists	Bachelor's degree	81	138	57
Surgeons	Doctoral or professional degree	12	68	56
Medical Records and Health Information Technicians	Postsecondary non degree award	150	190	40
Licensed Vocational Nurses	Postsecondary non degree award	841	866	25
Health Educators	Bachelor's degree	80	103	23

Appendix F provides the gap analysis for all 55 occupations by the level of education.

Sub regional Gap Analysis ⁷

Metro San Bernardino County

In Metro San Bernardino Sub region, there are nine occupations that show undersupply of trained workforce by at least 20 workers for each occupation. Occupations with the largest training gaps include nursing assistants, registered nurses, and social and human services assistants. Many occupations that experience shortages require a certificate or a high school diploma. These include nursing assistants, LVNs, social and human service assistants, phlebotomists, and massage therapists. Exhibit 23 shows all occupations with a shortage of at least 20 trained workers. Occupations that require no formal education were excluded from this analysis.

Exhibit 23 – Occupations with the Annual Training Undersupply in Metro San Bernardino County

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Nursing Assistants	Postsecondary non degree award	370	35	(335)
Registered Nurses	Bachelor's degree	462	373	(89)
Social and Human Service Assistants	High school diploma or equivalent	106	50	(56)
Licensed Vocational Nurses	Postsecondary non degree award	140	84	(56)
Health care Social Workers	Master's degree	53	0	(53)
Phlebotomists	Postsecondary non degree award	38	0	(38)
Massage Therapists	Postsecondary non degree award	28	0	(28)
Veterinary Assistants and Laboratory Animal Caretakers	High school diploma or equivalent	25	0	(25)
Pharmacy Technicians	High school diploma or equivalent	46	24	(22)

Metro San Bernardino area is home to large universities that educate health professionals, such as medical doctors, dentists, and others. Hence, it may seem that many occupations with the highest education requirements are in oversupply in this sub region. However, these professional are likely to obtain employment across the Inland Empire region and beyond. Some of the occupations that require less education and show more completers than projected openings include EMT and paramedics, medical and health services managers, medical secretaries, and dental assistants. (Exhibit 24)

⁷ The Subregional demand numbers for Family and General Practitioners are available only for the Inland Empire as a whole (see page 21).

Exhibit 24 – Occupations with the Annual Training Oversupply in Metro San Bernardino

Description	Typical Entry Level Education	Annual Openings	Regional Completions (2016)	Oversupply
Emergency Medical Technicians and Paramedics	Postsecondary non degree award	18	303	285
Medical and Health Services Managers	Bachelor's degree	47	182	135
Dietitians and Nutritionists	Bachelor's degree	10	113	103
Physical Therapists	Doctoral or professional degree	21	118	97
Family and General Practitioners	Doctoral or professional degree	6	100	94
Medical Secretaries	High school diploma or equivalent	136	207	71
Health Educators	Bachelor's degree	12	80	68
Surgeons	Doctoral or professional degree	2	68	66
Dental Assistants	Postsecondary non degree award	98	159	61
Dental Hygienists	Associate degree	22	81	59
Pharmacists	Doctoral or professional degree	29	79	50
Respiratory Therapists	Associate degree	25	74	49
Nurse Practitioners	Master's degree	17	59	42
Radiologic Technologists	Associate degree	23	65	42
Physical Therapist Assistants	Associate degree	11	44	33
Speech-Language Pathologists	Master's degree	14	47	33
Medical Assistants	Postsecondary non degree award	147	179	32
Physician Assistants	Master's degree	8	37	29
Occupational Therapists	Master's degree	14	38	24

Education and training program institutions with completers in Metro San Bernardino Sub region include:

- California State University-San Bernardino
- Colton-Redlands-Yucaipa Regional Occupational Program
- Concorde Career College-San Bernardino
- Crafton Hills College
- Everest College-San Bernardino
- Loma Linda University
- San Bernardino County Superintendent of Schools Regional Occupational Program
- San Bernardino Valley College
- University of Redlands

West End San Bernardino County

The West End areas of San Bernardino County have significant shortages of educated workers across many occupations. Top twenty occupations with gaps are shown in Exhibit 25. Registered nurses, nursing assistants, social and human service assistants, and medical secretaries are among them. (Exhibit 25)county

Exhibit 25 – Occupations with the Annual Training Undersupply in West End San Bernardino County

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Registered Nurses	Bachelor's degree	705	342	(363)
Nursing Assistants	Postsecondary non degree award	352	101	(251)
Social and Human Service Assistants	High school diploma or equivalent	106	2	(104)
Medical Secretaries	High school diploma or equivalent	264	165	(99)
Medical and Health Services Managers	Bachelor's degree	92	12	(80)
Health care Social Workers	Master's degree	61	0	(61)
Mental Health Counselors	Master's degree	52	0	(52)
Pharmacists	Doctoral or professional degree	49	0	(49)
Massage Therapists	Postsecondary non degree award	107	58	(49)
Pharmacy Technicians	High school diploma or equivalent	103	56	(47)
Nurse Practitioners	Master's degree	44	0	(44)
Dental Hygienists	Associate degree	44	0	(44)
Physical Therapists	Doctoral or professional degree	43	0	(43)
Phlebotomists	Postsecondary non degree award	42	0	(42)
Mental Health and Substance Abuse Social Workers	Bachelor's degree	40	0	(40)
Veterinary Assistants and Laboratory Animal Caretakers	High school diploma or equivalent	40	0	(40)
Medical and Clinical Laboratory Technicians	Associate degree	33	0	(33)
Dentists, General	Doctoral or professional degree	30	0	(30)
Physical Therapist Aides	High school diploma or equivalent	27	0	(27)
Speech-Language Pathologists	Master's degree	25	0	(25)

The number of annual completers exceeds the annual job openings for ten of the 55 occupations in West End San Bernardino County. These include medical assistants, EMTs and paramedics, LVNs, pharmacy aides, and veterinary technologists. (Exhibit 26)

Exhibit 26 – Occupations with the Annual Training Oversupply in West End San Bernardino County

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Oversupply
Medical Assistants	Postsecondary non degree award	367	670	303
Emergency Medical Technicians and Paramedics	Postsecondary non degree award	34	330	296
Licensed Vocational Nurses	Postsecondary non degree award	237	498	261
Pharmacy Aides	High school diploma or equivalent	21	260	239
Veterinary Technologists and Technicians	Associate degree	17	156	139
Respiratory Therapists	Associate degree	26	98	72
Medical Records and Health Information Technicians	Postsecondary non degree award	43	101	58
Dental Assistants	Postsecondary non degree award	183	239	56
Diagnostic Medical Sonographers	Associate degree	13	45	32
Medical Transcriptionists	Postsecondary non degree award	16	38	22

Education and training programs with completers in West End San Bernardino include:

- American Career College-Ontario
- Argosy University-Inland Empire
- Baldy View ROP
- Chaffey College
- Everest College-Ontario
- Platt College-Ontario
- San Bernardino County Superintendent of Schools ROP
- San Joaquin Valley College-Ontario
- Summit College
- United Education Institute-Ontario



High Desert

- The High Desert areas are characterized by limited occupational demand compared to other areas and very few training providers. Gaps and oversupplies are relatively small for most occupations – less than 20 workers/positions. Occupations with the largest training gaps in the High Desert areas are nursing assistants, dental assistants, medical secretaries, and others. (Exhibit 33)

Exhibit 33 – Occupations with the Annual Training Undersupply in High Desert

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Nursing Assistants	Postsecondary non degree award	71	0	(71)
Dental Assistants	Postsecondary non degree award	56	0	(56)
Medical Secretaries	High school diploma or equivalent	53	0	(53)
Medical Assistants	Postsecondary non degree award	56	7	(49)
Licensed Vocational Nurses	Postsecondary non degree award	42	0	(42)
Pharmacy Technicians	High school diploma or equivalent	35	0	(35)
Massage Therapists	Postsecondary non degree award	21	0	(21)

- The respiratory therapist occupation is the only occupation with possible oversupply in High Desert. (Exhibit 34)

Exhibit 34 – Occupations with the Annual Training Oversupply in High Desert

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Oversupply
Respiratory Therapists	Associate degree	7	26	19

- The only education and training provider in High Desert Sub region is Victor Valley Community College.

Western Riverside County

In Western Riverside County, the training gaps are similar to those of the region overall and other sub regions, including the shortages of nursing assistants, registered nurses, medical secretaries, social and human service assistants, and Healthcare social workers. (Exhibit 27)

Exhibit 27 – Occupations with the Annual Training Undersupply in Western Riverside County

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Nursing Assistants	Postsecondary non degree award	348	80	(268)
Registered Nurses	Bachelor's degree	565	319	(246)
Medical Secretaries	High school diploma or equivalent	210	65	(145)
Social and Human Service Assistants	High school diploma or equivalent	132	23	(109)
Health care Social Workers	Master's degree	68	3	(65)
Mental Health Counselors	Master's degree	53	0	(53)
Pharmacists	Doctoral or professional degree	38	0	(38)
Licensed Practical and Licensed Vocational Nurses	Postsecondary non degree award	187	152	(35)
Radiologic Technologists	Associate degree	34	0	(34)
Massage Therapists	Postsecondary non degree award	85	52	(33)
Phlebotomists	Postsecondary non degree award	31	0	(31)
Physical Therapists	Doctoral or professional degree	28	0	(28)
Psychiatric Technicians	Postsecondary non degree award	27	0	(27)
Dental Hygienists	Associate degree	39	12	(27)
Dental Assistants	Postsecondary non degree award	164	139	(25)
Medical and Clinical Laboratory Technicians	Associate degree	25	0	(25)
Respiratory Therapists	Associate degree	24	0	(24)
Dentists, General	Doctoral or professional degree	24	0	(24)

There are only a few occupations that are projected to have an oversupply of at least 20 trained workers in Western Riverside. These include EMT and paramedics, medical assistants, surgical technologists, and diagnostic medical sonographers, among others. (Exhibit 28)

Exhibit 28 – Occupations with the Annual Training Oversupply in Western Riverside County

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Oversupply
Emergency Medical Technicians and Paramedics	Postsecondary non degree award	120	323	203
Medical Assistants	Postsecondary non degree award	262	450	188
Surgical Technologists	Postsecondary non degree award	27	90	63
Diagnostic Medical Sonographers	Associate degree	11	52	41
Medical Records and Health Information Technicians	Postsecondary non degree award	35	75	40
Pharmacy Technicians	High school diploma or equivalent	77	111	34

Education and training programs with completers in Western Riverside County include:

- American College of Health care
- Brightwood College-Riverside
- California Baptist University
- InterCoast Colleges-Riverside
- La Sierra University
- Moreno Valley College
- North-West College-Riverside
- Platt College-Riverside
- Riverside City College
- Riverside County Office of Education - Area 2
- UEI College-Riverside

Eastern Desert

The Eastern Desert areas of the Inland Empire region are characterized by generally low labor market demand compared to other areas. Interestingly, unlike in other sub regions, the top occupations with shortages do not include nursing assistants. (Exhibit 29)

Exhibit 29 – Occupations with the Annual Training Undersupply in Eastern Desert

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Registered Nurses	Bachelor's degree	232	80	(152)
Social and Human Service Assistants	High school diploma or equivalent	48	0	(48)
Pharmacy Technicians	High school diploma or equivalent	46	0	(46)
Mental Health Counselors	Master's degree	30	0	(30)

Medical and Health Services Managers	<i>Bachelor's degree</i>	27	0	(27)
Psychiatric Technicians	<i>Postsecondary non degree award</i>	24	0	(24)
Veterinary Assistants and Laboratory Animal Caretakers	<i>High school diploma or equivalent</i>	22	0	(22)
Pharmacists	<i>Doctoral or professional degree</i>	21	0	(21)
Health care Social Workers	<i>Master's degree</i>	20	0	(20)

Sub regional oversupply of trained workers exists in six occupations of study. Medical assistants top this list, with over four completers for each projected job opening. (Exhibit 30)

Exhibit 30 – Occupations with the Annual Training Oversupply in Eastern Desert

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Oversupply
Medical Assistants	<i>Postsecondary non degree award</i>	103	413	310
Emergency Medical Technicians and Paramedics	<i>Postsecondary non degree award</i>	14	104	90
Dental Assistants	<i>Postsecondary non degree award</i>	48	131	83
Mental Health and Substance Abuse Social Workers	<i>Bachelor's degree</i>	22	101	79
Licensed Practical and Licensed Vocational Nurses	<i>Postsecondary non degree award</i>	73	132	59
Massage Therapists	<i>Postsecondary non degree award</i>	27	79	52

Education and training program providers with completions in Eastern Desert include:

- Beaumont Adult School
- Brightwood College-Palm Springs
- California Nurses Educational Institute
- College of the Desert
- Copper Mountain Community College
- Mayfield College
- Milan Institute-Palm Desert
- Palo Verde College
- Riverside County Office of Education-School of Career Education
- San Bernardino County Superintendent of Schools ROP

Southwest Riverside

In Southwest Riverside County Sub region, anticipated shortages largely mirror those in the Inland Empire region - registered nurses, nursing assistants, LVNs, pharmacy technicians, mental health counselors, etc. are in undersupply. However, while in other sub regions medical assistants are expected to be in oversupply, this occupation is projected to have shortages in the Southwest Riverside County areas as no medical assisting training is offered here. (Exhibit 31)

Exhibit 31 – Occupations with the Annual Training Undersupply in Southwest Riverside

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Undersupply
Registered Nurses	Bachelor's degree	163	47	(116)
Medical Assistants	Postsecondary non degree award	86	0	(86)
Nursing Assistants	Postsecondary non degree award	86	0	(86)
Dental Assistants	Postsecondary non degree award	70	0	(70)
Medical Secretaries	High school diploma or equivalent	74	15	(59)
Licensed Vocational Nurses	Postsecondary non degree award	54	0	(54)
Massage Therapists	Postsecondary non degree award	52	0	(52)
Pharmacy Technicians	High school diploma or equivalent	41	0	(41)
Social and Human Service Assistants	High school diploma or equivalent	40	0	(40)
Mental Health Counselors	Master's degree	28	0	(28)
Veterinary Assistants and Laboratory Animal Caretakers	High school diploma or equivalent	27	0	(27)
Medical and Health Services Managers	Bachelor's degree	22	0	(22)

The only occupation that is expected to have sizable oversupply in Southwest Riverside is EMT and paramedics. (Exhibit 32)

Exhibit 32 – Occupations with the Annual Training Oversupply in Southwest Riverside

Description	Typical Entry Level Education	Annual Openings	Completions (2016)	Oversupply
Emergency Medical Technicians and Paramedics	Postsecondary non degree award	12	104	92

Education and training program providers with completions in Southwest Riverside County Sub region include:

- Mt San Jacinto Community College District
- Riverside County Office of Education - Area 1
- Riverside County Office of Education - Area 3

Workforce Equity Gaps

Health care employers are increasingly striving to build a workforce that is representative of the diverse regional populations. In order to measure whether or not the current workforce ethnic and racial composition reflects the ethnic and racial composition of the regional population, the relative shares of each were compared for each occupation.

The look at the racial and ethnic composition of the overall Healthcare workforce in 2017 reveals that equity gaps exist, primarily for the Hispanic/Latino populations. For example, Hispanics make up almost half of the total regional population, but comprise only one-third of the health sector workforce. The ethnic gaps for higher education/higher wage occupations have slightly decreased demonstrating a positive change. For example, Hispanics currently represent 18% of the Registered Nursing workforce compared to 12% in 2012. However, this is still far from being representative of the region’s population (Exhibit 35).

Exhibit 35 - Racial and Ethnic Composition of Inland Empire Population, Health Workforce and RNs

Race/Ethnicity	% of Population	% of Health care Workforce	% of Registered Nurses
White	32.9%	39.0%	45.6%
Hispanic or Latino	45.8%	33.8%	18.3%
Asian	7.2%	16.7%	26.6%
Black or African American	8.2%	8.4%	7.6%
Two or More Races	3.5%	1.4%	1.4%
American Indian or Alaska Native	1.9%	0.3%	0.3%
Native Hawaiian or Other Pacific Islander	0.5%	0.3%	0.2%

The analysis of ethnic composition by occupation shows that the Hispanic/Latino and Black/African American populations are underrepresented across many of the Healthcare occupations. The gaps in Hispanic/Latino representation exist in 51 of the 55 occupations, with double-digit percentage point difference between those employed in the occupation and the share of total population. The gaps for Blacks/African Americans exist for at least 30 occupations. However, most gaps are not significant, ranging between 1 to 10 percentage points.

Exhibit 36 presents the top 20 Healthcare occupations with the largest equity gaps for Hispanic/Latino populations. The data demonstrates significant underrepresentation of this demographic group in the occupations with the highest educational requirements, such as bachelor's and doctoral degrees. Among those occupations that require less than a bachelor's degree, occupations with significant underrepresentation among Hispanics include medical transcriptionists, occupational therapy assistants, respiratory therapists, medical and clinical laboratory technicians, and psychiatric technicians.

Exhibit 36 – Top 20 Occupations with the Largest Employment Equity Gaps for Hispanic/Latino Workforce

Description	Typical Entry Level Education	Hispanic/Latino % of Occupation	Hispanic/Latino Equity Gaps (Difference between % in occupation and % in population)
Optometrists	Doctoral or professional degree	10%	(36%)
Pharmacists	Doctoral or professional degree	13%	(33%)
Veterinarians	Doctoral or professional degree	13%	(33%)
Nurse Anesthetists	Master's degree	15%	(31%)
Physical Therapists	Doctoral or professional degree	15%	(31%)
Psychiatrists	Doctoral or professional degree	15%	(30%)
Anesthesiologists	Doctoral or professional degree	16%	(30%)
Family and General Practitioners	Doctoral or professional degree	16%	(30%)
Surgeons	Doctoral or professional degree	16%	(30%)
Occupational Therapists	Master's degree	16%	(30%)
Registered Nurses	Bachelor's degree	18%	(28%)
Nurse Practitioners	Master's degree	18%	(27%)
Dentists, General	Doctoral or professional degree	20%	(25%)
Medical Transcriptionists	Postsecondary non degree award	22%	(24%)
Speech-Language Pathologists	Master's degree	22%	(23%)
Occupational Therapy Assistants	Associate degree	23%	(23%)
Medical and Clinical Laboratory Technologists	Bachelor's degree	24%	(22%)
Respiratory Therapists	Associate degree	25%	(21%)
Medical and Clinical Laboratory Technicians	Associate degree	26%	(20%)
Psychiatric Technicians	Postsecondary non degree award	27%	(19%)

Cross-Ranking: Top Occupations with Most Job Opportunities and Gaps

The following three main factors were selected for cross-ranking of occupations: labor market demand measured using annual job openings, training undersupply or gap, and ethnic diversity gaps. All 55 occupations were ranked for each factor; then the overall ranking was determined. The highest ranked occupations are registered nurses, pharmacists, massage therapists, mental health counselors and nursing assistants.

Exhibit 37 – Top 20 Occupations with the Highest Ranking across Three Factors

Occupations	Overall Rank	Rank by Most Job Openings	Rank by Largest Training Gaps	Rank by Largest Equity Gaps
Registered Nurses	1	2	2	11
Pharmacists	2	17	14	2
Massage Therapists	3	11	11	22
Mental Health Counselors	4	14	8	29
Nursing Assistants	5	3	3	46
Medical Secretaries	6	5	6	42
Medical and Health Services Managers	7	12	23	23
Physical Therapists	8	23	30	5
Dental Hygienists	9	19	16	24
Medical and Clinical Laboratory Technicians	10	27	13	19
Health care Social Workers	11	13	7	40
Psychiatric Technicians	12	25	15	20
Pharmacy Technicians	13	10	9	43
Nurse Practitioners	14	24	27	12
Social and Human Service Assistants	15	9	5	49
Occupational Therapists	16	33	22	10
Veterinary Assistants and Laboratory Animal Caretakers	17	16	10	41
Radiologic Technologists	18	22	19	27
Veterinarians	19	46	25	3
Medical and Clinical Laboratory Technologists	20	40	20	17

GIS Mapping for Top 10 Occupations

This report provides geographic mapping of labor market demand and training supply by sub region. Each of the ten maps profiles gap analysis for the ten occupations with the largest training shortages. Only occupations that require some postsecondary education and show completions were included in the 10 occupations that were mapped.

Conclusion and Recommendations

As articulated in IERC strategic plan, the Inland Empire's projected considerable growth in population and economic power by 2030 sets the stage for bold and important opportunities for economic development in the Healthcare sector – a singular moment in time to build a virtual Silicon Valley of Health care.

The greater Inland Empire region already possesses a wealth of resources – three medical schools (and three more in planning and implementation stages), numerous Allied Health and Public Health educational facilities, a fledgling biotech sector in Southwest Riverside County, a strong intermediary in the Inland Health Professions Coalition, and a growing population of residents who are desirous to enter training and educational programs that lead to sustainable wage jobs and careers.

The Health Industry SlingShot recommendations are as follows:

Use of this report

This report contains sub regional data that may vary from other sub regions. This should be considered when planning the location and need of training programs.

Address the Nursing Shortage

The Inland Empire has a shortage of 1,499 Registered Nurses, and 1,190 Nursing Assistants (total of 2,689 open positions in nursing professions alone). Suggested strategies include:

- Convene clinical site coordinators to discuss and explore alternative site placements for nursing programs and report back to WDB.
 - Discuss options for funding of LVN programs and bring down costs (i.e., Office of Statewide Health Planning and Development, California Hospital Association, nursing unions, California Association Nurses, United Nurses Association of CA)
 - Create a forum with Community Colleges to discuss the possibility of summer classes for students of merit to begin foundation classes leading to preferential admissions to the nursing program.

Advance Soft Skills Training

- Train County Workforce Development Board Business Services Representatives (BSR's) to inform and advise employers of the existence of Workforce Readiness Credential to use as pre-employment and incumbent training.

Champion the Role and Education of Community Health Workers

- Recruit the partners such as Community Health Association Inland Southern Region, Hospital Association of Southern California and *Promotores* to explore the viability and utility of the Community Health Worker Core Consensus (C3) Project to lift, support, and build awareness of CHWs as a valued part of the health workforce in the community, clinic, and acute care setting.

Alignment with Statewide Initiative

- Assign Reach Out as the Health Industry Consultant to participate in the California Future Health Workforce Commission at the state level, which is developing a blueprint for the modern health workforce in California. Consultant will bring back recommendations for implementation strategies including standardization and expansion of CHW engagement.

WDB Staffing Support for Health Industry Sector

- Continue to contract with the SlingShot Health industry consultant, Reach Out, as a strategy that will be embedded in long-term practice. Create exchange points between the Health Industry Consultant and the Business Service Representatives to bring greater value to the health industry sector. Create time for Health industry consultant to provide ongoing information exchange to the BSRs working with Healthcare employers. Create more opportunities for cross-pollination of ideas and services; for example, communication between training providers and employers in need of employees, and customized training needs.

Advancement of Technology

- Continue to offer and enhance Health Information Technology training that is responsive to employer needs in the Inland Empire.

Health Workforce Training Data

- The Inland Empire has a large gap in the ability to capture data from small- to mid-size health training organizations, including both independent training providers, as well as some Regional Occupational Programs. Without this data, it will be difficult to perform accurate reporting on overage/shortage data for the region. It is recommended that the Inland Empire Regional Planning Unit develop a collaborative system to work with training providers, and to incentivize their participation in shared data collection.

Appendix A – Occupations and Job Titles

SOC	Description	Other Common Titles
Doctoral or professional degree		
29-1021	Dentists, General	Associate Dentist, Dental Surgery Doctor (DDS), Dentist, Dentist/Owner, Doctor of Dental Medicine (DMD), Doctor of Dental Surgery (DDS), Family Dentist, General Dentist, General Dentist/Owner, Pediatric Dentist
29-1041	Optometrists	Chief, Optometry Service; Doctor of Optometry (OD); Eye Clinic Manager; Independent Contractor; Optometrist; Optometrist, Owner; Optometrist, President/Practice Owner; Optometrist/Practice Owner
29-1051	Pharmacists	Clinical Pharmacist; Hospital Pharmacist; Outpatient Pharmacy Manager; Pharmacist; Pharmacist in Charge (PIC); Pharmacist in Charge, Owner (PIC, Owner); Pharmacy Informaticist; Registered Pharmacist; Staff Pharmacist; Staff Pharmacist, Hospital
29-1061	Anesthesiologists	Anesthesia Associate, Anesthesia Director, Anesthesia Resident, Anesthesiologist, Attending Anesthesiologist, Medical Doctor (MD), Obstetrical Anesthesiologist, Physician Anesthesiologist, Staff Anesthesiologist, Staff Anesthetist
29-1062	Family and General Practitioners	Board Certified Family Physician, Family Medicine Physician, Family Physician, Family Practice Medical Doctor (FP MD), Family Practice Physician, Family Practitioner, Medical Doctor (MD), Medical Staff Physician, Physician, Primary Care Physician
29-1066	Psychiatrists	Adult Psychiatrist, Child & Adolescent Psychiatrist, Child Psychiatrist, Clinical Director, Consulting Psychiatrist, Medical Doctor (MD), Outpatient Psychiatrist, Prison Psychiatrist, Psychiatrist, Staff Psychiatrist
29-1067	Surgeons	Cardiovascular Surgeon, General Surgeon, Hand Surgeon, Orthopedic Surgeon, Orthopedic Surgeon, Physician, Plastic Surgeon, Surgeon, Thoracic Surgeon, Vascular Surgeon
29-1123	Physical Therapists	Chief Physical Therapist; Home Care Physical Therapist; Outpatient Physical Therapist; Pediatric Physical Therapist; Per Diem Physical Therapist; Physical Therapist (PT); Physical Therapist, Director of Rehabilitation; Registered Physical Therapist (RPT); Rehabilitation Services Director; Staff Physical Therapist (Staff PT)
29-1131	Veterinarians	Associate Veterinarian, Doctor of Veterinary Medicine (DVM), Emergency Veterinarian, Equine Vet (Equine Veterinarian), Mixed Animal Veterinarian, Small Animal Veterinarian, Staff Veterinarian, Veterinarian (VET), Veterinary Medicine Doctor (DVM), Veterinary Surgeon
29-1181	Audiologists	Audiologist, Audiology Director, Audiology Doctor (AUD), Certificate of Clinical Competence in Audiology Licensed Audiologist (CCC-A Licensed Audiologist), Clinical Audiologist, Clinical Director, Dispensing Audiologist, Doctor of Audiology, Educational Audiologist, Pediatric Audiologist
Master's degree		
21-1014	Mental Health Counselors	Behavior Analyst, Behavior Support Specialist (BSS), Case Manager, Clinician, Correctional Counselor, Counselor, Mental Health Counselor, Mental Health Specialist, Mental Health Therapist, Therapist
21-1022	Health care Social Workers	Clinical Social Worker, Dialysis Social Worker, Director of Social Work, Hospice Social Worker, Medical Social Worker, Nephrology Social Worker, Oncology Social Worker, Renal Social Worker, Social Work Case Manager, Social Worker
29-1071	Physician Assistants	Certified Physician Assistant (PA-C), Clinical Physician Assistant, Family Practice Physician Assistant, General Surgery Physician Assistant, Midlevel Provider, Orthopedic Physician Assistant, Physician Assistant Certified (PAC), Physician Extender, Physician's Assistant, Surgical Physician Assistant

SOC	Description	Other Common Titles
29-1122	Occupational Therapists	Assistive Technology Trainer, Early Intervention Occupational Therapist, Industrial Rehabilitation Consultant, Occupational Therapist (OT), Occupational Therapy Co-Director, Pediatric Occupational Therapist, Registered Occupational Therapist, Rehabilitation Supervisor, Staff Occupational Therapist, Staff Therapist
29-1127	Speech-Language Pathologists	Bilingual Speech-Language Pathologist, Communication Specialist, Educational Speech-Language Clinician, Speech and Language Clinician, Speech and Language Specialist, Speech Pathologist, Speech Therapist, Speech-Language Pathologist (SLP), Speech/Language Therapist, Teacher of the Speech and Hearing Handicapped
29-1151	Nurse Anesthetists	Certified Registered Nurse Anesthetist (CRNA); Chief Certified Registered Nurse Anesthetist (Chief CRNA); Chief Nurse Anesthetist; Nurse Anesthetist; Professor/Nurse Anesthetist; Senior Certified Registered Nurse Anesthetist (Senior CRNA); Staff Certified Registered Nurse Anesthetist (Staff CRNA); Staff Certified Registered Nurse Anesthetist, Anesthesia Service (Staff CRNA, Anesthesia Service); Staff Nurse Anesthetist
29-1171	Nurse Practitioners	Acute Care Nurse Practitioner; Adult Nurse Practitioner; Advanced Practice Registered Nurse (APRN); Family Nurse Practitioner; Family Practice Certified Advanced Registered Nurse Practitioner; Gastroenterology Nurse Practitioner; Nurse Practitioner; Nurse Practitioner, Adult; Pediatric Nurse Practitioner; Women's Health Care Nurse Practitioner
Bachelor's degree		
11-9111	Medical and Health Services Managers	Clinical Director, Health Information Management Corporate Director, Health Information Management Director, Health Manager, Mental Health Program Manager, Nurse Manager, Nursing Director, Office Manager, Practice Administrator, Program Manager
21-1023	Mental Health and Substance Abuse Social Workers	Case Manager, Psychotherapist, Substance Abuse Counselor, Therapist
21-1091	Health Educators	Certified Diabetes Educator, Clinical Instructor, Clinical Nurse Educator, Community Health Consultant, Community Health Education Coordinator, Health Promotion Specialist, Public Health Educator
29-1031	Dietitians and Nutritionists	Clinical Dietician, Clinical Dietitian, Correctional Food Service Supervisor, Dietary Manager, Dietitian, Nutritionist, Outpatient Dietitian, Pediatric Clinical Dietician, Registered Dietician, Registered Dietitian
29-1141	Registered Nurses	Charge Nurse, Director of Nursing (DON), Emergency Department RN (Emergency Department Registered Nurse), Oncology RN (Oncology Registered Nurse), Operating Room Registered Nurse (OR RN), Public Health Nurse (PHN), Registered Nurse (RN), School Nurse, Staff Nurse, Staff RN (Staff Registered Nurse)
29-2011	Medical and Clinical Laboratory Technologists	Clinical Laboratory Scientist (CLS); Clinical Laboratory Technologist; Histologist Technologist (MT); Medical Laboratory Technologist (Medical Lab Tech); Medical Microbiologist; Microbiology Technologist; Research Assistant
Associate degree		
29-1126	Respiratory Therapists	Cardiopulmonary Rehabilitation Respiratory Therapist, Cardiopulmonary Technician and EEG Tech (Cardiopulmonary Technician and Electroencephalogram Technician), Clinical Coordinator of Respiratory Therapy, Respiratory Care Practitioner, Respiratory Therapist, Respiratory Therapy Director, Staff Respiratory Therapist, Staff Therapist
29-2012	Medical and Clinical Laboratory Technicians	Clinical Laboratory Scientist, Clinical Laboratory Technician (Clinical Lab Technician), Laboratory Assistant (Lab Assistant), Laboratory Supervisor, Laboratory Technician, Medical Laboratory Technician (MLT), Medical Laboratory Technicians (Medical Lab Technician), Medical Technician

SOC	Description	Other Common Titles
29-2021	Dental Hygienists	Dental Hygienist, Mobile Coordinator; Implant Coordinator; Pediatric Dental Hygienist
29-2031	Cardiovascular Technologists and Technicians	Cardiac Catheterization Laboratory Technologist, Cardiac Catheterization Technician, Cardiac Technician, Cardiology Technician, Cardiopulmonary Technician, Cardiovascular Technician, Cardiovascular Technologist (CVT), Electrocardiogram Technician (EKG Technician),
29-2032	Diagnostic Medical Sonographers	Cardiac Sonographer, Cardiac/Vascular Sonographer, Diagnostic Medical Sonographer, Medical Sonographer, Registered Diagnostic Medical Sonographer, Sonographer, Staff Sonographer, Ultrasonographer, Ultrasound Technician (Ultrasound Tech), Ultrasound Technologist (Ultrasound Tech)
29-2033	Nuclear Medicine Technologists	Certified Nuclear Medicine Technologist (CNMT), Lead Nuclear Medicine Technologist (Lead Nuc Med Tech), Nuclear Cardiology Technologist, Nuclear Medicine PET-CT Technologist (Nuclear Medicine Positron Emission Tomography - Computed Tomography Technologist), Nuclear Medicine Technologist (Nuclear Med Tech), Radiation Safety Officer, Senior Nuclear Medicine Technologist, Staff Nuclear Medicine Technologist, Supervisor Nuclear Medicine
29-2034	Radiologic Technologists	Computed Tomography Technologist (CT Technologist), Mammographer, Mammography Technologist, Radiographer, Radiologic Technologist (RT), Radiological Technologist, Radiology Technologist, Staff Technologist, X-Ray Technologist (X-Ray Tech)
29-2035	Magnetic Resonance Imaging Technologists	Chief Magnetic Resonance Imaging Technologist (Chief MRI Technologist), Magnetic Resonance Imaging Coordinator (MRI Coordinator), Magnetic Resonance Imaging Director, Magnetic Resonance Imaging Quality Assurance Coordinator (MRI Quality Assurance Coordinator), Medical Imaging Director, MRI Specialist (Magnetic Resonance Imaging Specialist), MRI Supervisor (Magnetic Resonance Imaging Supervisor), MRI Technologist (Magnetic Resonance Imaging Technologist)
29-2056	Veterinary Technologists and Technicians	Veterinary Technician, Emergency Veterinary Technician, Internal Medicine Veterinary Technician, Medical Technologist, Veterinary Assistant, Veterinary Laboratory Technician/ Lab Tech, Veterinary Nurse
31-2011	Occupational Therapy Assistants	Acute Care Occupational Therapy Assistant, Occupational Therapist Assistant
31-2021	Physical Therapist Assistants	Home Health Physical Therapist Assistant, Outpatient Physical Therapist Assistant, Per Diem Physical Therapist Assistant, Physical Therapy Technician/Tech, Staff Physical Therapy Assistant
Postsecondary non degree award		
29-2041	Emergency Medical Technicians and Paramedics	Emergency Medical Technician (EMT); Emergency Medical Technician, Basic (EMT, B); Emergency Medical Technician/Driver (EMT/DRIVER); EMT Intermediate (Emergency Medical Technician, Intermediate); EMT, Paramedic (Emergency Medical Technician, Paramedic); EMT/Dispatcher (Emergency Medical Technician/Dispatcher); First Responder; Flight Paramedic; Multi Care Technician (Multi Care Tech); Paramedic
29-2053	Psychiatric Technicians	Behavioral Health Technician, Licensed Psychiatric Technician, Mental Health Assistant, Mental Health Associate, Mental Health Specialist, Mental Health Technician, Mental Health Worker, Residential Aide
29-2055	Surgical Technologists	Certified Surgical Tech/First Assistant, Certified Surgical Technician, Certified Surgical Technologist (CST), Operating Room Surgical Technician (OR St), Operating Room Technician (OR Tech), Operating Room Technologist (OR Tech), Surgical Scrub Technician, Surgical Scrub Technologist (Surgical Scrub Tech), Surgical Technician, Surgical Technologist (Surgical Tech)

SOC	Description	Other Common Titles
29-2057	Ophthalmic Medical Technicians	Ophthalmic Assistant, Ophthalmic Medical Assistant, Ophthalmic Medical Technician, Ophthalmic Technician, Surgical Coordinator
29-2061	Licensed Vocational Nurses	Charge Nurse; Licensed Vocational Nurse (LVN); Private Duty Nurse
29-2071	Medical Records and Health Information Technicians	Medical information technician, application technologist, Health Information Specialist, Health Information Technician/Tech, Medical Records Analyst, Medical Records Clerk, Medical Records Coordinator, Medical Records Director, Medical Records Technician/Tech, Registered Health Information Technician
31-1014	Nursing Assistants	Certified Nursing Assistant (CNA)
31-9011	Massage Therapists	Bodywork Therapist, Clinical Massage Therapist, Integrated Deep Tissue Massage Therapist, Medical Massage Therapist, Therapeutic Massage Technician
31-9091	Dental Assistants	Dental Assistant (DA), Expanded Duty Dental Assistant (EDDA), Expanded Function Dental Assistant, Oral Surgery Assistant, Orthodontic Assistant (Ortho Assistant), Orthodontic Technician, Surgical Dental Assistant
31-9092	Medical Assistants	Clinical Assistant, Doctor's Assistant, Ophthalmic Technician, Optometric Assistant, Optometric Technician
31-9094	Medical Transcriptionists	Medical coder, Clinical Medical Transcriptionist, Documentation Specialist, Medical Language Specialist, Medical Secretary, Medical Transcriber, Medical Transcription, Medical Transcription Supervisor, Medical Transcriptionist, Radiology Transcriptionist, Transcriptionist
31-9097	Phlebotomists	Lab Asst; Patient Service Technician PST; Phlebotomist; Phlebotomist Supervisor/Instructor; Phlebotomist, Medical Lab Assistant; Phlebotomy Director; Phlebotomy Program Coordinator; Phlebotomy Supervisor;
High school diploma or equivalent		
21-1093	Social and Human Service Assistants	Peer and family advocates
21-1094	Community Health Workers	Community Health Outreach Worker, Community Health Program Coordinator, Community Health Program Representative (Community Health Program Rep), Community Health Promoter, Community Health Worker (CHW), Community Nutrition Educator, HIV CTS Specialist (Human Immunodeficiency Virus Counseling and Testing Services Specialist)
29-2052	Pharmacy Technicians	Accredited Pharmacy Technician, Certified Pharmacy Technician (CPhT), Compounding Technician, Lead Pharmacy Tech, Pharmacy Tech, Senior Pharmacy Technician, Inventory Specialist
31-2022	Physical Therapist Aides	Clinical Rehabilitation Aide, Physical Therapist Technician, Physical Therapy Aide, Physical Therapy Attendant, Physical Therapy Technician, Rehabilitation Aide, Rehabilitation Attendant, Restorative Aide, Restorative Care Technician
31-9095	Pharmacy Aides	Ancillary, Certified Pharmacist Assistant, Drug Purchaser, Front Counter Clerk, Pharmacist Assistant, Pharmacy Aide, Pharmacy Ancillary, Pharmacy Assistant, Pharmacy Cashier, Pharmacy Clerk
31-9096	Veterinary Assistants and Laboratory Animal Caretakers	Animal Care Provider, Animal Caregiver, Avian Keeper, Emergency Veterinary Assistant, Research Animal Attendant, Small Animal Caretaker, Technician Assistant, Veterinarian Assistant, Veterinary Assistant (Vet Assistant), Veterinary Technician Assistant (Vet Tech Assistant)
43-6013	Medical Secretaries	Admissions Coordinator, Billing Coordinator, Health Unit Coordinator, Medical Office Specialist, Medical Secretary, Patient Coordinator, Physician Office Specialist, Unit Secretary, Unit Support Representative, Ward Clerk

SOC	Description	Other Common Titles
No formal educational credential		
31-1011	Home Health Aides	Home Attendant, Home Care Aide, Home Health Aide (HHA), Home Health Provider, Hospice/Home Health Aide, In Home Caregiver
39-9021	Personal Care Aides	Caregiver, Home Care Aide, Medication Aide, Patient Care Assistant, Personal Care Assistant, Personal Care Attendant, Resident Care Assistant

Appendix B – Sub regional ZIP Code Areas of the Inland Empire

Eastern Desert

92201	Indio, CA (in Riverside county)	92256	Morongo Valley, CA (in San Bernardino county)
92202	Indio, CA (in Riverside county)	92258	North Palm Springs, CA (in Riverside county)
92203	Indio, CA (in Riverside county)	92262	Palm Springs, CA (in Riverside county)
92210	Indian Wells, CA (in Riverside county)	92263	Palm Springs, CA (in Riverside county)
92230	Cabazon, CA (in Riverside county)	92264	Palm Springs, CA (in Riverside county)
92234	Cathedral City, CA (in Riverside county)	92268	Pioneertown, CA (in San Bernardino county)
92235	Cathedral City, CA (in Riverside county)	92270	Rancho Mirage, CA (in Riverside county)
92236	Coachella, CA (in Riverside county)	92274	Thermal, CA (in Riverside county)
92240	Desert Hot Springs, CA (in Riverside county)	92276	Thousand Palms, CA (in Riverside county)
92241	Desert Hot Springs, CA (in Riverside county)	92277	Twentynine Palms, CA (in San Bernardino)
92247	La Quinta, CA (in Riverside county)	92278	Twentynine Palms, CA (in San Bernardino)
92248	La Quinta, CA (in Riverside county)	92282	Whitewater, CA (in Riverside county)
92252	Joshua Tree, CA (in San Bernardino county)	92284	Yucca Valley, CA (in San Bernardino county)
92253	La Quinta, CA (in Riverside county)	92286	Yucca Valley, CA (in San Bernardino county)
92254	Mecca, CA (in Riverside county)		

High Desert

92307	Apple Valley, CA (in San Bernardino county)	92345	Hesperia, CA (in San Bernardino county)
92308	Apple Valley, CA (in San Bernardino county)	92368	Oro Grande, CA (in San Bernardino county)
92311	Barstow, CA (in San Bernardino county)	92392	Victorville, CA (in San Bernardino county)
92312	Barstow, CA (in San Bernardino county)	92393	Victorville, CA (in San Bernardino county)
92340	Hesperia, CA (in San Bernardino county)	92394	Victorville, CA (in San Bernardino county)
92344	Hesperia, CA (in San Bernardino county)	92395	Victorville, CA (in San Bernardino county)

Southwest Riverside

92530	Lake Elsinore, CA (in Riverside county)	92584	Menifee, CA (in Riverside county)
92531	Lake Elsinore, CA (in Riverside county)	92589	Temecula, CA (in Riverside county)
92532	Lake Elsinore, CA (in Riverside county)	92590	Temecula, CA (in Riverside county)
92562	Murrieta, CA (in Riverside county)	92591	Temecula, CA (in Riverside county)
92563	Murrieta, CA (in Riverside county)	92592	Temecula, CA (in Riverside county)
92564	Murrieta, CA (in Riverside county)	92593	Temecula, CA (in Riverside county)
92570	Perris, CA (in Riverside county)	92595	Wildomar, CA (in Riverside county)
92571	Perris, CA (in Riverside county)	92596	Winchester, CA (in Riverside county)
92572	Perris, CA (in Riverside county)	92599	Perris, CA (in Riverside county)

Metro San Bernardino

92313	Grand Terrace, CA (in San Bernardino county)	92403	San Bernardino, CA (in San Bernardino county)
92318	Bryn Mawr, CA (in San Bernardino county)	92404	San Bernardino, CA (in San Bernardino county)
92320	Calimesa, CA (in Riverside county)	92405	San Bernardino, CA (in San Bernardino county)
92346	Highland, CA (in San Bernardino county)	92406	San Bernardino, CA (in San Bernardino county)
92350	Loma Linda, CA (in San Bernardino county)	92407	San Bernardino, CA (in San Bernardino county)
92354	Loma Linda, CA (in San Bernardino county)	92408	San Bernardino, CA (in San Bernardino county)
92357	Loma Linda, CA (in San Bernardino county)	92410	San Bernardino, CA (in San Bernardino county)
92359	Mentone, CA (in San Bernardino county)	92411	San Bernardino, CA (in San Bernardino county)
92373	Redlands, CA (in San Bernardino county)	92413	San Bernardino, CA (in San Bernardino county)
92374	Redlands, CA (in San Bernardino county)	92415	San Bernardino, CA (in San Bernardino county)
92375	Redlands, CA (in San Bernardino county)	92418	San Bernardino, CA (in San Bernardino county)
92399	Yucaipa, CA (in San Bernardino county)	92423	San Bernardino, CA (in San Bernardino county)
92401	San Bernardino, CA (in San Bernardino county)	92427	San Bernardino, CA (in San Bernardino county)
92402	San Bernardino, CA (in San Bernardino county)		

West End San Bernardino

91701	Rancho Cucamonga, CA (in San Bernardino county)	91784	Upland, CA (in San Bernardino county)
91708	Chino, CA (in San Bernardino county)	91785	Upland, CA (in San Bernardino county)
91709	Chino Hills, CA (in San Bernardino county)	91786	Upland, CA (in San Bernardino county)
91710	Chino, CA (in San Bernardino county)	92316	Bloomington, CA (in San Bernardino county)
91729	Rancho Cucamonga, CA (in San Bernardino county)	92324	Colton, CA (in San Bernardino county)
91730	Rancho Cucamonga, CA (in San Bernardino county)	92331	Fontana, CA (in San Bernardino county)
91737	Rancho Cucamonga, CA (in San Bernardino county)	92334	Fontana, CA (in San Bernardino county)
91739	Rancho Cucamonga, CA (in San Bernardino county)	92335	Fontana, CA (in San Bernardino county)
91758	Ontario, CA (in San Bernardino county)	92336	Fontana, CA (in San Bernardino county)
91761	Ontario, CA (in San Bernardino county)	92337	Fontana, CA (in San Bernardino county)
91762	Ontario, CA (in San Bernardino county)	92376	Rialto, CA (in San Bernardino county)
91763	Montclair, CA (in San Bernardino county)	92377	Rialto, CA (in San Bernardino county)
91764	Ontario, CA (in San Bernardino county)		

Western Riverside

91752	Mira Loma, CA (in Riverside county)	92522	Riverside, CA (in Riverside county)
92501	Riverside, CA (in Riverside county)	92551	Moreno Valley, CA (in Riverside county)
92502	Riverside, CA (in Riverside county)	92552	Moreno Valley, CA (in Riverside county)
92503	Riverside, CA (in Riverside county)	92553	Moreno Valley, CA (in Riverside county)
92504	Riverside, CA (in Riverside county)	92554	Moreno Valley, CA (in Riverside county)
92505	Riverside, CA (in Riverside county)	92555	Moreno Valley, CA (in Riverside county)
92506	Riverside, CA (in Riverside county)	92556	Moreno Valley, CA (in Riverside county)
92507	Riverside, CA (in Riverside county)	92557	Moreno Valley, CA (in Riverside county)
92508	Riverside, CA (in Riverside county)	92860	Norco, CA (in Riverside county)
92509	Jurupa Valley, CA (in Riverside county)	92877	Corona, CA (in Riverside county)
92513	Riverside, CA (in Riverside county)	92878	Corona, CA (in Riverside county)
92514	Riverside, CA (in Riverside county)	92879	Corona, CA (in Riverside county)
92516	Riverside, CA (in Riverside county)	92880	Corona, CA (in Riverside county)
92517	Riverside, CA (in Riverside county)	92881	Corona, CA (in Riverside county)
92519	Riverside, CA (in Riverside county)	92882	Corona, CA (in Riverside county)
92521	Riverside, CA (in Riverside county)	92883	Corona, CA (in Riverside county)

Appendix C – Employers Interviewed

The list below represents the Healthcare employers interviewed for this project as well as the size and the type of each employer.

1. **American Medical Response (AMR)** – 1,500+ employees - Emergency Medical Response Units
2. **Ballard Rehabilitation Hospital** – 1,000+ employees - Physical Rehabilitation
3. **Ben Hudnall Trust - Kaiser Permanente Labor Management Partnership** - 80,000+ employees - Union Educational Trust
4. **Community Health Association Inland Southern Region** - 6 employees - Clinical Consortium serving 43 Inland Empire clinics
5. **Community Health Systems** - 500+ employees - Federally Qualified Health Centers
6. **Desert Regional Medical Center** - 6,000+ employees - General Acute Care Hospital
7. **Dignity Health - Community Hospital of San Bernardino and St. Bernardine Medical Center** – 3,200 employees - General Acute Care Hospitals
8. **EPIC Management, LP** – 1,000+ employees, Medical Practice Management & Consulting
9. **Heritage Garden Centers** - 200 employees - Skilled Nursing Facility
10. **Hi Desert Medical Center** – 2,500+ employees - General Acute Care Hospital
11. **Inland Empire Health Plan** – 2,000+ employees - Health Plan
12. **JFK Medical Center** – 3,000+ employees - General Acute Care Hospital
13. **Knolls West Post-Acute Care** - 187 employees - Skilled Nursing Facility
14. **Loma Linda University Medical Center** - 5000+ Employees - Acute Care Teaching Hospital
15. **Molina Health Care** – 21,000 employees - Healthcare Network/Health Plan
16. **Parkview Community Hospital** - 4000+ employees - General Acute Care Hospital
17. **Pomona Valley Hospital Medical Center** - 3400 employees - Acute Care Hospital/ Medical Center
18. **Providence Nursing Homes** - 138 employees - Skilled Nursing, Licensed
19. **Redlands Community Hospital** – 2,000+ employees - Acute Care Hospital
20. **Riverside University Health System** - over 4,000 - Public Health and Medical Center
21. **San Antonio Regional Hospital** - 2000 Employees - Hospital/Healthy Community Institute
22. **San Geronio Memorial Hospital** - 731 employees – General Acute Care Hospital
23. **St. Joseph Health/St. Mary Medical Center** - 1200+ employees – General Acute Care Hospital
24. **Temecula Valley Family Physicians** - 40 employees - Family Practice Clinic

Appendix D – Health care Education and Training Providers

Institution	Address	Website
American Career College-Ontario	3130 East Sedona Court, Ontario, CA 91764	americancareercollege.edu/
American College of Health care	11801 Pierce St., Suite 100, Riverside, CA 92505	www.ach.edu
Argosy University-Inland Empire	3401 Centre Lake Drive, Suite 200, Ontario, CA 91761	www.argosy.edu/locations/inland-empire
Ashdown College of Health Sciences	101 E. Redlands Blvd., Suite 285, Redlands, CA 92373	ashdowncollege.edu
Barstow Community College	2700 Barstow Road, Barstow, CA 92311	www.barstow.edu
Beaumont Adult School	1575 Cherry Ave, Beaumont, CA 92223	bas-beaumont-ca.schoolloop.com/
Brightwood College-Palm Springs	2475 E Tahquitz Canyon Way, Palm Springs, CA 92262-7011	www.brightwood.edu
Brightwood College-Riverside	4040 Vine Street, Riverside, CA 92507-0000	www.brightwood.edu
California Baptist University	8432 Magnolia Ave, Riverside, CA 92504-3297	www.calbaptist.edu
California Nurses Educational Institute	5200 E. Ramon Rd. Suite I-1, Palm Springs, CA 92264	www.cnei.edu
California Paramedical And Technical College	4550 LA SIERRA AVE, RIVERSIDE, CA 92505	http://www.career-college.org/california+paramedical+and+technical+college+-+riverside-716
California State University-San Bernardino	5500 University Parkway, San Bernardino, CA 92407-2397	www.csusb.edu
CET-Rancho Temecula	27941 Jefferson Avenue, Temecula, CA 92590	cetweb.org
Chaffey College	5885 Haven Ave, Rancho Cucamonga, CA 91737-3002	www.chaffey.edu
Coast Career Institute	1250 E. Cooley Drive, Colton, CA 92324-3956	www.coastcareer.com/
College of the Desert	43-500 Monterey Ave, Palm Desert, CA 92260	collegeofthedesert.edu
Colton-Redlands-Yucaipa Regional Occupational Program	1214 Indiana Ct, Redlands, CA 92374	www.cryrop.org
Concorde Career College-San Bernardino	201 East Airport Drive, Suite A, San Bernardino, CA 92408-3403	www.concorde.edu
Copper Mountain Community College	6162 Rotary Way, Joshua Tree, CA 92252	www.cmccd.edu
Crafton Hills College	11711 Sand Canyon Road, Yucaipa, CA 92339-1799	www.craftonhills.edu
Everest College-Ontario	1460 S. Milliken Ave, Ontario, CA 91761-2338	www.everest.edu/campus/ontario
Everest College-Ontario Metro	1819 South Excise Avenue, Ontario, CA 91761	www.everest.edu/campus/ontario_metro
Everest College-San Bernardino	217 E. Club Center Drive, Ste. A, San Bernardino, CA 92408	everest.edu/campus/san_bernardino

Four-D College	1020 East Washington Street, Colton, CA 92324	www.4dcollege.edu
Franklin Career College	1274 Slater Cir, Ontario, CA 91761	www.franklincareercollege.com
InterCoast Colleges-Riverside	1989 Atlanta Ave, Riverside, CA 92507	www.intercoast.edu
International School of Beauty Inc.	72261 Hwy 111 Ste 121-B, Palm Desert, CA 92260-2740	internationalschoolofbeauty.com
ITT Technical Institute-San Bernardino	670 E Carnegie Drive, San Bernardino, CA 92408	www.itt-tech.edu
La Sierra University	4500 Riverwalk Parkway, Riverside, CA 92515-8247	https://lasierra.edu
Loma Linda University	11139 Anderson Street, Loma Linda, CA 92350	www.llu.edu/index.html
Marinello Schools of Beauty- Hemet	2627 W Florida Ave-Ste 100, Hemet, CA 92545	www.marinello.com
Mayfield College	35-325 Date Palm Dr Ste 101, Cathedral City, CA 92234	www.mayfieldcollege.edu
Milan Institute-Palm Desert	75-030 Gerald Ford Drive, Suite 203, Palm Desert, CA 92211	www.milaninstitute.edu
Moreno Valley College	16130 Lasselle St, Moreno Valley, CA 92551	www.mvc.edu/
Mt San Jacinto Community College District	1499 N. State St., San Jacinto, CA 92583-2399	www.msjc.edu
North-West College-Riverside	4550 La Sierra Ave, Riverside, CA 92503	www.north-westcollege.edu
Palo Verde College	One College Drive, Blythe, CA 92225	www.paloverde.edu
Platt College-Ontario	3700 Inland Empire Boulevard, Ste 400, Ontario, CA 91764	www.plattcollege.edu
Platt College-Riverside	6465 Sycamore Canyon Blvd Ste 100, Riverside, CA 92507	www.plattcollege.edu
Riverside City College	4800 Magnolia Avenue, Riverside, CA 92506	www.rcc.edu/riverside/
Riverside County Office of Ed- School of Career Education	47-336 Oasis St., Indio, CA 92201	www.riversidesce.org
San Bernardino Valley College	701 South Mount Vernon Avenue, San Bernardino, CA 92410-2798	www.valleycollege.edu
San Joaquin Valley College- Hesperia	9331 Mariposa Rd, Hesperia, CA 92344	www.sjvc.edu
San Joaquin Valley College- Ontario	4580 Ontario Mills Parkway, Ontario, CA 91764	sjvc.edu
San Joaquin Valley College- Temecula	27270 Madison Ave Ste 103, Temecula, CA 92590	www.sjvc.edu/
Summit College	851 S. Cooley Dr, Colton, CA 92324	www.summitcollege.edu
The University of America	38397 Innovation Court, Murrieta, CA 92563	ua-edu.us
UEI College-Riverside	1860 University Avenue, Riverside, CA 92507-5344	www.uei.edu

United Education Institute-Ontario	4730 Ontario Mills Parkway, Ontario, CA 91764-5574	www.uei.edu
University of Redlands	1200 E. Colton Ave, Redlands, CA 92373-0999	www.redlands.edu
Victor Valley College	18422 Bear Valley Rd, Victorville, CA 92395-5850	www.vvc.edu
West Coast University-Ontario	2855 E. Guasti Rd, Ontario, CA 91761	westcoastuniversity.edu/
Westtech College	9490 Sierra Avenue, Fontana, CA 92335	www.westtech.edu
Westwood College-Inland Empire	20 W 7th St, Upland, CA 91786-7148	www.westwood.edu

Appendix E – Gap Analysis

Description	Annual Openings	Regional Completions (2016)	Oversupply or undersupply	Pct. 10 Hourly Earnings	Median Hourly Earnings	Pct. 90 Hourly Earnings
Doctoral or professional degree						
Pharmacists	187	79	(108)	\$49.90	\$67.84	\$80.46
Veterinarians	35	0	(35)	\$27.77	\$38.23	\$72.22
Physical Therapists	139	118	(21)	\$25.75	\$42.62	\$57.76
Optometrists	20	0	(20)	\$39.96	\$54.15	\$91.79
Psychiatrists	18	11	(7)	\$58.97	\$141.52	\$213.11
Anesthesiologists	6	0	(6)	\$76.92	\$105.49	\$185.52
Surgeons	12	68	56	\$86.67	\$113.71	\$210.29
Family and General Practitioners	41	100	59	\$33.44	\$96.37	\$161.48
Audiologists	6	70	64	\$35.24	\$46.37	\$59.98
Dentists, General	102	171	69	\$22.88	\$70.84	\$114.07
Master's degree						
Health care Social Workers	251	3	(248)	\$16.36	\$32.42	\$47.31
Mental Health Counselors	242	25	(217)	\$12.99	\$18.38	\$29.06
Occupational Therapists	81	38	(43)	\$27.11	\$44.47	\$59.71
Nurse Practitioners	124	95	(29)	\$41.13	\$54.59	\$64.36
Speech-Language Pathologists	97	80	(17)	\$29.42	\$39.92	\$58.05
Physician Assistants	65	49	(16)	\$37.98	\$52.39	\$77.67
Nurse Anesthetists	10	0	(10)	\$64.25	\$96.16	\$157.86
Bachelor's degree						
Registered Nurses	2,442	1,283	(1,159)	\$32.01	\$45.21	\$62.98
Medical and Clinical Laboratory Technologists	63	18	(45)	\$21.18	\$39.85	\$51.95
Medical and Health Services Managers	301	258	(43)	\$28.56	\$52.25	\$79.63
Mental Health and Substance Abuse Social Workers	180	180	0	\$15.47	\$24.21	\$46.43
Health Educators	80	103	23	\$18.30	\$30.41	\$53.29
Dietitians and Nutritionists	81	138	57	\$18.11	\$33.26	\$39.59
Associate degree						
Medical and Clinical Laboratory Technicians	110	0	(110)	\$13.12	\$20.04	\$30.29
Dental Hygienists	161	93	(68)	\$34.24	\$45.38	\$59.17
Radiologic Technologists	142	91	(51)	\$20.32	\$33.56	\$45.37
Cardiovascular Technologists and Technicians	43	0	(43)	\$15.42	\$28.85	\$49.19
Occupational Therapy Assistants	35	0	(35)	\$19.92	\$32.49	\$39.54

Physical Therapist Assistants	74	44	(30)	\$15.12	\$30.60	\$41.89
Nuclear Medicine Technologists	12	0	(12)	\$40.89	\$48.50	\$62.46
Magnetic Resonance Imaging Technologists	17	10	(7)	\$30.15	\$38.83	\$57.54
Diagnostic Medical Sonographers	48	130	82	\$25.15	\$37.41	\$56.75
Respiratory Therapists	109	198	89	\$26.27	\$34.66	\$45.80
Veterinary Technologists and Technicians	79	181	102	\$11.35	\$19.23	\$28.50
Postsecondary non degree award						
Nursing Assistants	1,529	339	(1,190)	\$10.40	\$13.87	\$21.59
Massage Therapists	352	189	(163)	\$10.43	\$14.50	\$22.36
Phlebotomists	160	14	(146)	\$13.47	\$18.64	\$25.45
Psychiatric Technicians	119	24	(95)	\$24.62	\$29.08	\$36.24
Ophthalmic Medical Technicians	24	0	(24)	\$10.81	\$14.17	\$22.19
Medical Transcriptionists	53	45	(8)	\$14.31	\$18.38	\$30.48
Dental Assistants	676	668	(8)	\$10.63	\$15.23	\$23.32
Licensed Practical and Licensed Vocational Nurses	841	866	25	\$16.62	\$23.47	\$30.36
Medical Records and Health Information Technicians	150	190	40	\$13.44	\$20.51	\$35.75
Surgical Technologists	114	173	59	\$16.61	\$23.98	\$37.23
Medical Assistants	1,077	1,719	642	\$10.89	\$14.04	\$19.49
Emergency Medical Technicians and Paramedics	241	1,239	998	\$10.70	\$14.73	\$24.93
High school diploma or equivalent						
Social and Human Service Assistants	511	75	(436)	\$12.10	\$16.78	\$23.99
Medical Secretaries	888	525	(363)	\$11.60	\$15.72	\$24.02
Pharmacy Technicians	401	191	(210)	\$12.11	\$17.26	\$25.09
Veterinary Assistants and Laboratory Animal Caretakers	191	23	(168)	\$10.05	\$13.11	\$19.31
Community Health Workers	64	0	(64)	\$12.33	\$24.01	\$37.44
Physical Therapist Aides	91	30	(61)	\$10.54	\$13.01	\$17.94
Pharmacy Aides	83	273	190	\$10.38	\$13.81	\$22.74
No formal educational credential						
Personal Care Aides	4,187	0	(4,187)	\$10.02	\$10.81	\$13.60
Home Health Aides	759	23	(736)	\$10.10	\$12.64	\$25.32

Appendix F – Cross-Ranking of 55 Occupations by Job Demand, Training Gaps, and Equity Gaps

Color Coding Key:

	Rank 1-10
	Rank 11-20

Occupations	Overall Rank	Rank by Most Job Openings	Rank by Largest Training Gaps	Rank by Largest Equity Gaps
Registered Nurses	1	2	2	11
Pharmacists	2	17	14	2
Massage Therapists	3	11	11	22
Mental Health Counselors	4	14	8	29
Nursing Assistants	5	3	3	46
Medical Secretaries	6	5	6	42
Medical and Health Services Managers	7	12	23	23
Physical Therapists	8	23	30	5
Dental Hygienists	9	19	16	24
Medical and Clinical Laboratory Technicians	10	27	13	19
Health care Social Workers	11	13	7	40
Psychiatric Technicians	12	25	15	20
Pharmacy Technicians	13	10	9	43
Nurse Practitioners	14	24	27	12
Social and Human Service Assistants	15	9	5	49
Occupational Therapists	16	33	22	10
Veterinary Assistants and Laboratory Animal Caretakers	17	16	10	41
Radiologic Technologists	18	22	19	27
Veterinarians	19	46	25	3
Medical and Clinical Laboratory Technologists	20	40	20	17
Speech-Language Pathologists	21	30	32	15
Optometrists	22	48	31	1
Physical Therapist Aides	23	31	18	32
Phlebotomists	24	20	12	50
Licensed Practical and Licensed Vocational Nurses	25	6	43	34
Occupational Therapy Assistants	26	45	24	16
Cardiovascular Technologists and Technicians	27	43	21	25
Medical Transcriptionists	28	41	36	14
Nurse Anesthetists	29	53	35	4
Dentists, General	30	29	51	13
Psychiatrists	31	49	38	6

Respiratory Therapists	32	28	49	18
Mental Health and Substance Abuse Social Workers	33	18	41	37
Physical Therapist Assistants	34	37	26	33
Veterinary Technologists and Technicians	35	36	29	31
Dental Assistants	36	8	37	53
Family and General Practitioners	37	44	48	8
Anesthesiologists	38	54	40	7
Dietitians and Nutritionists	39	34	46	21
Community Health Workers	40	39	17	48
Medical Records and Health Information Technicians	41	21	44	39
Surgeons	42	51	45	9
Emergency Medical Technicians and Paramedics	43	15	55	36
Physician Assistants	44	38	33	35
Surgical Technologists	45	26	47	38
Medical Assistants	46	4	54	54
Nuclear Medicine Technologists	47	52	34	26
Magnetic Resonance Imaging Technologists	48	50	39	28
Ophthalmic Medical Technicians	49	47	28	45
Diagnostic Medical Sonographers	50	42	52	30
Health Educators	51	35	42	47
Pharmacy Aides	52	32	53	52
Personal Care Aides	N/A	1	N/A	51
Home Health Aides	N/A	7	N/A	44
Audiologists	N/A	55	50	N/A

Appendix G – GIS Maps

