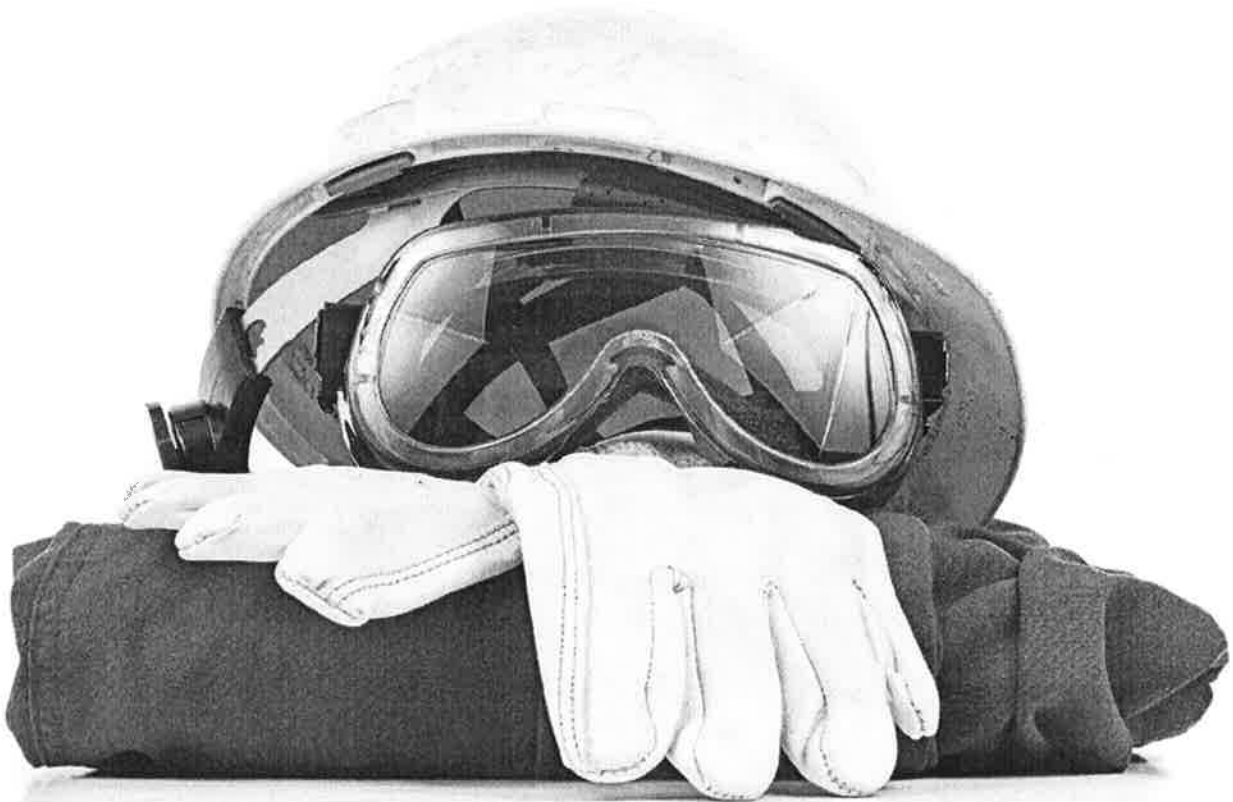


No Four-Year Degree Required

A look at a selection of in-demand
careers in Minnesota



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Ollen R. Nalley Associate Professor and Associate Chair,
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1. Introduction

Minnesota is a prime example of the way in which the economy in the U.S. has changed. Demand has shifted away from lower-skilled jobs to higher-skilled positions that require some training or formal education. However, many of these in-demand positions do not require a four-year degree, or the often high

costs that accompany such a degree. These positions, such as in the healthcare or manufacturing sectors of the economy, often require skilled training, either on the job or in a more formal setting, and as such are rewarded with relatively high pay. Importantly, these positions are not only currently in-demand but are projected to continue to increase over the next de-

cade. In addition, many of these fields have an aging population of workers, meaning that many jobs will be opening up in the next decade for replacement by new and younger workers.

A recurring theme when speaking with representatives of Minnesota industry and higher education, and with state policymakers, is the existence of a mismatch between workers and jobs available, meaning there is a growing demand for skilled workers in a number of industries that is not being matched by a supply of workers. While many students consider and originally pursue a four-year degree with hopes of high earnings after graduation, the reality is that graduation rates are low on average at many Minnesota colleges and universities. Using data from 2015, Minnesota's public four-year institutions have an average four-year graduation rate of only 38.5 percent, and a six-year graduation rate of 59.3 percent.¹

While many students will thrive and excel in a four-year setting, this path carries with it inherent uncertainty and may not be appropriate for all students. For many, a four-year degree may not be desired, feasible, or the best option overall. Additionally, it appears that workers entering a number of these fields are waiting several years past usual labor market entry—perhaps into their late 20's—to start the training necessary to go down a more lucrative, in-demand career path. This delay results in a number of “lost years,” when a worker could have been earning much higher wages, thereby dragging down lifetime earnings.

These two observations about the labor market in Minnesota underline the importance of encouraging young people to consider and enter these valuable fields. For these workers, we wish to shine a light on a set of high-skilled jobs that are in-demand, pay well, and require more limited formal educational training. To this end, this paper focuses on jobs that require no more than a two-year degree, a one-year certificate or an apprenticeship, and that have wages that are high for a relatively condensed level of required education. The paper is organized by example career paths, with information on educational requirements and costs, average wages in the field, projected demand, estimates of lifetime earnings, and examples of similar occupations. The paper

starts with occupations that require the most formal education, a two-year Associate's degree, focusing on skilled manufacturing and registered nurses. Next, it examines jobs in the construction industry with less formal educational requirements such as an apprenticeship. Finally, it looks at occupations that typically require only a one-year certificate such as HVAC workers and electrical power-line installers.

The calculations reported in the paper are striking. Estimated lifetime earnings for the fields highlighted here exceed those of four-year degree-holders earning median wages for that educational group by as much as 61 percent.²

2. Fields that Require an Associate's Degree

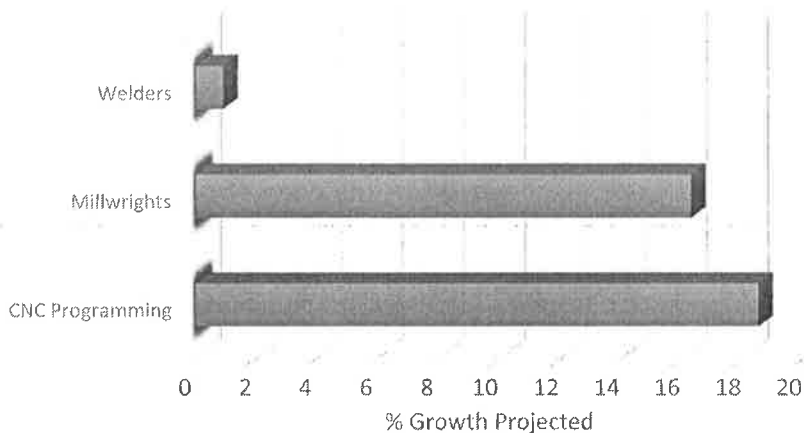
This section will focus on two skilled professions in high demand in Minnesota that one can enter after obtaining a specialized Associate's degree. Although we will highlight two distinct paths, a number of similar occupations also offer very promising career paths.

Computer Numerical Control (CNC) Programming and Related Occupations

These skilled positions are carried out in a manufacturing environment that differs greatly from that of past generations. Manufacturing in the United States has embraced the use of technology, and requires skilled workers to manage this technology. This type of work is generally conducted indoors, in a controlled and much safer environment than seen on manufacturing floors in the past. Workers program machines, perform quality checks, and prepare machines for production runs.³ Some of these positions are for “lights out” production, where the actual production occurs during the night shift, allowing the programmers to work shifts during the day. In the Twin Cities area, the most prominent industries are medical device manufacturing and food processing. However, these positions are not in demand only in the Twin Cities region, but also in many regions around the state, producing larger machinery and computer hardware.

Similar occupations include machinists, millwrights, and welders. The last two occupations have more opportunity for outdoor work, as well as more flexibility in job sites. However, for most of

FIGURE 1: 2014-2024 PROJECTED GROWTH FOR SKILLED MANUFACTURING POSITIONS



Source: MN DEED Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>

the positions mentioned, skilled training is required in the form of a two-year degree.⁴ Upon entering the industry, workers enjoy generous wages, with opportunities for upward mobility. Figure 1 illustrates that for most of these occupations, the Minnesota Department of Employment and Economic Development (MN DEED) has projected high rates of growth over the next decade. In addition to new jobs, a large percentage of the workforce in each of these occupations is nearing retirement age, indicating that a number of replacement positions will open up in the next decade as well.⁵ Finally, in good economic times, there are often ample opportunities for overtime in these fields.

FIGURE 2: MEDIAN WAGES FOR IN-DEMAND SKILLED MANUFACTURING POSITIONS COMPARED TO MINIMUM WAGE OPTION



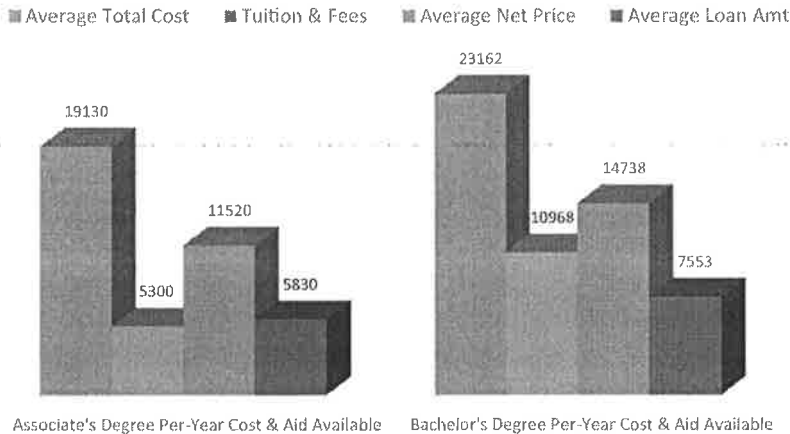
Source: MN DEED Career Profile. <https://mn.gov/deed/data/data-tools/career-profile/>

The generous wages for these occupations are displayed in Figure 2, for both the Twin Cities region and for Minnesota as a whole. CNC programming and millwrights have the highest median wage, with welders not far behind. All three are at least double (or close to triple) the minimum wage in Minnesota.⁶ For many in these career paths, there will be opportunities to move up within the industry either through increased experience, or on-the-job training, leading to still higher wage paths.

Of course, the cost of education must be factored in. The average total cost of a two-year degree at a public institution in Minnesota is shown in Figure 3.⁷ Total cost is calculated to capture the direct costs of tuition and fees, as well as living expenses such as room and board, and the cost of textbooks. The second column in the figure indicates the average tuition and fees charged at these institutions. Although the average total cost per year is just under \$20,000, with roughly \$5,300 of this coming from tuition and fees, there are a number of opportunities for most lower-income students to receive aid to help fund this investment. There are grant opportunities from the federal government, the state government, and institutions themselves, resulting in students who are eligible for aid paying a net cost of just over \$11,000 per year on average, and taking on an average loan of roughly \$5,800.⁸

Students from the lowest income brackets would likely be eligible for federal Pell Grants to cover much if not all of their tuition and fees. Students can also reduce these costs by living at home. Additionally, many of these programs are flexible enough to allow for at least part-time work during the two years, and many programs encourage students to start in internships and other paid positions within their intended industry during the course of the two-year program. These costs and

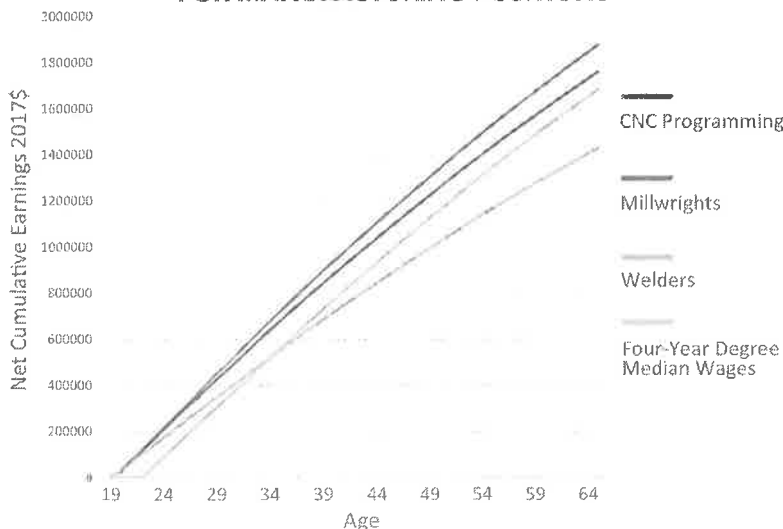
FIGURE 3: AVERAGE TOTAL COST AND AID AVAILABLE AT PUBLIC FOUR-YEAR INSTITUTIONS IN MN, AND TWO-YEAR PUBLIC INSTITUTIONS IN MN OFFERING A.A. DEGREES FOR SKILLED MANUFACTURING POSITIONS



Source: 2015 data from the Integrated Post-Secondary Education Data System (IPEDS).

expected loan amounts can be compared to those of the four-year public institutions in Minnesota, shown in the adjacent panel. The average total cost at a four-year public institution is quite a bit higher, as are tuition and fees, and despite slightly more generous aid opportunities, average loan debt per year is over \$7,500.⁹ Factoring in that students will need to pay these costs for four years rather than two, the cost of the Associate's degree required for the fields highlighted here is much less than that of a four-year degree.¹⁰

FIGURE 4: NET CUMULATIVE VALUE IN 2017 DOLLARS OF LIFETIME EARNINGS AT EACH AGE, FOR MANUFACTURING POSITIONS



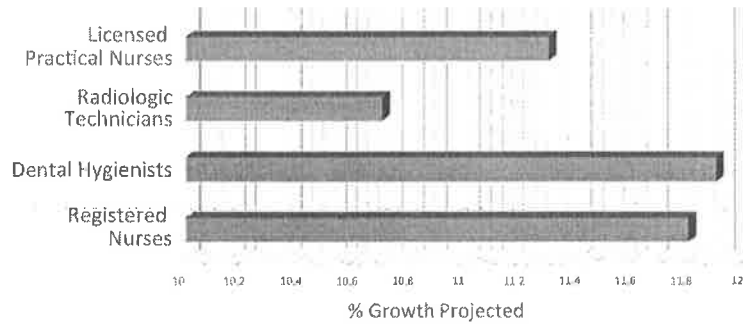
Putting together the educational costs and median wages, we are able to create lifetime earnings profiles for these manufacturing positions, as displayed in Figure 4. This shows, at each age of a worker over 19, the net present value of earnings in today's dollars.¹¹ As the figure indicates, the progression into the industry is swift, with only two years of education needed. Then as earnings grow with experience on the job, lifetime earnings increase steadily. Therefore, a CNC programmer who chose to retire at age 65 could expect to earn a total of just over 1.8 million dollars (in 2017 dollars) over his or her career.¹²

To get a sense of what these lifetime earnings mean, we compare this to two other scenarios. First, in comparison to a low-wage job such as retail, expected lifetime earnings are only \$881,000. Second, when compared to the median earnings for a college graduate in Minnesota, due to the lower cost of obtaining the Associate's degree and the high median wages for CNC programmers and millwrights, the cumulative lifetime earnings of the four-year degree holder do not catch up by age 65.¹³ For welders, median wages are slightly lower, and the four-year degree line overtakes the welders line for workers in their late 30's. These earnings profiles also illustrate that loan payments to finance the necessary Associate's degree are easy to make, with room for savings early on in one's lifetime for other investments such as housing or retirement.

Registered Nursing

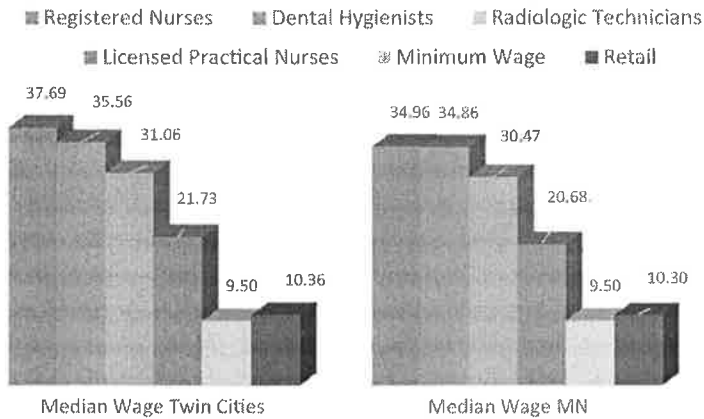
Healthcare is a booming component of the U.S. economy, particularly as our population ages. As such, there is a strong on-going demand for healthcare professionals such as registered nurses (RNs). Although some registered nurses may work directly in a hospital setting, those who obtain the certification for this position through an Associate's

FIGURE 5: 2014-2024 PROJECTED GROWTH FOR HEALTHCARE POSITIONS



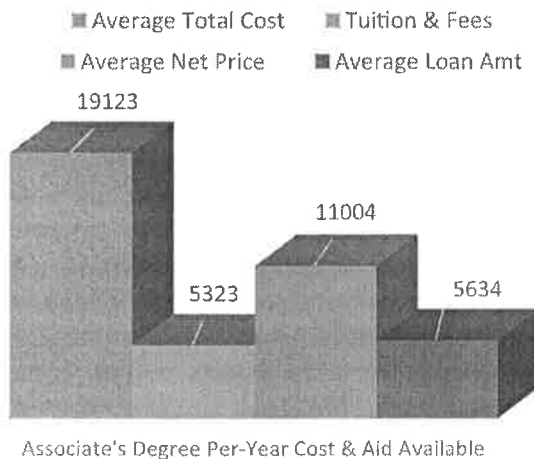
Source: MN DEED Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>

FIGURE 6: MEDIAN WAGES FOR IN-DEMAND HEALTHCARE POSITIONS COMPARED TO MINIMUM WAGE OPTION



Source: MN DEED Career Profile. <https://mn.gov/deed/data/data-tools/career-profile/>

FIGURE 7: AVERAGE TOTAL COST AND AID AVAILABLE AT TWO-YEAR PUBLIC INSTITUTIONS IN MN OFFERING A.A. DEGREES FOR HEALTHCARE POSITIONS



Source: 2015 data from the Integrated Post-Secondary Education Data System (IPEDS).

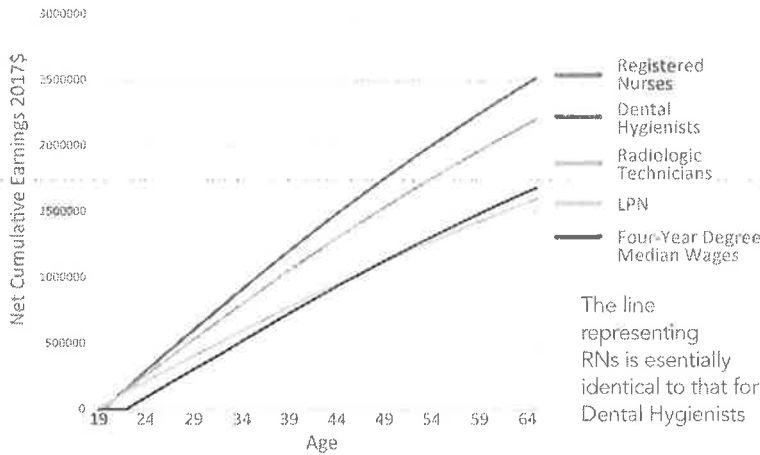
degree (rather than a four-year Bachelor's degree) are most likely to work in other healthcare settings such as private practices, nursing homes, schools, etc. The work occurs primarily inside, with a lot of patient interaction and often flexible shifts. This profession is also characterized by more opportunities for overtime work and pay, which can often be generous.

A number of other similar healthcare oriented positions are also in high demand in Minnesota. These include dental hygienists, ultrasound technicians, radiological technicians, EMTs and paramedics. All of these positions are fairly similar in their educational requirements, with most requiring a two-year degree or a one-year certificate. In particular, there is also demand for LPNs, a position that requires a one-year certificate, but also earns lower wages and has less opportunity for upward mobility than does an RN position.

High growth is anticipated for all of these positions, as shown in Figure 5.¹⁴ Wages for registered nurses and related positions can be quite generous as well, as is seen in Figure 6.¹⁵ In the Twin Cities region the median wage for an RN is \$37.69 per hour, and it is estimated that the median starting wage is \$26.71 an hour, increasing quite quickly to \$30.93 within two years. Dental hygienists start at a lower median wage of \$19.05 per hour, with a sharp increase early in the career, resulting in a \$35.56 per hour median wage in the Twin Cities. Finally, radiologic technicians can expect a median wage of \$31.06.

The cost of obtaining the needed certification to be an RN or related occupation is reasonable (illustrat-

FIGURE 8: NET CUMULATIVE VALUE IN 2017 DOLLARS OF LIFETIME EARNINGS AT EACH AGE, FOR HEALTHCARE POSITIONS



ed in Figure 7). The average net price, after average grant aid available is factored in, is roughly \$11,000 per year for a two-year degree. This is accompanied by an average loan of \$5,634.¹⁶ It is also possible to receive a one-year certificate and pursue an occupation as an LPN, reducing the educational costs. However, median wages are also lower for this position. Lifetime earnings profiles, similar to those described above for manufacturing positions, are displayed in Figure 8. Dental hygienists and registered nurses who work until age 65 can expect total lifetime earnings in excess of \$2.5 million, while licensed practical nurses can expect lifetime earnings of roughly \$1.6 million. It is only for this last group that the four-year graduate median earnings profile overtakes that of the highlighted profession. Again, all the healthcare occupations profiled here have lifetime earnings well above what would be anticipated at a minimum wage job, or employment in the retail sector.

3. Fields Entered by Apprenticeship Carpentry, Electricians, Plumbers

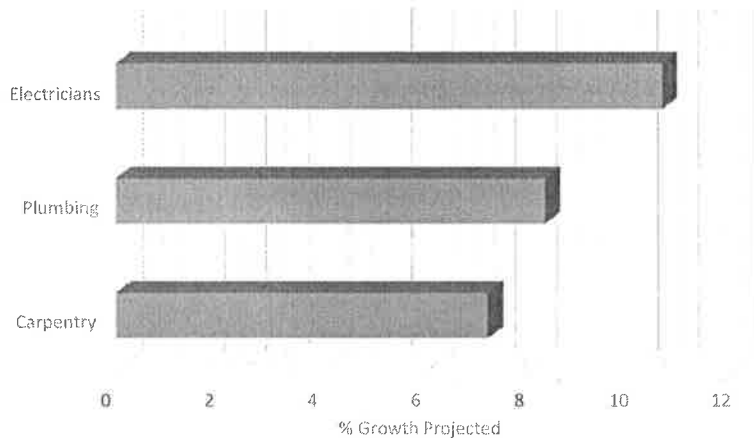
This category of occupations has quite a different entry route than those mentioned previously. Although there are some formal apprenticeship programs, there are also a number of more informal programs in each of these related oc-

cupations. It is also possible to enter certain of these occupations through more formal education with a two-year degree or a certificate. Here, we will highlight the formal carpentry apprenticeship program developed by the North Central States Regional Council of Carpenters, but there are a number of other routes to a job in these fields. These occupations are currently in high demand with opportunities for overtime work in many areas of Minnesota. However, demand is cyclical, showing decreases during downturns in the economy. Employment is also somewhat transitory, as many in this occupation will move from employer to employer, or

job site to job site, as jobs demanding their specific skills pop up. Despite this, MN DEED anticipates high rates of growth for carpenters, as well as related fields such as plumbers and electricians.¹⁷ See Figure 9 for estimates of projected growth in these fields.

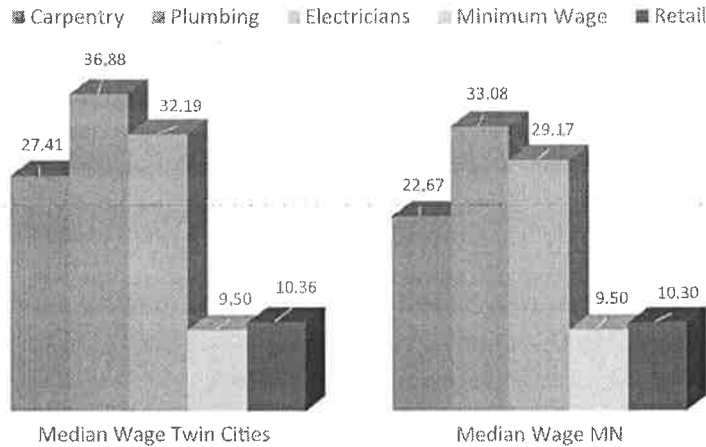
Workers are generally hired as apprentices in their field, such as a carpenter, electrician or plumber, and spend the next four years or so receiving the training and certifications they need. (In the case of electricians or plumbers, the apprenticeships typically require five years.) Workers should also expect to stay abreast of any changes to laws or codes that might require re-certification in future

FIGURE 9: 2014-2024 PROJECTED GROWTH FOR CONSTRUCTION-RELATED POSITIONS



Source: MN DEED Employment Outlook Projections 2014-2024.
<https://mn.gov/deed/data/data-tools/employment-outlook/>

FIGURE 10: MEDIAN WAGES FOR IN-DEMAND CONSTRUCTION POSITIONS COMPARED TO MINIMUM WAGE OPTION



Source: MN DEED Career Profile, <https://mn.gov/deed/data/data-tools/career-profile/>

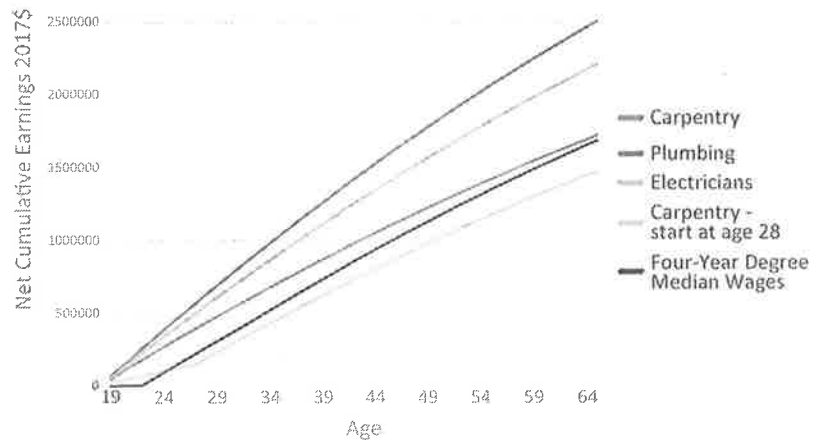
formal, non-union pathways in each of these occupations. In either case, the “cost” of entering this career path is the lower wages that one will earn during training. However, these wages are still well above minimum wage, and can rise as much as two-fold as one completes the apprenticeship. For workers who combine their apprenticeship with a two-year technical degree or certificate, there will be more direct educational costs to factor in as well. (The service track of the pipe-fitting apprenticeship program, for example, requires a two-year technical school degree/certificate.)

years. Once hired as an apprentice, workers begin at an entry-level wage, and wages increase as the hours of work and skills required for certification are completed. Following completion of the process, workers are certified as journey-workers in their field, and often earn roughly twice their starting wage as apprentices. Once a full-fledged member of their profession, they have many opportunities to advance and increase earnings. For example, they can take on more responsibility and move into managerial positions such as foreman. There are also entrepreneurial opportunities in these fields, and some individuals will branch out on their own and start their own companies.

Median wages for these construction-related trades in the Twin Cities region and Minnesota as a whole are shown in Figure 10.¹⁸ All are quite attractive, leading to high life-time earnings as shown in Figure 11, exceeding that expected for the median bachelor’s degree holder.¹⁹ It is important to note the large loss in lifetime earnings that can occur when workers wait to start their careers in these fields. It has been reported that in apprenticeship programs such as the formal carpentry union training program, the median starting age is 28 years old. Figure 11 shows a difference in lifetime earnings of over \$246,000 for those who start the apprenticeship path in carpentry at age 19 rather than age

The training required as an apprentice may occur on-the-job in less formal settings, or take place at a separate training facility, as is the case with the North Central States Regional Carpenters union. In this more formal case, apprentices come to the union’s training center for a week of training at a time, four times a year. There is no out-of-pocket cost for the apprenticeship, as all training costs are negotiated with the many employers who participate. Workers do join the union and pay union dues. There are, of course, less

FIGURE 11: NET CUMULATIVE VALUE IN 2017 DOLLARS OF LIFETIME EARNINGS AT EACH AGE, FOR CONSTRUCTION-RELATED POSITIONS



28. This is a significant difference, indicating the importance of starting on a career path as early as possible.

These occupations are particularly appropriate for those who like to work with their hands, and are comfortable with a little more uncertainty about work hours and employers. In a booming economy, all of these occupations will experience an increase in hours worked in certain seasons, as well as per year. However, in a downturn, workers should expect increased fluctuation in hours.

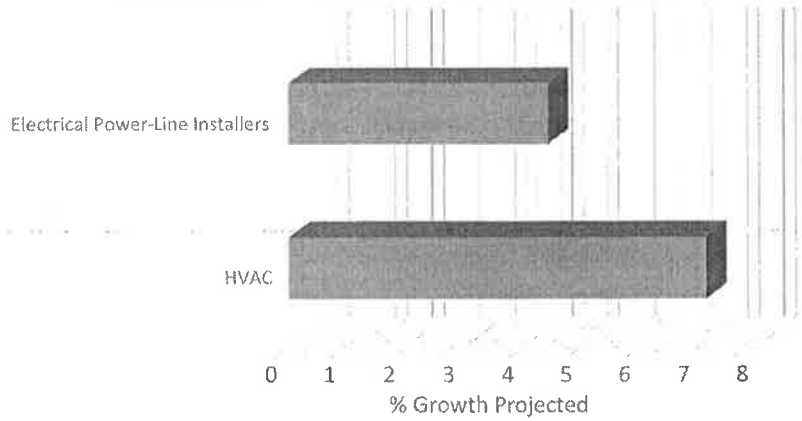
4. Jobs that Require a Two- or Three-Semester Certificate or Diploma

HVAC

The market for heating and air conditioning installation and maintenance workers is quite strong. As seen in Figure 12, MN DEED predicts a growth of over 7 percent in jobs in this field by 2024, and a large number of replacement jobs opening up as workers retire or leave the field.²⁰ These jobs typically involve day-to-day travel in a given work area for installation and maintenance at various work sites. However, hours are often set and employment can be stable.

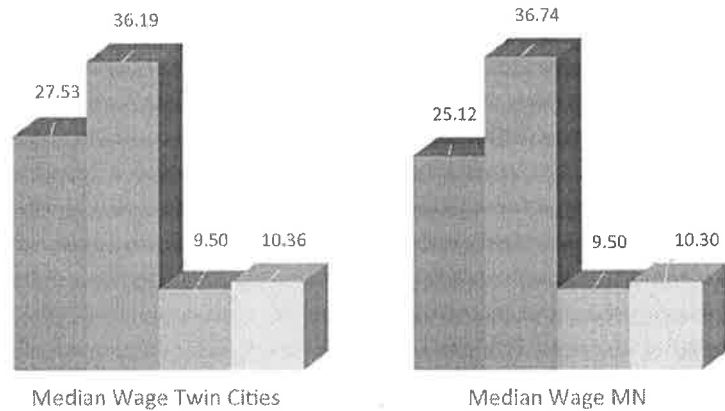
The median wages for this field, as seen in Figure 13, are quite high at just over \$25 in Minnesota, and the position typically requires only a one-year certificate.²¹ With the availability of grant aid from federal, state, and institutional sources, the average student would pay \$11,000 and take on a loan of roughly \$6,000.²² The lifetime earnings profile shown in Figure 14 indicates that this low cost of education, coupled with high median wages, results in a very reasonable total lifetime earn-

FIGURE 12: 2014-2024 PROJECTED GROWTH FOR FIELDS NOT REQUIRING A TWO-YEAR DEGREE OR ABOVE



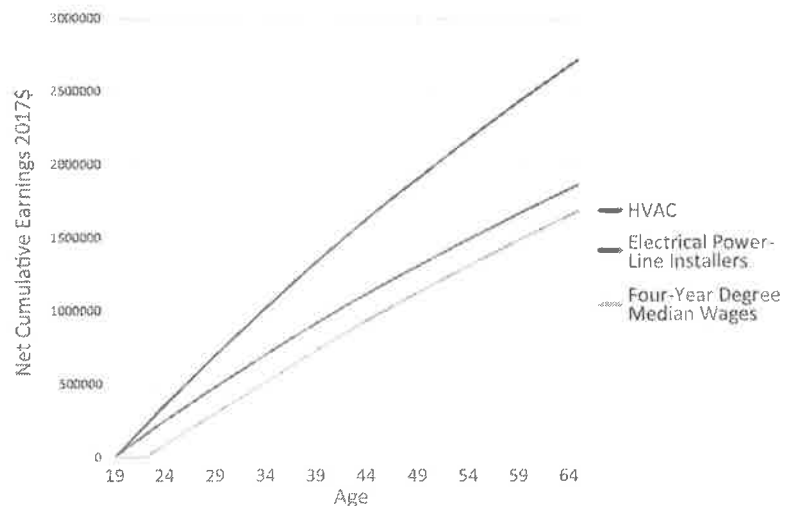
Source: MN DEED Employment Outlook Projections 2014-2024, <https://mn.gov/deed/data/data-tools/employment-outlook/>

FIGURE 13: MEDIAN WAGES FOR HVAC AND ENERGY POSITIONS COMPARED TO MINIMUM WAGE OPTION



Source: MN DEED Career Profile, <https://mn.gov/deed/data/data-tools/career-profile/>

FIGURE 14: NET CUMULATIVE VALUE IN 2017 DOLLARS OF LIFETIME EARNINGS AT EACH AGE, FOR HVAC & ENERGY POSITIONS



ings of just under \$2 million, again exceeding that expected for median bachelor's degree holders.

Electrical Power-Line Installers

The occupation of electrical power-line installer is another prime example of a high-paying, high-demand field that generally requires only a two- or three-semester educational credential. The job requires some outdoor work, as well as day-to-day travel in a given work area. The occupation is estimated to have high demand with some growth (See Figure 12) over time, and wages are high. Workers in this field will be well-positioned to take advantage of the many alternative energy-related positions that will open up in the future. In the Twin Cities region, workers of this type would expect median wages of over \$36 per hour, with slightly higher median wages for Minnesota as a whole. The diploma required is offered at select public two-year campuses in Minnesota, and cost is similar to the HVAC certificate discussed above.²³ These very high wages, with low educational costs, result in a lifetime earnings profile that is quite impressive. As shown in Figure 14, the cumulative lifetime earnings for those who work until age 65 are over \$2.7 million.

5. Conclusion

This paper illustrates the varied high-demand, high-paying career paths that one can take in Minnesota without pursuing a four-year degree. These career paths span a variety of occupations and job duties, providing opportunities for workers interested in a number of different fields. For many of these fields, the median age of current workers is quite high, prompting a continued demand for new workers as older workers begin to retire in the coming years. In other fields, there will also be additional growth as new jobs are created.

For the fields highlighted here that require one to two years of formal education, as well as other fields with similar requirements, employers can play a role in encouraging students to enter these occupations. Although funds are available to reduce the net price per year at two-year public institutions, the figures in this document indicate that workers will often graduate with \$5,000-\$6,000 worth of loan debt for each year they spend obtaining their degree.

Employers interested in attracting students to these fields and to their workplace could consider developing or expanding plans to help students repay their loans or reduce their loan burdens through tuition reimbursement, as many employers—particularly in the manufacturing sector in Minnesota—currently do.²⁴ In addition, employers across Minnesota are eligible to receive tax deductions when providing tuition reimbursement for further education of their employees. Employers seeking to increase their workforce would benefit from taking further advantage of these opportunities.

It is important to note that despite the high wages in the fields highlighted here, relative to the median wages paid to four-year degree-holders in Minnesota, there remains a mismatch of demand for workers and supply of workers. This likely reflects, to some extent, both a function of workers' preferences and a lack of information regarding what is available in these fields. However, there may also be a role for an increase in wages to attract more workers.

Although there are many fields one can enter with a four-year degree that will both pay well and provide stable employment, it is not necessary for all to go this route to achieve these outcomes. For many, it may make more sense to follow one of the career paths highlighted in this paper, or other paths similar to these, which require less formal education. It is also important to consider that while those pursuing a four-year degree may face uncertainty about whether they will finish, how long it will take to finish, and what the employment options will be after graduation, the paths highlighted here often exhibit much less of this type of uncertainty, which may be attractive to many potential employees.



Acknowledgements

This paper benefited from valuable conversations with King Banaian, Luke Greiner, Kyle Makarios, E.J. Daigle, Mike McGee, and Matthew Bombyk. I would also like to thank Todd McFall and Doug Webber for their helpful comments.

Technical Appendix

1. Calculation of Graduation Rates for Four-Year Public Institutions in Minnesota

To calculate the average graduation rates for four-year public institutions in Minnesota, data were collected from the Integrated Post-Secondary Education Data System (IPEDS) for 2015. The mean four-year and six-year graduation rates were then calculated, weighted by the full-time equivalent enrollment of each institution. This creates a mean that is representative of the student bodies at these institutions, rather than over-weighting smaller institutions' graduation rates in the overall mean.

2. Calculation of Educational Costs

Educational costs for each route requiring a formal degree or certificate were calculated using data from the Integrated Post-Secondary Education Data System (IPEDS) using 2015 data. Data were collected on the following variables:

- Reported total price for in-state undergraduate students living off-campus. This calculation includes tuition, fees, as well as room and board and textbook costs.
- Net Price paid by the average in-state student receiving financial aid. This is the amount expected net of any grants received. Costs are weighted by percentage of students living on-campus, off-campus, and at home.
- Average Loan reported as the average loan size taken on by a student on financial aid per year.
- Tuition and Fees are the posted tuition and fees charged to each student.

To calculate the average cost of obtaining a four-year degree (necessary to calculate the lifetime earnings of Bachelor's degree holders), the average net

price at all Minnesota four-year public institutions was found, weighting each by the full-time equivalent enrollment. For the two-year degree costs, only two-year public institutions in Minnesota that offer the relevant degree were used in the calculation of the average total price, tuition and fees, net price, grant or loan offered for that degree.

Net price is used for the calculations below, to properly account for indirect costs of the educational investment such as the cost of textbooks. Additionally, loans are awarded by financial aid officers based on estimated total cost, rather than merely tuition and fees. Therefore, net price is the appropriate measure to capture the expected costs of a certificate or degree.

3. Calculation of Cumulative Lifetime Earnings Profiles

The net present value of cumulative lifetime earnings was calculated for ages 19-65 in the following way, depending on the educational requirements for the career under consideration. For the two-year degree requiring fields (Manufacturing & Healthcare), the average net price and loan were calculated as described above in section 1 of the appendix. Students were assumed to take two years to finish their degree, and worked a total of 2,000 hours at minimum wage during these two years. Therefore, total income for the first two years (ages 19 and 20) is equal to their income from minimum wage work minus the average net price at two-year public institutions in Minnesota offering the appropriate degree, net of the average loan taken on in these programs.

It is then assumed that upon completion of the degree, the students become employed in their industry and are paid the median wage as reported by MN DEED on the Career Profile. This median wage experiences a growth rate of 2% annually (growth rate was estimated based on data from MN DEED's Quarterly Census using data from 2008-2016). Although workers likely start at a wage lower than the median, this will be balanced by the years they would likely experience wages above the median, later in their careers. Annual total income is calculated using these median wages and assuming that each worker has an average of 2,000 hours per

year. Workers are also assumed to have a 10-year loan repayment schedule, at the current interest rate of 4.3%. The loans are assumed to be unsubsidized.

Fields that require only one year of education follow a similar path, with only one year of work at minimum wage before entering their industry of choice. Fields that do not require any formal education assume that the worker enters his or her chosen field immediately at age 19, earning median wages. Wages for all fields are expected to grow at a rate of 2% annually (again, calculated for each field using data from MN DEED's Quarterly Census 2008-2016).

To calculate the four-year degree comparison, a similar method is used with the following changes. Students are assumed to take four years to complete their degree, and are assumed to work only part-time (1,000 hours annually) at a minimum wage job while completing their schooling. They then repay their loans over the following 10-year period while working at the median wages for four-year degree holders. The median wage is taken as that reported by the American FactFinder in 2015 for Bachelor's degree holders in Minnesota.²⁵

Discounted total earnings are calculated in 2017 dollars using a discount rate of 3%. This allows us to consider how much the earnings at a future age are worth in today's current dollars. Cumulative earnings are then calculated as the sum of all discounted earnings in each year up until each subsequent age. The amount reported at each age is the present value of the total earnings a worker in that occupation would be expected to earn by that age using the assumptions listed above.

Students who are higher-income and are not eligible for aid may pay a higher net price for schooling than the costs used in these calculations. However, they will pay a higher cost for a two-year or four-year degree, resulting in a shift in the lifetime earnings profiles that leaves the differences relatively the same. For example, when it is assumed instead that a worker pays the average total cost for a CNC Programming two-year degree, or a four-year degree, and takes out no loans, the relative difference in lifetime earnings between these two

pathways is the same as for the aided case reported in the paper, 12%.

Estimates of lifetime earnings may be conservative for a number of reasons. First, students may have much lower net costs of education if they choose to live at home, avoiding some of the indirect costs of education. Second, students may earn more than minimum wage during their schooling. And last, students who earn a four-year degree at a private, not-for-profit institution will likely have a higher cost of education, resulting in lower lifetime earnings for four-year degree holders in Minnesota. •

Endnotes

1. Graduation rates are calculated using 2015 data from the Integrated Post-Secondary Education Data System (IPEDS), and weighted by full-time equivalent size of institution. Please see Technical Appendix for more details on calculations.
2. These earnings are not necessarily representative of two-year degree holders on average, but rather of these specific high-skill, in-demand and therefore high-wage, occupations highlighted in this paper.
3. Bureau of Labor Statistics “*Occupational Outlook Handbook*” for Production Occupations.
4. A two-year degree is typically not required for welding positions. Most workers enter this position with a one-year occupational certificate.
5. Minnesota Department of Employment and Economic Development (MN DEED) Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>
6. MN DEED Career Profile. <https://mn.gov/deed/data/data-tools/career-profile/>
7. To see tuition and fees for each public institution in Minnesota separately, please visit this website: <http://www.minnstate.edu/admissions/collegecostcomparison.html>
8. Costs are calculated for two-year public institutions in Minnesota that offer the appropriate degree using 2015 data from the Integrated Post-Secondary Education Data System (IPEDS). See Technical Appendix for details on calculations.
9. Throughout this analysis we use four-year public institutions to calculate cost. Four-year private institutions in Minnesota have a much higher total cost of \$45,813 on average, and a slightly higher average net cost of \$24,604.
10. Average costs are weighted by student enrollment (see Technical Appendix for description of weighting). Student enrollment patterns in Minnesota are such that much of the two-year enrollment occurs in high cost-of-living areas, leading to the fairly low difference in total cost between two-year and four-year programs. However, as mentioned above, students often decrease their costs by living at home during their two-year program. The net price figure partially reflects this, by weighting costs by the percentage of students at each institution who live on-campus, off-campus, and at home.
11. Please see the Technical Appendix for a more detailed discussion of how these profiles were calculated.
12. These earnings profiles are most appropriate for low-income students who are eligible for financial aid. Total lifetime earnings will be lower for every career path for higher-income students, but the relative differences are quite similar. Please see Technical Appendix for more detail on calculations.
13. Four-year graduate lifetime earnings are calculated using public four-year costs. Students who received their degree from a private, not-for-profit four-year institution would experience higher costs and lower lifetime earnings than seen here.
14. MN DEED Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>
15. MN DEED Career Profile. <https://mn.gov/deed/data/data-tools/career-profile/>
16. Costs are calculated for two-year public institutions in Minnesota that offer the appropriate degree using 2015 data from IPEDS. See Technical Appendix for details on calculations.
17. MN DEED Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>
18. MN DEED Career Profile. <https://mn.gov/deed/data/data-tools/career-profile/>
19. Workers who pursue this career path through a formal degree, rather than solely through an apprenticeship program, should expect slightly lower lifetime earnings, due to the cost of education.
20. MN DEED Employment Outlook Projections 2014-2024. <https://mn.gov/deed/data/data-tools/employment-outlook/>
21. In some cases a diploma is required, which can take between two or four semesters. Educational costs will vary accordingly.
22. Costs are calculated for two-year public institutions in Minnesota that offer the appropriate degree using 2015 data from IPEDS. See Technical Appendix for details on calculations.
23. The calculations in this paper assume that the educational credential in question is obtained in two semesters. Therefore, lifetime earnings will be slightly lower if the time required to obtain the credential is longer.
24. See, for example, employers such as Kurt Manufacturing and E.J. Ajax Metalforming Solutions in Minneapolis, which have offered opportunities like this in the past.
25. American FactFinder. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_1YR_B20004&prodType=table