Practical Applications for Pre Health Science

PRACTICAL APPLICATIONS FOR PRE HEALTH SCIENCE

TARA LAWRENCE

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ABOUT THIS BOOK

This textbook was created for the Pre-Health Sciences Pathway to Advanced Diplomas and Degrees program (PHS) program. This resource will further build on the foundational skills for health science, with an emphasis on critical thinking. Health research is defined using the scientific method as an approach to problem-solving with exposure to different situations and diverse populations in health care. Health and wellness topics are covered as an awareness for personal health as well as an advocate for patients.

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CHAPTER 1 - WHAT IS HEALTH RESEARCH

Chapter Outline

1.0 LEARNING OBJECTIVES

Learning Objectives

- Define health research
- List and describe the 4 main pillars of health research in Canada
- Identify the importance of health research

1.1 WHAT IS HEALTH RESEARCH

As a health care professional, you will advocate for the health of your patients using the treatments and knowledge provided. According to the World Health Organization (n.d.), the average Canadian's current life expectancy is 81.6 years. That has increased by more than 20 years in the last century. Many factors contribute to the health and wellness of a Canadian, but "what we know about health and disease today—and what we can do with that knowledge—comes from decades of research" (Canadian Institutes of Health Research, 2022, para. 5). How you use that knowledge as a health care professional directly impacts the care you can provide. Using that knowledge personally can help advocate for your health and wellness.

Medical research, discovering pathologies and treatments in a lab, while an intricate part of health research, is not the only area of research that impacts our health care. "The Canadian Institutes of Health Research (CIHR) supports this type of work across four main pillars. Each one is described below. These pillars are all important for addressing the health challenges we still face today and preparing us for the ones we'll face tomorrow" (Canadian Institutes of Health Research, 2022, para. 7).

The four pillars of health research are defined below. Click on the title for more information on each Pillar.

Biomedical Research (Pillar 1)

Biomedical research focuses on understanding how every part of the human body works—right down to our cells.

By studying these workings at the molecular, cellular, organ system, and whole-body levels, biomedical research leads to new ways of diagnosing, preventing, and treating illness and disease.

Read more about Biomedical Research.

"Pillar 1" by CIHR, reproduced for non-commercial purposes.

Clinical Research (Pillar 2)

With the help of volunteer participants, clinical research leads to new and improved:

- Medications, vaccines, therapies and treatments
- Medical tests, procedures and practices
- Medical tools, equipment and devices
- Scientific knowledge and understanding of illness and disease

Read more about Clinical Research

"Pillar 2" by CIHR, reproduced for non-commercial purposes.

Health Services Research (Pillar 3)

Health services research focuses on improving health care for everyone.

By studying how health care services are organized, supported, and delivered across Canada, we can make the overall system better.

This research generates information to help enhance care for patients, reduce costs, and address the needs of health care providers.

"Pillar 3" by CIHR, reproduced for non-commercial purposes.

Read more about Health Services Research
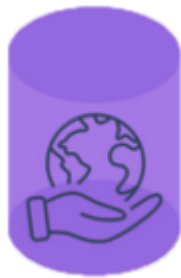
Social, Cultural, Environment, and Population Health Research (Pillar 4)

Social, cultural, environmental, and population health research aims to improve the health of entire communities.

There is more to your health than meets the eye! This type of research uncovers the ways that social, cultural, environmental, occupational, and economic factors can affect it—for better or for worse.

"Pillar 4" by CIHR, reproduced for non-commercial purposes.

Read more about Social, Cultural, Environment, and Population Health Research

Whether you choose a career in science, working in a lab or home care health, understanding the process and critical review of research studies is important not only to participate in a project but to approach any

problem and form a solution. The steps to understanding health research will apply to any situation you may encounter in a personal and professional environment.

1.2 CLINICAL HEALTH RESEARCH APPLICATION

Health Application: An Example of Using Health Research Pillar 2

Yvonne Drasovean, RRT, M.Ed., FCSRT

My name is Yvonne Drasovean; I am a Registered Respiratory Therapist and professor in the Respiratory Therapy program at Fanshawe College. What follows is an example of turning challenges into opportunities and the importance of critical reasoning and the ability to solve problems that are sometimes outside the practice norm.

On March 11, 2020, the World Health Organization declared the novel coronavirus (COVID-19) outbreak a global pandemic. The chaos of news and information from around the world that followed brought on a heightened state of awareness for healthcare workers. There was so much to learn, prepare and provide so that Canada's healthcare force could rise to the challenge of supporting patients' needs. Between fear of the unknown and the excitement of making a difference for the community, every respiratory therapist stepped up to the occasion. As the pandemic critically affected an increasing number of patients, there was an acknowledged shortage of ventilators worldwide.

In response, on March 18, the Montreal General Hospital Foundation, in collaboration with the Research Institute of the McGill University Health Centre, launched a global innovation challenge, Code-Life-Ventilator-Challenge, calling for teams to design a simple, low-cost, easy-to-manufacture and easy-to-maintain ventilator which could be deployed anywhere needed to save lives. The idea was that the wide availability of rapid manufacturing (3D printers, CNC machines) combined with low-cost computers (such as smartphones and tablets) would offer the possibility of a simple, broadly available ventilator with sufficient performance to help hospitals get through the pandemic. Team requirements asked for at least one relevant medical professional with

Code Life Ventilator Challenge - C...
mghfoundation.com

Figure 1.2.1 CodeLife.ca from the Respiratory Therapy Program Fanshawe College Facebook Page. Included with permission.

publicized credentials (proof of right to practice), and one relevant technical/ engineering professional with credentials to approve safety requirements, and each team member must provide a short resume of qualifications relevant to the design (engineering degree or industry experience). To say that building a low-cost, simple, easy-to-use and easy-to-build ventilator is a challenge is probably the understatement of the year. I challenged my fellow professor in respiratory therapy, Dave Wall, to attempt the challenge. As ventilator users, we realize that all ventilators used in our ICUs have many hours of research and development behind them to make them inherently intuitive to a trained user.

Figure 1.2.2 Toyota-Fanshawe Team, included with permission.

We partnered up with four engineers from Toyota Canada, and on March 20, we assembled the team and entered the competition. This moment gave us renewed purpose and pride in our profession. This was the time to put our critical thinking and research skills into practice. The work began on Monday, March 23, to design a ventilator and meet the deadline of March 31, when the best ten ventilator designs were selected to continue to the semifinals.

Over 900 participating teams have over 2500 participants from about 90 countries in this initial competition phase. And so, we were off, venturing into this unknown world to give our best effort at a seemingly impossible task: designing and building the COVINATOR FT (F for Fanshawe, T for Toyota).

We started educating each other on engineering processes and clinical applications of mechanical ventilation. The engineer printed 3D parts, assembled pieces every day, and built a prototype ventilator. After only seven days, when the prototype was completed, we finally met as a team under social distancing guidelines for the first time at the Toyota Woodstock assembly plant. Our challenges were far

Figure 1.2.3 A diagram of the initial " plan" that was used to teach the engineers what a ventilator does, included with permission.

from over. For example, we realized that standard medical connections we are accustomed to, such as DISS medical gas connections, were not standard in car manufacturing facilities. We adapted to the situation and macgyver'd fittings and

connections to make things work. The Covinator-FT was packaged up and sent on a truck to Montreal for feedback from the judges.
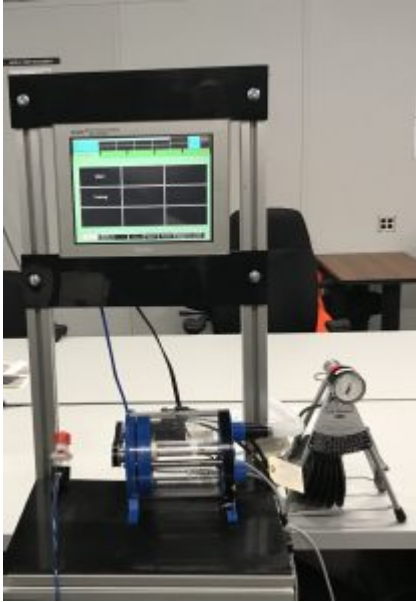
Figure 1.2.4 The Covinator FT, included with permission.

The Covinator FT is a time-triggered pressure-controlled ventilator that has the potential to safely ventilate patients in a time of need. An incredibly innovative addition we are very proud to offer is the ability to control the Covinator-FT remotely with a tablet. This can reduce clinician exposure by allowing changes to ventilation without entering a contaminated area. The Covinator FT can also use one central controller (tablet) to manage a fleet of Covinator-FT ventilators in the ICU. The user would be able to check the ventilation status of multiple patients and make changes as needed. Regardless of the outcome, the rewards of this challenge were never about prize money or exposure but rather the ability to apply and share our team's knowledge and innovation to make a difference. We are proud that the Covinator-FT was selected as one of the top nine entries to the Code-Life Challenge semifinals. We plan to use the Covinator at Fanshawe College for teaching purposes to inspire innovation and encourage student respiratory therapists to think outside the box, collaborate in multi-disciplinary teams, and, every once in a while, try to do the impossible.

1.3 POPULATION HEALTH APPLICATION

Health Services Research Impacting Social, Cultural, Environmental, and Population Health

Lara Timlar BA, BEd, RDH, MPH

My name is Lara Timler, and I am the Academic Program Coordinator for Fanshawe's Dental Hygiene program. I obtained my honours degree in women's studies from Western University in 2004 and decided soon after graduation that I wanted to enter healthcare. I graduated from Fanshawe's Dental Hygiene program in 2009. Once I was registered with the College of Dental Hygienists of Ontario and could practice, I was lucky enough to work with a London dentist specializing in geriatric dentistry. I worked two afternoons a week in a small, one-operatory clinic in a retirement residence/long-term care home, providing dental hygiene care to older adult clients. Working in this environment, I quickly realized that there were many structural barriers to optimal oral health for older adults in LTC settings, everything from financial barriers experienced by seniors with fixed incomes, medical conditions including Alzheimer's and other complex diagnoses which made the provision of dental care very challenging, to the lack of importance of oral health in our larger healthcare system.

I started teaching part-time in the Dental Hygiene program in 2012. One of my roles at Fanshawe includes facilitating dental hygiene student placements in non-traditional practice settings, and I have had the opportunity to create partnerships with many organizations across London, including London InterCommunity Health Centre, My Sister's Place, Community Living London, St.

Joseph's Healthcare and more. Early in my career, I realized that persons with low income who experience multiple barriers to dental care have very few options to obtain quality oral healthcare services, which significantly impacts their overall health and quality of life. I connected with a like-minded group of dental professionals and community advocates in 2017 to develop a practical solution to increase access to oral healthcare for vulnerable Londoners, including those with low income and those experiencing homelessness. In 2018, the London Community Dental Alliance formed to establish London's first not-for-profit community-based dental clinic. We named The Wright Clinic in honour of dentist and community champion Dr. Ken Wright.

Throughout my professional journey, I have developed skills in health services research and evaluation, which are integral to supporting my work as a board member of the London Community Dental Alliance (LCDA). When the LCDA initially tried to secure capital funding to build the clinic, now located on the second floor of Glen Cairn Community Resource Centre, we worked with Pillar's Impact Consulting group to develop a business case to demonstrate the clinic's financial viability and sustainability. This involved market research, understanding the needs of the clients we were gearing services to, and researching different models for not-for-profit dental clinics across Canada. Once the clinic was built and we started seeing clients in April of 2021, it was clear that we needed additional funding to support everyday operations at the clinic. Providing high-quality dental care is very expensive, especially when the clients you serve cannot afford to pay for services out of pocket and don't have access to employer insurance plans. We hired an evaluation consultant to help us establish processes at the clinic to continually monitor key metrics, including productivity (how many clients we see in a typical week), how much income we bring in from billable dental services (if the client could pay a small fee, or if we billed a provincial social services program, like Ontario Works or Ontario Disability Support Program), and the client experience. Our evaluator administers a client feedback survey annually and interviews clients directly to understand how they experience care at the clinic and how accessible oral healthcare has impacted their overall quality of life. The information she gathers, both quantitative and qualitative data, is used when I apply for grants and other forms of funding. I have

written successful grant applications that have provided over half a million dollars in funding for The Wright Clinic since 2021. Our ability to fundraise successfully over the past four years depends on the data we collect and how we share it with potential funders and community members. To learn more about the clinic and the work we do, please visit our website: [The Wright Clinic](). To review our most recent annual report, highlighting some of our key metrics and client stories, please visit [The Wright Clinic – News and Updates]().

1.4 KNOWLEDGE CHECK

Applying Your Knowledge

1. What are the 4 pillars of health research?
2. What pillar would address the needs of health care provider?
3. If you pursue a career to study science in a lab, what pillar of health research would you mostly be focusing on?

Reflection

Thinking about your career choice, how do you see health research impacted you and or your chosen profession?

CHAPTER 2 - SCIENTIFIC METHOD

Chapter Outline

2.0 LEARNING OBJECTIVES

Learning Objectives

- Define the scientific method.
- Outline the steps to solving problems using the scientific method
- Analyze problems using the scientific method

2.1 OVERVIEW OF THE SCIENTIFIC METHOD

Scientific method refers to the body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge. It is based on gathering observable, empirical and measurable evidence subject to specific principles of reasoning (Newton, 1726/1999, pp 794-796)

Making new scientific discoveries is not as straightforward and neat as it may first appear. As a student scientist, you read textbooks and conduct 'cookbook' practicals in which you follow a series of steps. In practice, creating new knowledge in science is characterized by difficulties, uncertainties and competing hypotheses.

Science is a vast discipline, and how science is done depends on the field of study. Exactly how a scientist conducts their craft depends on what knowledge and answers they are pursuing. For example, astronomers and geologists base their understanding on field observations, whereas physiologists and chemists base their understanding on experiments. As noted in Chapter 1.2 to a Health care professional, the scientific method means implementing a series of steps based on their understanding and evaluation of their population's health.

The scientific method means implementing experimental steps to create new knowledge and develop a more sophisticated understanding of a particular topic.

The scientific method follows seven general steps:

1. Make an observation
2. Research what is already known about the topic (literature review)
3. Form a testable hypothesis that may explain the observation
4. Perform an experiment or series of experiments

5. Analyze the results
6. Accept or dismiss the hypothesis (conclusion)
7. Share the results.

Some philosophers and scientists prefer to see the scientific method as an ideal rather than a rule or a description of the practice of all scientists. Scientists are humans, and this means that we are not perfect and we are different in terms of our motivation, drive and ideas – all of which may result in science being practiced differently.

Scientists may approach their quest for new discoveries differently, but they will always seek evidence that can be obtained in different ways. The scientific method combines rational thought and imagination to predict and explain phenomena, and the work of scientists is always open to scrutiny, criticism and debate.

One of the key things to using the scientific method is "try again". In many cases, especially in Health care, making an observation and asking a question requires working with a team for the experimental and analysis, and this may "dismiss" the hypothesis, OR it may simply shift the hypothesis and encourage new research, as in the Yvonne's health application example in Chapter 1.2.

Figure 2.1.2 shows a cyclic model of the scientific method, indicating its ongoing process.
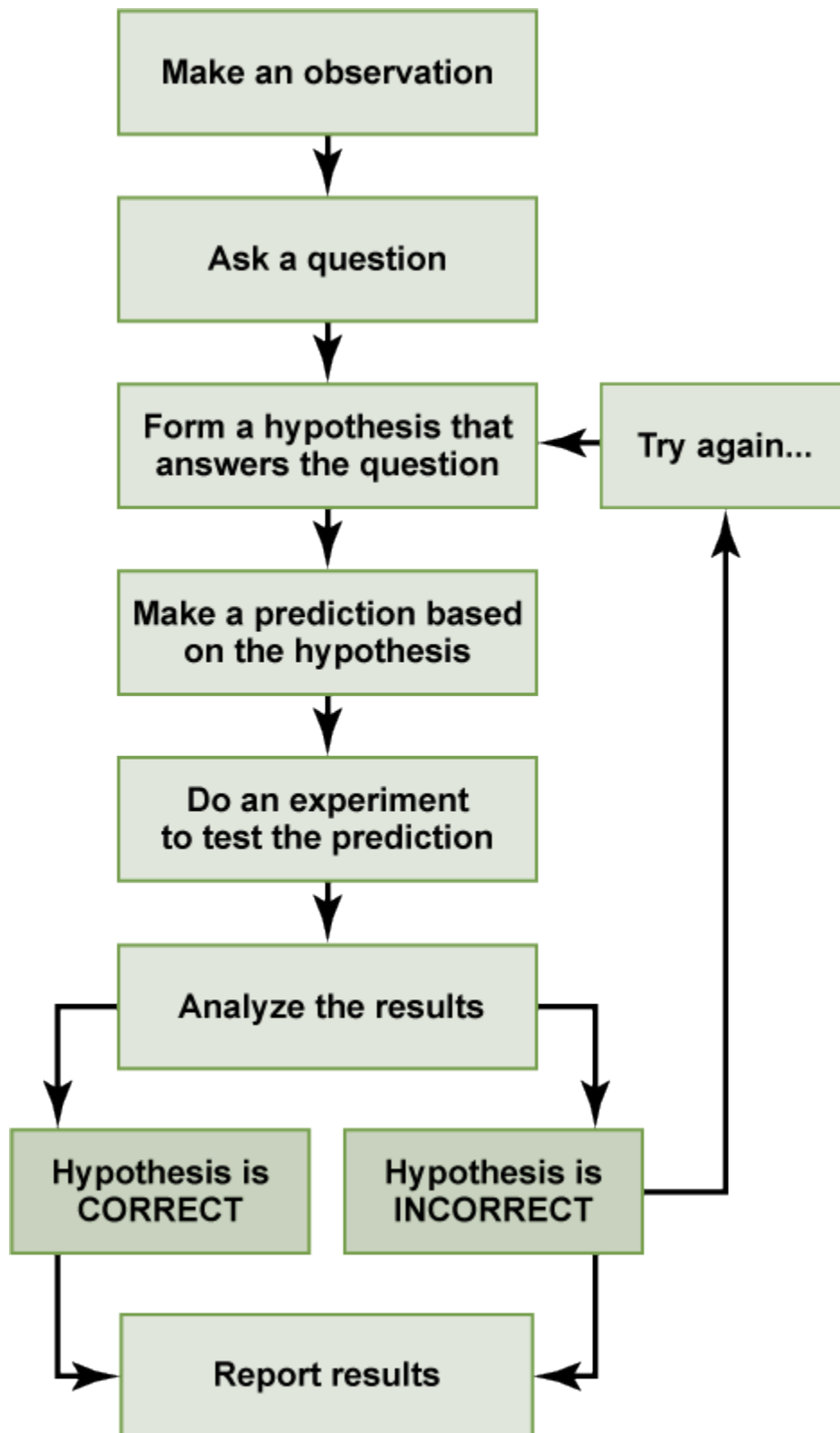
Figure 2.1.2. The scientific method as an ongoing process. "Scientific Method" by OpenStax, CC BY 4.0.

Image Description

Begin: Make an observation

 Ask a question

 Form a hypothesis that answers the question

 Make a prediction based on the hypothesis

 Do an experiment to test the prediction

 Analyze the results

 If the hypothesis is *correct*, report the results

 If the hypothesis is *incorrect* report the results **and** return to form a hypothesis that answers the question and try again.

Applying Your Knowledge

Watch the following TED-ED video by Adam Savage on two spectacular examples of profound scientific discoveries from simple, creative methods that anyone could have followed. Write a summary of the main point the speaker is trying to express to the students he is speaking with.

"How Simple Ideas Lead to Scientific Discoveries" from TED-Ed, [7:31] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

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2.2 PROCESS FOR USING THE SCIENTIFIC METHOD

Observation and Research

Scientific research starts with scientists making an initial observation that they cannot explain with an existing theory. It can also be a more open-ended question, such as 'How can I treat this particular disease?' The scientist will study any previous data – that is, review the existing literature on the topic area- to determine which facts are relevant to the problem at hand. This research may reveal that another scientist has already answered the question, and, in this case, a new question will be asked. If the question hasn't been answered, the scientist will use the findings of their research to help them design a good question that they can test.

Hypothesis and Aim

Research and imaginative and creative thinking help scientists formulate hypotheses that they can test to explain an observation or answer a question. A hypothesis is an assumption based on knowledge obtained during the observation stage – it is an 'educated guess.'

Data generated during an experiment either supports or fails to support the hypotheses. Hypotheses may be specific (e.g. chronic ingestion of artificial sweeteners causes weight gain in humans) or broad (e.g. viruses cause disease in animals). Hypotheses are always subject to modification.

However, it is important to note that hypotheses may be proven untrue. This occurs when the data do not support the hypothesis, in which case, the hypothesis must be rejected or refined.

A hypothesis is tightly linked to the aim of the study, which is the objective or goal of an experiment or series of experiments. The aim is written in a similar manner to the hypothesis. A hypothesis is a prediction about the outcome of an experiment; an aim is usually written in the form of an instruction:

> **Hypothesis**: chronic ingestion of artificial sweeteners causes weight gain in humans.

Aim: To determine if chronic ingestion of artificial sweeteners causes human weight gain.

Experiment

Physiologists conduct experiments to test whether the real world behaves as predicted by the hypothesis. The purpose of the experiments is to find out if the resulting observations of the real world agree or conflict with the prediction – if they agree, we can be more confident that the hypothesis is true, but if they disagree, we become less confident.

Experiments are a valuable scientific tool because when experimenting, we are able to control and manipulate phenomena and events. However, this also means that we are creating an 'artificial environment' for our experiments. This may not end up reflecting what is happening in the real – messy – world.

Experiments will only help us to support or not support hypotheses if they are carried out properly. This means using care and the right equipment and settings with the goal of minimizing error. If we conduct careless experiments that introduce errors in the results, the observations (or data) are useless when we try to evaluate our hypothesis.

Part of understanding how science works includes becoming aware of the methods and tools of science. Each scientific discipline has its own specialized techniques and tools that it uses to observe the natural world; student scientists will be exposed to some of these methods in practical classes during their studies. Experimental methods are not perfect, even when scientists try their best, and they can be updated or replaced over time. Advances in technology or scientific understanding may mean that previously accepted methods are rejected and replaced with new ones. This may also mean that experimental results obtained using old methods are ignored or viewed as less relevant because our way of thinking about the topic has changed.

It is not always easy to conduct well-designed experiments and to get reliable results. New experiments may take months or even years to perfect. Scientists need to work hard to collect high-quality results, including:

- developing their theoretical and practical knowledge of an area and a technique
- learning through trial and error
- mastering the available technology.

Researchers must provide details on how their experiments were conducted because other researchers must be able to repeat the results. If results cannot be repeated, the hypothesis is no longer supported, and the

conclusion may be incorrect. When the results of experiments are shared with the wider scientific community, the research will be judged on many things, including the methods employed.

Also, it is very rare for a researcher to generate their experimental methods from scratch; it is more common to use methods that have been shown by other researchers to be successful at measuring particular variables. This is another reason it is important to provide details of your methodology.

Results

Scientists collect the data generated from their experiments and analyze them to determine whether the hypothesis was supported or not. In the analysis stage, the scientist combines the results from repeated experiments and carries out statistical analysis to test the hypothesis – for example, to determine whether differences exist between different experimental groups. Scientists will present their results as text, tables and graphs.

Results should be reproducible – that is, another scientist should be able to follow the same method and obtain the same results. If they are not able to do this, it may mean that the original results were an error. For this reason, scientists will usually conduct a single experiment multiple times.

Scientists rarely attempt to replicate the findings of other scientists despite the importance of reproducibility. There are few incentives for scientists to dedicate time to replicating existing studies, and it can be difficult to replicate studies because the methods may be unclear, and poor or incorrect study designs may have been used in the original research (Belluz et al., 2016).

Recently, some scientists have found that when they do try to replicate studies, they have not been able to obtain the same results. This has led to a 'crisis of reproducibility.' Scientists who have investigated reproducibility have found that few findings published in top psychology journals as well as highly cited papers on psychiatric treatment (Tajika et al., 2015) could be replicated (Open Science Collaboration, 2015). This issue is gaining more attention and must be addressed by scientists from all disciplines.

Conclusion

Conclusions are made about the results of the experiment in light of the hypothesis. Simply, the results do or do not support the hypothesis. The conclusions below are the two possibilities arising from the example hypothesis and aim shown previously:

Conclusion: Chronic ingestion of artificial sweetener caused weight gain in humans.

Conclusion: Chronic ingestion of artificial sweetener did not cause weight gain in humans.

The study hypothesis, aim and conclusion are therefore highly connected.

Scientific conclusions are subject to change when new findings dictate that they need to be changed. Quite often in science, new studies, which might use new techniques and equipment, tell us when conclusions need to be modified or changed entirely.

Share results

Results of experiments should be shared with the wider scientific community, so they can contribute to the pool of knowledge on a topic and lead to better understanding for everyone.

Scientists can communicate with their peers in different ways:

- make an oral presentation at a conference
- present a poster at a conference
- publish a journal article in a peer-reviewed academic journal

The publication of results makes information widely available, and the results will be used by others if they are seen as interesting. Results that are not deemed interesting will fade from sight; sadly, this is the fate of most published articles.

The Scientific Method in Action

Observation: A physiologist determines that available evidence indicates that, say, drug X – which Australia's Therapeutic Goods Administration does not yet approve – increases the metabolic rate and may, therefore, be a promising weight loss drug.

Hypothesis: The physiologist hypothesizes that 'drug X will cause weight loss in adult rats.'

Aim: The physiologist plans a study with the aim to 'determine if drug X will cause weight loss in adult rats'.

Experiment: The physiologist randomly assigns 20 adult rats to a control and treatment group – 10 per group. The control group is administered a daily dose of the placebo, and the treatment group is administered a daily dose of the drug for four months. The control group receives a placebo instead of a drug, and all other conditions are identical to the treatment group, with the exception of the drug. They receive the same kind of food and water. Body weight is recorded daily.

Results: At the end of the 4-month treatment period, the physiologist performs a statistical analysis on the body weight data. The data reveal a statistical difference between treatment groups, with the treatment rats weighing less than the control rats.

Conclusion: Drug X caused weight loss in adult rats.

Share results: The physiologist will share their work with peers through a poster or oral presentation at a conference and/or a journal article.

Figure 2.2.1. The Scientific method in action. Image by La Trobe University, CC BY-NC-SA 4.0.

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2.3 KNOWLEDGE CHECK

Applying Your Knowledge

1. Define each step of the scientific method
2. Why is the cyclic model of the scientific method important to health care professionals
3. What is a hypothesis?
4. What is the difference between aim and the hypothesis?
5. What steps come before the hypothesis?
6. Scientists can communicate with their peers in different ways, Name 3.
7. True or False: The results of an experiment should be reproducible?
8. Watch the TED-ED by Adam Savage in Chapter 2.1. Write a brief summary of the main point the speaker is trying to express to the students he is speaking with.

Reflection

Sometimes, the experiment may disprove the hypothesis, and it may feel like a waste of time. Think of times that this may happen and how observations and research can also help the scientist.

Many things are deemed as knowledge if they are posted on the World Wide Web. What things should you think about or check before accepting this as fact?

Consider

If an advertisement says 9 out of 10 professionals agree, what questions should you ask about that 9 out of 10?

CHAPTER 3 - UNDERSTANDING DATA

Chapter Outline

3.0 LEARNING OBJECTIVES

Learning Objectives

- List categories of data and define types of data in each category
- Organize data using Excel, tables and graphs
- Perform common functions using Excel
- Interpret misrepresentation of visual data

Using the Scientific method (Chapter 2) it is important to have an appreciation for using data. This chapter will provide baseline knowledge to understand what data is and how visual representations are used in presentations and reports.

3.1 WHAT IS STATISTICS?

Statistics is the science that deals with the collection, analysis and interpretation of numerical data. Statistics has entered almost every aspect of human endeavour. We can use it for better planning, more efficient delivery of services and increased productivity. It is important to improve statistical literacy among scientists, journalists, health care professionals, patients, and the community at large to make informed decisions in the face of uncertainty.

In scientific research, we conduct statistical analyses to help us determine whether datasets differ. When statistical analysis determines that datasets are different, we refer to the datasets as 'statistically different,' or the difference as 'statistically significant' or that there is 'a significant difference.' When statistical analysis reveals that datasets are not different, we say there is 'no significant difference' between groups.

In health care, you may see many different types of datasets. For example, if you are working in a scientific lab, you may be comparing the impact of different medications in a controlled setting or tracking a specific ailment in geographic areas.

Examples of Using Statistics in Everyday Life

Cholera map made by John Snow in 1854

The location of reported cases of cholera is shown in Figure 3.1.1. Presentation of the data collected on the number of cases and where they occurred would have been very useful in understanding the spread of the disease and contributing to prevention.
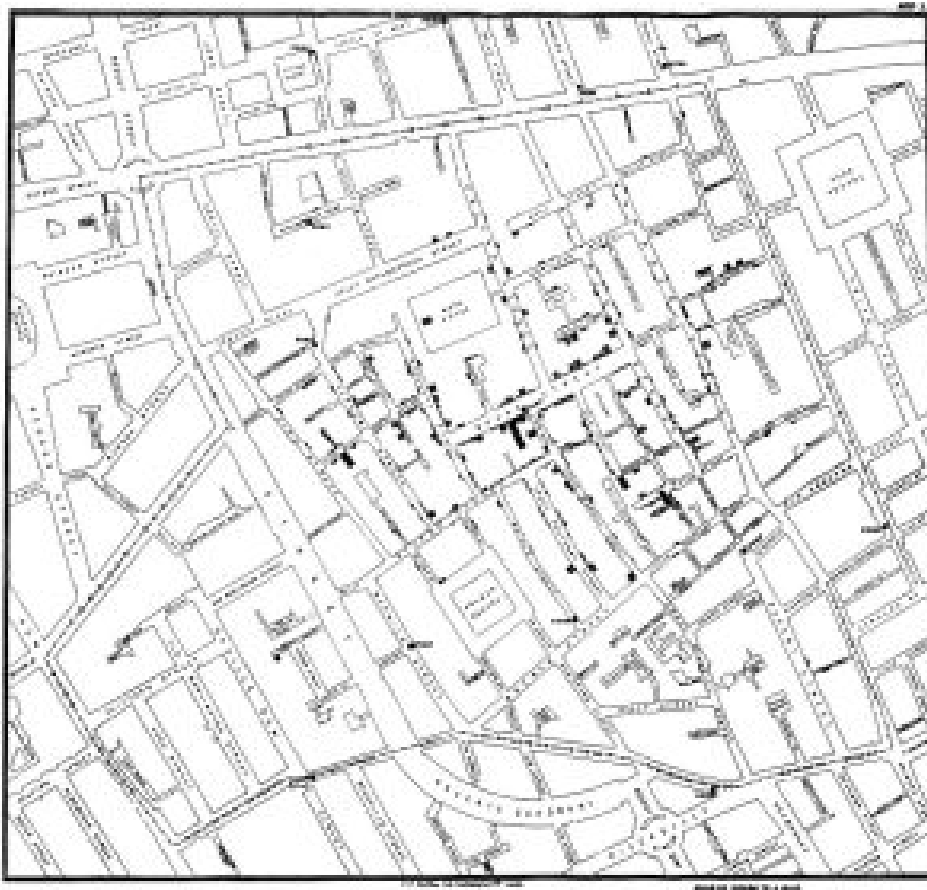
Figure 3.1.1: Cases of cholera in London in 1854. Source: 'Snow-cholera-map-1' by John Snow, CC0 1.0.

Image Description

The image depicts a detailed black-and-white map of an urban area. The map shows a grid of streets and buildings with some buildings or areas shaded or filled, indicating different types of structures or significant locations. Streets and blocks are numerous and tightly packed, likely representing a city or a dense urban neighbourhood.

Sporting Performance

Figure 3.1.2 summarises the test bowling statistics of cricketer Imran Khan, showing the number of runs conceded each innings and career and last 10-innings averages. Collecting so much information in one figure, combining raw data and averages, is a very economical way to summarise a sportsperson's career.

Figure 3.1.2: Test bowling career statistics for Imran Khan (1971-1991). "Imran Khans bowling statistic" by Masai 162, CC0 1.0.
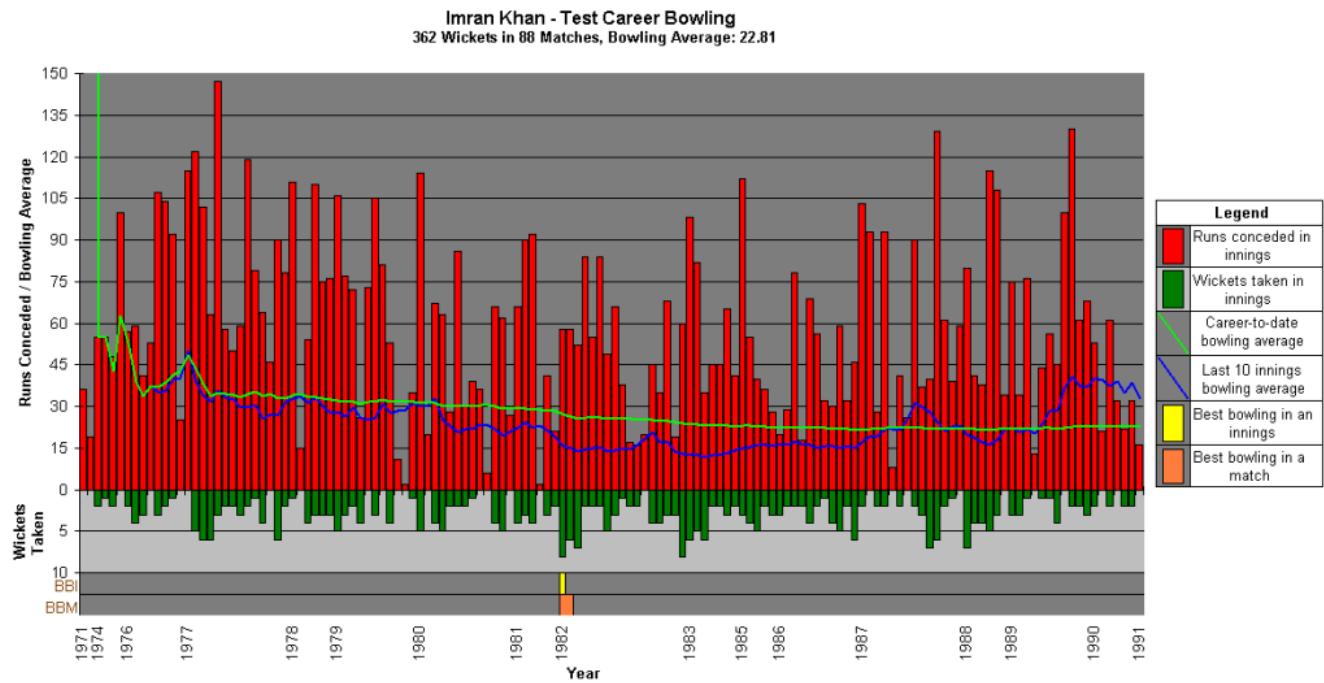
Image Description

This image is a graph titled "Imran Khan – Test Career Bowling." It displays data on Imran Khan's performance over his Test cricket career with the title indicating that he took 362 wickets in 88 matches, averaging 22.81 runs per wicket.

The x-axis represents the *Year*, ranging from 1971 to 1991. The y-axis on the left side represents the *Runs Conceded* and *Bowling Average*, with a scale from 0 to 150. The y-axis on the right side represents the *Wickets Taken*, with a scale from 0 to 10.

There are several data series plotted on the graph:

- Red vertical bars: These represent the *Runs conceded in innings*.
- Green vertical bars: These represent the *Wickets taken in innings*.
- Blue line: This line indicates the *Career-to-date bowling average*.
- Yellow line: This line indicates the *Last ten innings bowling average*.
- Orange vertical bar: This represents the *Best bowling in an innings*.
- Light brown vertical bar: This represents the *Best bowling in a match*.

On the right side of the image is a legend that explains the colours and their corresponding data series. The

graph provides a detailed view of the fluctuations in Imran Khan's bowling performance over his Test career, with varying heights of the bars and lines representing different statistical measures.

The health of the population

The bar graph shown in Figure 3.1.3 presents the percentage of the population aged 60 years and over in 41 countries with dementia. This figure provides the reader with details of the percentage of the population diagnosed with dementia while allowing a comparison of the percentages across several countries.
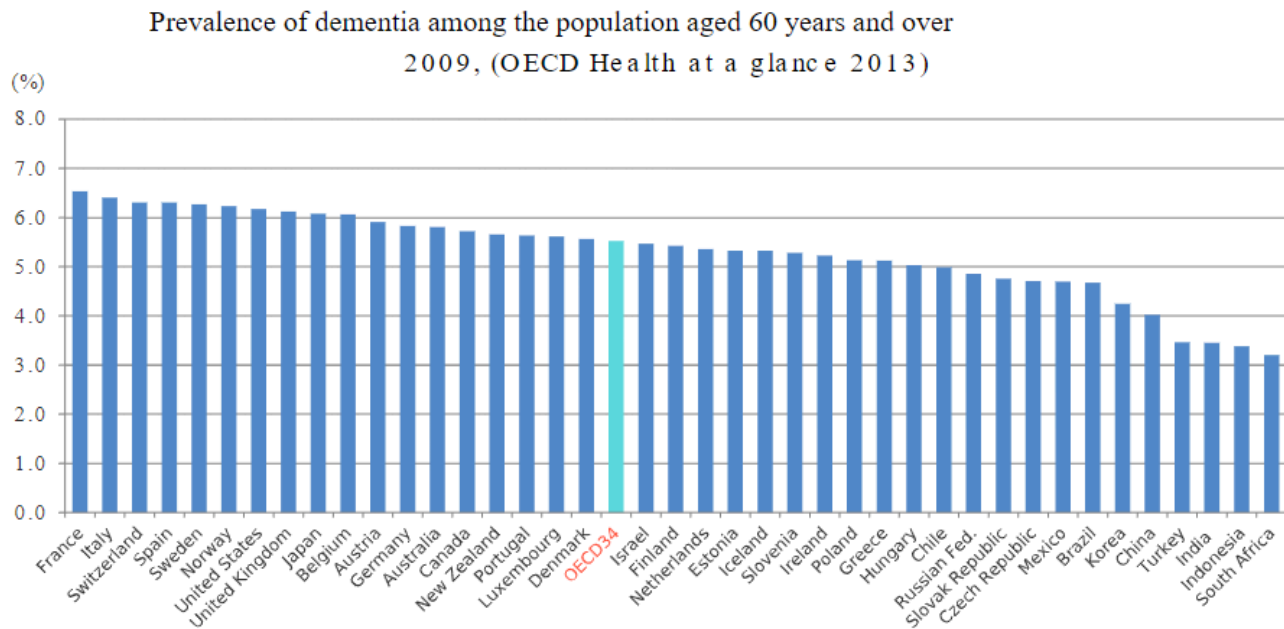
Figure 3.1.3: Prevalence of dementia among people aged 60 years and over. "Oecd-dementia" by Yuasan, CC0 1.01.

Image Description

The image is a bar graph titled "Prevalence of dementia among the population aged 60 years and over, 2009 (OECD Health at a Glance 2013)." The y-axis represents the percentage (%) of the population with dementia, ranging from 0.0% to 7.0%. The x-axis lists various countries and the OECD34 average, with each country's prevalence of dementia represented by a vertical bar.

The countries and their respective percentage values (approximated visually from the graph) are:

Country	Prevalence (%)
France	6.0%
Italy	6.0%
Switzerland	5.8%
Spain	5.7%
Sweden	5.6%
Norway	5.4%
United Kingdom	5.2%
Japan	5.0%
Belgium	5.0%
Austria	4.9%
Germany	4.8%
Australia	4.7%
New Zealand	4.6%
Canada	4.5%
Luxembourg	4.5%
Denmark	4.4%
OECD34	4.2%
Israel	4.1%
Finland	4.0%
Netherlands	3.9%
Slovenia	3.8%
Estonia	3.8%
Ireland	3.7%
Greece	3.6%
Hungary	3.5%
Chile	3.4%
Russia	3.3%
Slovak Republic	3.2%

Czech Republic	3.2%
Mexico	3.1%
Korea	3.0%
China	2.9%
Turkey	2.8%
India	2.7%
South Africa	2.6%

France, Italy, and Switzerland have the highest reported prevalence of dementia among the elderly population, each around or above 5.8%. South Africa shows the lowest prevalence at approximately 2.6%. The OECD34 average stands at about 4.2%.

3.2 CATEGORIZING DATA

Data can come in a variety of forms. It can fit into specific categories, or it can be more general in nature. We can collect data in different ways, such as through instruments like a thermometer or through an open-ended survey. Regardless of the data type and how it is collected, the information is useless without analysis. Data analysis is a powerful tool that can guide key strategic decisions. Businesses rarely make important decisions without some data analysis to support them. A key step in the analysis process is ensuring the reliability and validity of data. A business can then use various techniques to understand the information better. Microsoft Excel provides several tools to make that process easier for the business decision-maker.

Analysis of data to provide insights and recommendations to a team on ways to monitor and improve performance. The skills needed in this field include critical thinking, analytical thinking, problem solving, attention to detail, and communication. Skills you will apply as a health care professional. You may need to dig deeper into data by asking the "why" questions and then be able to clearly communicate your findings to colleagues.

What is Data?

Data are units of information that are collected through observation.

Data can be collected in many forms, such as surveys, interviews, focus groups, measurements, and controlled findings. As a result, they can be numeric or descriptive. For example, data could measure the number of people accessing a website compared to age of that client, or it could be measuring feedback such as that seminar was "wonderful", or a scale-based survey with a scale where five is wonderful. A dental hygienist may evaluate how many people are accessing community service based on many factors, including accessibility, as seen in Chapter 1, and correlate the documented dental ailments by income, age, accessibility, etc.

Once data is collected, it can be grouped into two broad categories: qualitative and quantitative.

Qualitative Data

Qualitative data is categorical information that does not include numbers, or if it does include numbers, those numbers do not have a true mathematical meaning. For example, a question on a class evaluation survey could ask about the mode of delivery for the course, which could be as follows: 1 – in-person, 2 – online, or 3 – hybrid. The numbers, in this case, do not have a meaning; instead, they are placeholders to indicate the category you select.

- Nominal Data is qualitative data that is categorized by naming or labelling and has no quantitative value or meaningful order associated with it. For example, gender, blood type, and marital status. All are grouped into distinct categories.
- Ordinal Data: is used to rank or order data. For example, a survey ranked the level of satisfaction on a scale of 1 to 5. The numbers assigned have a rank or order but no numeric measurement. For example, on a scale of 1 to 5, 4 is not necessarily twice as satisfied as 2 (Beacom, 2018).

Interviews, focus groups or data collected from a variety of sources such as photos, field notes, interview transcripts, and photos can also be included as qualitative data.

Quantitative Data

Quantitative data involves numerical evaluations. Think "quantity". This type of data is typically represented as whole numbers, cannot be broken down into smaller units, and is usually collected through surveys, experiments and statistical analysis. There are two main types of quantitative data: discrete and continuous.

- Discrete data: Discrete data refers to numerical values that can only take on specific, distinct values. This type of data is typically represented as whole numbers and cannot be broken down into smaller units. Examples of discrete data include the number of students in a class, the number of cars in a parking lot, and the number of children in a family (Hassan, 2024).
- Continuous data: Continuous data refers to numerical values that can take on any value within a certain range or interval. This type of data is typically represented as decimal or fractional values and can be broken down into smaller units. Examples of continuous data include measurements of height, weight, temperature, and time (Hassan, 2024).

Descriptive Statistics

Descriptive statistics summarize and describe the basic features of the data, such as the mean, median, mode, standard deviation, and range. There are three main types of Descriptive Statistics:

1. Frequency distribution: records how often data occurs.
2. Central tendency: records the data's center point of distribution and can be measured using mean and median.
3. Dispersion (spread): records its degree of dispersion and can be measured using standard deviation.

Mean: The arithmetic mean of a variable, often called the average, is computed by adding up all the values and dividing by the total number of values.

Median: The median of a variable is the middle value of the data set when the data are sorted in order from least to greatest. It splits the data into two equal halves, with 50% of the data below the median and 50% above the median. The median is resistant to the influence of outliers and may be a better measure of the centre with strongly skewed data.

Standard deviation is a statistic used as a measure of the dispersion or variation in a distribution, how much the data points differ from the mean.

Variables

In data analysis and statistics, variables are characteristics or attributes that are observed, measured, and recorded. Here are some types of variables:

- Independent Variable: The condition that you change in an experiment. These can vary or be manipulated. For example, the temperature in a room.
- Dependent Variable: The variable that you measure or observe. This changes as a result of the independent variable manipulation. It's the outcome you're interested in measuring, and it "depends" on your independent variable.
- Controlled Variable: A variable that does not change during an experiment.

Example

The following example uses the independent variable as the medication, which is changing, and the dependent, the blood pressure of the patient when given the medication.

Independent variable levels: You are studying the impact of a new medication on the blood pressure of patients with hypertension. Your independent variable is the treatment that you directly vary between groups.

You have three independent variable levels, and each group gets a different level of treatment.

You randomly assign your patients to one of the three groups:

- A low-dose experimental group
- A high-dose experimental group
- A placebo group (to research a possible placebo effect)

Independent Variable	Dependent Variable
Type of Treatment (level)	**Blood Pressure**
Level 1: Low dose of the new medication	No change in blood pressure
Level 2: High dose of the new medication	Blood pressure is lowered
Level 3: Placebo	No change in blood pressure
Apply different levels of the independent variable.	Measure the effect on the dependent variable

(Bhandari, 2022).

3.3 ORGANIZING DATA

Using Microsoft Excel is one way we can organize and analyze descriptive data. The basic features of Excel are a row, column, and cell to organize data. The rows and columns in Excel form the software's tabular format. Rows run horizontally, and Columns run vertically across the worksheet, with each row and column intersection point forming a Cell. While rows are denoted by numbers, columns are denoted by headers containing alphabets. A combination of Cells is a range.

Video: "Microsoft Excel. Working With Rows and Columns for Beginners" by Append Training is licensed under the Standard YouTube License [2:46] *Transcript and closed captions available on YouTube.*

Variables can be compared using the rows and columns. In Figure 3.3.1, the two variables are the patient's age and height (HT):

Figure 3.3.1. Patient Age and Height Table

Image Description

The image shows an open Microsoft Excel spreadsheet with data and a "Sort" dialogue box overlay. The spreadsheet contains three columns labelled "PATIENT," "AGE," and "HT." The first few rows of the data are visible with the following values:

PATIENT	AGE	HT
295	57	62.3
292	58	68.4
286	59	71.2
280	61	70.6
289	61	72.1
284	62	61.5
285	62	65.2
290	62	72.6
276	63	65.0

In the "Sort" dialogue box, there are options to add or delete levels for sorting. The current setting is:

- Column: AGE
- Sort On: Values
- Order: Smallest to Largest

There is a checkbox labelled "My data has headers" at the top of the dialogue box, and it is checked. Below this checkbox are buttons to manage the sort levels and to run or cancel the sort.

You can then sort and filter your data by column. For example, if I wanted to organize the data in the example table provided by age.

1. Select data
2. Within the HOME Ribbon (tab), select the Sort & Filter dropdown menu button (inverted triangle next to the word "Filter") and select the "Custom Sort..." option.
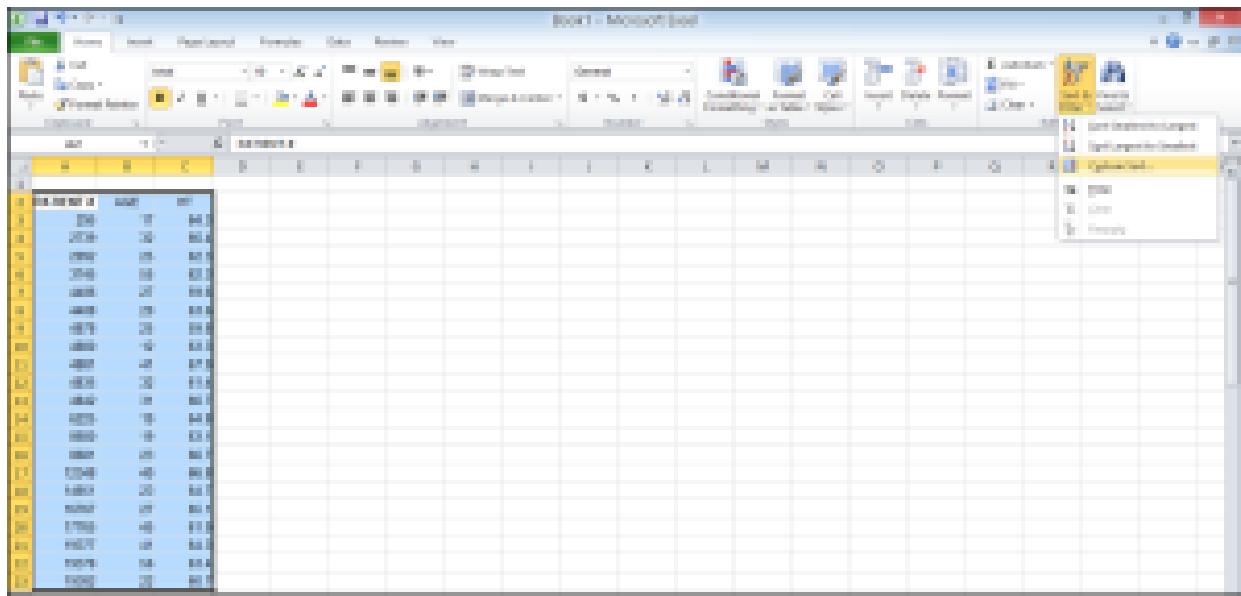
Figure 3.3.2. Table Filtered by Age

Image Description

This image depicts a screenshot of a Microsoft Excel 2010 spreadsheet. The spreadsheet interface includes the title bar at the top, which displays "Book1 – Microsoft Excel," indicating it is an unsaved new workbook.

Below the title bar is the ribbon, an area that contains several tabs, including "File," "Home," "Insert," "Page Layout," "Formulas," "Data," "Review," and "View." The "Home" tab is currently selected and active, with a variety of formatting options displayed in the ribbon, such as "Clipboard," "Font," "Alignment," "Number," "Styles," "Cells," and "Editing."

The worksheet grid is displayed below the ribbon. Columns are labelled with letters (A, B, C, D, etc.) along the top, and rows are labelled with numbers (1, 2, 3, etc.) down the left-hand side.

The range of cells from A1 to E20 is selected and highlighted in blue. The selected area appears to contain data, with the first column (A) showing a sequence of dates and the second column (B) corresponding values. The remaining columns seem to be empty.

On the far right side of the ribbon, a drop-down menu is visible under the "Sort & Filter" option, with the choices "Sort A to Z," "Sort Z to A," "Custom Sort," and a separator with options below.

3. The Sort box will appear, and under the Column heading, in the "Sort by:" category, select AGE. Under the Order heading, ensure "Smallest to Largest" has been selected. Click on OK
4. Check to make sure the new dataset is correct.
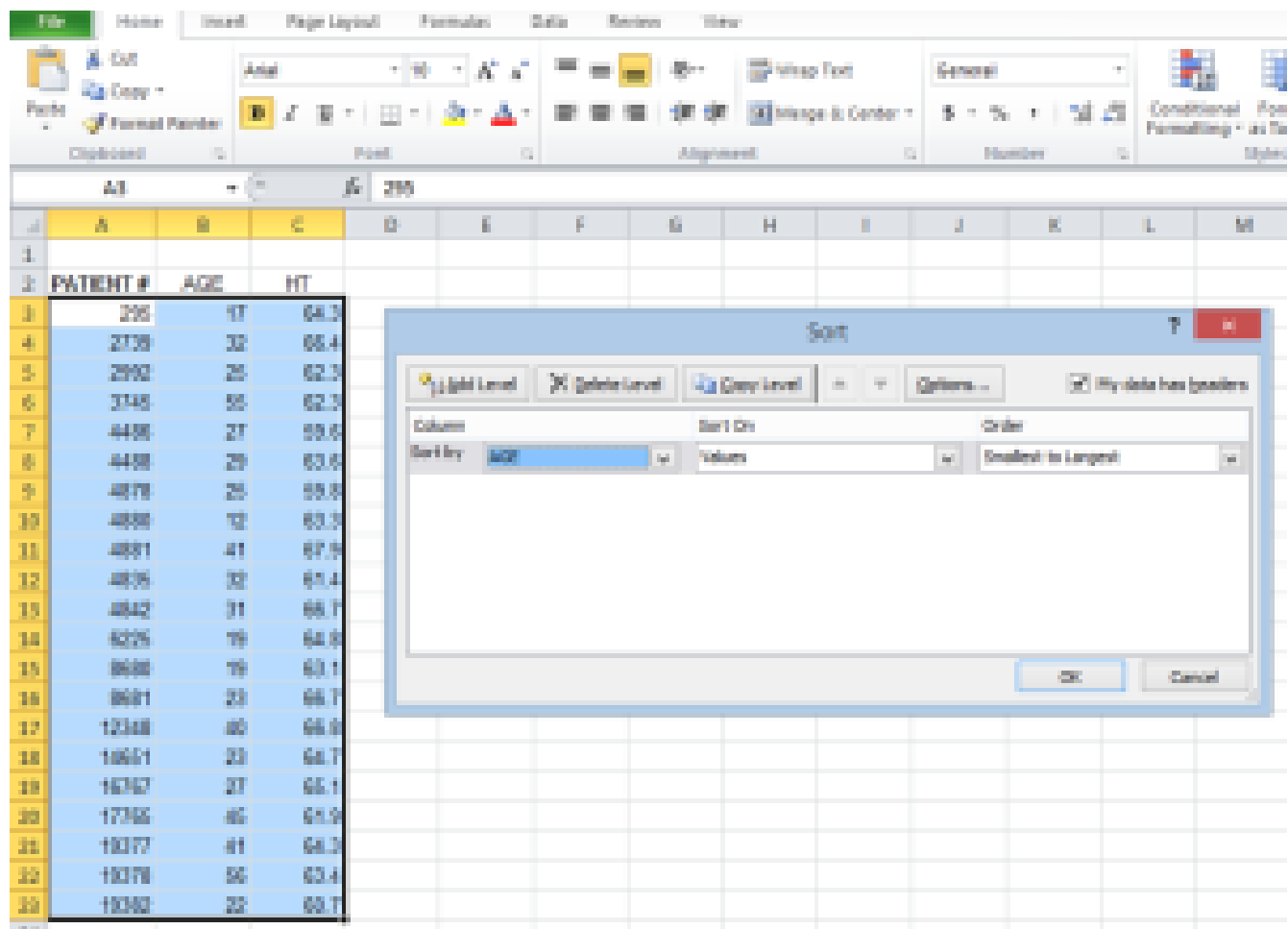
Figure 3.3.3. Table Sorted Smallest to Largest

Image Description

The image shows an open Microsoft Excel spreadsheet with data and a "Sort" dialogue box overlay. The spreadsheet contains three columns labelled "PATIENT," "AGE," and "HT." The first few rows of the data are visible with the following values:

PATIENT	AGE	HT
295	57	62.3
292	58	68.4
286	59	71.2
280	61	70.6
289	61	72.1
284	62	61.5
285	62	65.2
290	62	72.6
276	63	65.0

In the "Sort" dialogue box, there are options to add or delete levels for sorting. The current setting is:

- Column: AGE
- Sort On: Values
- Order: Smallest to Largest

There is a checkbox labelled "My data has headers" at the top of the dialogue box, and it is checked. Below this checkbox are buttons to manage the sort levels and to run or cancel the sort.

Video: "Excel: Sorting Data" by LearnFree is licensed under the Standard YouTube License [4:30] *Transcript and closed captions available on YouTube.*

Applying Your Knowledge

Using the following image:

1. Identify the row, column, cell and range.
2. What is the value in cell C18?
3. What is the range of cells selected?
4. What is the independent variable?

File	Home	Insert	Page Layout	Formulas	Data	Review	View

Clipboard | Font | Alignme

C3 f_x 64.3

	A	B	C	D	E	F	G
1							
2	**PATIENT #**	**AGE**	**HT**				
3	295	17	64.3				
4	2739	32	66.4				
5	2992	25	62.3				
6	3745	55	62.3				
7	4486	27	59.6				
8	4488	29	63.6				
9	4878	25	59.8				
10	4880	12	63.3				
11	4881	41	67.9				
12	4835	32	61.4				
13	4842	31	66.7				
14	6225	19	64.8				
15	8680	19	63.1				
16	8681	23	66.7				
17	12348	40	66.8				
18	14651	23	64.7				
19	16767	27	65.1				
20	17765	45	61.9				
21	19377	41	64.3				
22	19378	56	63.4				
23	19382	22	60.7				
24	20278	57	63.4				
25	21626	24	62.6				

Sheet1   Sheet2   Sheet3

Image Description

The image is a screenshot of a Microsoft Excel spreadsheet. The spreadsheet displays three columns labelled "PATIENT #," "AGE," and "HT," with data entries in each column. Here is the detailed description of the data:

PATIENT #	AGE	HT
295	17	64.3
2739	32	66.4
2992	25	62.3
3745	55	62.3
4486	27	59.6
4488	29	63.6
4878	25	59.8
4880	12	63.3
4881	41	67.9
4835	32	61.4
4842	31	66.7
6225	59	64.8
8680	19	63.3
8681	23	66.7
12348	40	66.8
14651	23	64.7
16767	27	65.1
17765	45	61.9
19377	41	64.3
19378	56	63.4
19382	22	60.7
20278	57	63.4
21626	24	62.6

The spreadsheet interface includes the following tabs in the toolbar: "File," "Home," "Insert," "Page Layout," "Formulas," "Data," "Review," and "View." Various formatting options, such as

font type, size, alignment, and styles, are present above the data. The "HT" column is highlighted in light blue.

Below the data area are sheet names "Sheet1," "Sheet2," and "Sheet3," with "Sheet1" currently selected.

Microsoft Excel screenshots used with permission from Microsoft.

3.4 BASIC FUNCTIONS IN EXCEL

Often, when collecting data, we will need to use formulas to determine things like count, averages, etc. You can use a cell in Excel to create a formula.

Video: "Excel: Intro to Formulas" by LearnFree is licensed under the Standard YouTube License [3:39] *Transcript and closed captions available on YouTube.*

In Excel, a function is a predefined formula that performs a specific calculation by using values a user inputs. You will see in the video there are many functions that can be used in place of formulas when using Excel. The most common functions we will use are found in Excel by clicking the Formulas ribbon and AutoSum.
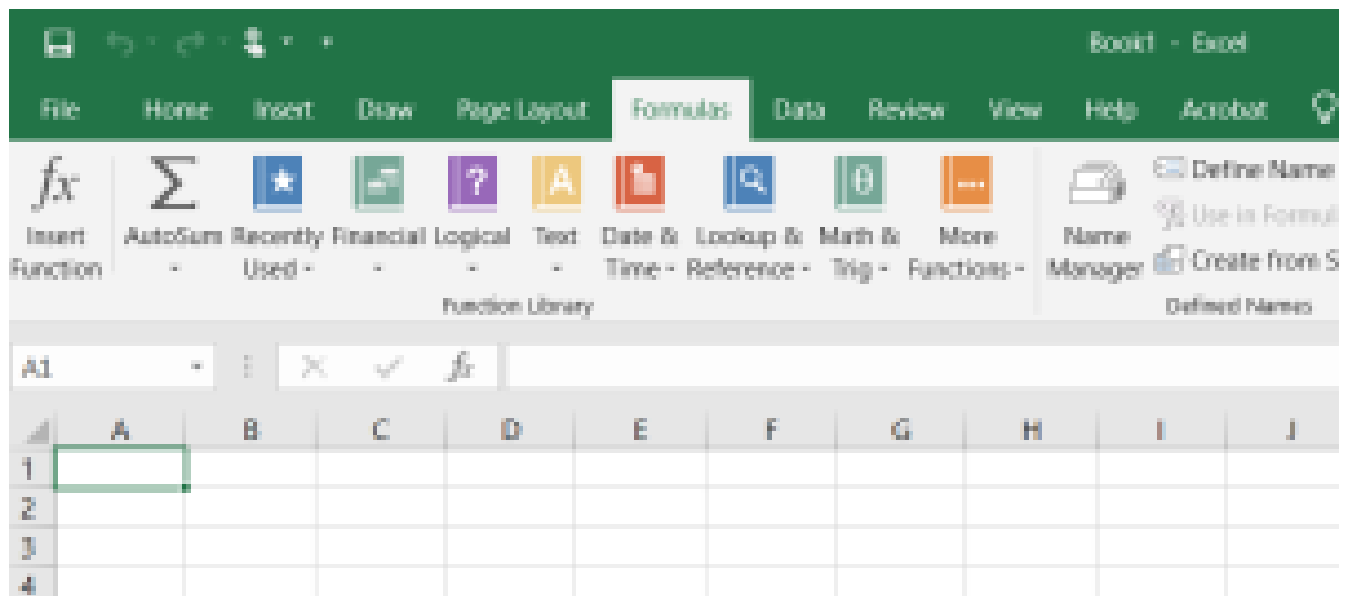

Figure 3.4.1.

Image Description

The image is a screenshot of a Microsoft Excel interface.

At the topmost section, there is a green title bar displaying "Book1 – Excel" on the right side. Below that is a ribbon menu with the following tabs from left to right: *File, Home, Insert, Draw, Page Layout, Formulas (selected), Data, Review, View, Help, and Acrobat*. The *Tell me what you want to do...* search bar is next to these tabs on the right.

Underneath the ribbon menu, there's a toolbar specific to the "Formulas" tab, divided into several groups:

- *Function Library* including icons for *Insert Function, AutoSum, Recently Used, Financial, Logical, Text, Date & Time, Lookup & Reference, Math & Trig, More Functions*
- *Defined Names*, including icons for *Define Name, Use in Formula, Create from Selection*
- *Formula Auditing*, including icons for *Name Manager*

Below this toolbar, there's a standard Excel grid with columns labelled from A to I and rows labelled from 1 to 4.

A single cell, A1, is highlighted, indicating it is currently selected.

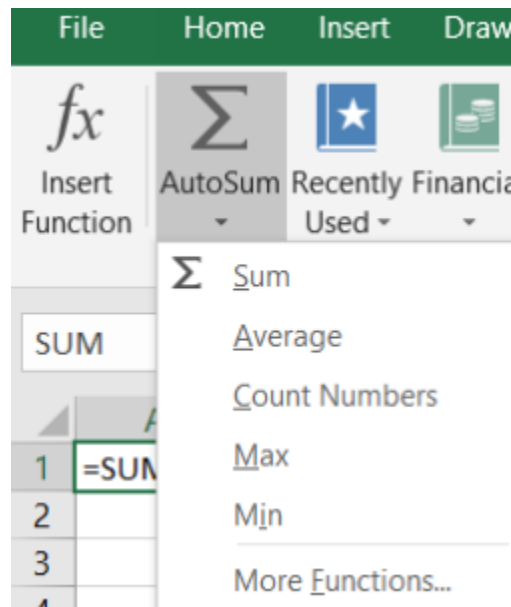Here, you will find quick functions like Sum and Average.

Figure 3.4.2.

Image Description

The image is a screenshot of a section of the Microsoft Excel interface. The top menu bar displays the options "File," "Home," "Insert," and "Draw." Below this menu bar, there is a toolbar with various buttons and icons commonly used in Excel.

On the left side of the toolbar, there is an "fx" icon with the text "Insert Function" next to it. To the right, there is an "AutoSum" button denoted by a summation symbol (Σ). Next to the "AutoSum" button, there are two more buttons labelled "Recently Used" and "Financial."

When the AutoSum button is clicked, a dropdown menu appears. This dropdown menu contains the following options:

- Sum
- Average
- Count Numbers
- Max
- Min
- More Functions...

Below the toolbar, a small portion of a worksheet is visible. The formula "=SUM(" is displayed in a highlighted cell, indicating that the user is currently entering a SUM function.

You can also click Insert Function. If you are not sure, you can describe what you want to do, and Excel will recommend the function that may perform the formula you require.
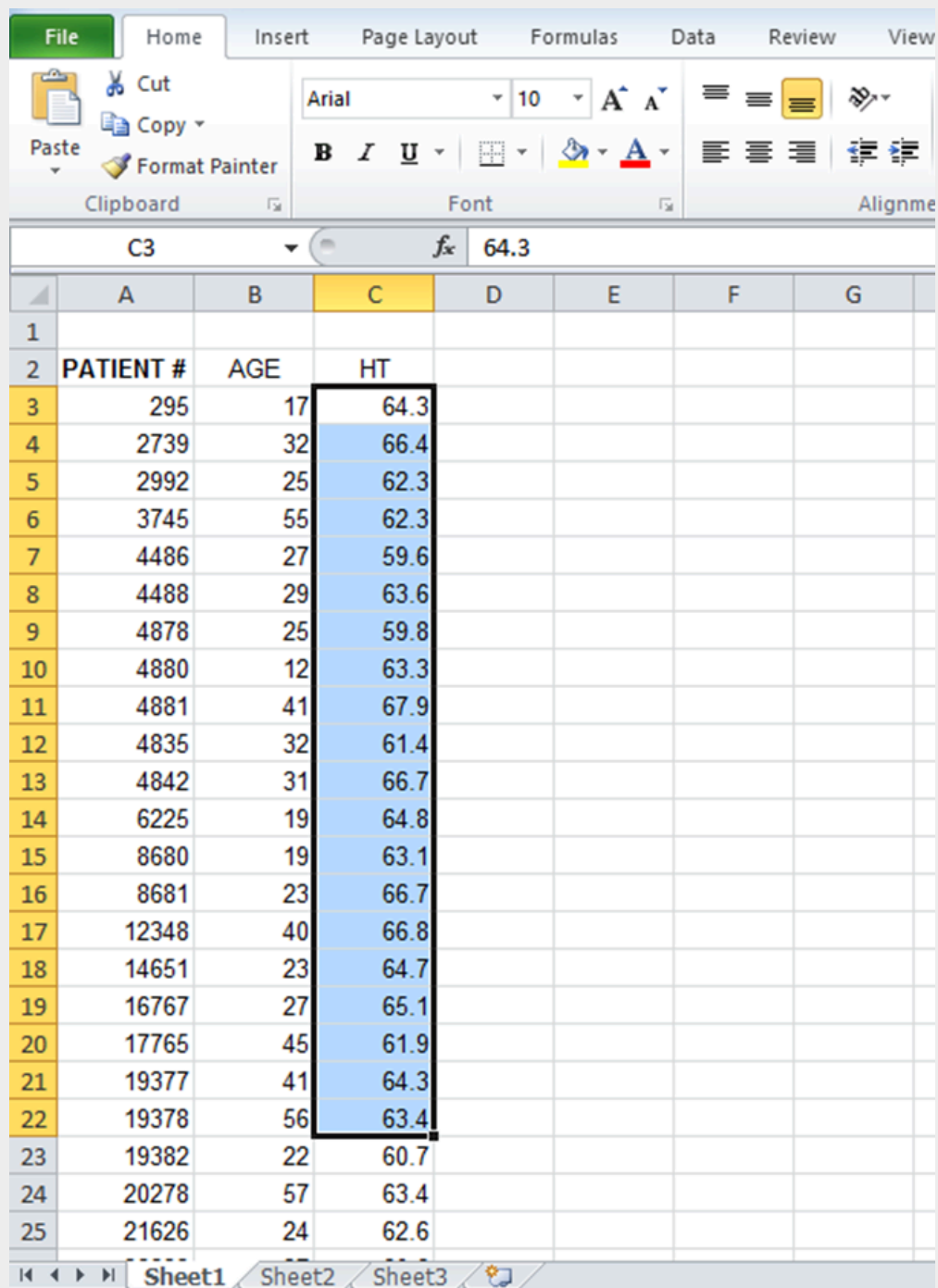
The following video shows the basic function skills you may use.

Video: "Excel: Functions" by LearnFree is licensed under the Standard YouTube License [5:15] *Transcript and closed captions available on YouTube.*

Applying Your Knowledge

1. Open Excel.
2. Create a worksheet and enter the data as shown in the image.
3. Using functions in your worksheet calculate the average and median age.

Figure 3.4.3

Image Description

    – The title at the top left reads "File."
– The horizontal menu options include Home, Insert, Page Layout, Formulas, Data, Review, and View. The "Home" tab is currently selected.
– Below the menu options, there are various buttons and tools, such as Clipboard, Font settings, Alignment, and Number formatting.
– The sheet has three columns with headers: "PATIENT #", "AGE", and "HT."
    The table data begins from row 2 and continues downwards. Here is a description of the table:

PATIENT #	AGE	HT
295	17	64.3
2726	37	69.2
3078	55	66.4
3176	43	62.6
4439	52	66.3
4575	41	63.4
4818	40	68.7
4831	57	61.8
4839	47	67.1
4881	25	64.4
4884	32	63.3
5065	23	64.8
5104	33	62.4
10577	47	68.1
14005	46	63.9
15835	30	65.5
16764	27	67.3
16677	29	64.9
17864	39	61.8
23472	23	62.4
23482	55	62.7

The HT column from C2 to C23 is highlighted in a light blue colour.

Microsoft Excel screenshots used with permission from Microsoft.

3.5 DATA VISUALIZATION

Visual elements are referred to as either Tables or Figures. Tables are made up of rows and columns, and the cells usually have numbers in them (but may also have words or images). Figures refer to any visual elements — graphs, charts, diagrams, photos, etc. — that are not Tables.

Table 3.4.1. Types of Visual Elements

Type of Visual		Description and Purpose
Tables		Place detailed data/information in categories formatted into rows and columns for comparison; use when exact figures are important. Label column headings (box heads) and/or rows (stubs).
Graphs	**Bar Graph**	Compare and contrast two or more subjects at the same point in time, or compare change over time.
	Column Graph	Reveal change in a subject at regular intervals of time.
	Line Graph	Show the degree and direction of change relative to two variables; compare items over time, show frequency or distribution, or show correlations.
Charts	**Pie Chart**	Display the number and relative size of the divisions of a subject; shows the relation of parts to a whole (parts must sum to 100% to make sense).
	Org. Chart	Map the divisions and levels of responsibility or hierarchy within an organization.
	Flow Chart	Show the sequence of steps in a process or procedure.
	Gantt Chart	Indicates timelines for multi-stepped projects, especially used in proposals and progress reports.
Illustrations	**Diagram**	Identify the parts of a subject and their spatial or functional relationship; emphasize detail or show dimensions.
	Photo	Show what a subject looks like in realistic detail or show it being used.
	Animation	Simulate a process, operation, or incident.
	Film clip	Depict a process, operation, or incident in realistic detail.

Tables

Tables can be used to summarize large amounts of data or data with exact values. For example, nominal data.

Recall that nominal data is qualitative data that is categorized by naming or labelling, has no quantitative value, and is grouped by categories. For example, To measure blood types within a group, the only options are A, B, AB, or O. These are distinct categories. A table may be the best visual option to organize this data for results.

In a table, you must include a label, a caption, and a description of what the table represents. If you have multiple tables in a report, they should be numbered Table 1, Table 2, etc.

Table 3.5.2 Blood Type. This table shows the frequency of each blood type in a Pre Health Science class n=25

Class: Blood Type	Frequency	Percent
A	5	20%
B	7	28%
O	9	36%
AB	4	16%
Totals	25	100%

Charts

The following video is an example of how to use Excel to create charts:

Video: "Excel: Charts" by LearnFree is licensed under the Standard YouTube License [4:30] *Transcript and closed captions available on YouTube.*

Histograms

Histogram is an example of a type of bar graph that displays data by using bars to show the frequency

distribution of continuous data. For example, a Professor may use a histogram to see the distribution of class grades.
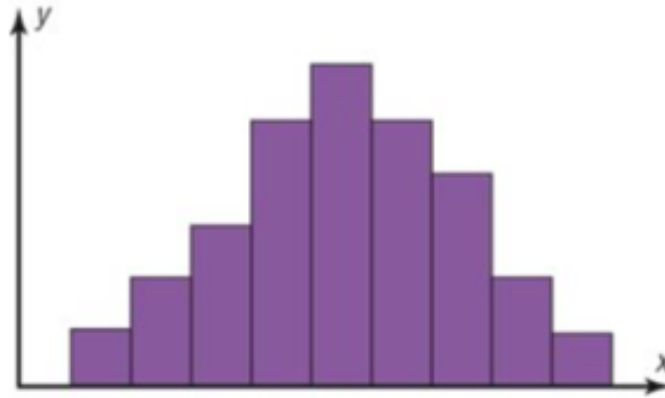
Figure 3.5.1. Human Anatomy midterm grades. This histogram represents the grade distribution of for midterm of Human Anatomy n=334 students.

Image Description

This image is a histogram with a series of adjacent purple bars. The x-axis and y-axis are labelled simply as "x" and "y," respectively. The histogram's bars vary in height, forming a symmetric distribution that peaks in the center and tapers off towards both ends. It appears as a bell-shaped curve, typically indicative of a normal distribution.

A visual will not tell the entire story but provides a summary for the reader. As in the example above, this is a bell curve and tells the reader that the majority of the class scored a grade in the approximate average of the class. Further details, such as the mean, median and standard deviation, will provide the reader with more accurate information about the overall class evaluation scores.

As a result, Graphs alone can be misleading. It is important for the reader to understand what the data visual is reporting and be aware of misleading data or do further research. This is why the skill of appreciating numbers and data for relevancy

is so important from Mathematics. The next section will review a few common ways visuals can be misleading.

Graphs can be used to skew data and spin a narrative like never before, especially with the velocity at which some topics spread across social media. All it takes is a single graph from an unreputable source to spread a false narrative around the world (McCready, 2020).

"3.4 Figures and Tables" from Technical Writing Essentials by Suzan Last is licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted.—Modifications: Used section *Terminology*, edited; Used Table 3.1.1.

3.6 MISLEADING DATA VISUALIZATIONS

Data visualizations can be confusing and misleading when the designer has picked a format that isn't well suited to the data they are analyzing.

Review Figure 3.6.1. There are 12 categories of television and similar colours used in the graph, as well as white font over the bright colours, making this hard to read.
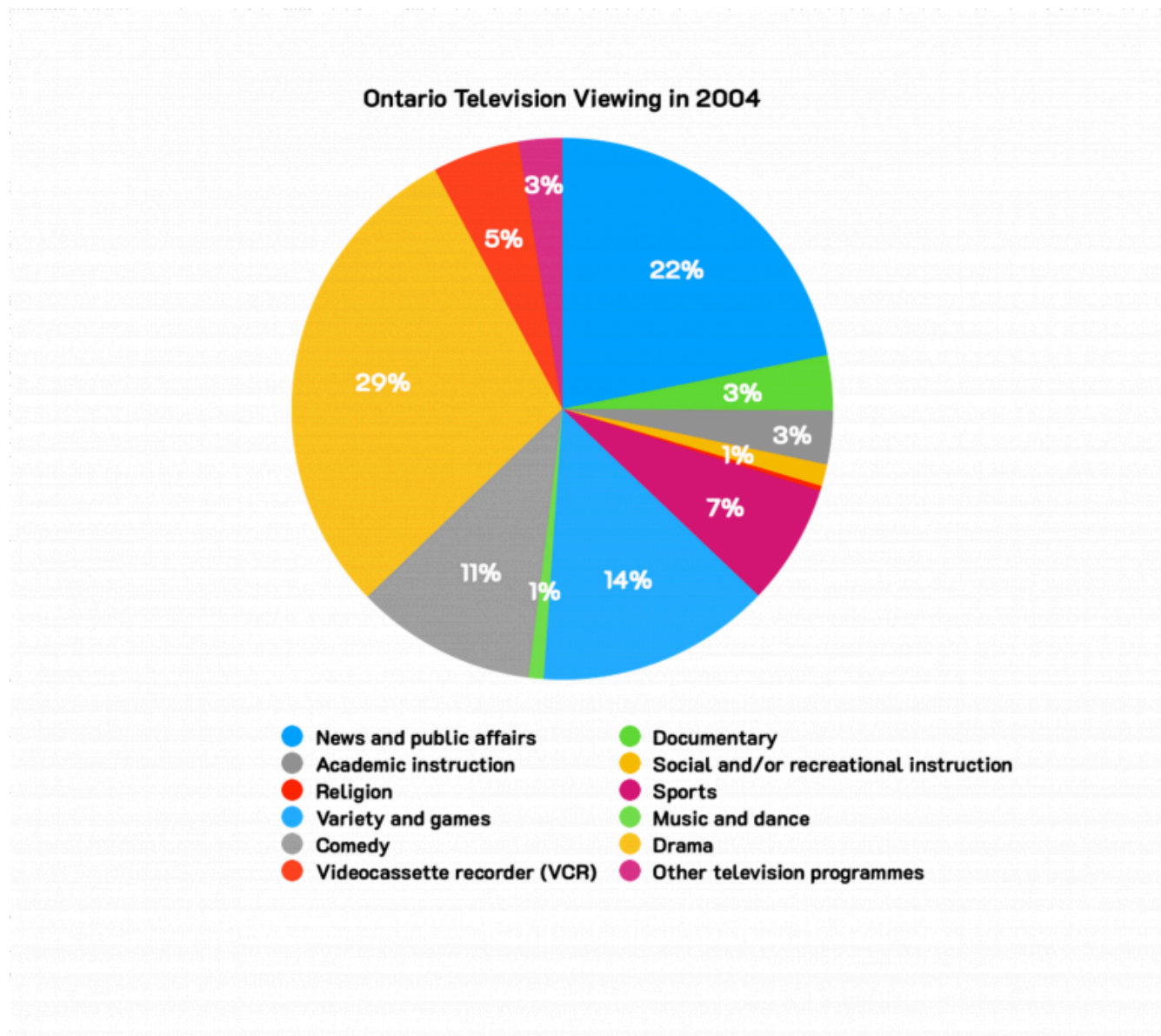

Figure 3.6.1."Ontario Television Viewing in 2004" (Statistics Canada, 2011. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence).

Image Description

The image is a pie chart titled "Ontario Television Viewing in 2004." It shows the percentages of time spent on various types of television programming. The slices are colour-coded and labelled with percentages as follows:

- News and public affairs: 22%
- Academic instruction: 3%
- Religion: 5%
- Variety and games: 14%
- Comedy: 11%
- Videocassette recorder (VCR): 1%
- Documentary: 3%
- Social and/or recreational instruction: 1%
- Sports: 7%
- Music and dance: 3%
- Drama: 1%
- Other television programmes: 29%

False Causation

Correlation does not imply causation.

If you've ever taken a statistics or data analysis course, you have almost certainly come across this common phrase. It means that just because two trends seem to fluctuate alongside each other, it doesn't prove that one causes the other or that they are related in a meaningful way.

Review Figure 3.6.2 below, which shows a line graph of the decrease of Canadian automotive apprenticeship registrations and nectarine production. What do these two things have to do with each other? They are unrelated quantities that appear to decrease at the same rate over a similar time period.
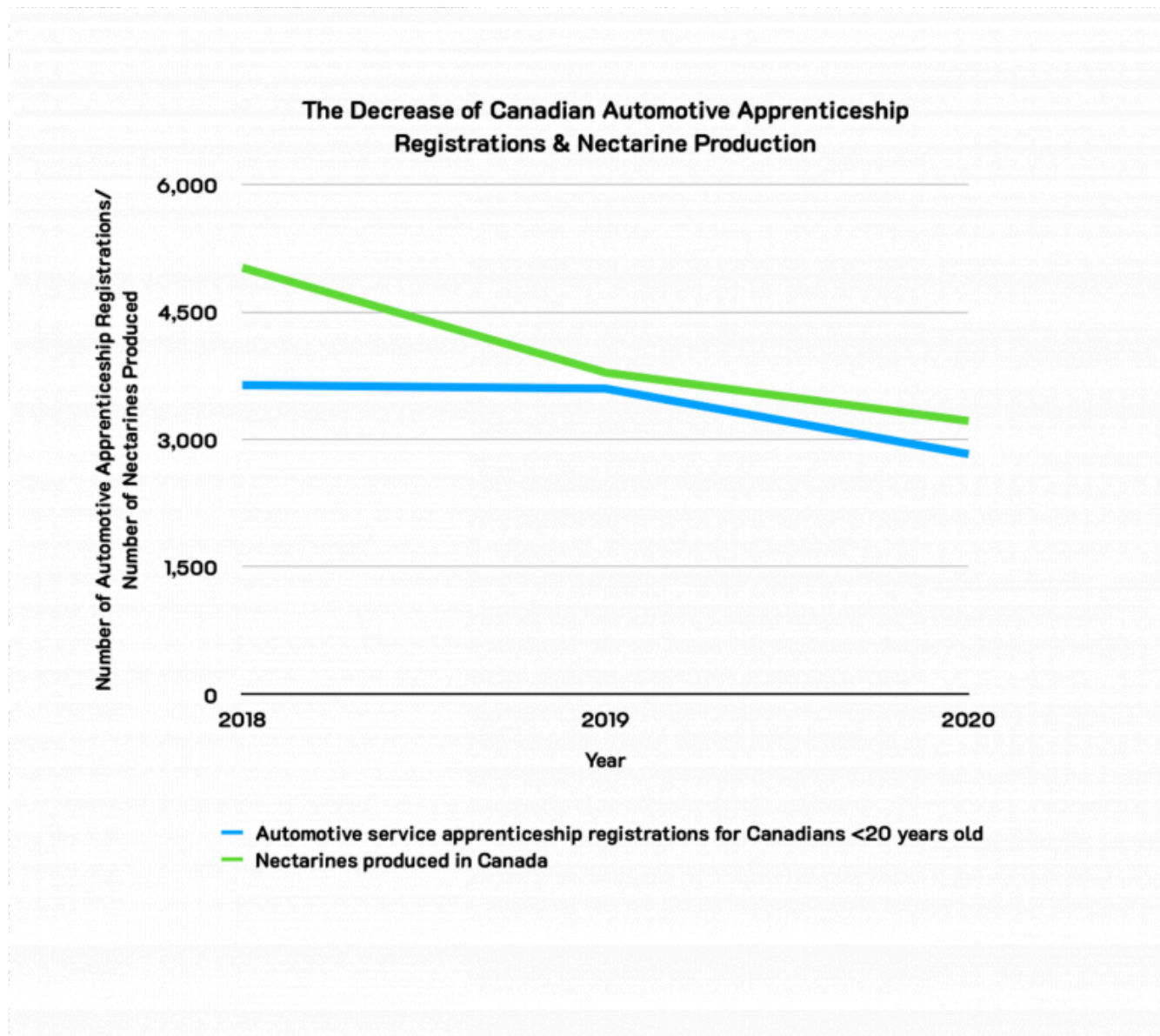
Figure 3.6.2. "The Decrease of Canadian Automotive Apprenticeship Registrations and Nectarine Production" (Statistics Canada, 2017; Statistics Canada, 2024. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The line graph is titled "The Decrease of Canadian Automotive Apprenticeship Registrations & Nectarine Production." The x-axis represents the years from 2018 to 2020. The y-axis represents the values for the number of automotive apprenticeship registrations and the number of nectarines produced, ranging from 0 to 6,000.

The graph shows two data series:

- A blue line representing "Automotive service apprenticeship registrations for Canadians under 20 years old."
- A green line representing "Nectarines produced in Canada."

In 2018, the number of automotive apprenticeship registrations is around 3,500, and the number of nectarines produced is above 4,500. Both lines show a decline over the years. By 2020, both values converge to be just above 3,000.

Inconsistent or Manipulated Scale

It's important to examine the scales of a data visualization carefully. Compressing or expanding the scale of a graph can make the changes between data points seem either more or less significant than they really are.

Review Figure 3.6.3 below, which shows the cost of sugar in Canada from January to July 2021. Because of the expanded scale on the line graph, there does not appear to be much fluctuation in the cost of sugar in Canada. This makes the data appear less significant than it could really be (see Figure 3.6.4 below for a more compressed scale).

Figure 3.6.3. "Cost of Sugar in Canada" (Statistics Canada, 2022. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The image is a line graph titled "Cost of Sugar in Canada." The x-axis represents the months, starting from January 2021 on the left and ending at July 2021 on the right. The y-axis represents the cost of sugar in Canadian Dollars (CAD), ranging from 0 to 10. The graph shows a line that is mostly flat, hovering around the $2 mark throughout the entire period, with a slight increase around May 2021. The line is orange in colour. Overall, the cost of sugar remains relatively stable over these months with minimal fluctuations.
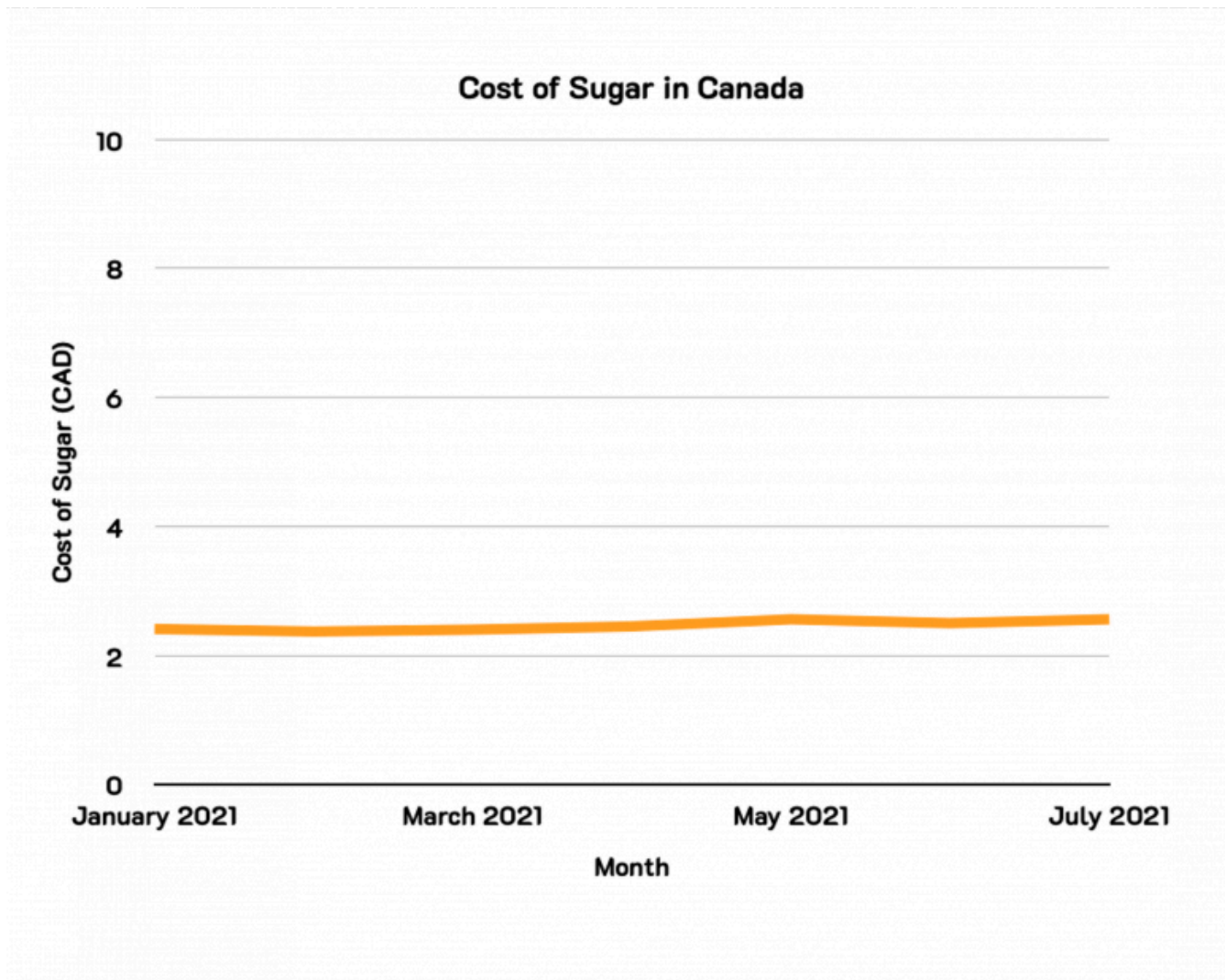
Figure 3.6.4. "Cost of Sugar in Canada" (Statistics Canada, 2022. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The image is a line graph depicting the cost of sugar in Canada from January to July 2021. The x-axis represents the months, with labels for January, March, May, and July 2021. The y-axis represents the cost of sugar in Canadian dollars (CAD), with markers at 1.8, 2.04, 2.28, 2.52, 2.76, and 3.0 CAD.

The title of the graph reads "Cost of Sugar in Canada." The data line, represented in orange, starts in January 2021 at approximately 2.52 CAD, dips slightly below 2.52 CAD in March 2021, rises to about 2.66 CAD by May 2021, slightly drops to around 2.60 CAD shortly after, and finally ends just above 2.66 CAD in July 2021.

Cherry-picking or Omitting Data

The term "cherry-picking" refers to only presenting the best data and omitting data points which are less favourable in order to reinforce a particular narrative. This can create a false impression of the data. For example, showing an upward sales trend over the first few months of a year, while omitting the data that showed sales declined for the rest of the year.

Review Figure 3.6.5 below, which shows a downward trend on gasoline prices in Canada from May 2019 to February 2020. Because of the carefully selected timeframe (i.e., short timeframe), it appears that the gasoline prices in Canada are decreasing.
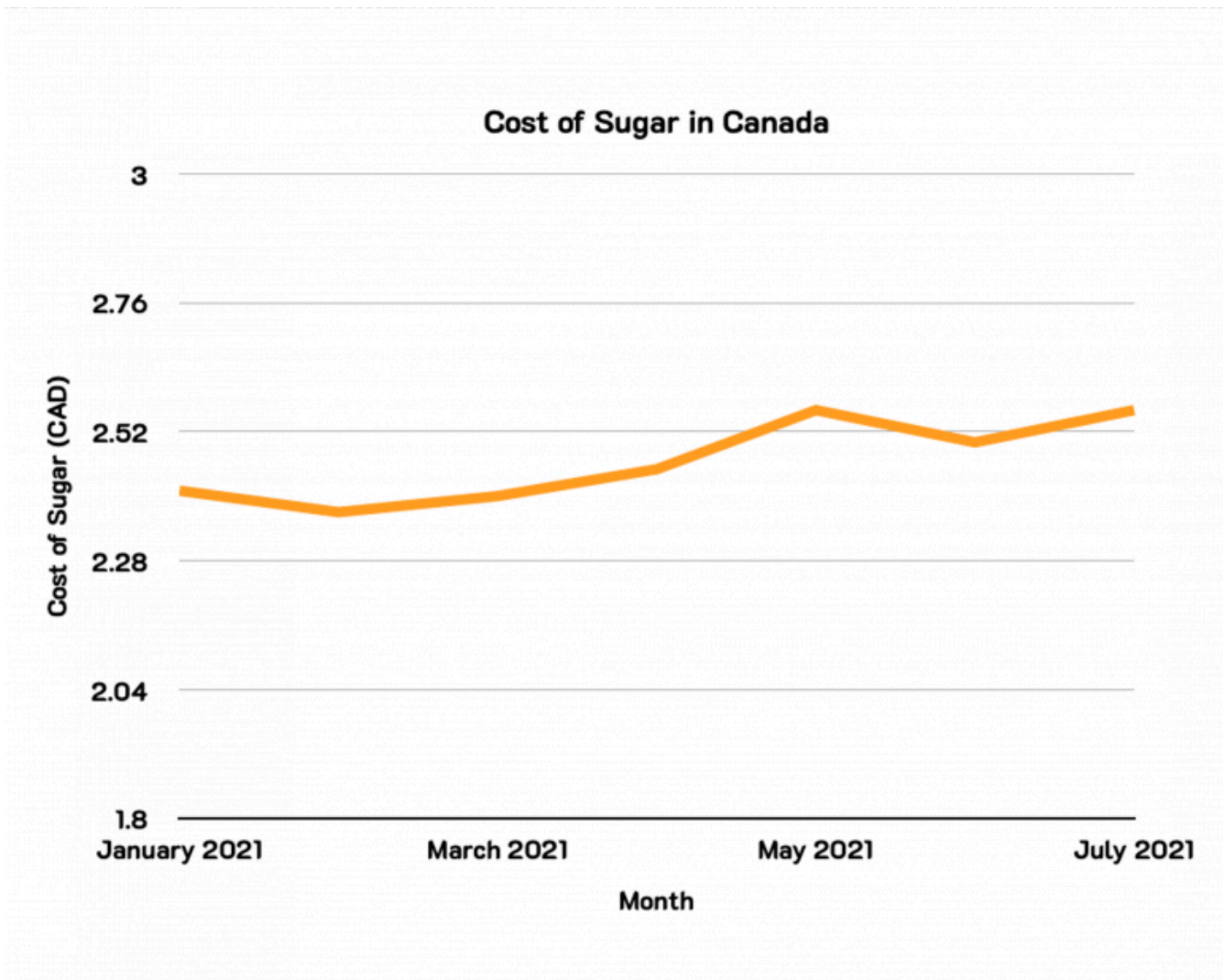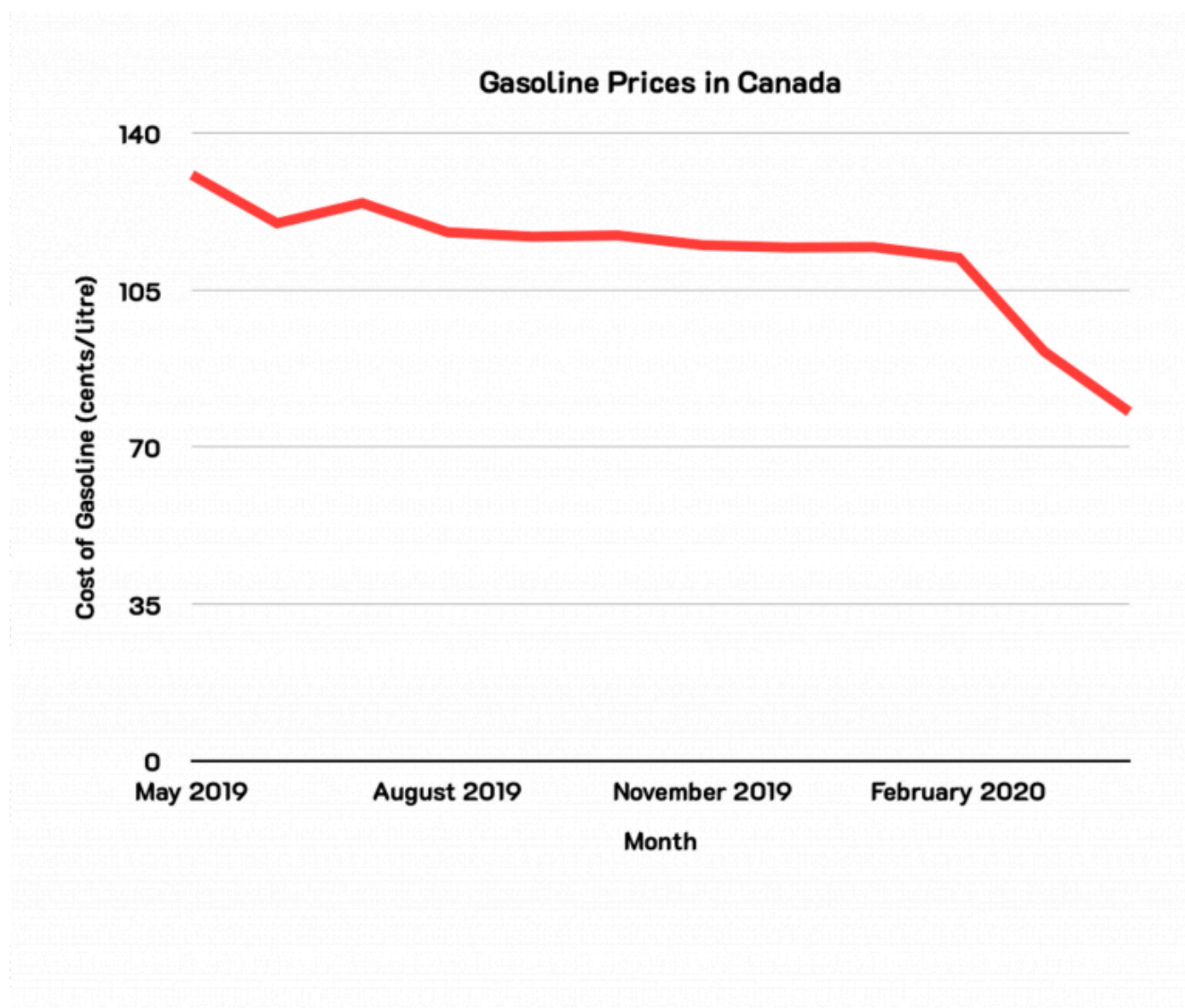

Figure 3.6.5. "Gasoline Prices in Canada" (Statistics Canada, 2022. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The image is a line graph titled "Gasoline Prices in Canada." The graph tracks the cost of gasoline (in cents per litre) over time, from May 2019 to February 2020. The horizontal axis (x-axis) represents the months, specifically May 2019, August 2019, November 2019, and February 2020. The vertical axis (y-axis) shows the cost of gasoline, ranging from 0 to 140 cents per litre, with markers at intervals of 35 cents (i.e., 0, 35, 70, 105, and 140 cents).

The data is depicted by a red line that generally trends downward over the period. The line starts at around 130 cents per litre in May 2019, initially drops and then fluctuates slightly to around 110 cents per litre until early 2020. From late 2019 to February 2020, the line shows a more significant decline, reaching about 70 cents per litre by the end of the graph.

Now review Figure 3.6.6 below, which shows an overall upward trend on gasoline prices in Canada from May 2019 to November 2021. When looking at the full timeline (i.e., long timeframe), the reader can see that gasoline prices are increasing in Canada.
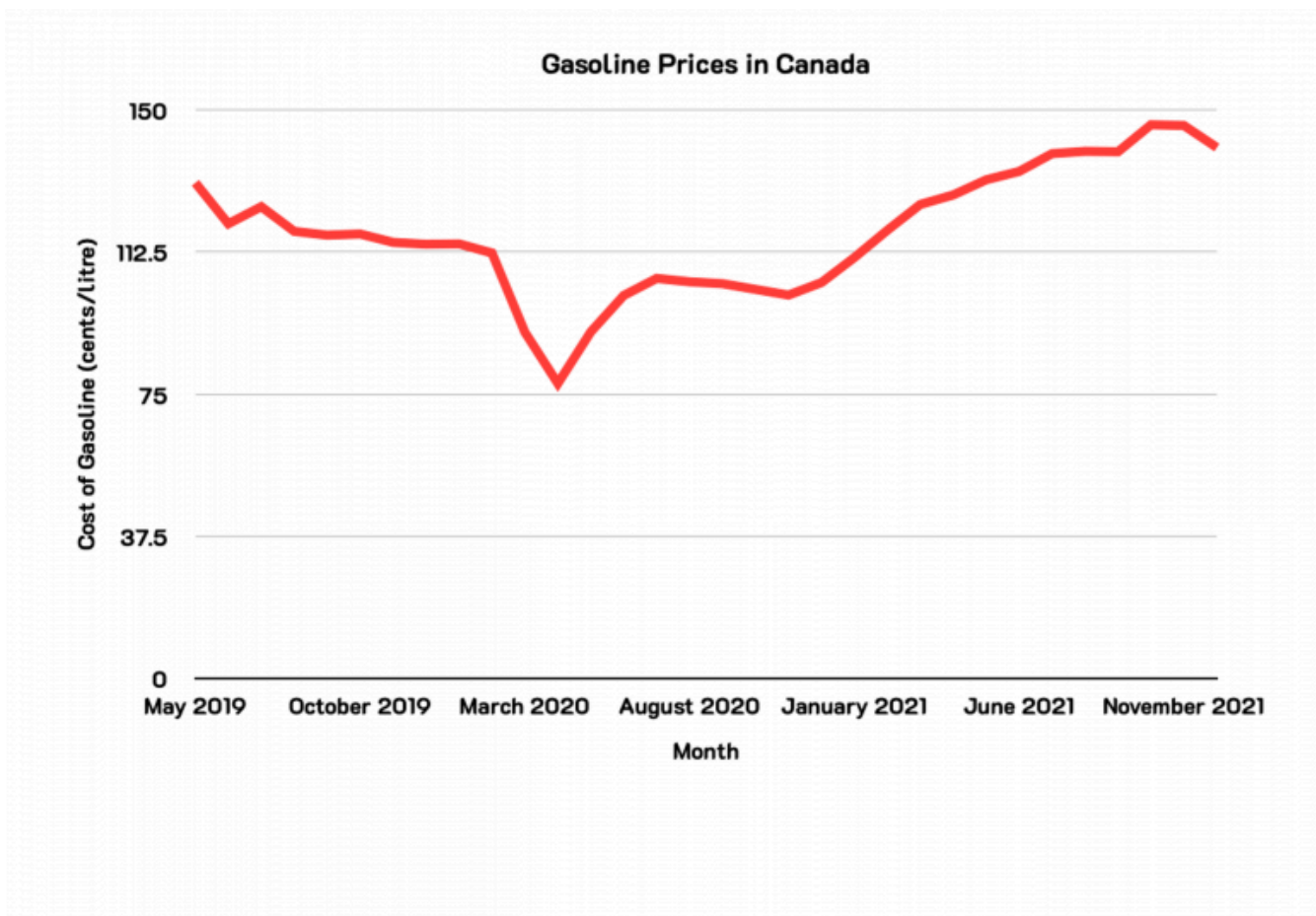

Figure 3.6.6. "Gasoline Prices in Canada" (Statistics Canada, 2022. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The image is a line graph titled "Gasoline Prices in Canada," which illustrates the cost of gasoline over time from May 2019 to November 2021.

The y-axis represents the "Cost of Gasoline (cents/litre)," ranging from 0 to 150, in intervals of 37.5. The x-axis represents the "Month," with notable points marked at May 2019, October 2019, March 2020, August 2020, January 2021, June 2021, and November 2021.

The red line on the graph shows how gasoline prices have changed over the specified period. Initially, gasoline prices fluctuated slightly but remained relatively steady around 112.5 cents per litre. In early 2020, there was a significant decline, reaching a low point around March 2020. Following this drop, prices gradually increased, showing a steady upward trend from mid-2020 through January 2021, continuing to rise until they slightly decline again nearing November 2021.

3D Distortion or Occlusion

Three-dimensional (3D) data visualizations may look visually appealing, but they often make it more difficult to interpret the data and spot patterns within them. Two common issues are distortion and occlusion. Distortion happens when objects in the foreground appear larger (and maybe more important) than objects in the background, which appear smaller. Occlusion happens when one 3D graphic partially blocks another one.

The original version of this chapter contained H5P content. You may want to remove or replace this element.

Review Figure 3.6.7 below, which is a 3D bar graph of the percentage of Canadian vs. foreign television programmes watched in Saskatchewan from 2000 to 2003. Because of the tilt of the 3D bar graph, the bars in the front hide the bars in the back, making it hard to read. The reader cannot pinpoint the exact percentage of Canadian vs. foreign programmes by the year it is presented.
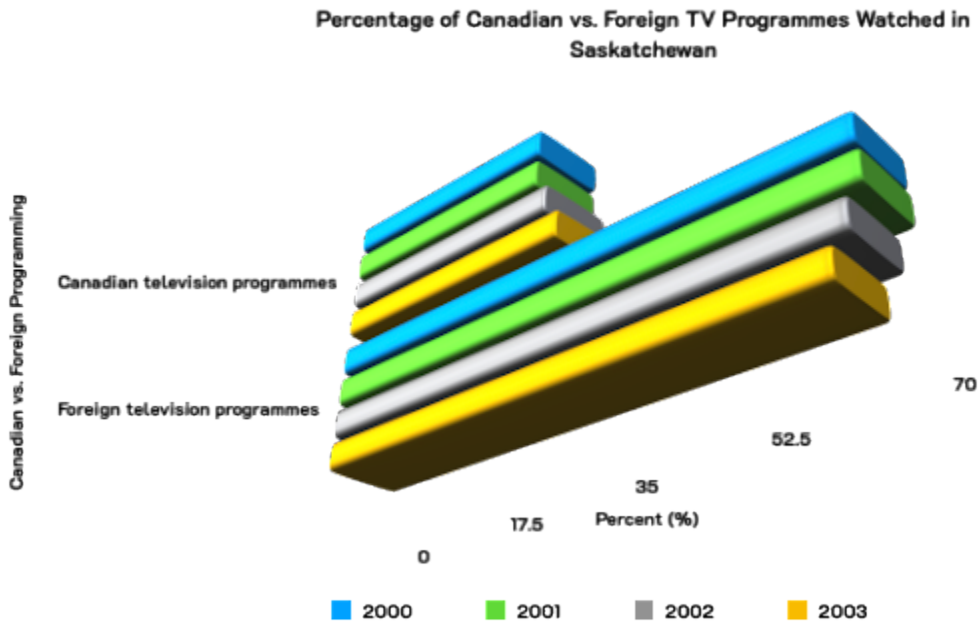
Figure 3.6.7. "Percentage of Canadian vs. Foreign TV Programmes Watched in Saskatchewan" (Statistics Canada, 2011. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

The image is a 3D stacked bar chart. It is on an angle, with small text and no lines to show the percentages. Each bar in the chart is composed of multiple layers of different colours. The legend at the bottom indicates the meaning of each colour:

  – Blue

– Green

– Gray

– Yellow

Each stack represents a category and is visually separated into segments to indicate the proportions of each subcategory. The stacks are arranged horizontally, with one stack on top of the other, representing different categories with varying proportions of the subcategories.

The chart includes three horizontal stacks, each with five segments:

1. **First stack (bottom)**:

– From top to bottom: blue, green, white, gray, yellow

2. **Second stack (middle)**:

– From top to bottom: blue, green, white, gray, yellow

   3. **Third stack (top and shortest)**:
 – From top to bottom: blue, green, white, gray, yellow
   The bar extends further to the right with descending order from the top to the bottom.

The Colour Scale

When used thoughtfully, colour can make it easier to spot trends and relationships in a data visualization. However, colour can also cause confusion.

   Some common issues include using too many colours, using colours with minimal contrast, using colours that aren't safe for colourblind viewers and using colours in unconventional ways. Review Figure 3.6.8 below, which is a line graph of the percentage of Canadian vs. foreign television programmes watched in New Brunswick from 2000 to 2004. Because of the similar colours of the lines, it is difficult for the reader to understand which line graph corresponds to which colour from the legend.
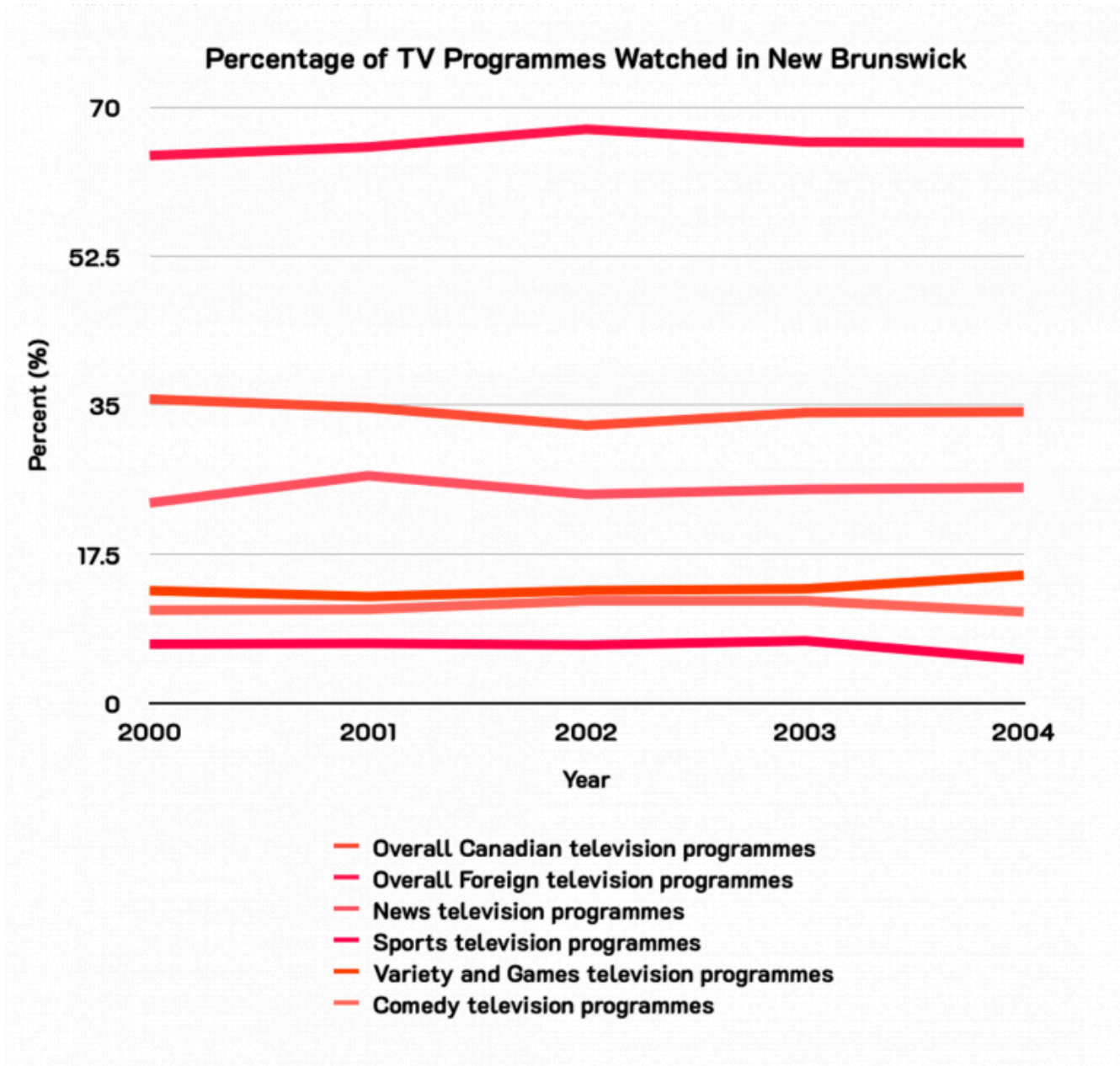
Figure 3.6.8. "Percentage of TV Programmes Watched in New Brunswick" (Statistics Canada, 2011. Data is reproduced and distributed on an "as is" basis with the permission of Statistics Canada. Statistics Canada Open Licence)

Image Description

Line graph titled 'Percentage of TV Programmes Watched in New Brunswick'. The x-axis represents the years 2000 to 2004, and the y-axis represents percentage ranging from 0 to 70%. The graph shows six lines representing different categories of television programmes:

- Overall Canadian television programmes: stays around 52.5% from 2000 to 2004.
- Overall Foreign television programmes: starts at around 35% in 2000, dips slightly in 2002, and then returns to around 35% by 2004.
- News television programmes: starts and ends at around 17.5% with no significant changes.
- Sports television programmes: remains at about 10% throughout the years with a slight upward trend.
- Variety and Games television programmes: starts below 7% and remains fairly stable.
- Comedy television programmes: starts at about 5%, increases slightly in 2002 and 2003.

3.7 USING EXCEL FOR DESCRIPTIVE STATISTICS

Download [Descriptive Statistics – Excel Instructions Data Sets [XLSX]](#).

Histogram

A **histogram** consists of contiguous (adjoining) boxes. It has both a horizontal axis and a vertical axis. The horizontal axis is labelled with what the data represents (for instance, distance from your home to school). The vertical axis is labelled either **frequency** or **relative frequency** (or percent frequency or probability). The graph will have the same shape with either label. The histogram (like the stemplot) can give you the shape of the data, the center, and the spread of the data.

Histogram in Excel

The following data are the heights (in inches to the nearest half inch) of 100 male semiprofessional soccer players. The heights are continuous data since height is measured.

60; 60.5; 61; 61; 61.5; 63.5; 63.5; 63.5; 64; 64; 64; 64; 64; 64; 64.5; 64.5; 64.5; 64.5; 64.5; 64.5; 64.5 66; 66; 66; 66; 66; 66; 66; 66; 66; 66; 66.5; 66.5; 66.5; 66.5; 66.5; 66.5; 66.5; 66.5; 66.5; 66.5; 67; 67; 67; 67; 67; 67; 67; 67; 67; 67; 67; 67; 67.5; 67.5; 67.5; 67.5; 67.5; 67.5; 67.5; 68; 68; 69; 69; 69; 69; 69; 69; 69; 69; 69; 69; 69.5; 69.5; 69.5; 69.5; 69.5; 70; 70; 70; 70; 70; 70; 70.5; 70.5; 70.5; 71; 71; 71; 72; 72; 72; 72.5; 72.5; 73; 73.5; 74

1. Enter the data into column A. Create *Bin Range* into column C
2. Click *Data*, *Data Analysis*, *Histogram,* and *OK*
3. Specify *Input Range ($A$1:$A$101)*, *Bin Range ($C$1:$C$9)*, and *Output Range ($E$1)*
4. Click *Labels*, *Chart Output,* and *OK*
5. Make changes for the Histogram (i.e. delete *Frequency*, *More* on the right side)
6. Click on one blue rectangle, right-click, and click *Format Data Series*
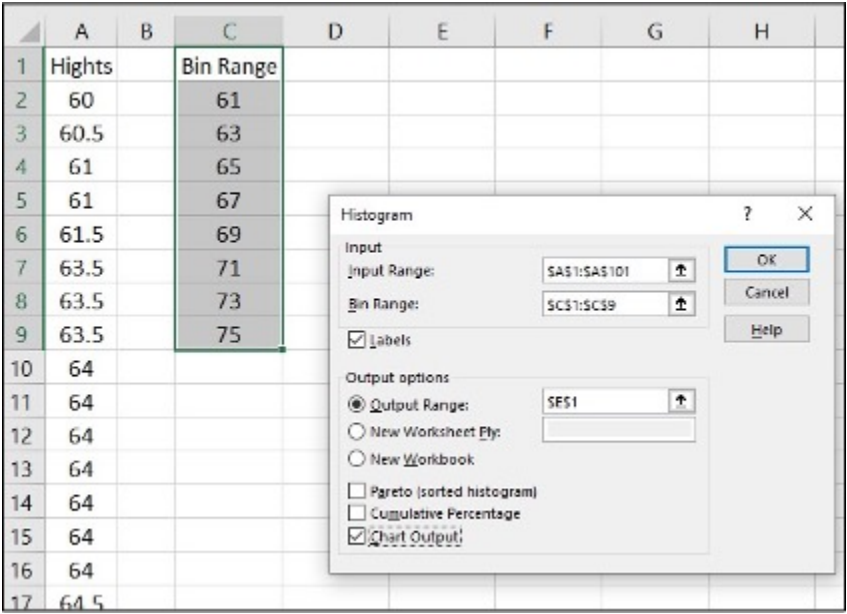
Figure 3.7.1. Depiction of Steps 1-4.

Image Description

The image shows an Excel spreadsheet with a histogram dialogue box open. The spreadsheet contains two columns labelled "Hights" and "Bin Range". Here is a detailed breakdown:

Hights	Bin Range
60	61
60.5	63
61	65
61.5	67
63	69
63.5	71
64	73
64.5	75

The histogram dialogue box titled "Histogram" contains the following fields and options:

- Input:

- ◦ Input Range:
- ◦ Bin Range:
- Labels

- Output options:
  - ◦ Output Range:
  - ◦ New Worksheet Ply
  - ◦ New Workbook
  - ◦ Pareto (sorted histogram)
  - ◦ Cumulative Percentage
  - ◦ Chart Output

Buttons at the bottom labelled "OK," "Cancel," and "Help."
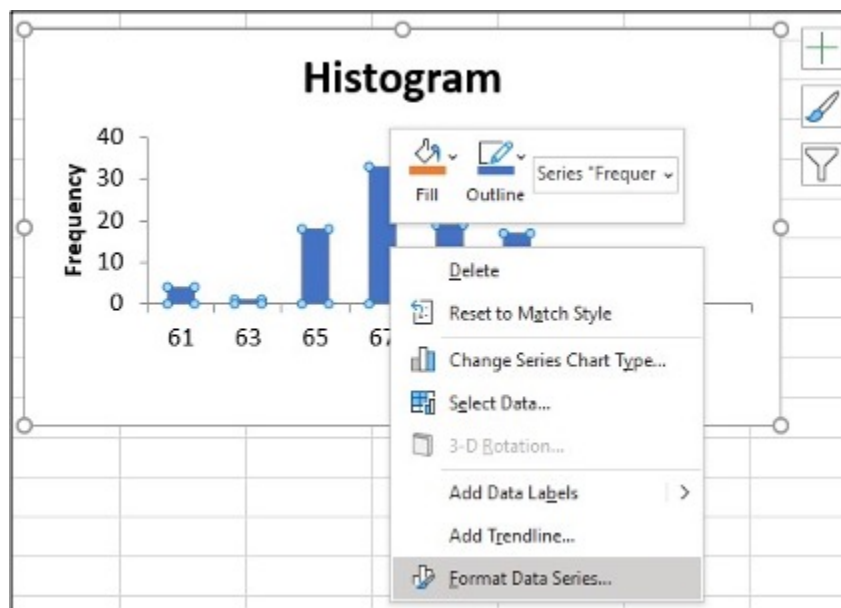
Figure 3.7.2. Depiction of Steps 5 & 6.

Image Description

An image of a histogram chart within a spreadsheet application. The histogram is titled "Histogram" and displays data in the form of vertical bars representing frequency on the y-axis and a range of numbers on the x-axis. The y-axis is labelled "Frequency" and has values ranging from 0 to 40, with tick marks at intervals of 10. The x-axis has numbers 61, 63, 65, and 67 with corresponding bars of varying heights, each indicating a different frequency.

Each bar is blue in colour, and small blue circles indicate data points. Additionally, a context menu is open within the chart area, showing various options. These options include:

- Delete
- Reset to Match Style
- Change Series Chart Type...
- Select Data...
- 3-D Rotation...
- Add Data Labels
- Add Trendline...
- Format Data Series...

Above the context menu, there is a floating format toolbar with "Fill" and "Outline" options for formatting the chart series. The option selected currently is "Series 'Frequer." The entire chart is enclosed within a gray border with adjustable handles indicating it is selected and can be resized or moved.

7. To change the 'gap width,' click on the slider under *Gap Width* slide line, hold and slide it to *0%*
8. Click on the *Histogram* and icon + to make changes
9. Change Axis Titles
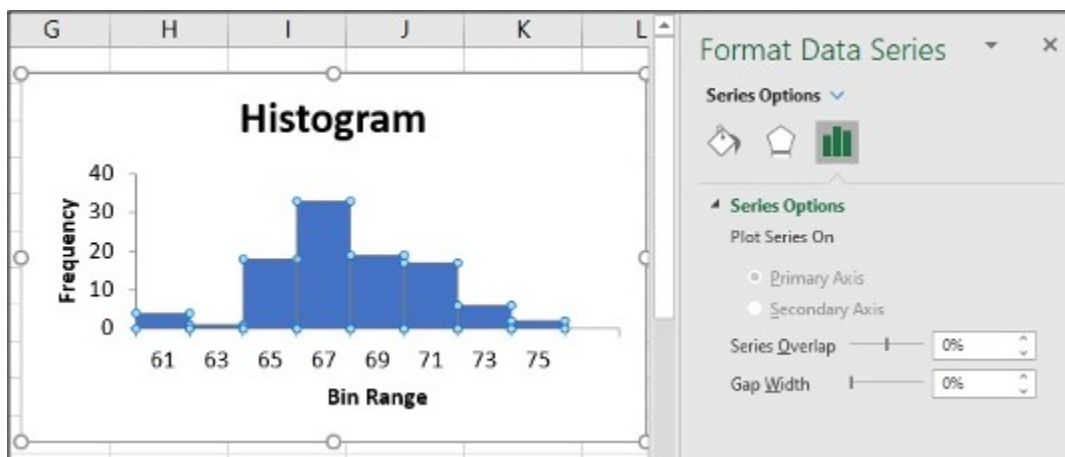
Figure 3.7.3 Depiction of Step 7

Image Description

The image is a screenshot of an Excel window. The main part of the image displays a histogram chart titled "Histogram," showing a frequency distribution of data across different bin ranges. The x-axis is labelled

"Bin Range" and shows the bins 61, 63, 65, 67, 69, 71, 73, and 75. The y-axis is labelled "Frequency" and shows values from 0 to 40 at intervals of 10.

The histogram features blue bars representing the frequency counts for each bin range as follows:

- 61: 0
- 63: 5
- 65: 20
- 67: 30
- 69: 15
- 71: 10
- 73: 5
- 75: 0

On the right side of the image, there is a "Format Data Series" pane. This pane includes options to customize the chart, including series options where users can choose to plot the series on the primary or secondary axis, adjust series overlap, and set gap width between the bars. The series overlap and gap width both have a setting of 0%.
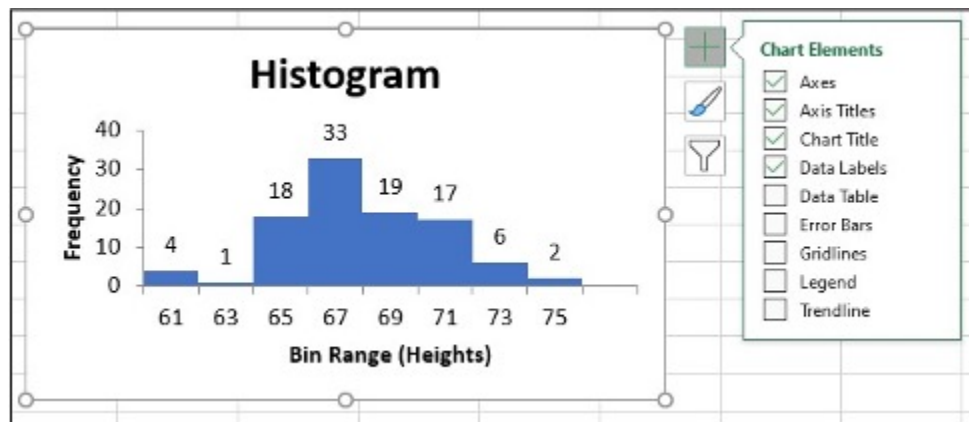
Figure 3.7.4 Depiction of Steps 8 & 9

Image Description

The image displays a histogram showing the distribution of heights with the title "Histogram" at the top center. The horizontal axis is labelled "Bin Range (Heights)" and spans from 61 to 75, marked at intervals of 2 (61, 63, 65, 67, 69, 71, 73, 75). The vertical axis is labelled "Frequency" and ranges from 0 to 40, marked at intervals of 10 (0, 10, 20, 30, 40).

The histogram consists of blue bars representing the frequency of heights falling within each bin range:

- 61-63: Frequency 4
- 63-65: Frequency 18
- 65-67: Frequency 33
- 67-69: Frequency 19
- 69-71: Frequency 17
- 71-73: Frequency 6
- 73-75: Frequency 2

To the right of the histogram, there is a "Chart Elements" menu with a list of checkboxes indicating which elements are turned on or off in the chart:

- Axes: Checked
- Axis Titles: Checked
- Chart Title: Checked
- Data Labels: Checked
- Data Table: Unchecked
- Error Bars: Unchecked
- Gridlines: Checked
- Legend: Unchecked
- Trendline: Unchecked

There are also icons for chart formatting and filtering in the "Chart Elements" menu.

To change the *bin range* on the histogram table, change the values in the x-axis data.
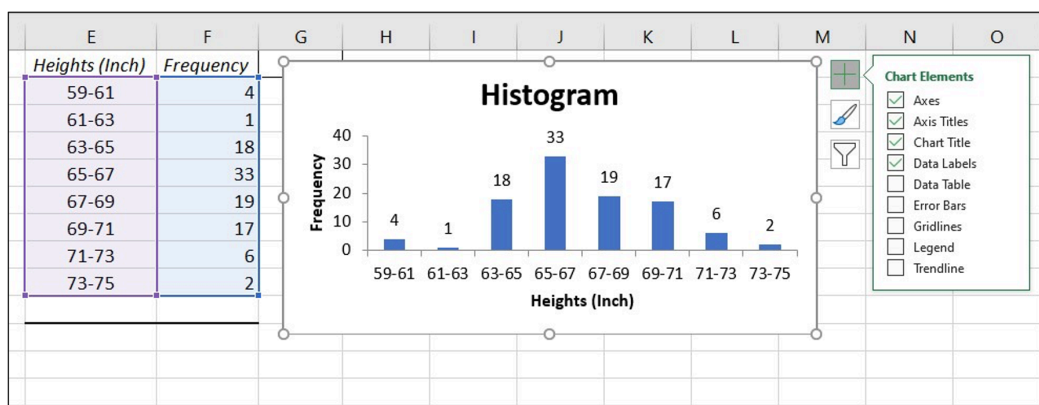
Figure 3.7.5 "Chart Elements Menu"

Image Description

The image displays an Excel spreadsheet containing a histogram alongside a data table.

Heights (Inch)	Frequency
59-61	4
61-63	1
63-65	18
65-67	33
67-69	19
69-71	17
71-73	6
73-75	2

The histogram graph shows the same data visually. Along the x-axis, it lists height ranges in inches (59-61, 61-63, etc.). The y-axis represents frequency, ranging from 0 to 40.

- 59-61 inches: frequency 4
- 61-63 inches: frequency 1
- 63-65 inches: frequency 18
- 65-67 inches: frequency 33
- 67-69 inches: frequency 19
- 69-71 inches: frequency 17
- 71-73 inches: frequency 6
- 73-75 inches: frequency 2

Next to the graph, there is a menu titled "Chart Elements" with options related to the chart's components:

- Axes: checked
- Axis Titles: checked
- Chart Title: checked
- Data Labels: checked
- Data Table: unchecked
- Error Bars: unchecked
- Gridlines: unchecked

- Legend: unchecked
- Trendline: unchecked

Line Chart

A **line chart** is often used to represent a set of data values in which a quantity varies with time. These graphs are useful for finding trends. That is, finding a general pattern in data sets, including temperature, sales, employment, company profit or cost over a period of time.

Line chart in Excel

1. Enter the data (Year and Annual) into *Column A, B*
2. Highlight the columns of data, click *Insert, Line Chart*
3. Click *"More Line Charts"*
4. Choose the graph with a single line.

Table 3.7.1 Construct a line chart for the Annual Consumer Price Index data only.

Year	Aug	Sep	Oct	Nov	Dec	Annual
2003	184.6	185.2	185.0	184.5	184.3	184.0
2004	189.5	189.9	190.9	191.0	190.3	188.9
2005	196.4	198.8	199.2	197.6	196.8	195.3
2006	203.9	202.9	201.8	201.5	201.8	201.6
2007	207.917	208.490	208.936	210.177	210.036	207.342
2008	219.086	218.783	216.573	212.425	210.228	215.303
2009	215.834	215.969	216.177	216.330	215.949	214.537
2010	218.312	218.439	218.711	218.803	219.179	218.056
2011	226.545	226.889	226.421	226.230	225.672	224.939
2012	230.379	231.407	231.317	230.221	229.601	229.594
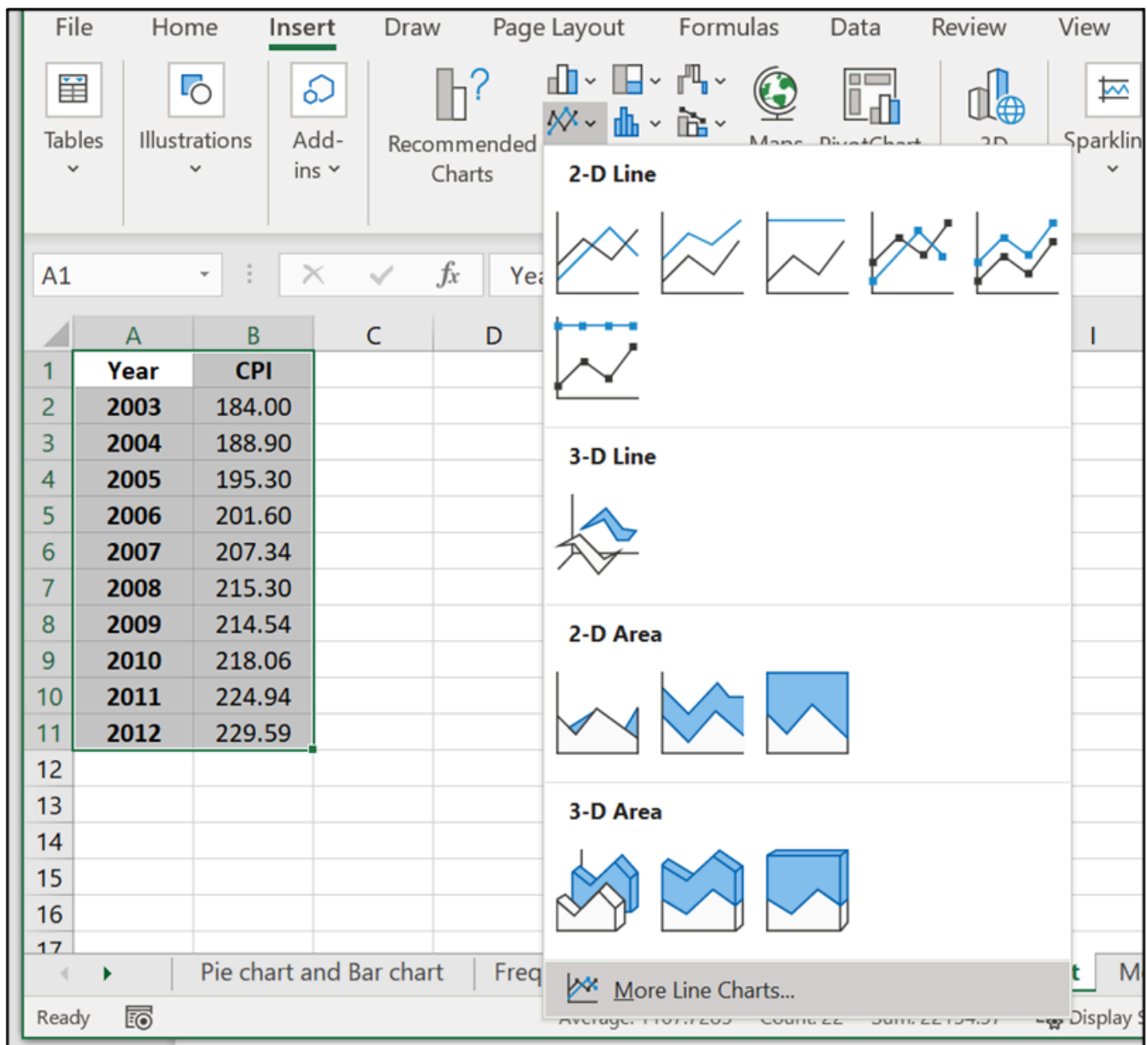
Figure 3.7.6 Depiction of Steps 1-3

Image Description

The image shows a Microsoft Excel spreadsheet with data in two columns labelled "Year" and "CPI" (Consumer Price Index). The data, starting from row 2, lists the years from 2003 to 2012 and their corresponding CPI values. The cells containing this data are highlighted.

To the right of the spreadsheet, an Insert Chart menu is displayed, showing various chart options. The menu specifically focuses on line charts and area charts with 2-D and 3-D variations. Below the chart icons, there is an option labeled "More Line Charts...".

Here is the data in table format:

Year	CPI
2003	184.00
2004	188.90
2005	195.30
2006	201.60
2007	207.34
2008	215.30
2009	214.54
2010	218.06
2011	224.94
2012	229.59
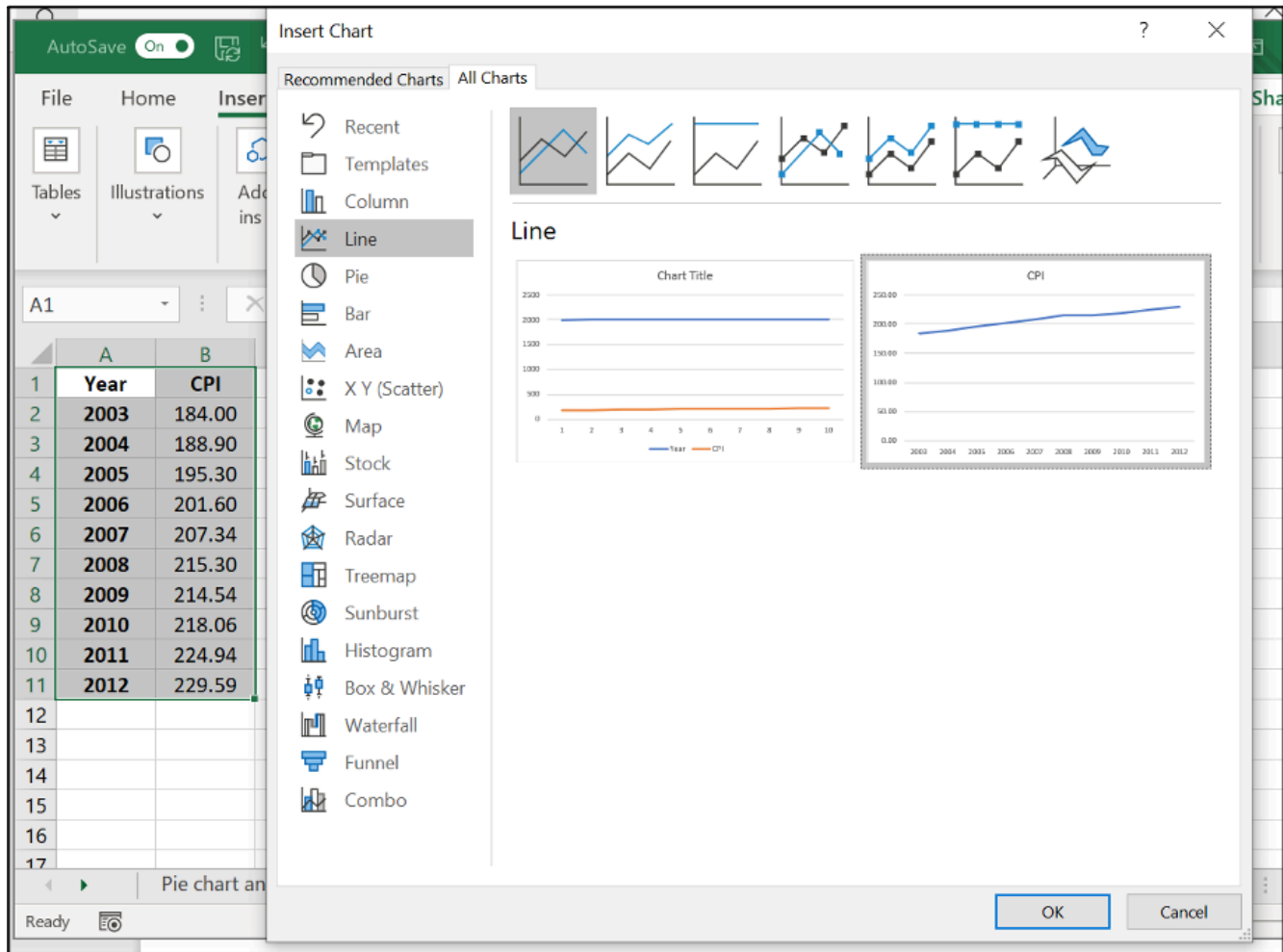
Figure 3.7.7 Depiction of Step 4

Image Description

The image displays a Microsoft Excel interface for creating a chart. On the left side of the image, there is a spreadsheet with a table containing two columns labelled "Year" and "CPI" (Consumer Price Index). The table includes the following data:

Year	CPI
2003	184.00
2004	188.90
2005	195.30
2006	201.60
2007	207.30
2008	215.30
2009	214.54
2010	218.06
2011	224.94
2012	229.59

To the right of the table is the "Insert Chart" pane, where various chart types can be selected. The "Line" chart type is chosen, which is highlighted in gray. Next to the selection pane, there are preview images of line charts, with the rightmost chart being a simple line chart titled "CPI," representing the data from 2003 to 2012 with a line showing an upward trend.

Below the chart previews are the "OK" and "Cancel" buttons for confirming or cancelling the chart insertion.

5. Click on *y-axis data*, right-click, *Format Axis*
6. Change *Minimum* and *Maximum values* which suit your data best, click *Enter*
7. Click on the *new bar graph* and icon + to make axis title changes
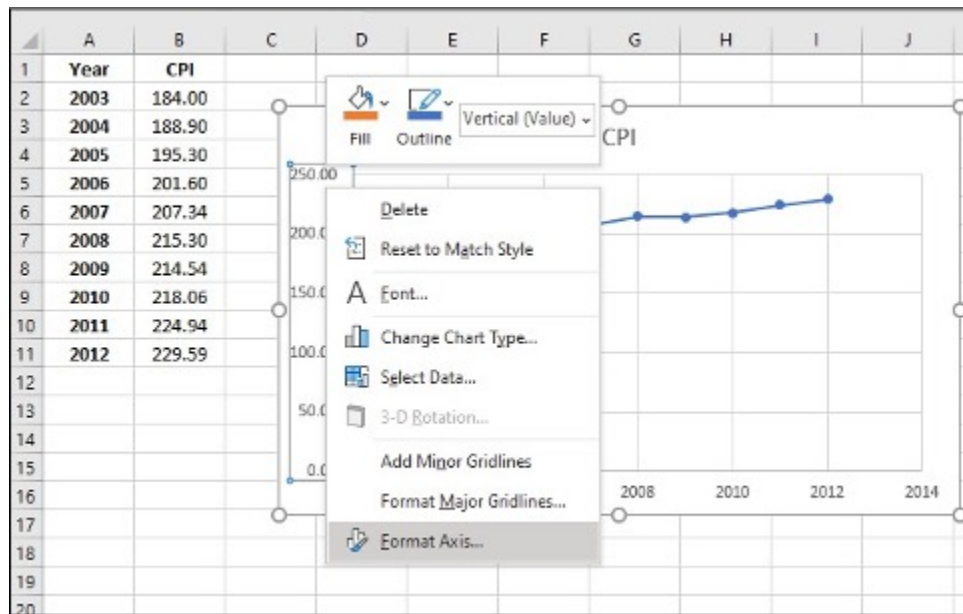
Figure 3.7.8 Depiction of Step 5.

Image Description

This image shows a spreadsheet application with a table and a chart. The table is in columns A and B with the following data:

Year	CPI
2003	184.00
2004	188.90
2005	195.30
2006	201.60
2007	207.34
2008	215.30
2009	214.54
2010	218.06
2011	224.94
2012	229.59

To the right of the table, there is a line chart representing the CPI (Consumer Price Index) data over the

years. The x-axis shows the years ranging from 2003 to 2012, and the y-axis shows the CPI values. The plotted line on the chart indicates a gradual increase in CPI over the given years.

There is a context menu open on the chart, showing the following options:

- Fill
- Outline
- Delete
- Reset to Match Style
- Font...
- Change Chart Type...
- Select Data...
- 3-D Rotation...
- Add Minor Gridlines
- Format Major Gridlines...
- Format Axis...
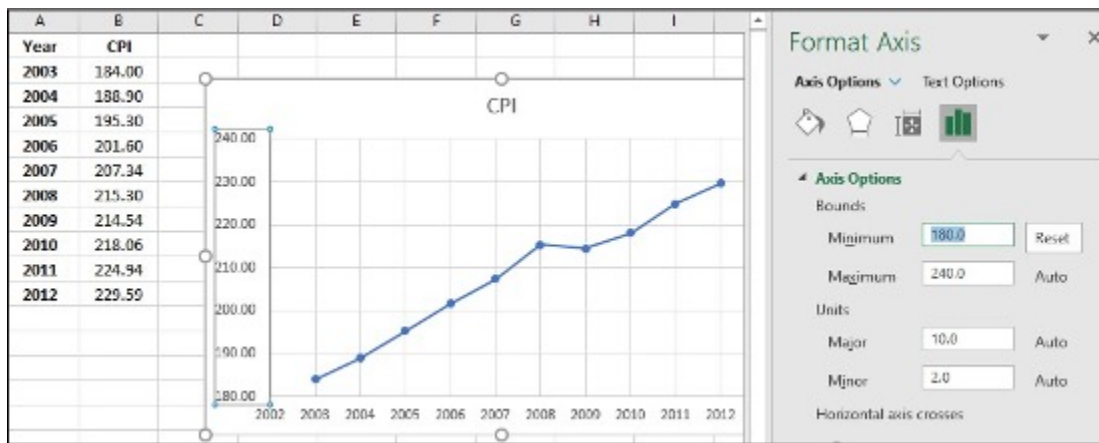
Figure 3.7.9 Depiction of Step 6.

Image Description

The image displays a screenshot of a spreadsheet and a line chart, along with a formatting pane on the right side.

The left part of the image contains a table with two columns and eleven rows. The table includes:

Year	CPI
2003	184.00
2004	188.30
2005	195.30
2006	201.60
2007	207.34
2008	213.00
2009	214.54
2010	218.06
2011	224.14
2012	229.59

In the center part of the image, there is a line chart that displays these data points, and the chart is titled "CPI." The x-axis represents the years from 2003 to 2012, and the y-axis represents the CPI values ranging from approximately 180 to 240.

The right part of the image shows the "Format Axis" pane with options to adjust the axis bounds, units, and other formatting settings. The current settings show the minimum bound set to 180 and the maximum bound to 240, with major units set to 10 and minor units to 2.
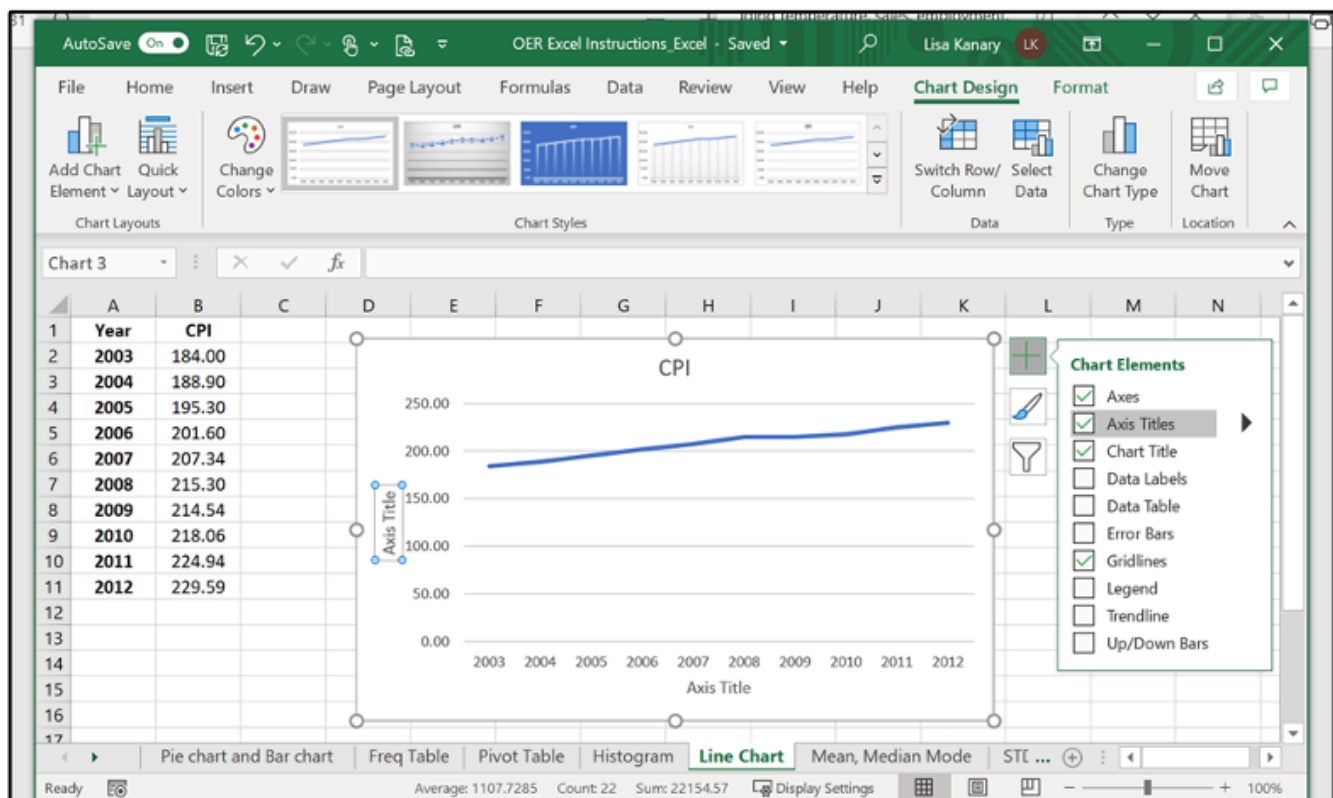
Figure 3.7.10 Depiction of Step 7

Image Description

The image shows an open Microsoft Excel window titled "OER Excel Instructions_Excel – Saved." The Excel workbook has multiple tabs (File, Home, Insert, Draw, Page Layout, Formulas, Data, Review, View, Help, Chart Design, Format) visible in the ribbon. Below the ribbon, there are various chart-related options such as Add Chart Element, Quick Layout, Change Colors, and Chart Styles.

A spreadsheet is shown with two columns of data:

Year	CPI
2003	184.00
2004	188.90
2005	195.30
2006	201.60
2007	207.34
2008	215.30
2009	214.54
2010	218.06
2011	224.94
2012	229.59

To the right of the data columns, there is a line chart depicting the CPI values over the years from 2003 to 2012. The chart has the title "CPI" above it and the x-axis labelled "Axis Title" with yearly increments from 2003 to 2012.

On the right side of the chart, there is a "Chart Elements" panel with checkboxes for Axes, Axis Titles, Chart Title, Data Labels, Data Table, Error Bars, Gridlines, Legend, Trendline, and Up/Down Bars.

Below the spreadsheet, there is a tab selection area with the active tab labeled "Line Chart". Other visible tabs include Pie chart and Bar chart, Freq Table, Pivot Table, Histogram, Mean, Median, and Mode.

Mean, Median, & Mode

- **Mean:** a number that measures the central tendency of the data; a common name for mean is 'average'.
- **Median:** a number that separates ordered data into halves; half the values are the same number or smaller than the median, and half the values are the same number or larger than the median. The median may or may not be part of the data.
- **Mode:** the value that appears most frequently in a set of data.

Mean, Median, & Mode in Excel (Formula tool)

Use the following information to answer the next three exercises: The following data show the lengths of boats moored in a marina. The data are ordered from smallest to largest:

16; 17; 19; 20; 20; 21; 23; 24; 25; 25; 25; 26; 26; 27; 27; 27; 28; 29; 30; 32; 33; 33; 34; 35; 37; 39; 40

1. Enter the data into *column A*
2. Create a table for *Mean*, *Median*, and *Mode*
3. Enter *=AVERAGE(A:A)* in cell D2, click *Enter*
4. Enter *=MEDIAN(A:A)* in cell D3, click *Enter*
5. Enter *=MODE(A:A)* in cell D4, click *Enter*

Figure 3.7.11 Depiction of Steps 1-3.

Image Description

The image shows an Excel spreadsheet with the "Home," "Insert," "Page Layout," "Formulas," "Data," and "Review" tabs visible at the top. The focus is on a portion of the spreadsheet displaying columns A, B, C, and D from rows 1 to 5.

Column A is labelled "Lengths" in cell A1. Below this, cells A2 to A5 contain the following numbers respectively: 16, 17, 19, and 20.

In column C, there are three rows labelled as follows:

- Cell C2: Mean
- Cell C3: Median
- Cell C4: Mode

In cell D2, there is a formula input box at the top, displaying the formula *=AVERAGE(A:A)*. This indicates that the mean of the values in column A is being calculated.

Figure 3.7.12 Depiction of Step 4

Image Description

The image shows a spreadsheet application with a table and some calculations displayed. There are various tabs like "File," "Home," "Insert," "Page Layout," "Formulas," "Data," and "Review" visible at the top, indicating this is likely a Microsoft Excel interface.

In the content area:

A	B	C	D
Lengths		Mean	27.33
16		Median	=MEDIAN(A:A)
17		Mode	
19			
20			
20			

On the right side, there is a column with statistical calculations:

- **Mean:** 27.33
- **Median:** =MEDIAN(A:A) (shows the formula for calculating the median of column A)
- **Mode:** (empty, no value provided)

Figure 3.7.13 Depiction of Step 5

Image Description

The image shows a Microsoft Excel spreadsheet window. The top menu bar contains options like "File," "Home," "Insert," "Page Layout," "Formulas," "Data," and "Review." Below the menu bar is a formula bar with the function "=MODE(A:A)" entered in it. The spreadsheet contains the following data:

A	B	C	D
1			
Lengths			
16		Mean	27.33
17		Median	27
19		Mode	=MODE(A:A)
20			

Column A contains numeric values 16, 17, 19, and 20. Column C includes statistical functions such as Mean, Median, and Mode, while Column D displays corresponding values: 27.33, 27, and a mode formula "=MODE(A:A)".

Mean, Median & Mode in Excel (Data Analysis tool)

Use the following information to answer the next three exercises: The following data show the lengths of boats moored in a marina. The data are ordered from smallest to largest:

16; 17; 19; 20; 20; 21; 23; 24; 25; 25; 25; 26; 26; 27; 27; 27; 28; 29; 30; 32; 33; 33; 34; 35; 37; 39; 40

1. Enter the data into column A
2. Click *Data*, *Data Analysis*
3. Click *Descriptive Statistics*, *OK*
4. Specify *Input Range ($A$1:$A$28)*, *Output Range ($C$1)*
5. Click *Labels* in the first row, *Summary statistics,* and *OK*
6. Find Mean, Median and Mode in the Summary statistics table
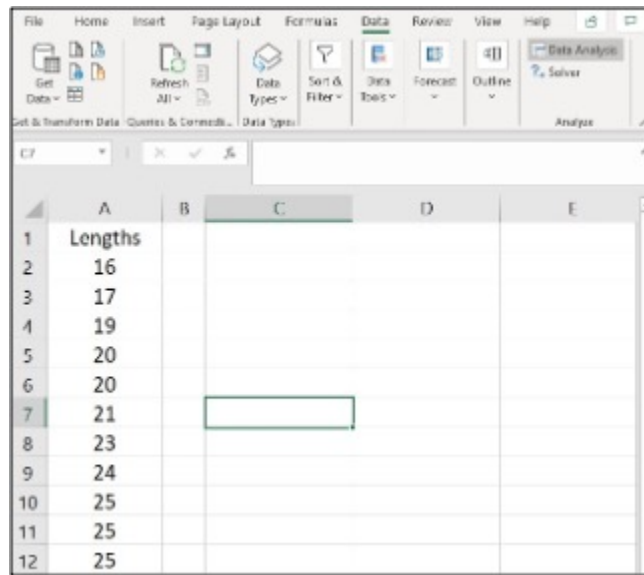
Figure 3.7.14 Depiction of Steps 1 & 2

Image Description

This image is a screenshot of a Microsoft Excel spreadsheet. The Excel window is open, displaying the toolbar with various tabs and options. Visible are tabs labelled Home, Insert, Page Layout, Formulas, Data, Review, View, and Help. The Data tab is currently selected.

Under the toolbar, there is an area with options related to data tasks like refreshing data, sorting, filtering, data types, and analysis tools.

Beneath this, there is the spreadsheet area. The spreadsheet consists of rows labelled numerically on the left (1, 2, 3, etc.) and columns labelled alphabetically at the top (A, B, C, etc.).

In this Excel sheet, the column "A" from row 1 to row 12 contains the following data:

Row	Column A
1	Lengths
2	16
3	17
4	19
5	20
6	21
7	20
8	21
9	23
10	21
11	25
12	25
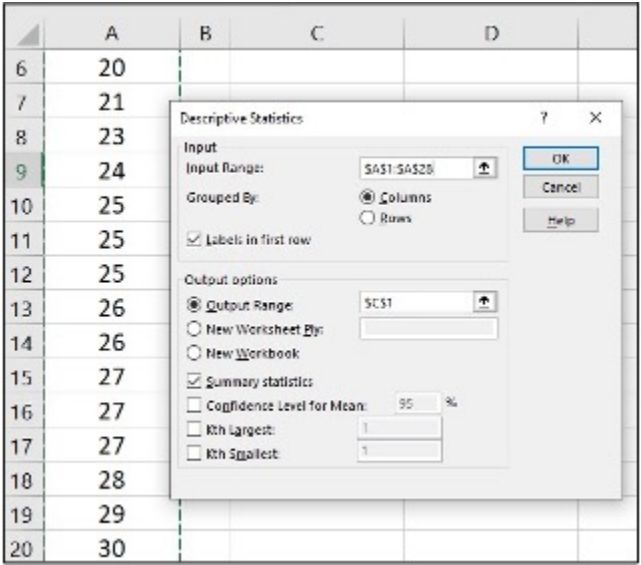
Figure 3.7.15 Depiction of Steps 3-5

Image Description

The image shows a partial view of a spreadsheet with a statistical analysis tool dialogue box open in the foreground.

The spreadsheet in the background has columns labelled A and B. The columns contain numerical data ranging from 20 to 30.

The dialogue box is titled "Descriptive Statistics" and contains various input fields and options:

Input

- Input Range: Text box containing the value "$A$1:$A$28".
- Grouped By: Radio buttons for "Columns" (selected) and "Rows".
- Labels in the first row: Checkbox (unchecked).

Output options:

- Output Range: Radio button (selected) with a text box containing the value "C$1".
- New Worksheet Ply: Radio button.
- New Workbook: Radio button.
- Summary statistics: Checkbox (unchecked).
- Confidence Level for Mean: Checkbox (unchecked) with a text box containing the value "95" and a percentage symbol.
- Kth Largest: Checkbox (unchecked) with a text box.
- Kth Smallest: Checkbox (unchecked) with a text box.

There are buttons for "OK", "Cancel", and "Help".

By selecting the desired options and columns, this tool can be used to generate descriptive statistics for the data in the spreadsheet.

	A	B	C	D
1	Lengths		Lengths	
2	16			
3	17		Mean	27.33333333
4	19		Standard Error	1.247219129
5	20		Median	27
6	20		Mode	25
7	21		Standard Deviatic	6.480740698
8	23		Sample Variance	42
9	24		Kurtosis	-0.585714286
10	25		Skewness	0.216397731
11	25		Range	24
12	25		Minimum	16
13	26		Maximum	40
14	26		Sum	738
15	27		Count	27

Figure 3.7.16 Depiction of Step 6

Image Description

Row	A	B	C	D
1	Lengths		*Lengths*	
2	16		Mean	27.33333333
3	17		Standard Error	1.247219129
4	19		Median	27
5	20		Mode	25
6	20		Standard Deviation	6.480740698
7	20		Sample Variance	42
8	21		Kurtosis	-0.585714286
9	23		Skewness	0.216397731
10	24		Range	24
11	25		Minimum	16
12	25		Sum	738
13	25		Count	27
14	26			
15	27			

Variance & Standard Deviation

- The **variance** is the **average of the squares of the deviations**.
- If x is a number, then the difference "x minus the mean" is called its **deviation**. The standard deviation is a number that is equal to the square root of the variance and measures how far data values are from their mean.
- Notation: s for sample standard deviation and σ for population standard deviation.

Variance and Standard Deviation in Excel (Formula tool)

In a fifth-grade class, the teacher was interested in the average age and the sample standard deviation of the ages of her students. The following data are the ages for a SAMPLE of n = 20 fifth-grade students. The ages are rounded to the nearest half year: 9; 9.5; 9.5; 10; 10; 10; 10; 10.5; 10.5; 10.5; 10.5; 11; 11; 11; 11; 11; 11; 11.5; 11.5; 11.5;

1. Enter the data into column A
2. Create a table for *Variance* and *Standard deviation*
3. Enter =*VAR.S(A:A)* in cell D2, click *Enter*
4. Enter =*STDEV.S(A:A)* in cell D3, click *Enter*

Figure 3.7.17 Depiction of Steps 1, 2, & 3.
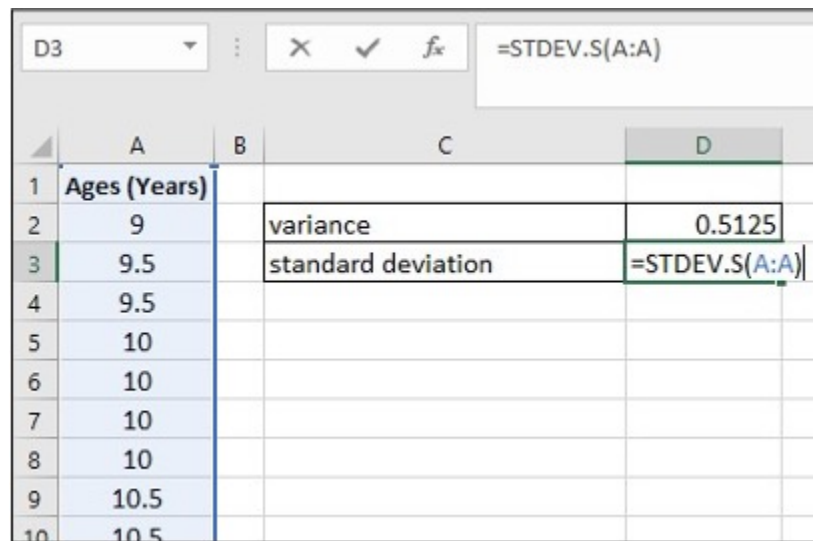
Image Description

The image displays a partial view of an Excel spreadsheet. Below is the description of its content translated into accessible HTML:

A	B	C	D
1	Ages (Years)		
2	9	variance	=VAR.S(A:A)
3	9.5	standard deviation	
4	9.5		
5	10		
6	10		
7	10		
8	10.5		

- Column A contains the header "Ages (Years)" and various age values listed from cells A2 to A8.
- Between cells C2 and D2, the word "variance" is written in C2, and the formula "=VAR.S(A:A)" is entered in D2.
- Between cells C3 and D3, the words "standard deviation" are written in C3, and D3 is empty.

The worksheet is designed to calculate the variance of the ages listed in column A using the formula written in cell D2.

D3	▾	⋮	✕ ✓ f_x	=STDEV.S(A:A)	
	A	B	C		D
1	Ages (Years)				
2	9		variance		0.5125
3	9.5		standard deviation		=STDEV.S(A:A)
4	9.5				
5	10				
6	10				
7	10				
8	10				
9	10.5				
10	10.5				

Figure 3.7.18 Depiction of Step 4

Image Description

A	B	C	D
Ages (Years)		variance	0.5125
9		standard deviation	=STDEV.S(A:A)
9.5			
9.5			
10			
10			
10			
10.5			
10.5			

The image is a screenshot of an Excel spreadsheet with a table that includes one column of data. Column A is titled "Ages (Years)" and contains the values: 9, 9.5, 9.5, 10, 10, 10, 10.5, and 10.5.

To the right of the table, in column C and D, two statistical calculations are shown:

- Variance is calculated in cell D2 with the result 0.5125.
- Standard deviation is calculated in cell D3 using the formula =STDEV.S(A:A).

Variance and Standard Deviation in Excel (Data Analysis tool)

In a fifth-grade class, the teacher was interested in the average age and the sample standard deviation of the ages of her students. The following data are the ages for a SAMPLE of n = 20 fifth-grade students. The ages are rounded to the nearest half year: 9; 9.5; 9.5; 10; 10; 10; 10; 10.5; 10.5; 10.5; 10.5; 11; 11; 11; 11; 11; 11; 11.5; 11.5; 11.5;

1. Enter the data into column A
2. Click *Data*, *Data Analysis*
3. Click *Descriptive Statistics*, *OK*
4. Specify *Input Range ($A$1:$A$21)*, *Output Range ($C$6)*
5. Click *Labels* in the first row, *Summary statistics,* and *OK*
6. Find *Variance* and *Standard Deviation* in the Summary statistics table
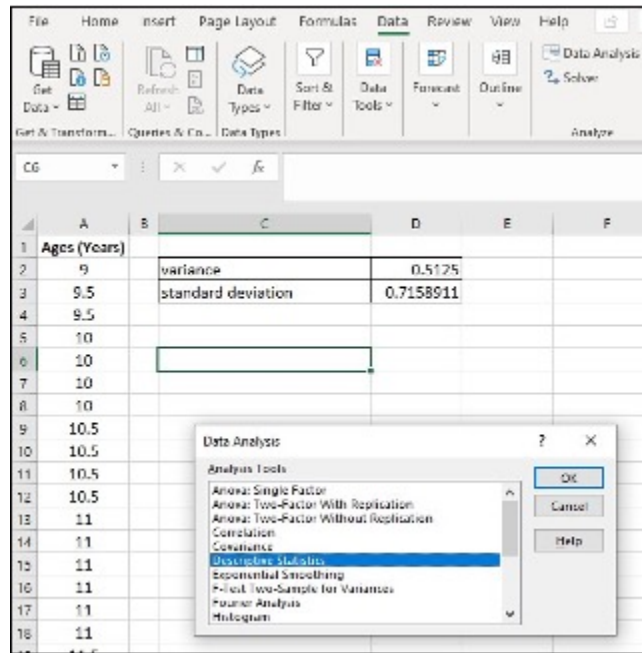
Figure 3.7.19 Depiction of Steps 1 & 2

Image Description

The image is a screenshot of an Excel spreadsheet displaying data and tools from the "Data Analysis" dialogue box. The screenshot includes the following key elements:

- Excel Interface:
    - The standard Excel tabs are visible at the top (File, Home, Insert, etc.).
    - The "Data" tab is selected.
    - The "Data Analysis" button is visible in the "Analysis" group on the ribbon.
- Spreadsheet Data:
    - A table titled "Ages (Years)" is present in column A, containing age values from 9 to 12.
    - There are additional calculations related to the data in columns C and D: "variance" and "standard deviation."

Row	A	B	C	>D
1	9		Variance	0.5125
2	9.5		Standard deviation	0.7158911
3	9.5			
4	10			
5	10			
6	10			
7	10			
8	10.5			
9	10.5			
10	10.5			
11	10.5			
12	11			
13	11			
14	11			
15	11			
16	11			
17	11			
18	11.5			
19	11.5			
20	11.5			

- Data Analysis Dialog Box:
    - A pop-up window titled "Data Analysis" with a list of analysis tools.
    - The "Descriptive Statistics" option is highlighted.
    - Buttons for "OK", "Cancel", and "Help" are visible within the dialog box.

This configuration indicates that the user is leveraging Excel's statistical tools to analyze the provided age data.
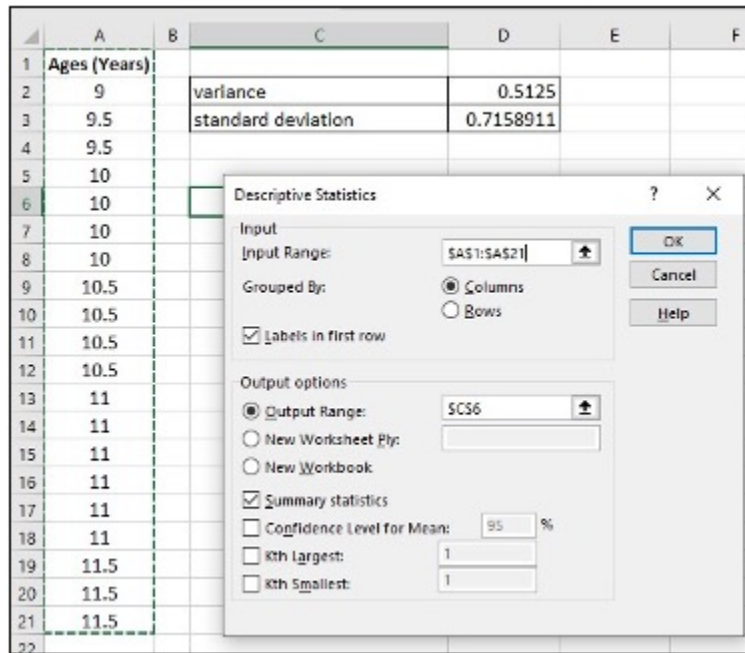
Figure 3.7.20 Depiction of Steps 3, 4, & 5

Image Description

The image shows a spreadsheet and a "Descriptive Statistics" dialogue box from Excel. The spreadsheet has data in two columns and at least 20 rows. Column A is labelled "Ages (Years)" and contains the following values:

- Row 2: 9
- Row 3: 9.5
- Row 4: 9.5
- Row 5: 10
- Row 6: 10
- Row 7: 10.5
- Row 8: 10.5
- Row 9: 10.5
- Row 10: 10.5
- Row 11: 11
- Row 12: 11
- Row 13: 11
- Row 14: 11
- Row 15: 11.5

- Row 16: 11.5
- Row 17: 11.5
- Row 18: 11.5

Columns B and D are empty. Column C contains two calculations labelled:

- Row 2: "variance" with a value of "0.5125"
- Row 3: "standard deviation" with a value of "0.7158911"

Columns E and F are empty.

The "Descriptive Statistics" dialogue box, which appears to be floating above the spreadsheet, includes fields and options:

- **Input**
  - Input Range:
  - Grouped By:
    - Columns
    - Rows
  - Labels in the First Row
- **Output options**
  - Output Range:
  - New Worksheet Ply:
  - New Workbook
  - Summary statistics
  - Confidence Level for Mean:
  - %
  - Kth largest:
  - Kth smallest:

Ages (Years)	
Mean	10.525
Standard Error	0.160078106
Median	10.5
Mode	11
Standard Deviation	0.715891053
Sample Variance	0.5125
Kurtosis	-0.53129464
Skewness	-0.45516018
Range	2.5
Minimum	9
Maximum	11.5
Sum	210.5
Count	20

Figure 3.7.21 Depiction of Step 6

Image Description

The image depicts a table titled "Ages (Years)" with statistical data. Below is the HTML representation of the table. Note that the rows corresponding to Standard Deviation and Sample Variance are highlighted in the table.

Ages (Years)	
Mean	10.525
Standard Error	0.160078106
Median	10.5
Mode	11
Standard Deviation	0.715891053
Sample Variance	0.5125
Kurtosis	-0.53129464
Skewness	-0.45516018
Range	2.5
Minimum	9
Maximum	11.5
Sum	210.5
Count	20

Quartiles

Quartiles are the numbers that separate the data into quarters; quartiles may or may not be part of the data. The second quartile is the median of the data.

Quartiles in Excel

Use the following data (first exam scores) from Susan Dean's spring pre-calculus class:

33; 42; 49; 49; 53; 55; 55; 61; 63; 67; 68; 68; 69; 69; 72; 73; 74; 78; 80; 83; 88; 88; 88; 90; 92; 94; 94; 94; 94; 96; 100

1. Enter the data into column A, and sort them
2. Create a table for Q1, Q2, Q3, and Q3-Q1
3. Enter =*QUARTILE.EXC($A:$A,1)* in cell D2, click *Enter*
4. Enter =*QUARTILE.EXC($A:$A,2)* in cell D3, click *Enter*
5. Enter =*QUARTILE.EXC($A:$A,3)* in cell D4, click *Enter*

6. Enter "=" in cell D5, click on cell D4, enter "-", click on cell D2, click *Enter*

Figure 3.7.22 Depiction of Steps 1, 2, & 3

Image Description

The image is a screenshot of an Excel spreadsheet. It features a table listing exam scores and calculations for quartiles.

First exam scores	Quartile	Value
33	Q1	=QUARTILE.EXC($A:$A,1)
42	Q2	
49	Q3	
49	Q3 – Q1	
53		
55		
55		

Cell A1 contains the header "First exam scores". Cells A2 to A7 contain the scores 33, 42, 49, 49, 53, 55, and 55.

Column C lists the quartiles: "Q1" in C2, "Q2" in C3, "Q3" in C4, and "Q3 – Q1" in C5.

In column D, D2 contains the formula "=QUARTILE.EXC($A:$A,1)". The cells D3, D4, and D5 are empty.

Figure 3.7.23 Depiction of Step 4

Image Description

The image displays a portion of a spreadsheet containing exam scores and quartile calculations.

Column A	Column B	Column C	Column D
First exam scores		Quartile	Value
33		Q1	61
42		Q2	=QUARTILE.EXC($A:$A,2)
49		Q3	
49		Q3 – Q1	
53			
55			

The quartile calculations are listed in column D, starting from row 2. The calculated value for the first quartile (Q1) is 61, and the cell containing the formula for the second quartile (Q2) shows "=QUARTILE.EXC($A:$A,2)". The other quartile values have not yet been computed.

Figure 3.7.24 Depiction of Step 5

Image Description

The image shows a screenshot of an Excel spreadsheet. The worksheet contains two main areas: a list of exam scores and a computation of quartiles.

The left side of the spreadsheet lists *First exam scores* in column A:

Row	Column A
1	First exam scores
2	33
3	42
4	49
5	49
6	53

The right side of the spreadsheet is a computation table with two columns: *Quartile* in column C and *Value* in column D:

Column C	Column D
Quartile	Value
Q1	61
Q2	73
Q3	The value is not calculated and shows an Excel formula: =QUARTILE.EXC(A:A,3)
Q3 – Q1	

Figure 3.7.25 Depiction of Step 6

Image Description

The image is a screenshot of an Excel spreadsheet.

- **Columns**:
  - Column A is labelled "First exam scores" and has the following data:
    - A2: 33
    - A3: 42
    - A4: 49
    - A5: 49
    - A6: 53
  - Column B is empty.
  - Column C is labelled "Quartile" and has the following data:
    - C2: Q1
    - C3: Q2
    - C4: Q3
    - C5: Q3 – Q1
  - Column D is labelled "Value" and has the following data:
    - D2: 61
    - D3: 73
    - D4: 90
    - D5 contains the formula =D4-D2.
- **Formula Bar**: The formula bar shows =D4-D2, indicating that D5 is the result of subtracting the number in D2 (61) from the number in D4 (90).

This data seems to be part of an analysis of exam scores and quartile values.

3.8 KNOWLEDGE CHECK

Applying Your Knowledge

[Link to the solutions in text format](#)

Text Description

MultiChoice Activity

This variable can be manipulated or varied.

a. Ordinal
b. Dependent
c. Mean
d. Independent

MultiChoice Activity

Quantitative Data:

a. Does not use numbers
b. Can not have a mean value
c. Involves numerical evaluations
d. Uses nominal scales

MultiChoice Activity

Which of the following categories of data does not include numbers, or if it does include numbers, those numbers do not have a true mathematical meaning.

a. Concrete
b. Discrete
c. Qualitative
d. Quantitative

MultiChoice Activity

This is defined as the middle value of the data set when the data are sorted in order from least to greatest.

a. Variance
b. Mean
c. Standard Deviation
d. Median

MultiChoice Activity

This is defined as the middle value of the data set when the data are sorted in order from least to greatest.

a. Standard Deviation
b. Variance
c. Median
d. Mean

Applying Your Knowledge

You are a nurse working in the Cancer Centre at Victoria Hospital. You, an attending oncologist,

and several other members of the healthcare team have been working with three pharmaceutical companies over the past two years. You are trying to determine which of the company's drugs for treating a type of non-small cell lung cancer is most successful at reducing patients' primary tumour diameters.Success in this study is defined as a reduction in tumour diameter. Generally, smaller tumour diameter often indicates that there is less of a chance that a tumour is malignant.

There are 30 subjects in your study – 10 subjects per group. All medication dosages and timing of drug administration has been kept constant across the three drugs. For the graph on the following slide, data were averaged across each participant within their group and then graphed against the 24-month study cycle.

The two years is now over and it is time to look at the results.
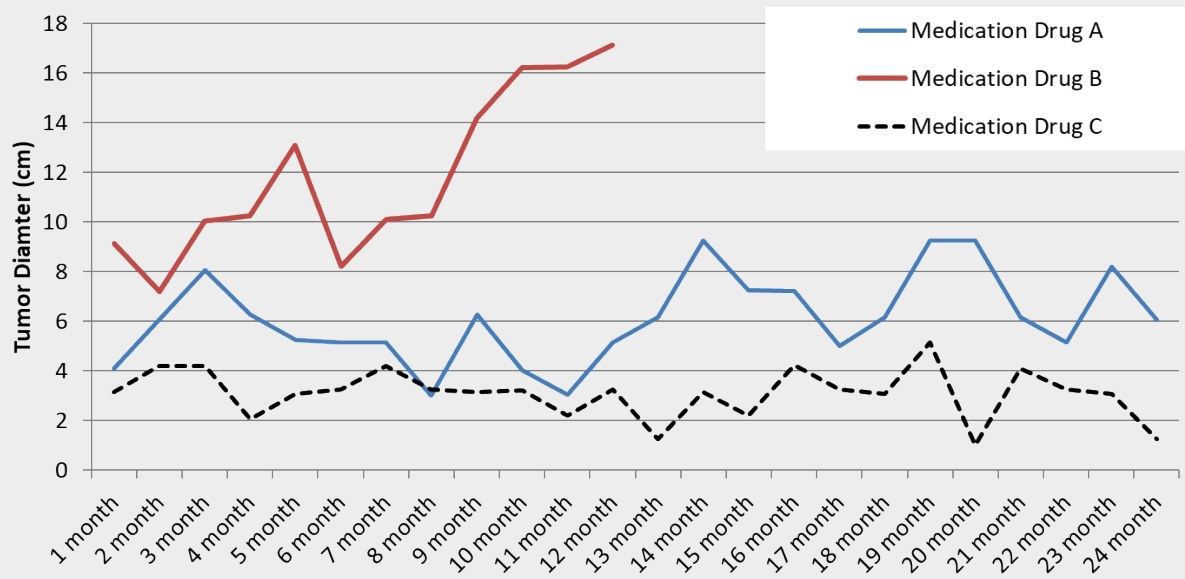
Click to enlarge

Image Description

Along the x-axis, time in months from 1 month to 24 months

Along the y-axis, Tumor Diameter (cm) from 0cm to 18cm

Line showing Drug A data points (1m, 4cm)(3m, 8cm)(8m, 3cm)(9m, 6cm)(11m, 3cm)(14m 9cm)(16m, 7cm)(17m, 5cm)(18m, 6cm)(19m, 9cm)(20m 9cm)(21m 6cm)(22m, 5cm)(23m, 8cm)(24m, 6cm)

Line showing Drug B data points (1m, 9cm)(2m, 7cm)(3m, 10cm)(4m, 10cm)(5m, 13cm)(6m, 8cm)(7m, 10cm)(8m, 10cm)(10m, 16cm)(10m, 16cm)(11m, 17cm)

Line showing Drug C data points (1m, 3cm)(2m, 4cm)(4m, 2cm)(7m, 4cm)(10m, 2cm)(11m, 3cm)(12m, 1cm)(13m, 3cm)(14m, 2cm)(15m, 4cm)(18m, 5cm)(19m 1cm)(20m, 4cm)(23m, 3cm)(24m, 1cm)

Answer the following questions using graph 1:

1. What is the independent variable
2. What is the dependent variable
3. Since you are wanting to publish your work in various scientific journals across the world, please perform the following conversions.

   - Average patient weight loss for subjects taking drug A was 15 kg — _____ lbs
   - Average patient weight loss for subjects taking drug B was 22 kg — _____ lbs
   - Average patient weight loss for subjects taking drug C was 10 kg — _____ lbs
   - Across the three groups, what is the average weight loss = _____ kgs and _____ lbs

4. Describe what you think happened to those taking drug B? Why does the line only go to month 12?
5. After assessing the graph, which drug would you recommend now to your future patients and why?

CHAPTER 4 - CRITICAL THINKING & REASONING

Chapter Outline

4.0 LEARNING OBJECTIVES

Learning Objectives

- Define Critical thinking
- Explain the importance of critical thinking as a healthcare professional
- Identify if a source is creditable
- Apply critical thinking skills as a health science student

4.1 THE NATURE OF SCIENCE

Defining Science

Science is a distinctive way of gaining knowledge about the natural world that starts with a question and then tries to answer the question using evidence and logic. It is an exciting exploration of all the whys and hows that any curious person might ask about the world. You can be part of that exploration! Besides your curiosity, you only need a basic understanding of how scientists think and how science is done. In this concept, you'll learn how to think like a scientist.

Thinking Like a Scientist

Thinking like a scientist rests on certain underlying assumptions. Scientists assume that:

Science cannot provide answers to all questions.	Nature can be understood through systematic study.
Sound scientific ideas withstand the test of time.	Scientific ideas are open to revision

Nature Is Understandable

Scientists think of nature as a single system controlled by natural laws. By discovering natural laws, scientists strive to increase their understanding of the natural world. Laws of nature are expressed as scientific laws. A **scientific law** is a statement that describes what always happens under certain conditions in nature.

Scientific Ideas Are Open to Change

Science is both a process and body of knowledge. Scientific knowledge is generated through systematic processes, such as **observation** and experimentation. Scientists are always testing and revising their ideas, and as new observations are made, existing ideas may be challenged. Ideas may be replaced with new ideas that better fit the facts, but more often, existing ideas are simply revised. Through many new discoveries over time, scientists gradually build an increasingly accurate and detailed understanding of the natural world.

Scientific Knowledge May Be Long Lasting

Many scientific ideas have stood the test of time. About 200 years ago, the scientist John Dalton proposed atomic theory — the theory that all matter is made of tiny particles called atoms. This theory is still valid today. During the two centuries since the theory was first proposed, scientists have learned a lot more about atoms and the even smaller particles that compose them. Nonetheless, the idea that all matter consists of atoms remains valid. There are many other examples of basic scientific ideas that have been tested repeatedly and proven sound. You will learn about many of them as you study human biology.

Not All Questions Can be Answered by Science

Science rests on evidence and logic, and evidence comes from observations. Therefore, science deals only with things that can be observed. An **observation** is anything that is detected through human senses or with instruments or measuring devices that extend human senses. Things that cannot be observed or measured by current means — such as supernatural beings or events — are outside the bounds of science. Consider these two questions about life on Earth:

- Did life on Earth evolve over time?
- How did life on Earth originate?

The first question can be answered by science on the basis of scientific evidence (such as fossils and logical arguments). The second question could be a matter of belief, but no evidence can be gathered to support or refute it. Therefore, it is outside the realm of science.

4.2 WHAT IS CRITICAL THINKING

In this resource, we use the scientific method to approach a problem. Critical thinking is necessary to use this method, but logic and reasoning are cognitive skills required of a health care professional.

Video: "What is Critical Thinking?" by LearnFree is licensed under the Standard YouTube License [2:35] *Transcript and closed captions available on YouTube.*

Critical Thinking

As a college student, you are tasked with engaging and expanding your thinking skills. Critical thinking is one of the most important skills because it relates to nearly all tasks, situations, topics, careers, environments, challenges, and opportunities. It is a "domain-general" thinking skill, not one specific to a particular subject area.

What Is Critical Thinking?

Critical thinking is clear, reasonable, reflective thinking focused on deciding what to believe or do. It means asking probing questions like "How do we know?" or "Is this true in every case or just in this instance?" It involves being skeptical and challenging assumptions rather than simply memorizing facts or blindly accepting what you hear or read.

Imagine, for example, that you're reading a history textbook. You wonder who wrote it and why because you detect certain biases in the writing. You find that the author has a limited scope of research focused only on a particular group within a population. In this case, your critical thinking reveals "other sides to the story."

Who are critical thinkers, and what characteristics do they have in common? Critical thinkers are usually curious and reflective people. They like to explore and probe new areas and seek knowledge, clarification, and new solutions. They ask pertinent questions, evaluate statements and arguments, and distinguish between facts and opinions. They are also willing to examine their own beliefs, possessing a manner of humility that allows them to admit a lack of knowledge or understanding when needed. They are open to changing their

mind. Perhaps most of all, they actively enjoy learning and seeking new knowledge is a lifelong pursuit. This may well be you!

No matter where you are on the road to being a critical thinker, you can always more fully develop and finely tune your skills. Doing so will help you develop more balanced arguments, express yourself clearly, read critically, and glean important information efficiently. Critical thinking skills will help you in any profession or any circumstance of life, from science to art to business to teaching. With critical thinking, you become a clearer thinker and problem solver.

Critical Thinking IS	Critical Thinking is NOT
Skepticism	Memorizing
Examining assumptions	Group thinking
Challenging reasoning	Blind acceptance of authority
Uncovering biases	

Critical Thinking and Logic

Critical thinking is fundamentally a process of questioning information and data. You may question the information you read in a textbook or what a politician, professor, or classmate says. You can also question a commonly-held belief or a new idea. With critical thinking, anything and everything is subject to question and examination to logically construct reasoned perspectives.

What Is Logic?

The word logic comes from the Ancient Greek logike, referring to the science or art of reasoning. Using logic, a person evaluates arguments and reasoning and strives to distinguish between good and bad reasoning or between truth and falsehood. Using logic, you can evaluate the ideas and claims of others, make good decisions, and form sound beliefs about the world.

Questions of Logic in Critical Thinking

Let's use a simple example of applying logic to a critical-thinking situation. In this hypothetical scenario, a man has a Ph.D. in political science, and he works as a professor at a local college. His wife works at the college, too. They have three young children in the local school system, and their family is well-known in the

community. The man is now running for political office. Are his credentials and experience sufficient for entering public office? Will he be effective in the political office? Some voters might believe that his personal life and current job, on the surface, suggest he will do well in the position, and they will vote for him. In truth, the characteristics described don't guarantee that the man will do a good job. The information is somewhat irrelevant. What else might you want to know? How about whether the man had already held a political office and done a good job? In this case, we want to think critically about how much information is adequate in order to make a decision based on logic instead of assumptions.

The following questions, presented in the figure below, are ones you may apply to formulate a logical, reasoned perspective in the above scenario or any other situation:

1. What's happening? Gather the basic information and begin to think of questions.
2. Why is it important? Ask yourself why it's significant and whether or not you agree.
3. What don't I see? Is there anything important missing?
4. How do I know? Ask yourself where the information came from and how it was constructed.
5. Who is saying it? What's the position of the speaker and what is influencing them?
6. What else? What if? What other ideas exist and

Questions a Critical Thinker Asks

What's Happening?

Gather the basic information and begin to think of questions

Why Is It Important?

Ask yourself why it's significant and whether or not you agree

What Don't I See?

Is there anything important missing?

Answers

How Do I Know?

Ask yourself where the information came from and how it was constructed

Who Is Saying It?

What's the position of the speaker and what is influencing them?

Pluto is not a planet

Figure 4.2.1

Image Description

Questions a Critical Thinker Asks:

What's Happening? Gather the basic information and begin to think of questions
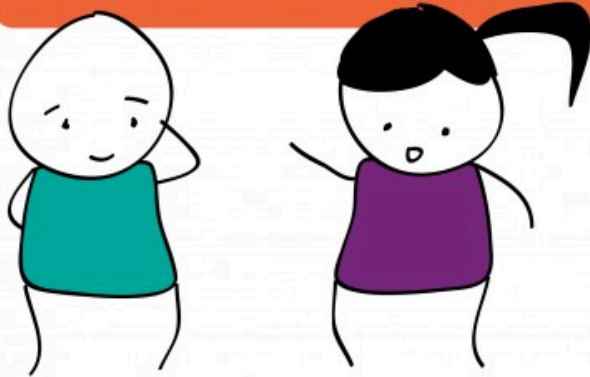
Why Is It Important? Ask yourself why it's significant and whether or not you agree

What Don't I See? Is there anything important missing

How Do I Know? Ask yourself where the information came from and how it was constructed.

Who is Saying it? What's the position of the speaker, and what is influencing them?

What Else? What If? What other ideas exist and are there other possibilities?

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4.3 EVALUATING INFORMATION WITH CRITICAL THINKING

Evaluating information can be one of the most complex tasks you will face in college. But if you utilize the following four strategies, you will be well on your way to success:

1. Read for understanding
2. Examine arguments
3. Clarify thinking
4. Cultivate "habits of mind"

Read for Understanding

When you read, take notes or mark the text to track your thinking about your reading. As you make connections and ask questions in response to your reading, you monitor your comprehension and enhance your long-term understanding of the material. You will want to mark important arguments and key facts. Indicate where you agree and disagree or have further questions. You don't necessarily need to read every word, but make sure you understand the concepts or the intentions behind what is written.

Examine Arguments

When you examine arguments or claims that an author, speaker, or other source is making, your goal is to identify and examine the hard facts. You can use the spectrum of authority strategy for this purpose. The spectrum of authority strategy assists you in identifying the "hot" end of an argument—feelings, beliefs, cultural influences, and societal influences—and the "cold" end of an argument—scientific influences. The most compelling arguments balance elements from both ends of the spectrum. The following video explains this strategy in further detail:

Clarify Thinking

When you use critical thinking to evaluate information, you need to clarify your thinking to yourself and likely to others. Doing this well is mainly a process of asking and answering probing questions, such as the

logic questions discussed earlier. Design your questions to fit your needs but cover adequate ground. What is the purpose? What question are we trying to answer? What point of view is being expressed? What assumptions are we or others making? What facts and data do we know, and how do we know them? What are the concepts we're working with? What are the conclusions, and do they make sense? What are the implications?

Cultivate "Habits of Mind"

"Habits of mind" are the personal commitments, values, and standards you have about the principle of good thinking. Consider your intellectual commitments, values, and standards. Do you approach problems with an open mind, a respect for truth, and an inquiring attitude? Some good habits to have when thinking critically are being receptive to having your opinions changed, having respect for others, being independent and not accepting something is true until you've had the time to examine the available evidence, being fair-minded, having respect for a reason, having an inquiring mind, not making assumptions, and always, especially, questioning your own conclusions—in other words, developing an intellectual work ethic. Try to work these qualities into your daily life.

4.4 SCIENCE AND CRITICAL THINKING

> A critical thinker will be good at reconstructing arguments, filling in assumptions, identifying the patterns of reasoning to which the argument appeal, and paying attention to factors that are being left out (Dayton & Rodier, Preface, para. 7)

A health professional needs to be a critical thinker and, as a result, open-minded to perspectives but also skeptical. Using a method for problem-solving, such as the scientific method, to apply critical reasoning.

Science and Common Sense

Some people wonder whether the scientific approach is necessary. Can we not reach the same conclusions based on common sense or intuition? Certainly, we all have intuitive beliefs about people's behaviour, thoughts, and feelings—and these beliefs are collectively referred to as folk psychology. Although much of our folk psychology is probably reasonably accurate, it is clear that much of it is not. For example, most people believe anger can be relieved by "letting it out"—perhaps by punching something or screaming loudly. Scientific research, however, has shown that this approach tends to leave people feeling more angry, not less (Bushman, 2002).

Forming detailed and accurate beliefs requires powers of observation, memory, and analysis to an extent we do not naturally possess. It would be nearly impossible to count the number of words spoken by the women and men we encounter, estimate the number of words they spoke per day, average these numbers for both groups and compare them—all in our heads. This is why we tend to rely on mental shortcuts (what psychologists refer to as heuristics) to form and maintain our beliefs. For example, if a belief is widely shared—especially if it is endorsed by "experts"—and it makes intuitive sense, we tend to assume it is true. This is compounded by the fact that we then tend to focus on cases that confirm our intuitive beliefs and not on cases that disconfirm them. This is called confirmation bias. For example, once we believe that women are more talkative than men, we tend to notice and remember talkative women and silent men but ignore or forget silent women and talkative men. We also hold incorrect beliefs in part because it would be nice if they were true. Have you ever purchased an item online based on a couple of reviews you read, and when you got it, it was not close to the quality you thought it was? This is an example of confirmation bias.

Scientists understand that they are just as susceptible as anyone else to intuitive but incorrect beliefs. This is why they cultivate an attitude of skepticism. Being skeptical does not mean being cynical or distrustful nor questioning every belief or claim. Instead, it means pausing to consider alternatives and to search for evidence—especially systematically collected empirical evidence—when there is enough at stake to justify doing so. For example, imagine that you read a magazine article that claims that giving children a weekly

allowance is a good way to help them develop financial responsibility. This is an interesting and potentially important claim (especially if you have children). Taking an attitude of skepticism, however, would mean pausing to ask whether it might be instead that receiving an allowance merely teaches children to spend money—perhaps even to be more materialistic. Taking an attitude of skepticism would also mean asking what evidence supports the original claim. Is the author a scientific researcher? Is any scientific evidence cited? If the issue was important enough, it might also mean turning to the research literature to see if anyone else had studied it.

Because there is often not enough evidence to fully evaluate a belief or claim, scientists also cultivate a tolerance for uncertainty. They accept that there are many things that they simply do not know. For example, it turns out that there is no scientific evidence that receiving an allowance causes children to be more financially responsible, nor is there any scientific evidence that it causes them to be materialistic. Although this kind of uncertainty can be problematic from a practical perspective—for example, making it difficult to decide what to do when our children ask for an allowance—it is exciting from a scientific perspective. If we do not know the answer to an interesting and empirically testable question, science, and perhaps even you, as a researcher, may be able to provide the answer. What we know from the scientific method is that creating a hypothesis and testing that hypothesis may lead us to results or a newly formed hypothesis. The key is not taking everything that is read for the truth, questioning the source, and being open to asking new questions and discussion.

4.5 CRITICAL REASONING

Born in 1909, Max Black was a philosopher who studied language, math, science and art. He wrote a resource, Critical Thinking: An Introduction to Logic and Scientific Method, that is still used by educators today. Recall the four categories for skill sets required of a health care professional. You can deduce from this that using an integral approach of critical thinking and the scientific method can enhance not only a health science student's cognitive skills but also interpersonal, communication and behavioural.
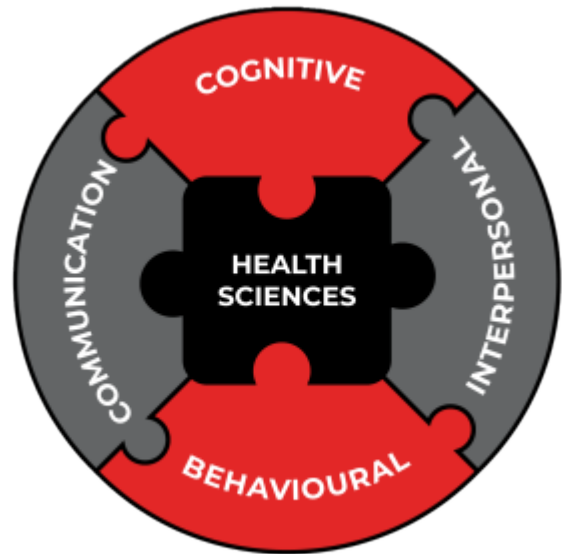
Good Reasoning

You know the answers to many of the questions you care about, but you merely have opinions about many others. What is the difference between knowledge and opinion? Why is it that you now know, for example, that your teacher is highly competent, even though, at one time, this was only your opinion? The answer has partly to do with your level of confidence; although once you believed it tentatively, you now believe it with assurance. But there is a more profound difference: you now have better reasons for believing it. You have read her student evaluations, talked to many of her former students, and maybe even taken a class from her yourself. There might still be some remote chance that she will disappoint you. (If it does turn out that you have been misled, you will conclude that it was merely an opinion all along—that you thought you knew that she was highly competent, but you never really knew it.) But, from where you now sit, your reasons are so good that you do justifiably claim it as knowledge and not as mere opinion.

So, an essential difference between knowledge and mere opinion is the quality of your reasons. Your reasons are what you depend on in support of what you believe—regardless of whether you consider what you believe to be knowledge or mere opinion.

Good reasoning is the thinking most likely to result in your having good reasons for your answers—and, thus, the sort of thinking most likely to give you knowledge rather than mere opinion.

While reasoning is the process of thinking logically about something to form a conclusion or judgment, an argument is a conclusion (a claim) backed up by one or more reasons. An argument is a series of statements in which at least one of the statements is offered as a reason to believe another.

4.6 EVALUATING SOURCES

Questioning your sources is a key component of critical thinking because not all sources of information are equally credible, accurate or relevant. Questioning and examining your sources will allow you to:

- eliminate irrelevant or erroneous sources
- select sources that are relevant and reliable
- sharpen the focus of your critical inquiry
- get a better understanding of current knowledge and debates relevant to your topic
- prepare the ground for analyzing and evaluating sources (Monash University, n.d.).

Regarding research, we agree that using Google to find sources is easy and relatively convenient. Given how pressed we are for time in this modern day and age with work, school, and other parts of our lives, it's easy to choose a research method that supports this. Very often in a class, the research process takes a back seat to available time. So we Google ideas, find sources that "look good," and hope for the best. However, what professors read some days on the other side of that research process is often pretty thin regarding substance. Sure, a source can look/appear decent, but often, hidden issues are discovered later on...usually by the professor when grading an essay. Instructors write things like "source lacks authority" or "this is worse than a well-researched Wikipedia article." And then there are the inevitable point deductions.

On the other hand, most everything else on the web (excluding Google Scholar) is a potential problem and credibility issues will remain. However, with some subjects, content from the web will remain an important part of our work. For instance, in the summer of 2018, students writing about immigration and the forced separation of children from parents will find the most important information in the newspapers of the day. So, for current issues, Google remains an important part of research.

The CRAAP Test
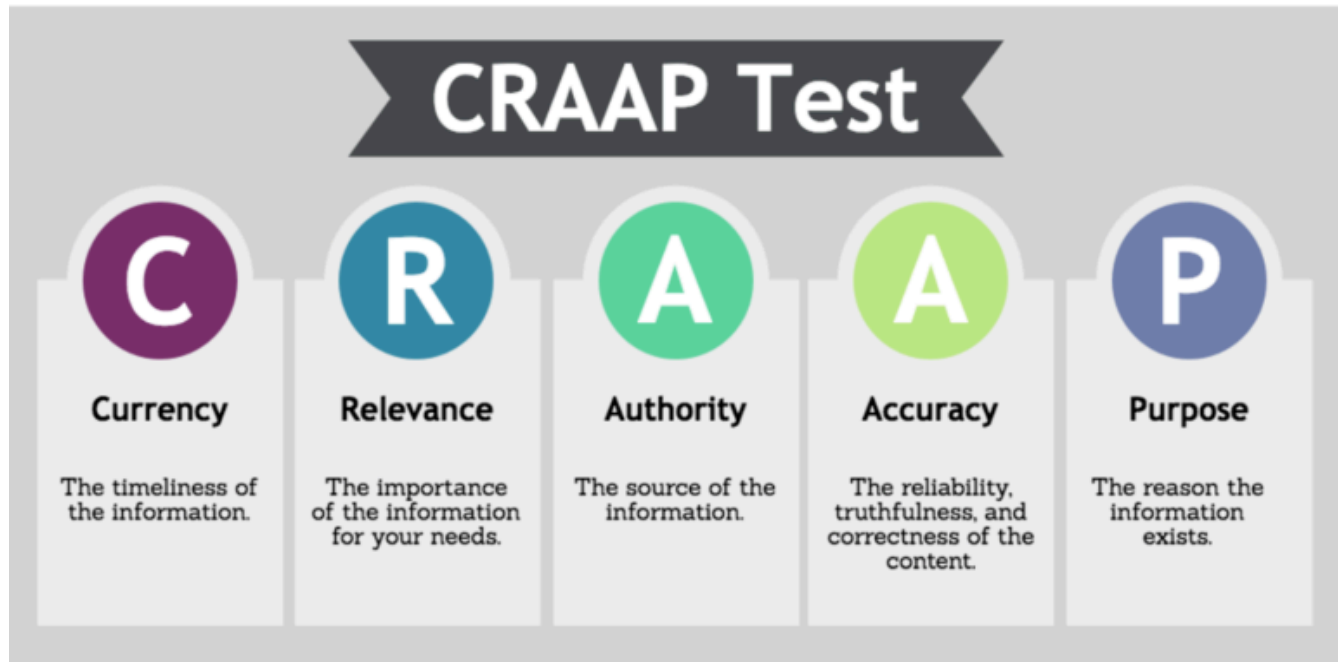
"CRAAP Test" from The Information Literacy User's Guide: Marietta College" by Linda Lockhart and Peter Thayer CC BY-NC-SA 4.0

Image Description

CRAAP Test

    C – Currency – The timeliness of the information

    R – Relevance – The importance of the information for your needs

    A – Authority – The source of the information

    A – Accuracy – The reliability, truthfulness, and correctness of the content

    P – Purpose – The reason the information exists

C Currency: How old is this information?

- When was the information published or posted?
- Has the information been revised or updated?
- Does your topic require current information?
- Are the links on the site functional?

R Relevance: Does this information help me finish my assignment?

- Does the information relate to your topic or answer your question?
- Who is the intended audience?
- Is the information at an appropriate level (i.e. not too easy or advanced for your needs)?
- Have you looked at a variety of sources before determining this is the one you will use?

A Authority: Is whoever created this an expert on the subject?

- Who is the author/publisher/source/sponsor?
- What are the author's credentials or organizational affiliations?
- Is the author qualified to write on the topic?
- Is there contact information, such as a publisher or email address?
- Does the URL (.edu/.gov/.com) reveal anything about the author or source?

A Accuracy: How much can I trust this information?

- Where does the information come from?
- Is the information supported by evidence?
- Has the information been reviewed or verified by someone other than the author?
- Can you verify any of the information in another source or from personal knowledge?
- Are there spelling, grammar, or typing errors?

P Purpose: Why was this information created?

- What is the purpose of the information? Is it to inform, teach, sell, entertain, or persuade?
- Is the information factual, opinion, or propaganda?
- Does the point of view appear objective and impartial?
- Are there political, ideological, cultural, religious, institutional or personal biases?

Video: "Evaluating Resources with CRAAP" by Shake Library is licensed under the Standard YouTube License [6:19] *Transcript and closed captions available on YouTube.*

The CRAAP Test handout takes you through a list of questions to help you evaluate the information you find.

4.7 DEVELOPING YOURSELF AS A CRITICAL THINKER

Critical thinking is a fundamental skill for college students, but it should also be a lifelong pursuit. Below are additional strategies to develop yourself as a critical thinker in college and everyday life:

- *Reflect and practice*: Always reflect on what you've learned. Is it true all the time? How did you arrive at your conclusions?
- *Use wasted time*: It's important to make time for relaxing, but if you are indulging in too much of a good thing, think about using your time more constructively. Determine when you do your best thinking and try to learn something new during that part of the day.
- *Redefine the way you see things*: It can be very uninteresting to always think the same way. Challenge yourself to see familiar things in new ways. Put yourself in someone else's shoes and consider things from a different angle or perspective. If you're trying to solve a problem, list all your concerns: what you need to solve it, who can help, what some possible barriers might be, etc. It's often possible to reframe a problem as an opportunity. Try to find a solution where there seems to be none.
- *Analyze the influences on your thinking and in your life*: Why do you think or feel the way you do? Analyze your influences. Think about who in your life influences you. Do you feel or react a certain way because of social convention or because you believe it is what is expected of you? Try to break out of any moulds that may be constricting you.
- *Express yourself:* Critical thinking also involves being able to express yourself clearly. The most important thing in expressing yourself clearly is to state one point at a time. You might be inclined to argue every thought, but you might have a greater impact if you focus just on your main arguments. This will help others to follow your thinking clearly. For more abstract ideas, assume that your audience may not understand. Provide examples, analogies, or metaphors where you can.
- *Enhance your wellness:* It's easier to think critically when you take care of your mental and physical health. Try taking activity breaks throughout the day to reach 30 to 60 minutes of physical activity each day. Scheduling physical activity into your day can help lower stress and increase mental alertness. Also, do your most difficult work when you have the most energy. Think about the time of day you are most effective and have the most energy. Plan to do your most difficult work during these times. And be sure to reach out for help if you feel you need assistance with your mental or physical health.

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4.8 KNOWLEDGE CHECK

Applying Your Knowledge

[Link to the solutions in text format](#)

Text Description

MultiChoice Activity

The following is/are an example(s) of critical thinking (select all that apply).

 a. Skepticism
 b. Group thinking
 c. Memorizing
 d. Examining Assumptions

MultiChoice Activity

Read for understanding means to:

 a. Make connections between material
 b. Memorize.
 c. Think in a group only.
 d. Blindly accept what your are reading for truth

MultiChoice Activity

Being receptive to having your opinions changed and having respect for others is an example of what strategy when evaluating information?

a. Clarify thinking
b. Examine arguments
c. Read for understanding
d. Cultivate "habits of mind"

CHAPTER 5 - POPULATION HEALTH APPLICATIONS

Chapter Outline

5.0 LEARNING OBJECTIVES

Learning Objectives

- Identify the Government of Canada's identified 12 Social Determinants of Health.
- Demonstrate awareness of how these determinants of health create inequalities in our communities.
- Explore strategies to working with and providing equality in health care
- Define diversity as it relates to patient care.
- Identify management strategies to address a diverse patient population.
- Summarize effective communication strategies that promote an inclusive and caring healthcare environment.
- Define health and wellness and identify strategies for personal health and wellness.

As you saw in Chapter 1, health research comes in many forms or "pillars" of health.

Pillar 4: Social, cultural, environmental, and population health research aims to improve the health of entire communities. To do this, it is important to understand the factors that affect the health of a population and appreciate the perspectives of different populations.

"Pillar 4" by CIHR, reproduced for non-commercial purposes.

5.1 SOCIAL DETERMINANTS OF HEALTH

"Social Determinants of Health" by Sanaz Habibi, CC BY-NC-SA 4.0

The Government of Canada has listed the following twelve factors as key Social Determinants of Health:

1. Income and social status
2. Employment and working conditions
3. Education and Literacy
4. Childhood experiences
5. Physical environments
6. Social support and coping skills
7. Healthy behaviours
8. Access to health services
9. Biology and genetic endowment
10. Gender
11. Culture
12. Race/Racism

Understanding the social determinants of health will equip you to better understand and empathize with others both in your work on campus and in your future endeavours. Knowing this will also serve as a guide in advocacy efforts.

"Overview of all 12 Social Determinants of Health (SDOH)" from Post-Secondary Peer Support Training Curriculum Copyright © 2022 by Jenn Cusick is licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted.—Modifications: Used 12 Determinants of Health only.

5.2 EQUITY VS. EQUALITY

"Equality focuses on creating the same starting line for everyone. Equity has the goal of providing everyone with the full range of opportunities and benefits – the same finish line." ~YWCA Calgary

It's important to distinguish between equity and equality because these concepts differ. For the purpose of this section, we are looking at equality and equity from a systemic approach. **Equality** is about sharing things equally between all people regardless of their circumstances. **Equity** realizes that people differ in their resources, abilities, barriers, and experiences and adjusts for them.

> Consider that you are serving a lasagna out to a group of people.
>
> - **Equality** means that every person gets the same size piece of lasagna, no matter their situation.
> - **Equity** means that the size of the lasagna piece will vary depending on the person: a child might get a smaller piece, someone who has just eaten might get a little morsel, and someone who hasn't eaten in a day might get an extra-large piece.
>
> With equality, it's about equal distribution of the lasagna amongst all people–everyone gets the same sized piece. With equity, the goal is that everyone gets nourished and hunger is alleviated. This means that some people might get more or less lasagna depending on their situation. Equity also avoids the issue of some people eating so much that they need an antacid.

Equity within systems that provide support services means taking into account that many people have suffered oppression and injustice and have experienced multiple barriers. It also recognizes other people have privilege. Equity means that those who have less will get more to make up for past inequalities, as those inequalities eventually create significant barriers. The goal of equity is that we all eventually succeed at the same level.

Equality – treating everyone the same – sounds wonderful in theory. But in practice, when we treat people

equally rather than based on their unique situations and needs, we ignore the complex barriers that many people face. This includes the impact their experiences, social status and background can have on their access to resources. If we ignore these barriers, then we're inadvertently reinforcing privilege and feeding into the inequities they experience.

Equity recognizes that not everyone is coming from the same "starting line," that many face numerous obstacles in their path while others face few, and tries to provide each person access to the same "finish line."

The research paper entitled, *Social Determinants of Mental Health: Where We Are and Where We Need to Go* (Alegría et al., 2019), states the following:

> Social determinants frameworks build upon the concept of the "social gradient"—that individuals with lower social status have greater health risks and lower life expectancy than those with higher status, and that the impact of social position can accumulate over time. Observed differences in social determinants are thought to develop from unequal distribution of resources; thus, they can be reduced through targeted social and economic policies and programs.

5.3 DIVERSITY OF PATIENTS

This chapter provides an overview of diversity in patients. While the chapter is meant to bring awareness, further study is recommended throughout your career and life. Some of the things we discuss in this module may be uncomfortable. That's how we learn and grow. This is a space that is free of judgment and criticism.

Diversity in healthcare refers to the wide range of individuals who exhibit differences in various aspects such as race, ethnicity, gender, sexual orientation, age, socioeconomic status, religion, and physical abilities among healthcare professionals, patients, and other groups within the healthcare system (CCDI, 2022). Diversity is about the individual. It is about the variety of unique dimensions, qualities, and characteristics we all possess and the mix that occurs in any group of people. (CCDI, 2022).

There are various dimensions of diversity, including but not limited to race, ethnicity, gender, sexual orientation, age, socioeconomic status, religion, and physical abilities (CCDI, 2022).

- *Race and Ethnicity*: Different racial and ethnic groups can have distinct health disparities, genetic predispositions, cultural beliefs, and healthcare experiences that need to be considered in the provision of care.
- *Gender:* Gender-related health issues and differences in healthcare utilization and experiences are important considerations in healthcare settings.
- *Sexual Orientation and Gender Identity*: 2SLGBTQI+ individuals may face specific health challenges and unique healthcare needs, requiring culturally competent and inclusive care.
- *Age:* Healthcare requirements vary across different age groups, from pediatric to geriatric care, each with its own set of concerns and priorities.
- *Socioeconomic Status*: Socioeconomic factors can significantly impact access to healthcare, treatment options, and health outcomes. Addressing disparities based on income and education is crucial.
- *Religion:* Religious beliefs and practices can influence medical decision-making, treatment preferences, and end-of-life care, making cultural sensitivity essential.
- *Physical Abilities:* Ensuring accessibility for individuals with physical disabilities is crucial for providing equitable healthcare services.
- *Language*: Language barriers can hinder effective communication and understanding between healthcare providers and patients, potentially leading to misdiagnosis or suboptimal care.
- *Cultural Background*: Cultural norms, values, and practices influence how individuals perceive and seek healthcare, affecting their treatment choices and adherence.

Diversity recognizes and values the uniqueness of individuals and their perspectives, experiences, and

backgrounds. It promotes inclusivity and equal representation, aiming to create an environment where everyone's contributions are acknowledged, respected, and appreciated. Embracing diversity can lead to enriched discussions, innovative solutions, and a more holistic world understanding. It's about recognizing the strength that comes from differences and working towards a more equitable society where everyone can thrive.

The concept of diversity and healthcare recognizes that individuals possess a unique set of attributes and experiences that can impact their healthcare needs, experiences, and outcomes. Embracing diversity in healthcare involves acknowledging and respecting these differences and ensuring that healthcare services are accessible, equitable, and sensitive to the diverse needs of all individuals (Togioka, et. al., 2023)

Adapted from "Diversity of Patients" by Walton & Darch in *DENT-1005: Patient Care Procedures,* © Fanshawe College 2023.

5.4 CULTURAL SENSITIVITY & COMPETENCE

The following video shows the definition of cultural sensitivities and disparities, and the second video demonstrates the patient and healthcare interactions related to this. These videos show one aspect of diversity related to cultural sensitivity and the effect or disparities our patients can encounter and experience through interaction and care.

Video: "Cultural sensitivity" by Aisha Khalaf [2:23] is licensed under the Standard YouTube License. *Music only, text on screen.* *Text Transcript*

Watch the video "Cultural Sensitivity Definition" by Study.com.

Cultural Competence

Ability of healthcare professionals to understand, respect, and respond appropriately to the cultural, linguistic, and social needs of patients from different backgrounds.

Cultural competence ensures that healthcare services are tailored to patients' values, beliefs, and preferences, promoting better communication, patient satisfaction, and health outcomes (Purnell, 2019). Cultural competence plays an important role in enhancing patient outcomes by providing effective communication, promoting patient-centred care and addressing healthcare disparities. By recognizing and accommodating the cultural diversity of patients, healthcare providers can deliver care that respects patients' values, improves communication, builds trust, and ultimately leads to better health outcomes for all individuals, regardless of their cultural backgrounds. This section reviews some cultural interactions a health care provider may encounter and continues to educate themselves on knowing.

Language barriers

Language barriers may come in many forms in healthcare and can result in:

- Communication breakdown
- Limited history taking
- Reduced quality of care
- Patient discomfort
- Ethical Concerns

(Al Shamsi et al., 2020)

Health care practice should include strategies that would help with language barriers. Using Interpreters, the use of visual aid and/or technology may be helpful. Speak slowly and clearly and use non-verbal gestures when appropriate while always confirming the patient understands. It may be helpful to have the patient's family or friend involved to help with understanding. In using any of these strategies, consider the role cultural differences play.

Religious and Spiritual Diversity

Religious beliefs and practices may influence a patients' healthcare decisions. A healthcare professional must respect patients' spiritual preferences while providing care. Some treatments might be perceived as conflicting with religious teachings or beliefs and may be rejected or accepted based on this. Access to care may focus on prayer or faith-based healing (Padela et al., 2017). Beliefs can influence the timing of medical care or the timing to seek that care—for example, Ramadan (when fasting from sunrise to sunset) or prayer times. Holistic choices and alternative therapies may lead patients to opt for alternative or complementary therapies that align with their faith.

Holistic choices and well-being can include three main areas: physical (body's needs, sleep, exercise), emotional (this is how someone may be stimulated with wonder or curiosity) and spiritual (worship or rituals). It may be common practice for family involvement and their role in patient decisions.

Demonstrate respect for patients' spiritual preferences while providing care.

- Inquire about beliefs
- Listen
- Respect
- Non-judgmental
- Accommodate
- Sensitivity to rituals

- Educate yourself

Gender and Sexual Diversity

2SLGBTQI+Canadians tend to have "less access to primary care and more unmet health care needs than the rest of the population" (Organek & Weisdorf, 2023). Challenges faced by this community include a history of discrimination and stigma from healthcare providers, creating a barrier to healthcare access by 2SLGBTQI+ patients. Misgendering and privacy concerns (not disclosing information about the patient's 2SLGBTQI+ status) are also challenges this community faces. Lack of awareness and training for health care professionals can exasperate this.

Applying inclusive language and practice to create a welcoming environment for all patients, regardless of their gender identity or sexual orientation, through the use of preferred pronouns, avoiding assumptions and providing visible support. Training and education should be readily available to ensure inclusive language and practices are being used.

> Examples of inclusive language can be found in the following articles:
>
> How to Use Inclusive Language in Healthcare
> Canada's First Federal 2SLGBTQI+ Action Plan

Recognize the Impact of Race and Ethnicity

When exploring the diversity of race and ethnicity, we first want to understand the historical and social factors and have a fair understanding of historical/social factors that can contribute to health disparities. "Health disparities among racial and ethnic groups are influenced by a complex interplay of historical and social factors that have contributed to systemic inequalities in healthcare access, outcomes, and treatment" (Williams & Mohammed, 2009).

Health Disparities result from multiple factors:

- *Historical factors*: Slavery, colonization, and forced migration have led to persistent inequalities in resources, education, and opportunities, affecting health outcomes (Gee & Ford, 2011).
- *Socioeconomic status*: including income, education, and employment opportunities.
- *Cultural differences:* Cultural norms and practices can influence health behaviours, attitudes toward healthcare, and willingness to seek medical care.

- *Healthcare access barriers* include limited transportation and geographical location (CDC, 2023).

Health disparities are inequitable and are directly related to the historical and current unequal distribution of social, political, economic, and environmental resources (CDC, 2023).

Health disparities result from multiple factors, including:

- Poverty
- Environmental threats
- Inadequate access to healthcare
- Individual and behavioural factors
- Educational inequalities (CDC, 2023)

Diversity of Patients: Age-related Considerations

Working in health care means working with all ages, where the health priority/focused needs will differ with age-related considerations. Pediatric Patients' needs will differ with a focus on overall growth and development and preventative care. Communicating playfully using simple terms may help with the approach while often at times managing parents' information and relatable communication. Adolescent Patients may still be under parental supervision but looking for more independence. Build a rapport with this demographic. Adult Patients have a goal of leading an overall healthy lifestyle, and it is best to provide clear explanations with follow-up. Geriatric Patient's needs may increase with age-related health issues including, but not limited to, hearing, mobility, confusion, frustration and side effects from medications. Be patient and adaptable to these limitations.

Support Accessibility and Inclusivity for Patients with Disabilities

Implement strategies to ensure equal services for patients with disabilities.

Disabilities are defined as any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities and interact with the world around them (participation restrictions)

> "Patients with disabilities face barriers when they attempt to access health care. These barriers include physical barriers to entering health care establishments, lack of accessible equipment, lack of a safe method for transferring the patient to an examination table, and the lack of policies that facilitate access" (Lagu., et al. 2015).

The inclusion of people with disabilities into everyday activities involves practices and policies designed to

identify and remove physical, communication, and attitudinal barriers that hamper individuals' ability to participate fully in society, the same as people without disabilities. Inclusion involves:

- Getting fair treatment from others (nondiscrimination);
- Making products, communications, and the physical environment more usable by as many people as possible (universal design);
- Modifying items, procedures, or systems to enable a person with a disability to use them to the maximum extent possible (reasonable accommodations); and
- Eliminating the belief that people with disabilities are unhealthy or less capable of doing things (stigma, stereotypes).

Disability inclusion involves input from people with disabilities, generally through disability-focused and independent living organizations, in program or structural design, implementation, monitoring, and evaluation (CDC, 2024).

Some common strategies for improving the patient-provider interaction and institutionalizing changes in the health care system include:

1. Provide interpreter services
2. Recruit and retain minority staff
3. Provide training to increase cultural awareness, knowledge, and skills
4. Coordinate with traditional healers
5. Use community health workers
6. Incorporate culture-specific attitudes and values into health promotion tools.
7. Include family and community members in healthcare decision-making
8. Locate clinics in geographic areas that are easily accessible to specific populations
9. Expand hours of operation
10. Provide linguistic competency that extends beyond the clinical encounter to the appointment desk, advice lines, medical billing, and other written materials.

(Health Policy Institute, n.d.)

Adapted from "Diversity of Patients" by Walton & Darch in *DENT-1005: Patient Care Procedures,* © Fanshawe College 2023.

5.5 TYPES OF COMMUNICATION IN HEALTHCARE

The previous sections provide an overview of the diversity of patients to bring awareness to the different types of patients you may encounter. However, completing an effective health care plan also means being able to communicate effectively, understand personal biases, and appreciate that the patient may have different views and needs. Also, using the scientific method as a way to use critical reasoning in your hypothesis, analysis, experiment, and results requires an individual to understand their own role in the situation as well as all of the parties involved.

Communication plays a vital role in healthcare, as it is essential for the effective delivery of patient care and the overall functioning of healthcare organizations. In a healthcare setting, communication occurs among healthcare professionals, between healthcare professionals and patients, and among patients and their families. Clear and effective communication is crucial to ensure accurate diagnosis, appropriate treatment, and the provision of compassionate care.

Types of Communication in Healthcare

Verbal Communication: Verbal communication involves the use of spoken words to convey information. This type of communication occurs during face-to-face interactions, team meetings, patient interviews, and discussions between healthcare professionals. Verbal communication can be direct, such as when healthcare providers explain diagnoses or treatment plans to patients, or it can be indirect, such as when healthcare professionals discuss patient cases with colleagues.

Non-Verbal Communication: Non-verbal communication includes body language, facial expressions, gestures, and other forms of communication that do not involve spoken words. Non-verbal cues can provide valuable information about a patient's emotional state, level of comfort, or understanding. Healthcare professionals also utilize non-verbal communication to convey empathy, reassurance, or attentiveness.

Written Communication: Written communication is crucial for documenting patient information, maintaining medical records, and transmitting information between healthcare professionals. This includes medical charts, progress notes, prescriptions, referral letters, and other written documents. Written communication must be clear, accurate, and accessible to ensure effective collaboration among healthcare team members.

Electronic Communication: With the increasing use of electronic health records (EHRs) and digital platforms, electronic communication has become prevalent in healthcare. It includes emails, text messages,

secure messaging systems, and teleconferencing. Electronic communication enables rapid information sharing, facilitates remote consultations, and supports timely collaboration among healthcare providers.

Interdisciplinary Communication: In a healthcare setting, multiple healthcare professionals from different disciplines work together as a team to provide comprehensive care. Interdisciplinary communication involves effective communication and collaboration among these professionals, such as doctors, nurses, pharmacists, therapists, and social workers. It ensures that all team members are informed, aligned, and coordinated in delivering patient care.

Patient-Provider Communication: Effective communication between healthcare providers and patients is essential for building trust, promoting patient engagement, and ensuring informed decision-making. Patient-provider communication involves active listening, empathy, and clear explanations of medical information. It helps patients understand their conditions and treatment options and actively participate in their care.

Family Communication: In healthcare, communicating with patients' families or caregivers is often necessary, particularly in cases involving minors or patients unable to communicate for themselves. Family communication includes providing updates on the patient's condition, discussing treatment plans, and addressing their concerns. It helps ensure the involvement of the patient's support system and facilitates shared decision-making.

These are some of the primary types of communication in healthcare. Effective communication across these channels is crucial for providing quality healthcare, enhancing patient safety, and improving overall patient outcomes.

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5.6 RECOGNIZE PERSONAL BIASES AND STEREOTYPES

Watch the video and identify possible personal biases and stereotypes that may occur in a clinical setting (hospital, doctor's office, dental office).

> Video: "Unconscious Bias Test – Diversity and Inclusion in the Workplace Training Clip" by Atana [1:07] is licensed under the Standard YouTube License. *Transcript and closed captions available on YouTube.*

Developing self-awareness and strategies to eliminate biases and provide unbiased care can be done through:

- Recognizing Biases,
- Continuous Education
- Listen Actively and
- Challenge Biases

Once you have self–awareness, this then needs to be applied to operate effectively in diverse teams to work collaboratively with a diverse healthcare team to provide patient-centred care, which requires:

- Clear Communication
- Role Clarification
- Cultural Competence
- Teamwork to put patient care first

Educate yourself and your team about cultural differences and practices that might affect patient care. You can commit to ongoing learning about diversity in healthcare to stay updated on best practices and emerging issues. Incorporate feedback from diverse patient experiences to enhance future care delivery.

6 Ways You Can Promote Diversity & Inclusion in Your

Everyday Life

1. Be an ally
2. Create a sense of belonging
3. Reconsider stereotypes
4. Consider your actions and reactions
5. Consider whose voices are and (aren't) represented
6. Ask questions and make connections

(The Ad Council, 2018).

What can you do to promote diversity, equity, and inclusion in the workplace?

- Be aware of unconscious bias
- Communicate the importance of managing bias
- Promote pay equity
- Develop a strategic training program
- Acknowledge holidays of all cultures
- Mix up your teams
- Facilitate ongoing feedback
- Assess company policies

(McClendon, 2022)

Reducing health inequalities means helping to give everyone the same opportunities to be healthy, no matter who they are or where they live. You can work in a number of ways to reduce health inequalities and address the social determinants of health.

Video: "Equity Vs Equality" by Beyer High YouTube [4:31] is licensed under the Standard YouTube License. *Transcript and closed captions available on YouTube.*

Adapted from "Diversity of Patients" by Walton & Darch in *DENT-1005: Patient Care Procedures,* © Fanshawe College 2023.

5.7 COMMUNICATION BARRIERS

Communication barriers are something that prevents us from correctly getting and accepting the messages others use to communicate their information, thoughts and ideas. Examples include information overload, choosy perceptions, workplace gossip, semantics, gender differences, etc.

Types of Communication Barriers

- Psychological Barriers
- Physical Communication Barriers
- Physiological Barriers
- Language Barriers
- Attitudinal Barriers

Examples of each include:

Anger is a *psychological barrier* to communication. When we are angry, it is simple to say things that we may afterwards regret and also to misunderstand what others are saying. Also, people with low self-esteem may be less self-assured and, therefore, may not feel comfortable communicating (Hassan, n.d.).

A *physiological barrier* could be a receiver with condensed hearing may not grab the sum of a spoken conversation, especially if there is significant surrounding noise (Hassan, n.d.).

Attitudinal barriers are perceptions that stop people from communicating well. Active receivers of messages should be challenged to overcome their attitudinal barriers to assist effective communication (Hassan, n.d.).

Barriers to effective communication skills include:

- *Lacking clarity.* Avoid abstract, overly formal language, colloquialisms, and jargon, which obscure your message more than they serve to impress people.
- *Using stereotypes and generalizations*. Speakers who make unqualified generalizations undermine their own clarity and credibility. Be careful not to get stuck in the habit of using stereotypes or generalizing about complex systems or situations. Another form of generalization is "polarization," or creating extremes. Try to be sensitive to the complexities of situations rather than viewing the world in black and white.

- *Jumping to conclusions.* Confusing facts with inferences is a common tendency. Do not assume you know the reasons behind events or that certain facts necessarily have certain implications. Ensure you have all the information you can get, and then speak clearly about the facts versus the meanings or interpretations you attach to those.
- *Dysfunctional responses.* Ignoring or not responding to a comment or question quickly undermines effective communication. Likewise, responding with an irrelevant comment that isn't connected to the topic at hand will quash genuine communication. Interrupting others while they are speaking also creates a poor environment for communication.
- *Lacking confidence*. Lacking confidence can be a major barrier to effective communication. Shyness, difficulty being assertive, or low self-worth can hinder your ability to make your needs and opinions known. Also, a lack of awareness of your rights and opportunities in a given situation can prevent you from expressing your needs openly.

Instead, try implementing strategies to improve effective communication using some of the following guidelines.

- *Focus on the issue, not the person*. Try not to take everything personally, and similarly, express your own needs and opinions in terms of the job at hand. Solve problems rather than attempt to control others. For example, rather than ignoring a student who routinely answers questions in class with inappropriate tangents, speak with the student outside of class about how this might disrupt the class and distract other students.
- *Be genuine*. Be yourself, honestly and openly. Be honest with yourself, and focus on working well with the people around you and acting with integrity.
- *Empathize rather than remain detached*. Although professional relationships entail some boundaries when it comes to interaction with colleagues, it is important to demonstrate sensitivity and to really care about the people you work with. If you don't care about them, it will be difficult for them to care about you when it comes to working together.
- *Be flexible towards others*. Allow for other points of view, and be open to other ways of doing things. Diversity brings creativity and innovation.
- *Value yourself and your own experiences*. Be firm about your own rights and needs. Undervaluing yourself encourages others to undervalue you, too. Offer your ideas and expect to be treated well.
- *Use affirming responses*. Respond to others in ways that acknowledge their experiences. Thank them for their input. Affirm their right to their feelings, even if you disagree. Ask questions, express positive feelings, and provide positive feedback when you can.

The key to good communication is good listening skills. Barriers to active listening include:

- *Focusing on a personal agenda*. When we spend our listening time formulating our next response, we cannot be fully attentive to what the speaker is saying.
- *Experiencing information overload*. Too much stimulation or information can make it very difficult to listen with full attention. Try to focus on the relevant information and the central points that are being conveyed.
- *Criticizing the speaker*. Do not be distracted by critical evaluations of the speaker. Focus on what they are saying – the message – rather than the messenger.
- *Being distracted by strong emotional responses*. When you have strong emotional response, acknowledge the emotion and shift your focus back to listening. Make a conscious effort not to get lost in your emotional response.
- *Getting distracted by external "noise"*. Audible noise may be extremely distracting. Some things can be minimized – e.g., turn down the ringer on your phone and notifications on your phone or computer while meeting with someone. Other noises may be unavoidable – e.g., construction, other people. Also, there may be figurative "noise" from the external environment, such as distracting or inappropriate decor in a room, or environmental conditions, such as the room being too hot or cold.
- *Experiencing physical illness or pain*. Feeling physically unwell or experiencing pain can make it very difficult to listen effectively. You may wish to communicate that this is not a good time and reschedule the discussion or have someone present.

Other strategies for active listening could include:

Stop: Focus on the other person, their thoughts and feelings. Consciously focus on quieting your own internal commentary and step away from your own concerns to think about those of the speaker. Give your full attention to the speaker.

Look: Pay attention to non-verbal messages without letting yourself be distracted. Notice body language and non-verbal cues to allow for a richer understanding of the speaker's point. Remember that "active listeners need to communicate to the speaker that they are involved and giving the person unconditional attention" (Weger et al., 2010, p. 35).

Listen: Listen for the essence of the speaker's thoughts: details, major ideas and their meanings. Seek an overall understanding of what the speaker is trying to communicate rather than reacting to the individual words or terms that they use to express themselves.

Be empathetic: Imagine how you would feel in their circumstances. Be empathetic to the feelings of the speaker while maintaining a calm centre within yourself. You need not be drawn into all of their problems or issues as long as you acknowledge what they are experiencing.

Ask questions: Use questions to clarify your understanding, as well as to demonstrate interest in what is being said.

Paraphrase: If you don't have any specific questions to ask, you may choose to repeat back to the speaker, in

your own words, what you have taken away in order to allow the speaker to clarify any points (Weger et al., 2010).

Overcoming Barriers

- Be aware of language, message and tone
- Consult others before communication
- Communicate according to the receiver
- Consistency of messages
- Follow up communication
- Proper feedback

"[Effective Communication: Barriers and Strategies](#)" from [University of Waterloo](#) by Centre for Teaching Excellence is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](#), except where otherwise noted.—Modifications: Changed order; Removed section *Perception;* Added introduction content.

5.8 CULTURAL AWARENESS IN COMMUNICATION

What is Culture?

"A social system of meaning and custom that is developed by a group of people to assure its adaptation and survival. These groups are distinguished by a set of unspoken rules that shape values, beliefs, habits, patterns of thinking, behaviours and styles of communication" (Institute for Democratic Renewal and Project Change Anti-Racism Initiative, 2000, p. 32). We have a habit of equating culture with ethnicity; however, culture can be cultivated anywhere people gather. Distinct cultures also form within cities, neighbourhoods, schools, workplaces, community associations, religious organizations, activism work, and family and friend groups (Cusick, 2022).

Culture is learned.

Behaviour-based on learned customs is not a bad thing, but it can create the problem of how to respond to cultural differences (Little, 2016)

Culture creates a sense of belonging.

When we embrace culture, we nurture our human need for connection, belonging, and purpose (Cusick, 2022)

Culture is innovative.

It is the repository of creative solutions, techniques, and technologies humans draw on to solve problems.

Culture is key to the way humans, as a species, have successfully adapted to the environment (Little, 2016)

Culture is restraining.

The intersection of cultures through globalization can allow people to reenvision and reinvent themselves, or it can remain rigid and restrict change (Little, 2016)

The Importance of Cultural Awareness in Communication

Cultural awareness plays a crucial role in effective communication across diverse populations. It refers to having an understanding and appreciation of different cultures, including their beliefs, values, norms, and customs. Here are some key reasons why cultural awareness is essential in communication:

Avoiding misunderstandings: Cultural differences can lead to misinterpretation of verbal and non-verbal cues. By being culturally aware, individuals can recognize and understand these differences, reducing the likelihood of miscommunication and misunderstandings.

Building trust and rapport: When people feel understood and respected in their cultural context, they are more likely to trust and engage in meaningful communication. Cultural awareness allows individuals to approach others with sensitivity and respect, fostering positive relationships and connections.

Overcoming stereotypes and biases: Cultural awareness helps challenge stereotypes and biases that can hinder effective communication. By acknowledging and appreciating different cultural perspectives, individuals can move beyond preconceived notions and engage in more open-minded and inclusive conversations.

Adapting communication styles: Cultures often have distinct communication styles, including direct or indirect communication, use of non-verbal cues, and varying levels of formality. Being aware of these differences enables individuals to adapt their communication styles to be more effective and respectful in different cultural contexts.

Enhancing empathy and perspective-taking: Cultural awareness encourages individuals to develop empathy and the ability to see the world from others' perspectives. This understanding promotes better communication by considering diverse viewpoints and experiences, leading to more inclusive and constructive conversations.

Facilitating collaboration and teamwork: In today's globalized world, many workplaces and communities are diverse, with people from various cultural backgrounds coming together. Cultural awareness

fosters a collaborative and inclusive environment, enabling effective teamwork and cooperation across cultural boundaries.

Navigating cultural taboos and sensitivities: Different cultures have unique taboos and sensitivities that must be acknowledged and respected. Cultural awareness allows individuals to navigate these areas with care, avoiding unintentional offences or conflicts.

Overall, cultural awareness is vital for effective communication, particularly in diverse and multicultural settings. By understanding and appreciating different cultures, individuals can bridge gaps, foster understanding, and promote meaningful interactions, leading to more successful and harmonious relationships.

Equity-Deserving Groups

When we identify with the dominant culture of a society, we can lose sensitivity to understanding and empathizing with people of other social demographics. This image is a representation of different social identities within cultures.
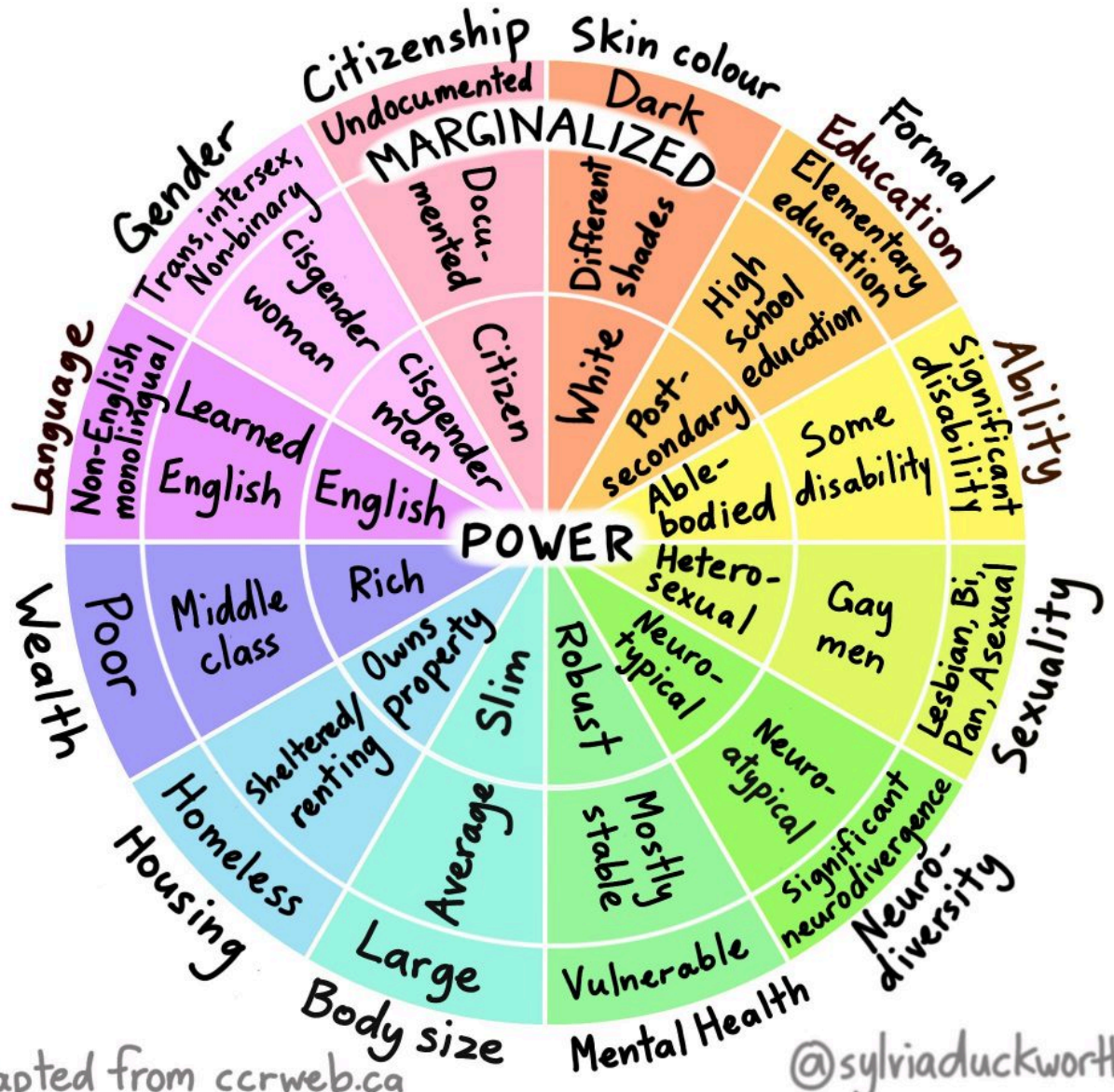
"Wheel of Power/Privilege", Sylvia Duckworth, CC BY-NC-ND 2.0

Image Description

Sylvia Duckworth's Wheel of Power/Privilege organizes the various identities of a person on a wheel, with the identities that hold the most power in our society placed at the centre and the identities that hold the least power in our society on the outskirts. The wheel is sectioned off into 12 categories, each marked by their own unique colour. In order of most powerful to least powerful, the text on the image reads:

- Citizenship: citizen, documented, undocumented
- Skin colour: white, different shades, dark
- Formal education: post-secondary, high school, elementary
- Ability: able-bodied, some disability, significant disability
- Sexuality: heterosexual; gay men; lesbian, bi, pan, asexual
- Neurodiversity: neurotypical, neuroatypical, significant neurodivergence
- Mental health: robust, mostly stable, vulnerable
- Body size: slim, average, large
- Housing: owns property, sheltered/renting, homeless
- Wealth: rich, middle class, poor
- Language: English, Learned English, non-English monolingual
- Gender: cisgender man; cisgender woman; trans, intersex, nonbinary

The wheel content is adapted into the chart below. As you navigate through, consider using the fill tool, highlight tool or bold tool to identify where your own identity falls.

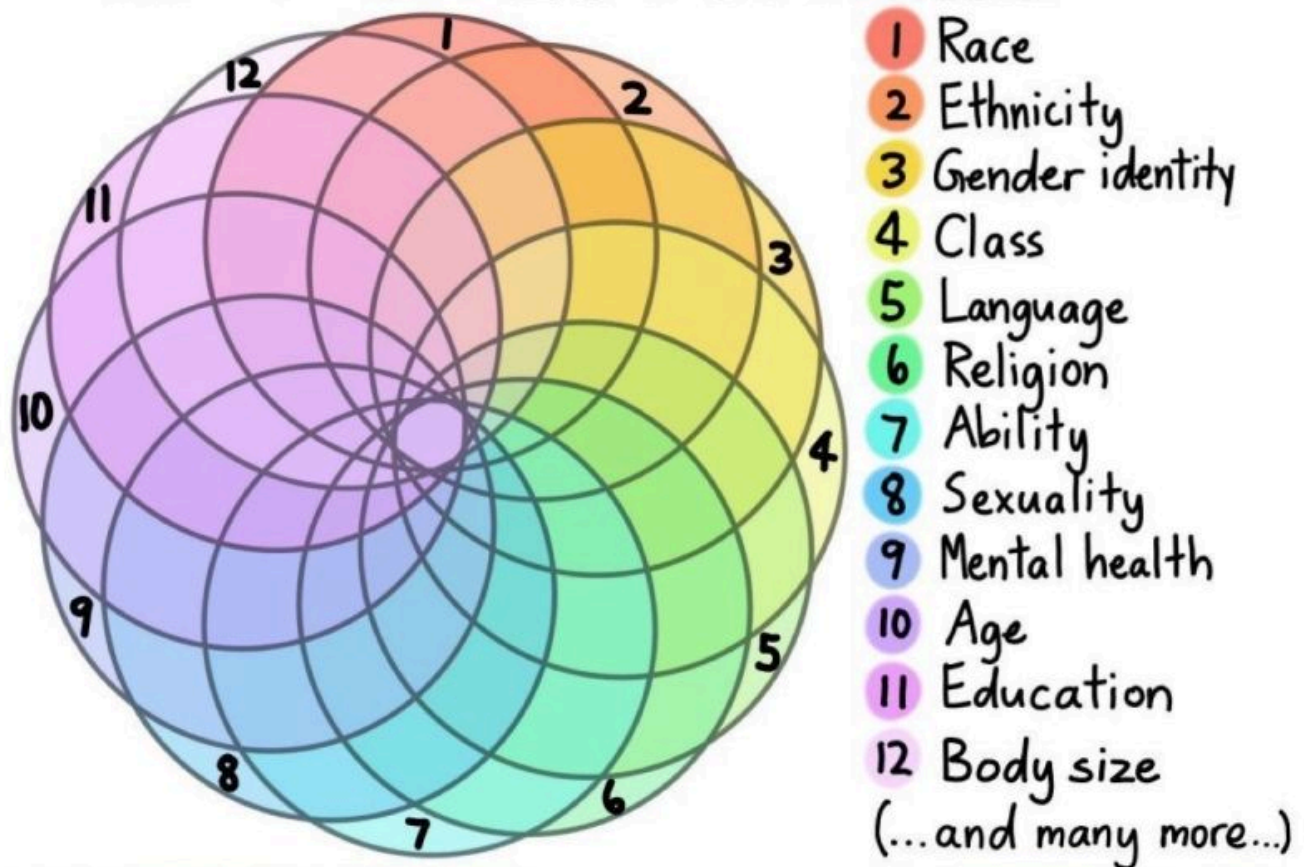| Identity Categories	Most Power	Neither the most powerful nor the least powerful	Least Power
Citizenship	Citizen	Documented	Undocumented
Skin colour	White	Different shades	Dark
Formal Education	Post-Secondary	High school	Elementary
Ability	Able-Bodied	Some disability	Significant disability
Sexuality	Heterosexual	Gay men	Lesbian, bi, pan, asexual
Neurodiversity	Neurotypical	Some neurodivergence	Significant neurodivergence
Mental health	Robust	Mostly stable	Vulnerable
Body size	Slim	Average	Large
Housing	Owns property	Sheltered/renting	Homeless
Wealth	Rich	Middle Class	Poor
Language	English	Learned English	Non-English monolingual
Gender	Cisgender man	Cisgender woman	Trans, intersex, nonbinary

Looking at the cells you've highlighted for yourself, what do you notice? Do most aspects of your identity fall in the most powerful area of the chart? Least?

"4.2: Positionality and Intersectionality" from Universal Design for Learning (UDL) for Inclusion, Diversity, Equity, and Accessibility (IDEA) by Darla Benton Kearney is licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted.

Intersectionality is a complex social structure that empowers people to not only recognize each individual experiences but also intersecting layers from different social identities (Thomas, n.d.). It acknowledges that "everyone has their own unique experiences of discrimination and privilege- Kimberlé Crenshaw" (Benton Kearney, 2022).

This image represents an example of how 12 social cultures (and more) can be identified, but also how they intersect and overlap – making each person experience unique. As a health care provider it is important to acknowledge and communicate based on diversity of patients, but understanding each person brings their own unique experiences that may impact their health treatment.

INTERSECTIONALITY

1 Race
2 Ethnicity
3 Gender identity
4 Class
5 Language
6 Religion
7 Ability
8 Sexuality
9 Mental health
10 Age
11 Education
12 Body size
(...and many more...)

Intersectionality is a lens through which you can see where power comes and collides, where it locks and intersects. It is the acknowledgement that everyone has their own unique experiences of discrimination and privilege.
— Kimberlé Crenshaw —

@sylviaduckworth

"Intersectionality", Sylvia Duckworth, CC BY-NC-ND 2.0

Image Description

In the graphic above, Sylvia Duckworth uses a Spirograph to illustrate the multitude of ways that social identities might intersect. The Spirograph is split into 12 overlapping circles, each numbered, connected to a specific social identity, and assigned a unique colour. To illustrate the intersections of the different social identities, where each circle intersects, a new shade of the original colour is visible (as would happen when

mixing paint colours together). At a glance, the graphic shows all colours of the rainbow in different shades. The 12 social identities listed are: race, ethnicity, gender identity, class, language, religion, ability, sexuality, mental health, age, education, and body size. A quote from Kimberlé Crenshaw appears beneath the spirograph that reads "Intersectionality is a lens through which you can see where power comes and collides, where it locks and intersects. It is the acknowledgement that everyone has their own unique experiences of discrimination and privilege."

"4.2: Positionality and Intersectionality" from Universal Design for Learning (UDL) for Inclusion, Diversity, Equity, and Accessibility (IDEA) by Darla Benton Kearney is licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted.

Adapted from "Cultural Awareness in Communication" by Tran and Vallaeys, © 2023 Fanshawe College.

5.9 KNOWLEDGE CHECK

Applying Your Knowledge

Link to the solutions in text format

Text Description

MultiChoice Activity

Which of the following is *not* listed by the Government of Canada as a key Social Determinant of Health?

a. Physical activity levels
b. Access to health services
c. Income and social status
d. Race/Racism

MultiChoice Activity

What is the key difference between equity and equality as described in the text?

a. Equity ensures that everyone receives the same size portion of resources, while equality varies the portion based on circumstances.
b. Equity focuses solely on economic policies, while equality addresses social and economic barriers.
c. Equality involves treating everyone the same regardless of their circumstances, while equity adjusts support to account for individual barriers and needs.
d. Equality focuses on adjusting support based on individual circumstances, while equity ensures

everyone starts at the same point.

MultiChoice Activity

Which of the following statements best describes diversity in healthcare as outlined in the chapter?

a. Diversity in healthcare acknowledges and respects the unique attributes, experiences, and needs of individuals across a wide range of dimensions.
b. Diversity in healthcare is primarily about addressing socioeconomic disparities among patients.
c. Diversity in healthcare involves standardizing care to ensure all patients receive identical treatment regardless of their circumstances.
d. Diversity in healthcare focuses solely on racial and ethnic differences among patients and healthcare providers.

MultiChoice Activity

Which of the following best describes the importance of cultural competence in healthcare?

a. Tailoring healthcare services to respect and address patients' cultural, linguistic, and social needs, thereby improving health outcomes and communication.
b. Limiting healthcare access to patients who align with the healthcare provider's cultural norms and practices.
c. Ensuring all patients receive identical care regardless of their cultural background.
d. Focusing primarily on eliminating language barriers to enhance patient-provider interaction.

TrueFalse Activity

Effective communication between healthcare providers and patients is essential for building trust, promoting patient engagement, and ensuring informed decision-making. (True/False)

MultiChoice Activity

Which of the following is an example of a **psychological barrier** to effective communication?

a. A lack of accessible equipment in a health care facility.

b. A person feeling anger, which leads them to misunderstand what others are saying.

c. A patient unable to understand a medical diagnosis due to language differences.

d. A person with hearing loss struggling to understand a conversation in a noisy environment.

MultiChoice Activity

Which of the following statements best describes the concept of culture as outlined in the content?

a. Culture is limited to traditional and historical practices within ethnic communities.

b. Culture is a learned system of meaning, customs, and habits shared by a group of people to adapt and thrive.

c. Culture is rigid and unchanging, offering little room for innovation or adaptation.

d. Culture is solely determined by a person's ethnicity and heritage.

CHAPTER 6 - HEALTH AND WELLNESS

Chapter Outline

6.0 LEARNING OBJECTIVES

Learning Objectives

- Define health and wellness.
- Identify strategies for personal health and wellness.

6.1 HEALTH AND WELLNESS

The terms Health and Wellness are often used interchangeably. What do they mean to you? The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (illness)" and defines wellness as "the optimal state of health of individuals and groups" (Smith et al., 2006) which may be expressed as "a positive approach to living." The National Wellness Institute (n.d.) explains wellness as "an active process through which people become aware of, and make choices toward, a more successful existence."

The National Wellness Institute states that there is general agreement that:

1. Wellness is considered a conscious, self-directed and evolving process of achieving full potential.
2. Wellness is multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment.
3. Wellness is positive and affirming.

The primary difference between health and wellness is that health is your state of being or a goal to achieve, and wellness is the active process of attaining it through growth and change. Through wellness, we hope to reach our fullest potential for health and well-being.

Why Study Wellness?

As most college students do, you have probably set goals. Your goals differ from those of your classmates, but everyone's goals share one common attribute: their intention to improve individual well-being. However, there are as many ideas about how to do that as there are individuals. Do your goals involve making more money, achieving better health, and improving your relationships? Holistic wellness involves all those aspects of life and more. This chapter explains the importance of overall wellness, which is more than being physically and mentally healthy, free from illness and disease. The study of wellness incorporates all aspects of life. Achieving overall wellness means living actively and fully. People in this state exude confidence, optimism, and self-efficacy; they have the energy reserves to do what needs to be done today and to plan for a better tomorrow. The most effective and transformative goals are those designed to achieve the highest level of personal wellness.

6.2 NINE DIMENSIONS OF WELLNESS

Wellness is a familiar term, but what is its true definition? Is it simply the absence of disease? This chapter will define all the components of holistic wellness and describe the factors that contribute to not only a person's physical and mental health but also their ability to develop, thrive, succeed, enjoy life, and meet challenges head-on with confidence and resolve.

To achieve this type of overall wellness, a person must be healthy in nine interconnected dimensions of wellness: physical, emotional, intellectual, spiritual, social, environmental, occupational, financial, and cultural. A description of each dimension follows.

"Wellness Wheel" – Starting a Conversation about Mental Health [PPTX] from *Starting A Conversation About Mental Health: Foundational Training for Students* by UBC Student Health and Wellbeing Staff, Jewell Gillies, Barbara Johnston, Liz Warwick, Dagmar Devine, Jenny Guild, Arica Hsu, Hamza Islam, Mehakpreet Kaur, Malena Mokhovikova, Jackson Mackenzie Nicholls, and Calla Smith is used under a CC BY 4.0 Licence.

Image Description

A large circle with "Self" in the centre, around are the nine dimensions of wellness: Physical, Emotional, Academic/Career, Social, Creative, Spiritual, Environmental, Financial, and Intellectual.

The Nine Dimensions of Wellness

1. Physical Wellness

People who are physically well actively make healthy decisions on a daily basis. They eat a nutritionally balanced diet, they try to get an adequate amount of sleep, and they visit the doctor routinely. They make a habit of exercising three to five times per week, they have the ability to identify their personal needs and are aware of their body's limitations. They maintain positive interpersonal relationships and make healthy sexual decisions that are consistent with their personal values and beliefs.

2. Emotional Wellness

An emotionally well person successfully expresses and manages an entire range of feelings, including anger, doubt, hope, joy, desire, fear, and many others. People who are emotionally well maintain a high level of self-esteem. They have a positive body image and the ability to regulate their feelings. They know where to seek support and help regarding their mental health, including but not limited to seeking professional counselling services.

3. Intellectual Wellness

Those who enjoy intellectual wellness engage in lifelong learning. They seek knowledge and activities that further develop their critical thinking and heighten global awareness. They engage in activities associated with the arts, philosophy, and reasoning.

4. Spiritual Wellness

People who can be described as spiritually well have identified a core set of beliefs that guide their decision-making, as well as other faith-based endeavours. While firm in their spiritual beliefs, they understand others may have a distinctly different set of guiding principles. They recognize the relationship between spirituality and identity in all individuals.

5. Social Wellness

A socially well person builds healthy relationships based on interdependence, trust, and respect. Those who are socially well have a keen awareness of the feelings of others. They develop a network of friends and co-workers who share a common purpose and provide support and validation.

6. Environmental Wellness

An environmentally well person appreciates the external cues and stimuli that an environment can provide. People who have achieved environmental wellness recognize the limits to controlling an environment and seek to understand the role an individual plays in the environment.

7. Occupational Wellness

An occupationally well person enjoys the pursuit of a career which is fulfilling on a variety of levels. This person finds satisfaction and enrichment in work while always in pursuit of opportunities to reach the next level of professional success.

8. Financial Wellness

Those who are financially well are fully aware of their current financial state. They set long- and short-term goals regarding finances that will allow them to reach their personal goals and achieve self-defined financial success.

9. Cultural Wellness

Culturally well people are aware of their own cultural background, as well as the diversity and richness present in other cultural backgrounds. Cultural wellness implies understanding, awareness and intrinsic respect for aspects of diversity. A culturally well person acknowledges and accepts the impact of these aspects of diversity on sexual orientation, religion, gender, racial and ethnic backgrounds, age groups, and disabilities.

Applying Your Knowledge

The Wellness Wheel can be used as a tool to check in and discover your overall wellness to understand better what is going well and what may be challenging in the moment. It can also help you assess choices or situations impacting your well-being.

- Go to the [Wellness Wheel Assessment website](#) and complete the assessment.

6.3 BEHAVIOUR MODIFICATION

Making permanent lifestyle changes is one of the greatest challenges a person can face. This section will explore how changes to behaviour occur, the psychological barriers that hamper efforts to change, and tips for making lasting change.

How Changes in Behaviour Occur

The Transtheoretical Model, also called the Stages of Change Model, was developed by James Prochaska and Carlo DiClemente in the late 1970s. Considered the dominant model for describing how behaviour changes occur, it evolved through studies examining the experiences of smokers who quit on their own and comparing them with the experiences of those requiring further treatment. The goal of those studies was to understand why some people were capable of quitting on their own. It was determined that people quit smoking if they were ready to do so. Thus, the Transtheoretical
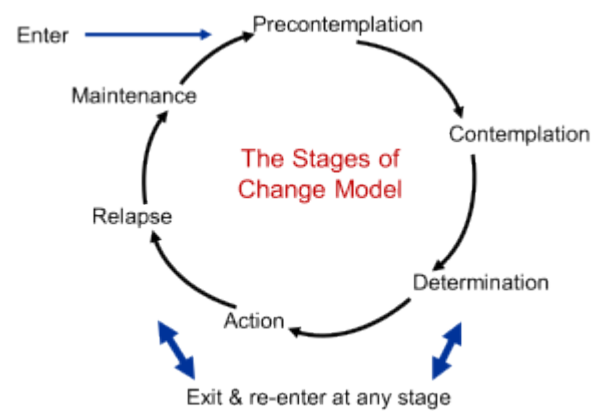
The Stages of Change Model

Model (TTM) focuses on the decision-making of the individual and is a model of intentional change. The TTM operates on the assumption that people do not change behaviours quickly and decisively. Rather, change in behaviour, especially habitual behaviour, occurs continuously through a cyclical process. The TTM is not a theory but a model; different behavioural theories and constructs can be applied to various stages of the model where they may be most effective.

The TTM posits that individuals move through six stages of change: pre-contemplation, contemplation, preparation, action, maintenance, and termination. Termination was not part of the original model and is less often used in the application of stages of change for health-related behaviours. For each stage of change, different intervention strategies are most effective at moving the person to the next stage of change and, subsequently, through the model to maintenance, the ideal stage of behaviour.

Six Stages of Change

Stage 1: Precontemplation: People do not intend to take action in the foreseeable future (defined as within the next six months). People are often unaware that their behaviour is problematic or produces negative

consequences. People in this stage often underestimate the pros of changing behaviour and place too much emphasis on the cons of changing behaviour.

Stage 2: Contemplation: People intend to start healthy behaviour in the foreseeable future (defined as within the next six months). People recognize that their behaviour may be problematic, and a more thoughtful and practical consideration of the pros and cons of changing the behaviour takes place, with equal emphasis placed on both. Despite this recognition, people may still feel ambivalent about changing their behaviour.

Stage 3: Preparation (Determination): People are ready to take action within the next 30 days. People start to take small steps toward behaviour change, and they believe changing their behaviour can lead to a healthier life.

Stage 4: *Action:* In this stage, people have recently changed their behaviour (defined as within the last six months) and intend to keep moving forward with that behaviour change. People may exhibit this by modifying their problems or acquiring new healthy behaviours.

Stage 5: Maintenance: In this stage, people have sustained their behaviour change for a while (defined as more than six months) and intend to maintain the behaviour change going forward—people in this stage work to prevent relapse to earlier stages.

Stage 6: Termination: In this stage, people have no desire to return to their unhealthy behaviours and are sure they will not relapse. Since this is rarely reached, and people tend to stay in the maintenance stage, this stage is often not considered in health promotion programs.

Goal Setting

One of the most effective tools for changing behaviour is goal setting. The link below provides information on how to set goals effectively to achieve greater success in goal attainment.

6.4 FOSTERING WELLNESS IN YOUR LIFE

Once again, you feel motivated to eat better, exercise more, drink less caffeine, or make any positive lifestyle changes you have been telling yourself you want to make. You have tried before—probably declaring another attempt as a New Year's resolution—but without experiencing much success. Making a lifestyle change is challenging, especially when you want to transform many things simultaneously. This time, think of those changes not as a resolution but as an evolution.

Lifestyle changes are a process that takes time and requires support. Once you are ready to make a change, the difficult part is committing and following through. So, do your research and make a plan that will prepare you for success. Careful planning means setting small goals and taking things one step at a time.

Here are five tips from the American Psychological Association (APA) that will assist you in making lasting, positive lifestyle and behaviour changes:

Make a plan that will stick.

Your plan is a map that will guide you on this journey of change. You can even think of it as an adventure. When making your plan, be specific. Want to exercise more? Detail the time of day when you can take walks and how long you will walk. Write everything down, and ask yourself if you are confident that these activities and goals are realistic. If not, start with smaller steps. Post your plan where you will most often see it as a reminder.

Start small.

After you've identified realistic short-term and long-term goals, break down your goals into small, manageable steps that are specifically defined and can be measured. Is your long-term goal to lose 20 pounds within the next five months? A good weekly goal would be to lose one pound a week. If you want to eat healthier, consider replacing dessert with a healthier option, like fruit or yogurt, as a goal for the week. At the end of the week, you will feel successful knowing you met your goal.

Change one behaviour at a time.

Unhealthy behaviours develop over time, so replacing unhealthy behaviours with healthy ones requires time. Many people run into problems when they try to change too much too fast. Focus on one goal or change at a

time to improve your success. As new healthy behaviours become a habit, try to add another goal that works toward the overall change you strive for.

Involve a buddy.

Whether it be a friend, co-worker or family member, someone else on your journey will keep you motivated and accountable. Perhaps it can be someone who will go to the gym with you or someone who is also trying to stop smoking. Talk about what you are doing. Consider joining a support group. Having someone to share your struggles and successes makes the work easier and the mission less intimidating.

Ask for support.

Accepting help from those who care about you and will listen strengthens your resilience and commitment. If you feel overwhelmed or unable to meet your goals, consider seeking help from a psychologist. Psychologists are uniquely trained to understand the connection between the mind and body and the factors that promote behaviour change. Asking for help does not mean a lifetime of therapy; even just a few sessions can help you examine and set attainable goals or address the emotional issues that may be getting in your way.

6.5 ESTABLISHING SELF-AWARENESS

VIA: The 24 Character Strengths

In the early 2000s, something groundbreaking occurred in the social sciences: Scientists discovered a common language of 24 character strengths that make up what's best about our personality. Everyone possesses all 24 character strengths to different degrees, so each person has a unique character strengths profile. Each character's strength falls under one of these six broad virtue categories, universal across cultures and nations (VIA, n.d.).

The VIA Survey, developed by renowned psychologist Christopher Peterson, Ph.D and recently revised by Dr. Robert McGrath, VIA's Senior Scientist, is a 96- 96-question, scientifically validated questionnaire that provides a rank order of an adult's 24 character strengths. The survey takes approximately 10-15 minutes to complete, and descriptive results and in-depth reports are available upon completion.

After completing the VIA Survey, you will have greater insight into the best qualities of your personality, such as your character strengths. These characteristics make you feel authentic, contribute to your successes and help you lead a happy, meaningful life.

Applying Your Knowledge

- [Take the VIA Character Survey](#)

6.6 FOOD AND NUTRITION

Most Canadians see the image below (Figure 6.6.1) when attempting to access Canada's Food Guide 2019 (Health Canada, 2019). This image is part of the "Food guide snapshot" that is often shared with clients and families as a starting point for discussion. When scanning the plate in Figure 6.6.1, you will notice a colourful plate with a diverse mix of foods in which half the plate is filled with vegetables and fruit; one-quarter of the plate has proteins, including tofu, legumes, nuts, seeds, yogurt, lean meat/fish and only a small amount of red meat; one-quarter of the plate has whole grain foods (e.g., bread, pasta, rice); and, there is a glass of water beside the plate.

Figure 6.6.1: Canada's Food Guide from Health Canada (2019) "Canada's Dietary Guidelines for Health Professional and Policy Makers"

Figure 6.6.2: Food guide snapshot available in 28 languages

There are three specific guidelines that inform "Canada's Dietary Guidelines for Health Professionals and Policy Makers" (Health Canada, 2019).

Guideline 1

As illustrated in Figure 6.6.3 and outlined in the content below, the first guideline focuses on the integration of nutritious foods to form the foundation of a person's eating patterns (Health Canada, 2019). The reproduction of the guideline is a copy in part of the version available in Canada's Dietary Guidelines

Figure 6.6.3: Integrating nutritious foods into eating patterns

Canada's Dietary Guidelines: Guideline 1

Nutritious foods are the foundation for healthy eating.

- Vegetables, fruit, whole grains, and protein foods should be consumed regularly. Among protein foods, consume plant-based more often. **Note:** Protein foods include legumes, nuts, seeds, tofu, fortified soy beverages, fish, shellfish, eggs, poultry, lean red meat including wild game, lower fat milk, lower fat yogurts, lower fat kefir, and cheeses lower in fat and sodium.
- Foods that contain mostly unsaturated fat should replace foods that contain mostly saturated fat.
- Water should be the beverage of choice.

Guideline 1 Considerations

Nutritious foods to encourage

- Nutritious foods to consume regularly can be fresh, frozen, canned, or dried.

Cultural preferences and food traditions

- Nutritious foods can reflect cultural preferences and food traditions.
- Eating with others can bring enjoyment to healthy eating and can foster connections between generations and cultures.
- Traditional food improves diet quality among Indigenous Peoples.

Energy balance

- Energy needs are individual and depend on a number of factors, including levels of physical activity.
- Some fad diets can be restrictive and pose nutritional risks.

Environmental impact

- Food choices can have an impact on the environment.

Guideline 2

As illustrated in Figure 6.6.4 and outlined below, the second guideline focuses on the

reduction of foods and beverages that are processed and pre-packaged (Health Canada, 2019). The reproduction of the guideline is a copy in part of the version available in Canada's Dietary Guidelines.

Figure 6.6.4:
Reducing
processed foods

Canada's Dietary Guidelines: Guideline 2

- Processed or prepared foods and beverages that contribute to excess sodium, free sugars, or saturated fat undermine healthy eating and should not be consumed regularly.

Guideline 2 Considerations

Sugary drinks, confectioneries and sugar substitutes

- Sugary drinks and confectioneries should not be consumed regularly.
- Sugar substitutes do not need to be consumed to reduce the intake of

free sugars.

Publicly funded institutions

- Foods and beverages offered in publicly funded institutions should align with Canada's Dietary Guidelines.

Alcohol

- There are health risks associated with alcohol consumption.

Guideline 3

As illustrated in Figure 6.6.5 and outlined below, the third guideline focuses on food skills and literacy to promote healthy eating patterns (Health Canada, 2019). The reproduction of the guideline is a copy in part of the version available in Canada's Dietary Guidelines.

Figure 6.6.5:
Family meal
preparation

Canada's Dietary Guidelines: Guideline 3

Food skills are needed to navigate the complex food environment and support healthy eating.

- Cooking and food preparation using nutritious foods should be promoted as a practical way to support healthy eating.
- Food labels should be promoted as a tool to help Canadians make informed food choices.

Guideline 3 Considerations

Food skills and food literacy

- Food skills are important life skills.
- Food literacy includes food skills and the broader environmental context.
- Cultural food practices should be celebrated.
- Food skills should be considered within the social, cultural, and historical context of Indigenous Peoples.

Food skills and opportunities to learn and share

- Food skills can be taught, learned, and shared in a variety of settings.

Food skills and food waste

- Food skills may help decrease household food waste.

Points of Consideration

As per Health Canada (2019), Canada's Food Guide 2019 was developed for individuals who are two years of age and older. In addition, it is clearly noted that specialized guidance is required for those who are younger than two years of age and/or have specific dietary requirements such as protein, iron, and calcium intake, among other

nutrients. More information on infant feeding and healthy term infants up to 24 months can be located at: [Infant feeding and healthy term infants](#).

"[Canada's Food Guidelines](#)" from [Interpreting Canada's 2019 Food Guide and Food Labelling for Health Professionals](#) by Jennifer Lapum; Oona St. Amant; Wendy Garcia; Lisa Seto Nielsen; and Rezwana Rahman is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](#), except where otherwise noted.

6.7 STRESS

Changing habitual behaviour requires a deep and abiding belief that change is needed. Your desire to change may be motivated by personal goals or results from your improved wellness's impact on those you love. Nietzsche said, "He who has a strong enough why can bear almost any how." Once you have a compelling reason to change, develop and commit to that plan; if you experience a moment of weakness, do not waste time on self-condemnation. Revisit your compelling reason and reaffirm your commitment to change. The health, peace, and sense of well-being inherent in the highest level of your wellness is more than worth the effort required to change.

> *Stress is an unavoidable part of post-secondary student life, but it isn't necessarily a bad thing. This section helps participants rethink stress and consider how it can help them. It also uses the Wellness Wheel to examine healthy coping strategies.*

One of the most common challenges students face is stress. While stress and mental distress are part of the human experience and definitely part of the post-secondary experience, people cope differently with stress, depending on their background, environment, relationships, and specific circumstances (e.g., living with an illness). In similar situations, two people may experience stress differently.

Rethinking Stress

It would help if you took on reasonable challenges to help condition your brain to respond to stressors and become more resilient.

The stress response is a response that your body can use to prepare you for a challenge. As post-secondary students, it's important to remember that you are here to learn and to grow, and with that comes challenges. If you experience the stress response as an opportunity to adapt, you can make stress work for you and help support your growth and resilience.

- Stress is part of the post-secondary experience.
- The stress response is normal. It signals our body to adapt.
- Each time we adapt to a daily stressor, we develop the skills to be more resilient and cope with stress the next time.

This short video from *Scientific American* shows how stress can be viewed as helpful.

Video: "[Why Stress Is Good for You – Instant Egghead #40](#)" by [Scientific American](#) [2:33] is licensed under the [Standard YouTube License](#). *Transcript and closed captions available on YouTube.*

In speaking about *adapting* when experiencing the stress response, we can think about ways to solve problems, try something new, or seek support. For example, you might feel stressed about starting classes online. Initially, you can acknowledge that, yes, this is a concern, and then you can move on to planning your time/schedule, setting up your workspace, connecting with your classmates, and so on. Once you put this into effect, you've developed a new skill that can be applied to other scenarios.

The Stress Curve
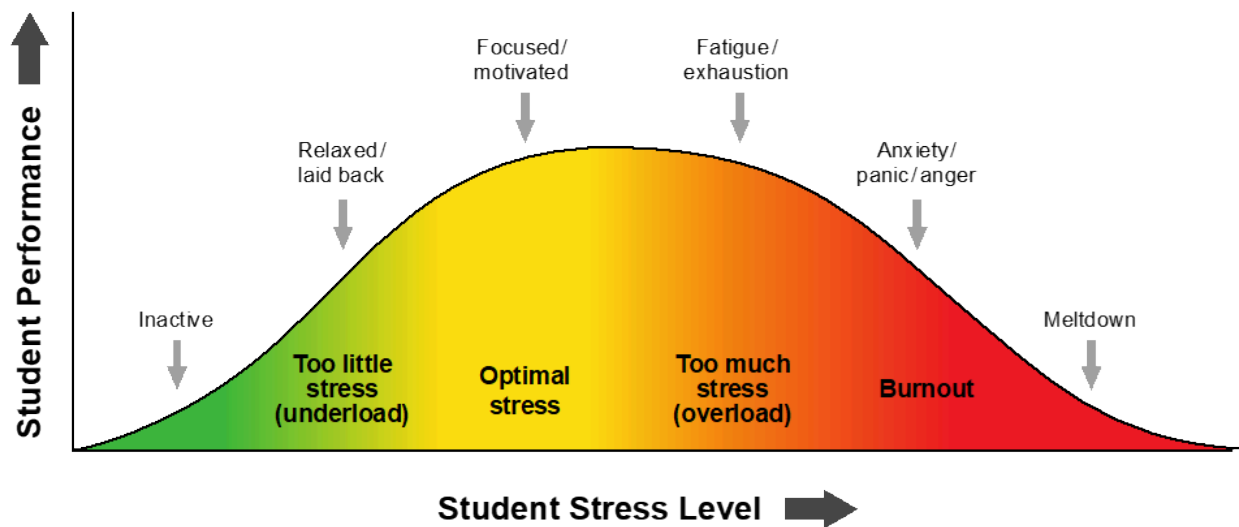
"The Stress Curve – [Starting a Conversation about Mental Health [PPTX]](#) from *[Starting A Conversation About Mental Health: Foundational Training for Students](#)* by UBC Student Health and Wellbeing Staff, Jewell Gillies, Barbara Johnston, Liz Warwick, Dagmar Devine, Jenny Guild, Arica Hsu, Hamza Islam, Mehakpreet Kaur, Malena Mokhovikova, Jackson Mackenzie Nicholls, and Calla Smith is used under a [CC BY 4.0 Licence](#).

Image Description

Student performance (increasing) on the y-axis and student stress level (increasing) on the x-axis.

The curve starts small with "inactive" then gains height with "relaxed/laid back," and just before the peak is "focused/motivated." Just after the peak is "fatugue/exhaustion," on the slope back down is "anxiety/panic/anger," and at the low point of the curve is "meltdown".

The curve is coloured starting with green (too little stress – underload) for interactive and laid back, then yellow for optimal stress (focused/motivated), then orange for too much stress (fatigue). Finally, it moves into red (burnout) with anxiety and meltdown.

The Stress Curve shows that small amounts of stress help increase our alertness and energy for meeting challenging situations, but if stress lasts a long time or overwhelms our ability to cope, it can have negative effects.

The curve demonstrates that when performance demands are too low, we become bored and inactive. But as performance demands increase, our physiology kicks in, and we start to feel alert and focused. We are motivated, and we feel capable of dealing with the demands of life. However, when performance demands become too high – or we have become exposed to too many demands over a prolonged period – we become fatigued and experience a cascade of stress hormones that can wear us down. This can lead to problems with health, relationships, and work and can affect our general enjoyment of life. Prolonged stress can often lead to burnout, serious illness, or mental health problems.

Resilience

Resilience is about being able to adapt to life's challenges and setbacks. When something is out of balance in our lives, or we're experiencing stress, resilience helps us to shift back toward balance and mental wellness. It's the ability to adapt to difficult situations, and it can help protect us from mental health problems. Resilience isn't about avoiding or ignoring challenges in life; rather, it's noticing when stress appears and taking proactive steps to manage the stress and pressure.

"Wellness Wheel" – Starting a Conversation about Mental Health [PPTX] from *Starting A Conversation About Mental Health: Foundational Training for Students* CC BY 4.0 Licence. Surrounding the large circle labeled "Self" are the nine dimensions of wellness: Physical, Emotional, Academic/Career, Social, Creative, Spiritual, Environmental, Financial, and Intellectual.

The Stress Curve helps us recognize that some stress can be good. The Wellness Wheel we discussed earlier can help us realize what might be causing stress or pressure in our lives. It also reminds us of our own resilience and strengths; while we may be struggling in one area, we may be doing well in many other areas.

Traditional Healing Practices

In many Indigenous cultures across Turtle Island (what we now call North America), Indigenous Peoples have used natural resources as a source of healing and ceremonial medicine since time began. These traditional healing practices are ways many Indigenous people restore balance and build resilience.

Below is one perspective on maintaining balance and wellness from Kwakwa̱ka̱'wakw culture. You can share this with your participants or consider reaching out to Indigenous Elders or Knowledge Keepers in your community to learn more about local traditional healing practices that you could share with participants.

In my culture, we use the roots of a yarrow plant steeped in hot water to make tea to soothe stomach aches, headaches, colds, and diarrhea. We steam cedar branches in a pot on the stove to help with respiratory distress. We burn sage to smudge and cleanse ourselves, our space, or items of negative energies or spirits. When we have painful or negative emotions or when grief, sadness, or loss overwhelms us, we are taught to go back to the land, to go back to the water, to reconnect with the universe's life force. Doing this through ceremony can be simple or elaborate; we can do this in private or within a trusted community.

One way we refer to these medicines is as helpers. Water is a common helper many people use, going to a natural body of water and submerging themselves entirely so the water cleanses them head to toe. If you do not have access to natural bodies of water, stand in the shower – not a bath that you soak in, but a shower to let the water run over you. This can be a time to speak to your helper and share with it your burdens; tell it what is weighing you down and ask for the help you need, allowing all the negativity to flow off you with the water. End with words of gratitude for the support of that helper.

As each Indigenous community has its own sacred connections to its territory and the medicines and plants that thrive there, we encourage you to seek out Knowledge Keepers in your area to learn more. Observe protocol by approaching the Elder or Knowledge Keeper with deep respect and an offering of tobacco (loose tobacco as it comes in the pouch from any general store is sufficient) while asking them to share with you what their traditional helpers may be. Not all ceremonial or cultural knowledge can be shared freely with people outside the community, as some sacred knowledge is kept

for the community alone. But what can be shared will be shared with a good heart, as it helps all peoples come together in harmony.

—Jewell Gillies (Musgamagw Dzawada'enuxw of the Kwakwa̱ka̱'wakw Nation – Ukwana'lis, Kingcome Inlet, B.C.)

Activity: Thinking about Stress

Divide participants into small groups and ask each group to examine the Wellness Wheel and discuss the following:

- What stressors might fall under different parts of the wheel?
- How might students behave when they are facing these stressors?
- What strengths and resilience might students show?

Ask participants to also look at the Stress Curve to determine where various stressors might fit.

After about five minutes, debrief with the group. Some common stressors include:

- Moving
- Adjusting to university
- Exams
- Financial pressure
- Difficulty finding childcare
- Breaking up with a partner or arguing with a friend
- Loneliness or isolation
- Job interview

6.8 KNOWLEDGE CHECK

Applying Your Knowledge

Text Description

MultiChoice Activity

Which of the following best describes the difference between health and wellness, according to the World Health Organization (WHO) and the National Wellness Institute?

a. Health is a state of being, and wellness is the active process of achieving it through conscious growth and change.
b. Health and wellness are interchangeable terms used to describe an individual's state of well-being.
c. Health is focused on physical well-being, while wellness focuses on mental and emotional aspects of life.
d. Health is the absence of disease, while wellness is the presence of mental and spiritual well-being.

MultiChoice Activity

Which of the following statements best summarizes the nine dimensions of wellness?

a. The nine dimensions of wellness represent interconnected areas of well-being, including physical, emotional, intellectual, spiritual, social, environmental, occupational, financial, and cultural health.

b. The nine dimensions of wellness focus solely on physical and emotional health to ensure an individual thrives.

c. Wellness is defined as the absence of disease and the maintenance of a balanced diet and regular exercise

d. Wellness is achieved by focusing exclusively on occupational and financial goals to support overall life satisfaction.

TrueFalse Activity

The Transtheoretical Model (TTM) assumes that people change behaviours quickly and decisively through a linear process. (True/False)

TrueFalse Activity

The VIA Survey identifies 24 character strengths that are universal across cultures and nations and provides a rank order of an individual's strengths through a 96-question questionnaire. (True/False)

MultiChoice Activity

According to the Stress Curve, which of the following statements is true about the relationship between stress and performance?

a. Prolonged exposure to any level of stress improves resilience and mental health.
b. Stress is always harmful and should be avoided to maintain optimal performance.
c. High levels of stress consistently lead to the best performance outcomes.
d. Low levels of stress decrease motivation, while moderate levels of stress can enhance alertness and focus.

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VIDEO TRANSCRIPTS

5.4 Cultural Sensitivity & Competence

Video: Cultural sensitivity by Aisha Khalaf

Cultural sensitivity

According to statistics, 29% of the population are of minority origin, with cultural diversity expected to increase to 50% by the year 2019. This statistic indicates the importance of being culturally aware and sensitive. Cultural sensitivity is a broad term with a variety of definitions. In summary, cultural sensitivity employs an individual's knowledge, consideration, understanding, respect, and tailoring skills,

Demonstrate knowledge by recognizing cultural differences and values. Knowledge be gained through training, education, and experience.

Show consideration through careful thought, deliberation, taking into account and having concern for others.

Show understanding by perceiving and comprehending the nature and significance of the individual's cultural preferences.

Show respect by demonstrating willingness to show appreciation or regard for the patient.

Display tailoring skills by having the ability to alter or adapt for an individual or group.

These values are important in demonstrating cultural sensitivity as we are encountering people of distinct groups. Cultural sensitivity results in effective communication leading to adequate health outcomes and overall patient satisfaction.

Communication is important to be aware of when dealing with different cultural groups to inform the patient, assess their capacity, obtain consent, understand their concerns and appropriately treat them. Therefore, if there is a language barrier between yourself and the patient, an interpreter can aid in communication. An interpreter is defined as "someone who conveys an oral message from one language to another." Services such as TIS National and LanguageLoop are available in Victoria, with an average cost of 70$ for 30 minutes.

Benefits of using Interpreters:

- Improved patient satisfaction
- Shorter hospital stays and reduced hospital admissions
- Ensure cultural liaison to aid in clarification for the clinician
- Fewer errors in communication

- Lower risk of malpractice

Thank you!

KNOWLEDGE CHECK SOLUTIONS

3.8 Knowledge Check

Activity 1 Correct answer(s): d. Independent

Activity 2 Correct answer(s): c. Involves numerical evaluations

Activity 3 Correct answer(s): b. Qualitative

Activity 4 Correct answer(s): c. Median

Activity 5 Correct answer(s): a. Standard Deviation

4.8 Knowledge Check

Activity 1 Correct answer(s): b. Examining Assumptions; c. Skepticism;

Activity 2 Correct answer(s): b. Make connections between material

Activity 3 Correct answer(s): c. Cultivate "habits of mind"

5.9 Knowledge Check

Activity 1 Correct answer(s): a. Physical activity levels

Activity 2 Correct answer(s): c. Equality involves treating everyone the same regardless of their circumstances, while equity adjusts support to account for individual barriers and needs.

Activity 3 Correct answer(s): a. Diversity in healthcare acknowledges and respects the unique attributes, experiences, and needs of individuals across a wide range of dimensions.

Activity 4 Correct answer(s): a. Tailoring healthcare services to respect and address patients' cultural, linguistic, and social needs, thereby improving health outcomes and communication.

Activity 5 Correct answer: True

Activity 6 Correct answer(s): b. A person feeling anger, which leads them to misunderstand what others are saying.

Activity 7 Correct answer(s): b. Culture is a learned system of meaning, customs, and habits shared by a group of people to adapt and thrive.

6.8 Knowledge Check

Activity 1 Correct answer(s): b. Health is a state of being, and wellness is the active process of achieving it through conscious growth and change.

Activity 2 Correct answer(s): a. The nine dimensions of wellness represent interconnected areas of well-being, including physical, emotional, intellectual, spiritual, social, environmental, occupational, financial, and cultural health.

Activity 3 Correct answer: False

Activity 4 Correct answer: True

Activity 5 Correct answer(s): c. Low levels of stress decrease motivation, while moderate levels of stress can enhance alertness and focus.

VERSION HISTORY

This page provides a record of changes made to the open textbook since its initial publication. If the change is minor, the version number increases by 0.1. If the change involves substantial updates, the version number increases to the next full number.

Version	Date	Change	Affected Web Rage
1.0	December 19, 2024	Publication	N/A