# 4 Data Collection

## 4.1 What is Data Collection? 📊

**Data Collection, woh process hai jis mein hum data ko collect karte hain.** 📊📈

Data, Data Science or Data Analysis k liay RAW material ka kaam karta hy or agar raw material kharab ho ga tu hamari end product b kharab nikaly ge, is liay hamen data ko collect karne se pehlay b planning karni chahyeay.

Angrez kehta hy k:

*"Data collection is a systematic process used to gather information from various sources to answer research questions, test hypotheses, or evaluate outcomes."*

## 4.2 Steps of Data Collection 📊

Here's an overview of the typical steps involved in this process:

1. **Define Objectives and Research Questions** 🎯: Clearly identify what you want to achieve and the questions you need answers to. This step sets the direction for your entire data collection process.

- Wazeh karein ke aap kya hasil karna chahte hain aur kin sawalaat ke jawabat chahiye. Yeh step pooray data collection process ko direction deta hai.

2. **Design the Data Collection Method/Tool** 📋🖊️: Choose the most appropriate method(s) for collecting data. This could be surveys, interviews, observations, experiments, or use of existing data sources. Design tools like questionnaires or interview guides accordingly.

- Sahi tareeqa chunain data ikattha karne ke liye. Yeh ho sakta hai surveys, interviews, observations, experiments, ya existing data sources ka istemal. Munaasib tools design karein jaise questionnaires ya interview guides.

3. **Determine the Sample** 👫: Decide on the sample size and the sampling method (random, stratified, convenience, etc.). This step is crucial to ensure the data is representative of the population being studied.

- Sample size aur sampling method ka faisla karen (random, stratified, convenience, waghera). Yeh step yeh ensure karne ke liye crucial hai ke data mutal'aa karne wale population ki numainda ho.

4. **Collect Data** 📈: Implement the data collection method. This could involve conducting surveys, performing experiments, observing behaviors, or compiling data from existing resources.

- Data collection method ko implement karen. Yeh involve kar sakta hai surveys conduct karna, experiments perform karna, behaviors observe karna, ya existing resources se data compile karna.

5. **Ensure Data Quality** ✔️: Check the data as it's collected for accuracy and completeness. This may involve reviewing responses, checking for missing data, and ensuring the data collection method is being followed correctly.

- Data ko check karein us ke ikatthe hone ke waqt accuracy aur completeness ke liye. Yeh review karna, missing data check karna, aur yeh ensure karna shamil hai ke data collection method sahi follow ho raha hai.

6. **Data Processing** 🖥️: Once collected, the data needs to be processed. This might include data entry, coding, transcription, and cleaning to prepare it for analysis.

- Ikattha kiye gaye data ko process karna. Yeh include kar sakta hai data entry, coding, transcription, aur cleaning tayyar karna ke liye analysis ke liye.

7. **Data Analysis** 🔍: Analyze the data using appropriate statistical methods or qualitative analysis techniques, depending on the nature of your data and research objectives.

- Data ko appropriate statistical methods ya qualitative analysis techniques ke zariye analyze karen, data ki nature aur research objectives ke hisab se.

8. **Interpreting Results** 📊: Draw conclusions from the data analysis. Interpret the results in the context of the research objectives and questions.

- Data analysis se nateejon ko nikalain. Results ko research objectives aur sawalaat ke context mein interpret karein.

9. **Report Writing and Presentation** 💼: Prepare a report or presentation to communicate the findings. This should include the methodology, analysis, results, and conclusions.

- Findings ko communicate karne ke liye ek report ya presentation tayyar karen. Is mein methodology, analysis, results, aur conclusions shamil hone chahiye.

10. **Data Storage and Management** 💾: Store the data securely, ensuring it is organized and accessible for future reference or further analysis.

- Data ko mehfooz aur munazzam tareeqe se store karein taake mustaqbil mein reference ya mazid analysis ke liye accessible ho.

Throughout this process, it's essential to consider ethical aspects, such as participant consent, confidentiality, and data privacy. Each step requires careful planning and execution to ensure the data collected is reliable, valid, and suitable for answering the research questions.

> ⚠ **Population vs. Sample**
>
> Hamen Agay move karne se pehlay ye samajhna zaroori hy k akhir sample hta kia hy? or Population kia hti hy? or in dono main kia farq hy?

## 4.3 Population vs. Sample

Yahan main ne ek table banaya hai jo “Population” aur “Sample” ke darmiyaan farq ko wazeh karta hai:

| Pehlu (Aspect) | Population | Sample |
|---|---|---|
| **Tareef (Definition)** | The entire group that is the subject of the study. | A subset of the population, selected for analysis. |
| **Size** | Usually large, encompassing all the individuals or items of interest. | Smaller, manageable in size, representing the population. |
| **Selection** | Not selected, but defined as the total group of interest. | Selected using various sampling methods (random, stratified, etc.). |
| **Usage** | Used for census or when comprehensive data is needed. | Used for surveys or experiments due to time and resource constraints. |
| **Example** | All residents of Lahore for a study on city-wide traffic patterns. | A group of 1,000 residents from different areas of Lahore for the same study. |

Is table se aap dekh sakte hain ke “Population” ka matlab hota hai poori group jis ke bare mein study ki ja rahi hai, jabke “Sample” is group ka ek chhota hissa hota hai jo analysis ke liye select kiya jata hai. Har aspect mein dono ki qualities ko samjha gaya hai.

## 4.4 Case Study for Data Collection 📊

**Kahani: Gulshan-e-Iqbal Park Mein Data Collection Ka Safar**

Ek dhoop bhari subah Lahore mein, Raza aur Amna, dono researchers, ne decide kiya ke Gulshan-e-Iqbal Park mein logon ki recreational habits pe ek study karenge. Unka maqsad tha pata lagana ke log park mein kitna waqt guzarte hain aur kin activities mein involve hote hain. Unhone project ka naam rakha, “Green Spaces in Urban Lahore: A Study on Usage Patterns.”

Jab Raza aur Amna ne park mein jaake surveys shuru kiye, to unko jald hi ek masla ka samna karna pada. Unka sample size bahut chhota tha aur wo sirf weekends pe data collect kar rahe the. Is se weekdays ke patterns miss ho rahe the.

Ek din, chai peete hue, Amna ne kaha, “Raza, kya tumhe nahi lagta humein weekdays aur alag alag waqt mein bhi data collect karna chahiye?” Raza ne jawab diya, “Bilkul, humein comprehensive data ke liye ye zaroori hai. Chalo, hum apne method mein tabdeeli laate hain.” 🤔☕

Dono ne apna approach badla aur diverse timings aur weekdays ko include kiya. Unhone ek app ka istemal shuru kiya jo location aur time tracking mein madad karta tha. Is se unka data collection zyada effective ho gaya.

Jab unhone apni final report likhi, to us mein unhone apne initial mistakes aur unse seekhe gaye sabak ko bhi shamil kiya. Unki study ne local authorities ko valuable insights diye park ki betterment ke liye.

Is tajurbe se Raza aur Amna ne bohat kuch seekha. Unhone samjha ke data collection ek evolving process hai, jisme flexibility aur adaptability key hai. Unka yeh safar unhe aur bhi samajhdar aur experienced researchers banane mein madadgar sabit hua.

Aakhir mein, unki study naye researchers ke liye ek misaal ban gayi. Yeh dikhaya ke kaise mistakes se seekh kar data collection process ko behtar kiya ja sakta hai aur quality data se community ke liye positive changes laaye ja sakte hain. Raza aur Amna ne is se ek important lesson liya: har ghalti ek mauka hoti hai seekhne ka aur behtar researcher banne ka. 📚✨🌳🌞

Raza aur Amna ne Gulshan-e-Iqbal Park mein apne data collection ke safar mein best practices ka istemal kar ke high-quality data ikattha kiya. Unki kahani mein yeh bhi shamil hai ke kaise unhone apni ghaltiyon se seekh kar behtar data collect kiya. 🌞📚

Jab Amna ne chai peete hue Raza se baat ki, “Raza, kya humein weekdays aur alag alag waqt mein bhi data collect nahi karna chahiye?” Raza ne jawab diya, “Bilkul, humein comprehensive data ke liye ye zaroori hai. Chalo, hum apne method mein tabdeeli laate hain.” ☕🤔

Is ke baad, unhone kuch best practices ko apnaya:

1. **Diverse Sampling**: Unhone apna sample diverse banaya, different days aur times ko cover karte hue, takay data zyada accurately reflect kare park ko use karne walon ki variety.
2. **Reliable Tools**: Unhone ek mobile app ka istemal kiya jo location aur time tracking mein madadgar tha, is se data collection zyada accurate aur less time-consuming hua.
3. **Data Verification**: Raza aur Amna ne regular intervals pe data ki accuracy check ki, taake kisi bhi tarah ki ghaltiyan jaldi pakdi ja saken.
4. **Feedback and Improvement**: Unhone apne approach mein flexibility dikhayi aur feedback ke base par continuous improvements kiye.
5. **Ethical Considerations**: Unhone ensure kiya ke participants ki privacy aur consent ka khayal rakha jaaye, especially personal information collect karte waqt.
6. **Clear Objectives**: Unka maqsad clear tha - park ki usage patterns ko samajhna. Is ne unhe focused rakha aur relevant data collect karne mein madad ki.
7. **Organized Data Management**: Collect kiye gaye data ko unhone systematically organize kiya, is se analysis aur reporting mein asani hui.

Jab unhone apni final report likhi, to unka data comprehensive, accurate, aur reliable tha. Unki study ne park ki usage patterns ke bare mein deep insights provide kiye, jis se local authorities ko park ki planning aur improvements mein madad mili.

Is safar ne Raza aur Amna ko sikhaya ke kaise best practices ko follow kar ke high-quality data collect kiya ja sakta hai, aur yeh ke har ghalti se seekhne ka mauka milta hai. Unki mehnat ne unhe naye researchers ke liye ek misaal bana diya, yeh dikhate hue ke high-quality data collection se community mein positive impact kaise laya ja sakta hai. 🌳✨📈🔍

## 4.5 Reliability and Validity 📊

Aaiye baat karte hain reliability aur validity ke concepts ke baare mein, statistics mein! 📊✨

### 4.5.1 Reliability - Bharosemandi 🔄

Jab Lahore ke galiyon mein aap ek dukaan se har roz achaar kharidte hain, aur har dafa uska taste wahi hota hai, toh aap kehte hain, “Yeh dukaan toh bharosemand hai!” Isi tarah, statistics mein, reliability ka matlab hota hai consistency. Agar aap ek survey bar bar conduct karte hain, aur har dafa lagbhag same results aate hain, toh keh sakte hain ke aapka data reliable hai.

**Kaise Check Karein Reliability?** 🤔 - **Test-Retest**: Ek hi test ko different waqt pe dobara karna aur dekhna ke results consistent hain ya nahi. - **Internal Consistency**: Survey ke andar different items ke responses ko compare karna aur dekhna ke kya woh aapas mein consistent hain.

### 4.5.2 Validity - Darusti 🔍

Ab sochiye, aap ek survey kar rahe hain ke log Lahore mein kitni chai peete hain. Agar aapka survey accurately chai peene ki aadat ko measure kar raha hai, toh keh sakte hain ke aapka data valid hai. Yani, aap jo measure karne ki koshish kar rahe hain, aapka tool wohi measure kar raha hai.

**Kaise Check Karein Validity?** 🧐 - **Content Validity**: Check kijiye ke aapke questions wohi cover kar rahe hain jo aap measure karna chahte hain. - **Criterion-Related Validity**: Aapke results ko kisi established standard ke results ke sath compare kijiye. - **Construct Validity**: Yeh check karta hai ke kya aapka measure woh theoretical concepts accurately capture kar raha hai jinko aap study kar rahe hain.

### 4.5.3 Reliability aur Validity Ka Importance 🌟

Sochiye aap ek research kar rahe hain ke Lahore mein traffic ki wajah se log kitna stressed hote hain. Agar aapka data reliable nahi hai, yani har baar alag results aate hain, toh aapke conclusions pe bharosa karna mushkil ho jayega. Aur agar data valid nahi hai, yani aap jo measure karne ki koshish kar rahe hain woh actually measure hi nahi ho raha, toh aapke nateeje ka koi maani nahi hoga.

Isliye, jab bhi statistics ka use karte hain, toh yeh ensure karna bohot zaroori hai ke aapka data reliable bhi ho aur valid bhi. Sirf is tarah se aapke research ke nateeje qabile bharosa aur mufeed hote hain. 📚🔬✨

> **Reliability and Validity kaisay ensure karen**
>
> Reliability aur validity ko ensure karne ke liye, aapko apne data collection process mein kuch best practices ko follow karna chahiye. Yeh practices aapke data ko reliable aur valid banane mein madadgar sabit hongi. Triangulation is one of them 📊✨

## 4.6 Triangulation 📊✨

Aaiye baat karte hain “triangulation” ke concept ke baare mein! 🌐🔍

**Triangulation - Teen Zaviai Pemaish** 📐 Imagine kariye, aap Lahore ke famous Food Street mein hain, aur aapko best biryani ki dukaan dhoondhni hai. Aap teen alag-alag logon se poochte hain, aur agar teeno ek hi dukaan ki taraf ishara karte hain, toh aapko yakeen ho jata hai ke wohi behtareen jagah hogi. Isi tarah, research mein triangulation ka concept istemal hota hai. Yeh basically yeh hai ke aap ek hi research question ko alag-alag methods, sources, ya perspectives se dekhte hain, aur agar sab ek hi result ki taraf ishara karte hain, toh aapke nateeje zyada bharosemand hote hain.

**Triangulation ke Types** 🎲 1. **Data Triangulation**: Alag-alag sources se data ikattha karna. Jaise, surveys, interviews, aur observational data. 2. **Methodological Triangulation**: Alag-alag methods use karna, jaise quantitative (numbers pe focus) aur qualitative (words aur meanings pe focus) methods. 3. **Researcher Triangulation**: Alag-alag researchers ya analysts ka data ko analyze karna, taake bias kam se kam ho. 4. **Theoretical Triangulation**: Alag-alag theories ya nazariyaat ko istemal karna data ko samajhne ke liye.

**Triangulation ka Faida** 🌟 Sochiye aap ek research kar rahe hain ke Lahore mein air pollution kis had tak health problems create karta hai. Agar aap sirf ek method (jaise sirf surveys) ya sirf ek source (jaise sirf hospital records) pe depend karte hain, toh ho sakta hai aap kuch important aspects miss kar jaayein. Lekin agar aap triangulation ka istemal karte hain, yani surveys, environmental data, aur doctors ki opinions bhi lete hain, toh aapke nateeje zyada comprehensive aur accurate honge.

**Triangulation ki Ahmiyat** 📈 Triangulation research ko zyada mazboot banata hai. Ye aapko yeh confidence deta hai ke aapke nateeje sirf ek angle se nahi aaye hain, balke multiple sources aur perspectives ne usay support kiya hai. Yeh aapke research ko zyada qabile bharosa aur impactful bana sakta hai.

Toh, jab bhi aap kisi research project pe kaam kar rahe hoon, triangulation ko zaroor consider karein. Yeh aapke findings ko depth aur strength deta hai, aur aapke conclusions ko zyada convincing banata hai. 📚✨🔬🌐

## 4.7 True and Error Scores 📊📋

### 4.7.1 True Score (Asal Score) 🎯

**True Score, ya asal score, woh score hai jo kisi shakhs ki asal salahiyat ya performance ko accurately represent karta hai.** 🌟📋

- **Tafseel:** Ye maan’na hai ke jab koi test ya assessment liya jata hai, to jo score milta hai, woh ideally us shakhs ki asal ability ya knowledge ko darust taur par bayan karta hai. Lekin, reality mein, kayi factors ki wajah se yeh hamesha mumkin nahi hota.
- **Application:** Educational assessments, psychological tests, ya kisi bhi qisam ke performance evaluations mein true score ko samajhna zaroori hota hai. Yeh humein batata hai ke agar tamam external factors ko control kiya jaaye, to shakhs ka actual performance kya hoga. 🏫📚
- **Ahmiyat:** True score ki understanding yeh ensure karti hai ke evaluations fair aur accurate hain, aur yeh bhi ke assessments ko improve kiya ja sake taake woh asal abilities ko behtar taur par measure kar sakein. 🎓⚖️

### 4.7.2 Error Score (Ghalti ka Score) ❌

**Error Score, ya ghalti ka score, woh farq hai jo true score aur observed score ke darmiyan hota hai.** 📉❓

- **Tafseel:** Jab koi assessment ya test liya jata hai, to jo score hasil hota hai, us mein kuch inaccuracies ya ghaltiyan ho sakti hain. Ye ghaltiyan external factors jaise test-taker ki thakan, misunderstanding of questions, ya testing environment ki wajah se ho sakti hain.
- **Application:** Error score ko samajhna educational testing, psychological assessments, aur kisi bhi qisam ke performance evaluation mein ahem hota hai. Yeh batata hai ke assessment kitna reliable ya valid hai. 🧐📉
- **Ahmiyat:** Error score ko kam se kam rakhne ki koshish ki jati hai taake assessment zyada accurate ho. Iske liye, test design aur administration ke methods ko behtar banaya jata hai, aur sometimes, statistical adjustments bhi kiye jaate hain. 📊🛠️

The equation that relates True Score and Error Score is fundamental in psychometrics and assessment theory. It's expressed as:

$$\text{Observed Score} = \text{True Score} + \text{Error Score}$$

or we can also write this as:

$$X = T + E$$

In this equation:

- **Observed Score $X$ (Mushaheda Shuda Score):** This is the score actually obtained from the assessment or test. It's the measurable outcome you see.
- **True Score $T$ (Asal Score):** The score that would theoretically be obtained if there were no errors in measurement. It represents the actual ability or characteristic being measured.
- **Error Score $E$ (Ghalti ka Score):** This represents the portion of the score that deviates from the true score due to various factors like measurement errors, environmental factors, or test-taker's condition.

In an ideal situation, where there's no error, the error score would be zero, and the observed score would equal the true score. However, in real-world scenarios, there's almost always some degree of error, making the observed score slightly different from the true score.

> ⚠ **Errors are important**
>
> Errors ko samjhna zaroori hy, yehi nahi k Data collection main sirf or sirf measurement main ghaltian ati hyn, balky data collection k har process main ghaltian ati hyn, jin ko samjhna or kam karna zaroori hy. Isi liay ap ko yeh janna zaroori hy k ghaltian kis tarah ki hoti hyn, or un ko kam karny k liay ap kis tarah ki strategies use kar sakty hyn.

## 4.8 Types of Errors (Ghaltiyon ke Iqsaam) 📊🚫

There are several Error Types that can affect the observed score. These include: Bilkul, aaiye dekhte hain data collection mein hone wale errors ko Roman Urdu mein, aur Pakistani style mein, thodi si emojis ke sath! 🌟

1. **Sampling Error (Namunaati Ghalti)** 📊: Jab sample poori population ka sahi se representation na kare. Masalan, agar Lahore ke sirf ek hisse ke logon se data liya jaye, magar pooray Lahore ke liye generalize kar diya jaye.

2. **Measurement Error (Pemaish Ki Ghalti)** 📏: Jab jo cheez measure karni ho, woh sahi se na ho paaye. Jaise, kisi survey mein "aap kitni dafa chai peete hain?" ka sawaal ho, aur log ghalat jawab dein ya sawaal ka ghalat matlab le lein.

    1. **Random Error (Ittefaqi Ghalti)** 🎲: Ye woh ghaltiyan hain jo bas ho jaati hain, bina kisi wajah ke. Yeh har data collection mein hoti hain aur inhe poori tarah se khatam nahi kiya ja sakta.

    2. **Systematic Error (Nizaamati Ghalti/Bias)** 🔍: Jab koi consistent ghalti ho, jo bar-bar ho. Jaise, agar survey mein sawaal hi aise ho ke logon ko ek khaas tarah ka jawab dene par majboor kare.

3. **Processing Error (Processing Ki Ghalti)** 💻: Data ko process karte waqt ghaltiyan, jaise ghalat data entry ya code. Misal ke taur pe, naam "Ahmed" ko "Ahmad" likh dena.

4. **Coverage Error (Coverage Ki Ghalti)** 🌍: Jab sample mein kuch log ya areas miss ho jaayein. Maan lo, Karachi ke kisi survey mein Clifton ka area hi na cover ho.

5. **Nonresponse Error (Jawab Na Milne Ki Ghalti)** 🤷: Jab log survey respond hi na karein ya kuch sawaalat ka jawab na dein. Socho, aap ne 100 logon se poocha magar sirf 50 ne jawab diya.

Umeed hai ke aap ko Pakistani style mein yeh examples samajh aaye honge! 🌼🇵🇰 Remember, data collection mein ghaltiyan aam baat hain, magar inhen samajhna aur kam karna zaroori hai! 🤓✨

## 4.8.1 Sampling Error 📊

**Sampling Error, ya namunaati ghalti, woh farq hota hai jo sample aur population ke darmiyan hota hai.** 📊❓

Aaiye baat karte hain "Sampling Error" ke baare mein! 🎲📊

**Sampling Error - Namunaati Ghalti** 🔄

Sochiye, aap Lahore ke kisi bazaar mein jate hain aur wahan ke kuch logon se poochte hain ke unhe cricket pasand hai ya nahi. Phir, aap ye generalise kar dete hain ke pooray Lahore ko cricket pasand hai. Yeh ho sakta hai ke jo log aap se mile woh cricket ke fans ho, lekin pure Lahore ka yehi opinion nahi ho. Is tarah ke generalization mein jo error aata hai, usse hum "sampling error" kehte hain. Yani, jab aapka sample (namuna) poori population (aabaadi) ka sahi se representation na kare.

**Sampling Error Kyun Hota Hai?** 🤔

1. **Chhota Sample Size**: Agar sample size bohot chhota ho, to yeh mushkil ho jata hai ke aap poori population ke trends ko accurately capture karein.
2. **Biased Selection**: Agar aapne sample ko biased tareeke se choose kiya ho, jaise sirf ek khaas area ke logon ko include kiya ho.
3. **Random Variability**: Kabhi-kabhi, pure ittefaq se, aapka sample aisi characteristics dikhata hai jo poori population mein nahi hoti.

**Sampling Error Se Kaise Bacha Ja Sakta Hai?** 🛡️

1. **Bigger and Diverse Sample**: Try karein ke aapka sample size bada aur diverse ho, taake woh better represent kare poori population ko.
2. **Random Sampling**: Use karein random sampling ka method, taake har individual ke selection ka chance barabar ho.

3. **Understanding the Population**: Pehle achi tarah samajh lein ke aapki population kya hai aur uske different aspects kya hain.

**Sampling Error Ka Asar** 📉

Agar aapka data sampling error se affected hai, toh aapke research ke nateeje kamzor ho sakte hain. Lahore mein traffic patterns ke study mein agar sirf ek area se data liya gaya ho, toh aap pooray shehar ke traffic ke bare mein accurate conclusions nahi nikal sakte.

Isliye, jab bhi research kar rahe ho, toh sampling error ko samajhna aur usse bachne ki koshish karna bohot zaroori hai. Ye ensure karta hai ke aapke ikatthe kiye gaye data accurate aur qabile bharosa hain, aur aapke nateeje sahi mayene mein useful hote hain. 📚🔍✨🎲

## 4.8.2 Measurement Error (Pemayesh ki Ghalti) ❌📏

**Measurement Error, ya pemayesh ki ghalti, woh farq hota hai jo actual result (asal nateeja) aur measured result (pemayesh shuda nateeja) ke darmiyan hota hai.** 📐❓

- **Tafseel:** Jab bhi hum kisi cheez ko measure karte hain, chahe woh educational test ho, scientific experiment, ya koi survey, to ghaltiyan hone ka imkaan hota hai. Yeh ghaltiyan asal aur measured outcomes ke darmiyan farq paida karti hain.
- **Ahmiyat:** In ghaltiyon ko samajhna aur unhen control karna zaroori hota hai taake hum jo nateeja nikal rahe hain woh zyada accurate aur reliable ho. 🧐🔍

### 4.8.2.1 Types of Measurement Errors (Pemayesh ki Ghaltiyon ke Iqsaam) 📊🚫

**1. Random Errors (Ittefaqi Ghaltiyan):**

- **Tafseel:** Ye wo ghaltiyan hoti hain jo unpredictably aur randomly hoti hain. In ka koi specific pattern ya wajah nahi hoti.
- **Misal:** Jaise, ek survey mein respondent ka randomly koi sawaal galat samajh lena.
- **Application:** Random errors ko kam karne ke liye, data ko carefully analyze karna aur large sample sizes use karna hota hai. 🎲🔎

**2. Systematic Errors (Nizami Ghaltiyan/Bias):**

- **Tafseel:** Ye ghaltiyan tab hoti hain jab measurement process mein koi constant bias ya error ho.
- **Misal:** Jaise, ek scientific instrument ka hamesha thoda sa zyada ya kam reading dena.
- **Application:** In errors ko identify kar ke unhen correct karna padta hai, jaise calibration of instruments ya testing procedures ko modify karna. 📈⚙️

> **Bias**
>
> Bias ko samajhna bohot zaroori hai taake aap apne data collection ko zyada accurate aur reliable bana sakein. Bias ke types aur us se bachne ke strategies ke baare mein aap yahan parh sakte hain: Bias and Measurement Bias

**3. Human Errors (Insaani Ghaltiyan):**

- **Tafseel:** Ye ghaltiyan insaan ki taraf se hoti hain, jaise ghalat data entry ya ghalat interpretation.

- **Misal:** Data ko galat tarike se enter karna ya kisi pattern ko ghalat samajhna.
- **Application:** Training aur careful review se in ghaltiyon ko kam kiya ja sakta hai. 👩‍🏫👀

> **Measurement Error aur Reliability!**
>
> Is tafseeli wazahat mein, pemayesh ki ghaltiyon aur unke mukhtalif iqsaam ko Roman Urdu mein samjhaya gaya hai, unke asraat aur unhen kam karne ke tareeqon ke sath. Yeh understanding kisi bhi qisam ke research, assessment, ya data collection process ke liye crucial hai taake nateejat zyada qabile bharosa aur durust ho sakein.

## 4.8.3 Processing Error (Processing Ki Ghalti) 💻

Len Janab-e-Aali, chaliye baat karte hain "Processing Error" ke baare mein! 💻🔄

**Processing Error - Data Ko Process Karne Mein Ghalti 💾**

Imagine kariye, aap ek restaurant mein order dene ke baad dekhte hain ke aapka order galat aaya hai. Shayad waiter ne galat likha ho ya kitchen mein kuch mix up hua ho. Isi tarah, jab data collect karne ke baad usay process karte waqt ghaltiyan hoti hain, toh isey "processing error" kehte hain. Yeh tab hota hai jab data ko enter karte waqt, sort karte waqt, ya analyze karte waqt kisi tarah ka error ho jaye.

**Processing Error Kyun Hota Hai? 🤔**

1. **Data Entry Errors**: Jab data ko system mein enter kiya jata hai, toh typing mistakes ho sakti hain.
2. **Coding Mistakes**: Agar data ko code karte waqt galat codes use kiye jayein, jaise survey responses ko galat categories mein rakhna.
3. **Software Errors**: Kabhi-kabhi software mein glitches ya bugs ki wajah se bhi processing errors ho sakte hain.

**Processing Error Se Kaise Bacha Ja Sakta Hai? 🛡️**

1. **Double-Check Data**: Data enter karne ke baad use dobara check karein.
2. **Automated Tools**: Jahan mumkin ho, automated tools ka use karein, jo errors ko kam karte hain.
3. **Training and Protocols**: Jo log data process kar rahe hain unko achi training dijiye aur clear protocols follow karne ko kahiye.

**Processing Error Ka Asar 📉**

Agar aapke data mein processing error hai, toh aapke research ke nateeje galat ho sakte hain. Maan lijiye, aap Lahore mein air quality ka study kar rahe hain aur aapke data mein entry error hai. Is se aapka analysis galat ho sakta hai aur aapke nateeje bhi.

Isliye, data ko process karte waqt bohot dhyan rakhna zaroori hota hai. Achi quality control practices aur careful data handling se aap processing errors ko kam kar sakte hain, aur apne research ke nateeje ko zyada accurate aur qabile bharosa banate hain. 📚💾🔍✨

## 4.8.4 Coverage Error (Coverage Ki Ghalti) 🌍

Bilkul, chaliye baat karte hain "Coverage Error" ke baare mein! 🌍📋

**Coverage Error - Data Collection Mein Kami 🗺️**

Imagine kariye, aap ek survey kar rahe hain ke Lahore ke log kis tarah ke mobile phones use karte hain. Agar aap sirf university students ko hi survey karte hain, toh aap baaki bohot se logon ko miss kar rahe hain jaise professionals, housewives, ya elderly log. Is tarah ke limitation ko "coverage error" kehte hain. Yeh tab hota hai jab aapka data collection ka method ya source poori population ko cover nahi karta.

**Coverage Error Kyun Hota Hai? 🤔**

1. **Limited Sources**: Agar aapka data collection ke sources limited hain, toh aap poori population ko represent nahi kar sakte.
2. **Outdated Lists**: Agar aap jo list use kar rahe hain woh outdated hai, toh new members ya recent changes miss ho sakte hain.
3. **Geographical Limitations**: Agar aap sirf ek specific geographical area ko cover karte hain, toh baaki areas miss ho jate hain.

**Coverage Error Se Kaise Bacha Ja Sakta Hai? 🛡️**

1. **Comprehensive Sources**: Apne sources ko zyada comprehensive banayein, taake aap poori population ko represent kar sakein.
2. **Update Lists Regularly**: Apne data collection lists ko regularly update karein.
3. **Include Diverse Areas**: Different geographical areas ko include karein apne study mein.

**Coverage Error Ka Asar 📉**

Agar aapke study mein coverage error hai, toh aapke nateeje poori population ke liye sahi nahi honge. Jaise agar aap Lahore ke mobile phone usage ka study kar rahe hain aur sirf university students ko include karte hain, toh aapke conclusions sirf unke liye valid honge, baaki population ke liye nahi.

Isliye, jab bhi aap kisi study ya research project pe kaam kar rahe hoon, toh coverage error ko samajhna aur usse bachne ki koshish karna bohot zaroori hai. Is se aapke data collection ko zyada accurate aur mufeed banaya ja sakta hai, aur aapke nateeje zyada qabile bharosa aur comprehensive hote hain. 📚🌍🔍✨

## 4.8.5 Nonresponse Error (Jawab Na Milne Ki Ghalti) 🤷‍♂️

Bilkul, chaliye baat karte hain "Nonresponse Error" ke baare mein! 📬🚫

**Nonresponse Error - Jawab Na Milne Ki Ghalti 📉**

Sochiye aap Karachi mein ek survey conduct kar rahe hain ke log kis tarah ke transport ko prefer karte hain. Aap 500 logon ko forms dete hain, lekin sirf 200 log hi jawab dete hain. Yeh jo missing data hai, usse "nonresponse error" kehte hain. Yeh tab hota hai jab logon se data collect karte waqt kuch log jawab hi nahi dete, ya phir kuch sawaalat chhod dete hain.

**Nonresponse Error Kyun Hota Hai? 🤔**

1. **Long or Complex Surveys**: Agar survey bohot lamba ya mushkil ho, toh log jawab dene se gurez karte hain.
2. **Privacy Concerns**: Kuch log personal ya sensitive sawalaat pe jawab dene mein hesitant hote hain.
3. **Accessibility Issues**: Agar survey sirf English mein ho aur respondent Urdu ya local language mein comfortable hoon.

**Nonresponse Error Se Kaise Bacha Ja Sakta Hai? 🛡️**

1. **Short and Simple Surveys**: Surveys ko mukhtasar aur asaan banayein, taake zyada log jawab dein.
2. **Assure Privacy**: Logon ko yakeen dilayein ke unka data safe aur confidential rahega.
3. **Language Options**: Multiple languages mein surveys provide karein, especially local languages.

**Nonresponse Error Ka Asar** 📉

Agar aapke data mein nonresponse error hai, toh aapke study ke nateeje distorted ho sakte hain. Karachi ke transport preferences ke study mein, agar sirf aadhe log hi jawab dete hain, toh aapka data sirf unhi ke preferences ko represent karega, baaki population ka nahi.

Isliye, data collect karte waqt nonresponse error ko minimize karne ki koshish zaroori hoti hai. Is se aapke data collection ko zyada reliable aur accurate banaya ja sakta hai, aur aapke nateeje zyada comprehensive aur qabile bharosa hote hain. 📚📬🔍✨

> **Bias**
>
> Bias ko samajhna bohot zaroori hai taake aap apne data collection ko zyada accurate aur reliable bana sakein. Bias ke types aur us se bachne ke strategies ke baare mein aap yahan parh sakte hain: Bias and Measurement Bias

## 4.9 Bias and Measurement Bias

Bilkul, chaliye detail se samajhte hain “bias” aur “measurement bias” ke concepts ko, Roman Urdu aur emojis ke saath! 📚🔍

### 4.9.1 General Bias

**Bias** research ya data collection mein systematic error ya haqeeqat se hat kar results ya inferencess ki taraf ishara karta hai. Research mein, bias data collection, analysis, interpretation, aur publication ke kisi bhi aspect mein aa sakta hai. Yeh biases mukhtalif sources se aate hain:

1. **Selection Bias (Intikhab Mein Jhukao)**: Jab study mein shamil kiye gaye participants general population ka sahi representation na karein. Misal ke taur pe, agar health survey sirf urban hospitals mein kiya jaye, to rural areas ke trends miss ho sakte hain.

2. **Confirmation Bias (Tasdeeqi Jhukao)**: Jab researchers ya data collectors jaan bujh kar ya anjaane mein data ko favor karte hain ya results ko interpret karte hain jo unke pehle se mojud beliefs ya hypotheses ko confirm karte hain.

3. **Publication Bias (Ishaa’at Mein Jhukao)**: Sirf positive ya significant results ko publish karna, jabke negative ya non-significant findings ko nahi karna.

4. **Reporting Bias (Reporting Mein Jhukao)**: Jab study ke sirf kuch outcomes ya aspects ko report kiya jata hai, aur dusre jo barabar important ho sakte hain, unhe chhoda jata hai.

### 4.9.2 Measurement Bias

**Measurement Bias** ek khaas tarah ka bias hai jo measurements ko collect, record, ya interpret karne mein systematic error se juda hota hai. Yeh study ke outcomes ki reliability aur validity par significantly asar daal sakta hai. Measurement bias ke types mein shamil hain:

1. **Instrument Bias (Aala Mein Jhukao)**: Jab khud measurement instruments mein kharabi hoti hai. Jaise, ek scale jo hamesha kam wazan dikha raha ho.
2. **Observer Bias (Mushahida Karne Wale Ka Jhukao)**: Jab measurement karne wala shakhs (observer) anjaane mein results ko influence karta hai, shayad apni expectations ya pehle se banaye gaye khayalat ki wajah se.
3. **Response Bias (Jawab Mein Jhukao)**: Jab study mein shamil log woh jawab dete hain jo unhe lagta hai ki expected hain ya socially acceptable hain, unke asal thoughts ya feelings ke bajaye.
4. **Sampling Bias (Namuna Mein Jhukao)**: Measurement bias ka ek type jo namuna (sample) kaise chuna gaya hai us se juda hota hai. Agar sample population ka sahi representation na ho, to measurement biased ho sakta hai.

### 4.9.3 Bias Aur Measurement Bias Ko Kam Karna

Research ki integrity aur usefulness ke liye bias ko kam karna bohot zaroori hai. Yahan kuch strategies hain:

1. **Diverse Sampling (Mukhtalif Namunaat)**: Yakeen karna ke sample jitna mumkin ho diverse aur representative ho.
2. **Blinding (Andha Banaye Rakhna)**: Single ya double-blind study designs ka istemal karna jahan zaroori ho, taake observer aur participant biases ko roka ja sake.
3. **Calibration aur Maintenance (Tarteeb aur Dekh-Bhaal)**: Regularly instruments ko check aur calibrate karna unki accuracy ko yakeen mein lane ke liye.
4. **Training aur Standardization (Tarbiyat aur Ma'yari Amal)**: Data collectors ko achi training dena aur measurement procedures ko standardize karna observer bias ko kam karne ke liye.
5. **Pilot Studies (Pehle Azmooda Mutala'a)**: Pilot studies conduct karna taake main study se pehle biases ko pakda aur durust kiya ja sake.
6. **Triangulation (Teen Zaviai Pemaish)**: Multiple methods, sources, ya theories ka istemal karna results ko cross-verify karne ke liye.
7. **Transparency in Reporting (Reporting Mein Shaffafiyat)**: Sabhi findings aur methodologies ko wazeh aur mukammal tor par report karna taake reporting bias se bacha ja sake.
8. **Peer Review aur Replication (Sathi Jaiza aur Dohrao)**: Research ko peer review ke liye pesh karna aur aise studies design karna jo replicate ki ja saken taake findings ki tasdeeq ho sake.

In tarikon ko apnakar, researchers apne data aur findings ki credibility aur reliability ko barha sakte hain. 📚🔍✨📐

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## 4.10 Follow us

Follow us

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