# E-Waste Recycling; Its Impact on Health & Environment

## A Case study of Pakistan

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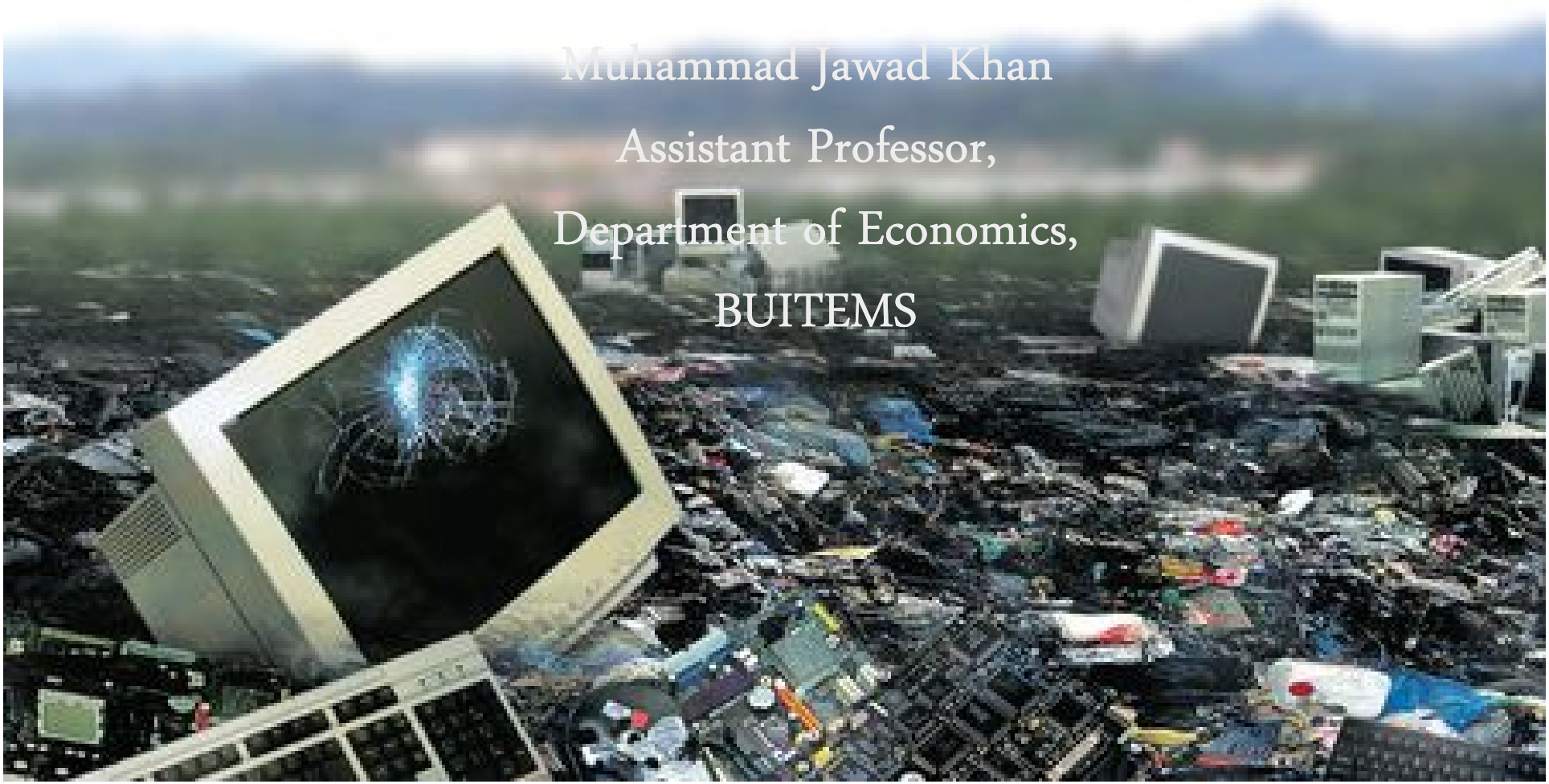
BUITEMS



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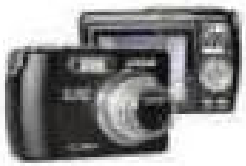
# ELECTRIC DEVICES



1. camera

2. laptop

3. calculator

4. computer

6. watch

7. headphones

5. razor

10. video camera

11. hair fan

8. iron

9. translator

12. TV set

13 cell phone

# Precious metals in e-waste

| Electronics | Copper (% by weight) | Gold (PPM) | Silver (PPM) | Palladium (PPM) |
|---|---|---|---|---|
| Television(TV)Board | 10% | 20 | 280 | 10 |
| Portable Audio Scrap | 21% | 10 | 150 | 4 |
| Personal Computer (PC) Board | 20% | 250 | 1000 | 110 |
| DVD Player Scrap | 5% | 15 | 115 | 4 |
| Mobile Phone | 13% | 340 | 3500 | 130 |
| Portable Audio Scrap | 21% | 10 | 150 | 4 |

(1) Source: Umicore Precious Metals Refining. Metals Recovery from e-scrap in a global environment. Geneva, September 7 2007.

http://archive.basel.int/industry/sideevent030907/umicore.pdf

# BURDEN OF E-WASTE

During the Period 1994-2003 500 Million PCs were discarded

- Containing 0.7 Million tonnes of lead,
- 0.0024 Million tonnes of cadmium and
- 287 tonnes of mercury

(Smith, Sonnenfeld & Naguib Pellow, 2006).

A study reveals that 1.7 million tons of electronic waste produced domestically in China, which is equal to 1.7 kg of E-waste per capita in 2006.

Another study concludes that developing nations' import of E-waste causes them a net loss of $108 million

➢ Developed Nations ship their E-waste to developing Nations because of our poor regulations over waste disposal(BAN, 2002; Wei et al., 2012).


Source; [UNEP], DTIE, 2007a)

# Why E-Waste is Growing?

- Rapid changes in Technology.
- Falling Prices (Competitive Tech).
- Irresponsible Company Manufacturing.

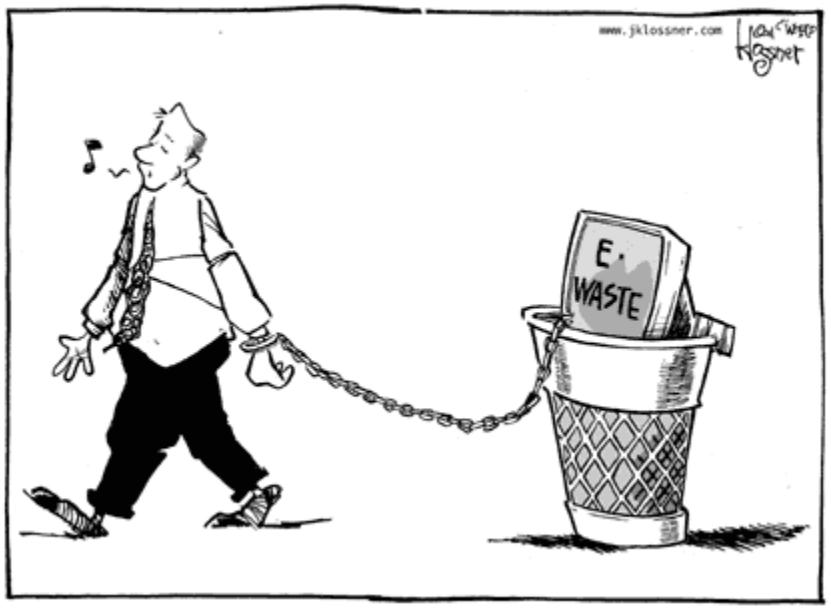
- Lack of Proper Knowledge on its risks and disposal.
- Repairs cost more than new products. ( Not Upgrading)
- Planned Product Obsolescence.

# Environmental Impact

- **Contamination of Ground Water:** One Mobile Battery pollutes 600 $m^3$ ground water. (Lepawsky & McNabb, 2010)

- **Air Pollution:** Toxic dioxins & Furans (Comes from burning plastic cables and PVC materials.) (Prakash & Manhart, 2010)

- **Soil Pollution:** Melting Computer Chips (Nordbrand, 2009; Xu et al, 2015; Tsydenova & Bengtsson, 2011)

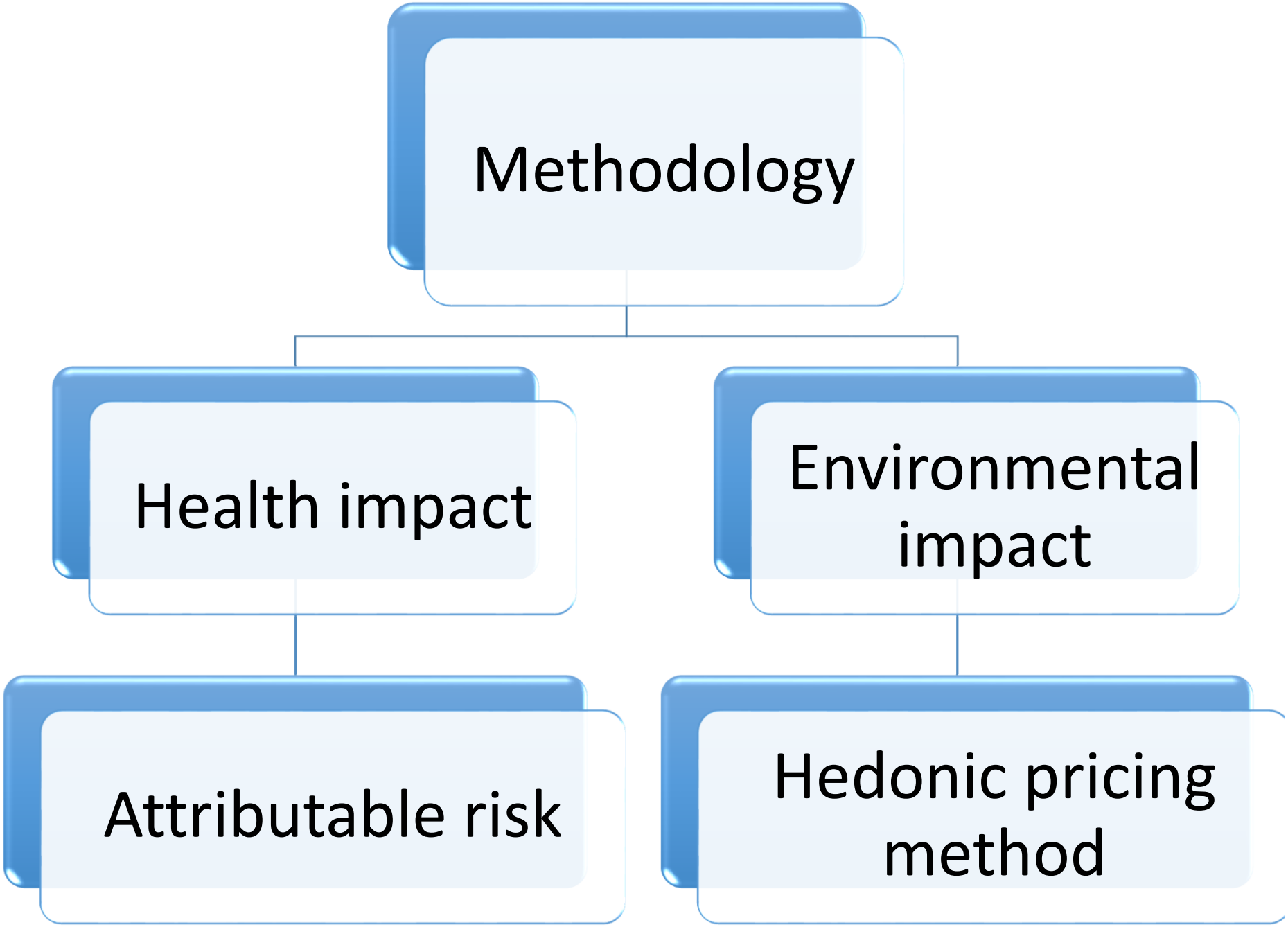



# Impacts on Our Health

# Hazardous materials

| Constituents ( Hazardous ) | Health effects |
|---|---|
| **Lead (PB)** | • Damage to nervous system and kidney<br>• Affects brain development of children |
| **Cadmium (CD)** | • Accumulates in kidney and liver<br>• Causes neural damage |
| **Mercury (Hg)** | • Chronic damage to the brain<br>• Respiratory and skin disorder |
| **Beryllium (Be)** | • Lung cancer |
| **Barium (Ba)** | • Muscle weakness; Damage to heart, liver and spleen |
| **Chromium** | • Asthma<br>• DNA Damage |

source :Wath, S. B., Dutt, P. S., & Chakrabarti, T. (2011). E-w aste scenario in India, its management and implications. Environmental Monitoring and Assessment , 172, 249-262


Methodology
Health impact
Environmental impact
Attributable risk
Hedonic pricing method

# Attributable Risk

- "The Attributable Risk indicates the number of cases of a disease among exposed individuals that can be attributed to that exposure"
- (MacMahon and Pugh, 1997; Kaelin, 2004; Rosen, 2013; & Kanchanaraksa, 2008)

# Attributed risk percent

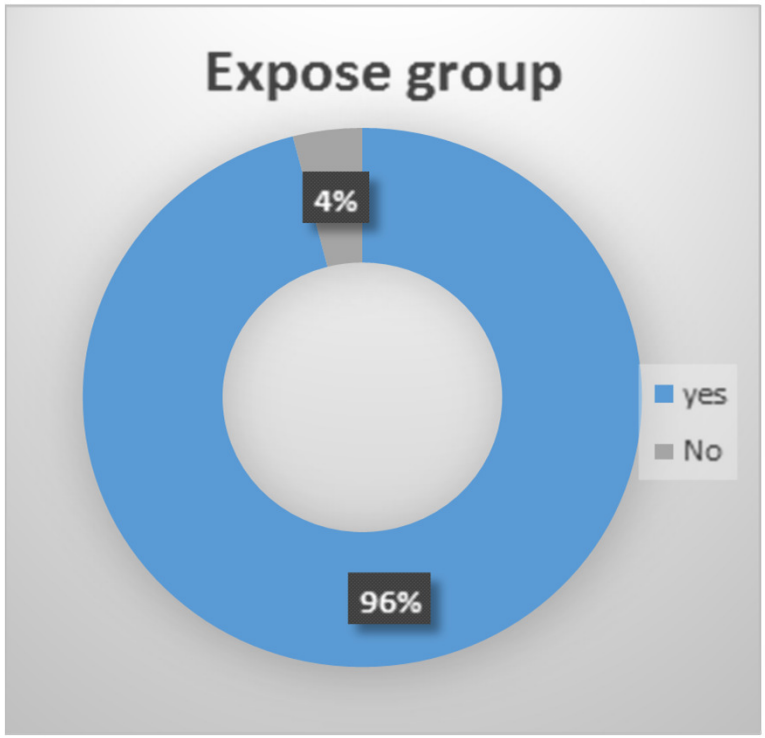
- ***[Incidence (exposed) – Incidence (unexposed)] ÷***
- ***Incidence (exposed)***

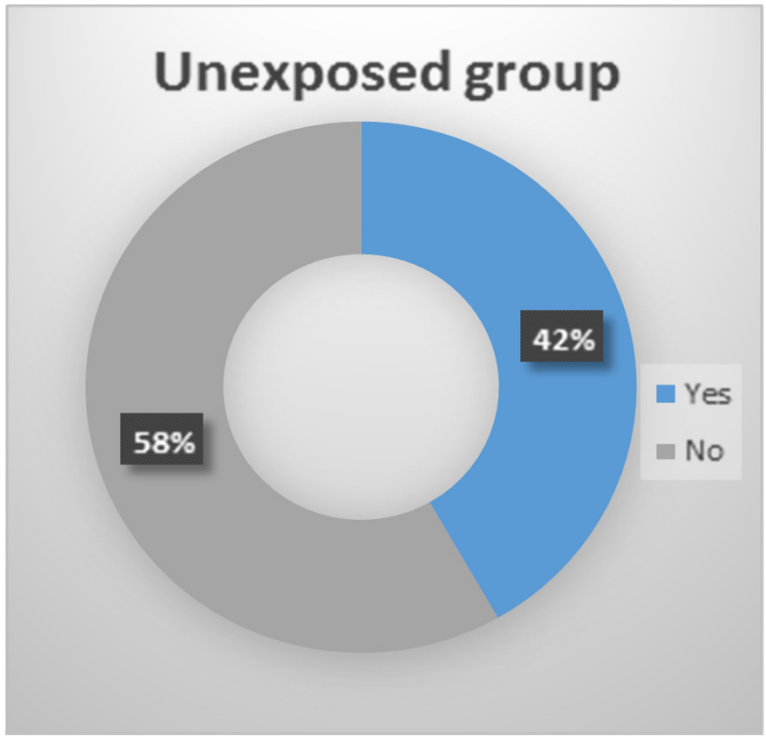
*The attributable risk percent can calculated by multiplying above expression by 100.*

**Where**

- *Ae% = Attributable risk percent*
- *Re = Absolute risk among exposed group*
- *Ro = Absolute risk among unexposed group.*

# Shortness of breath



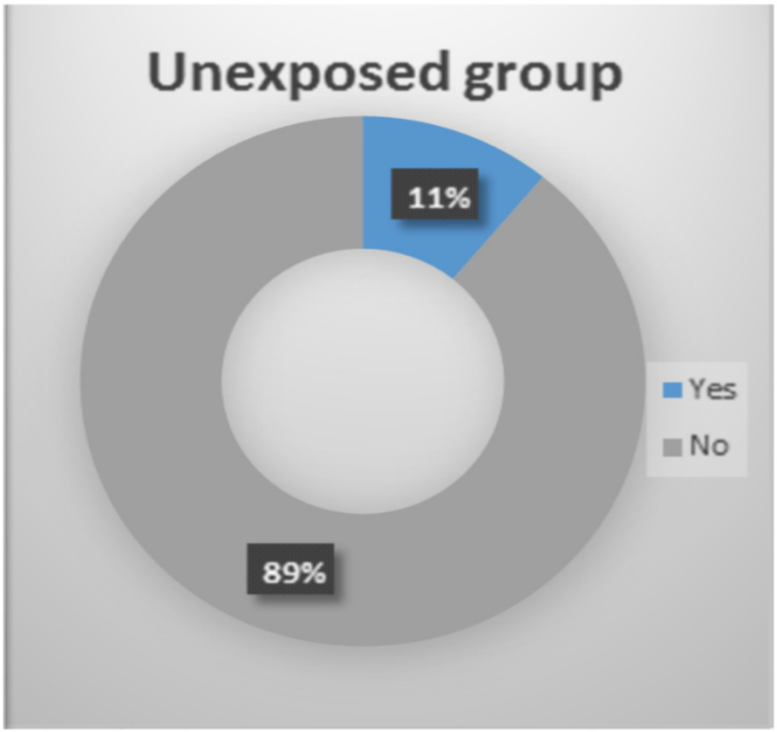



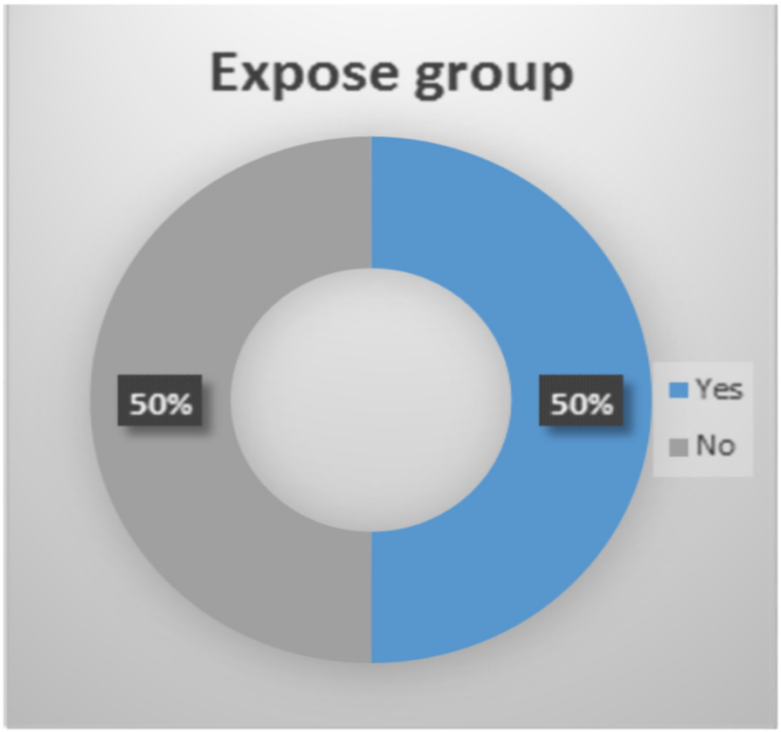

*Calculating for attributable risk percent:*

*Ae = 56 %*

*56 % of shortness of breath is attributable to exposure.*

# Skin disease

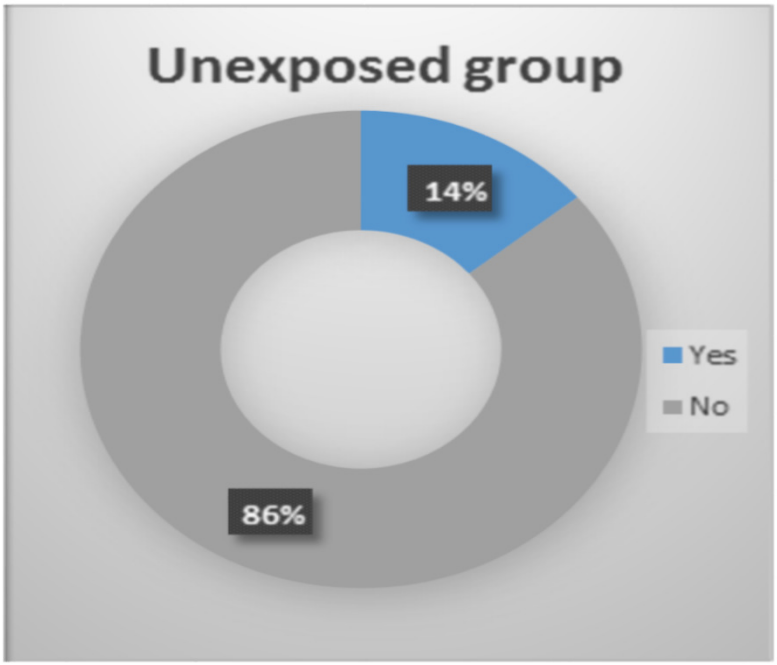


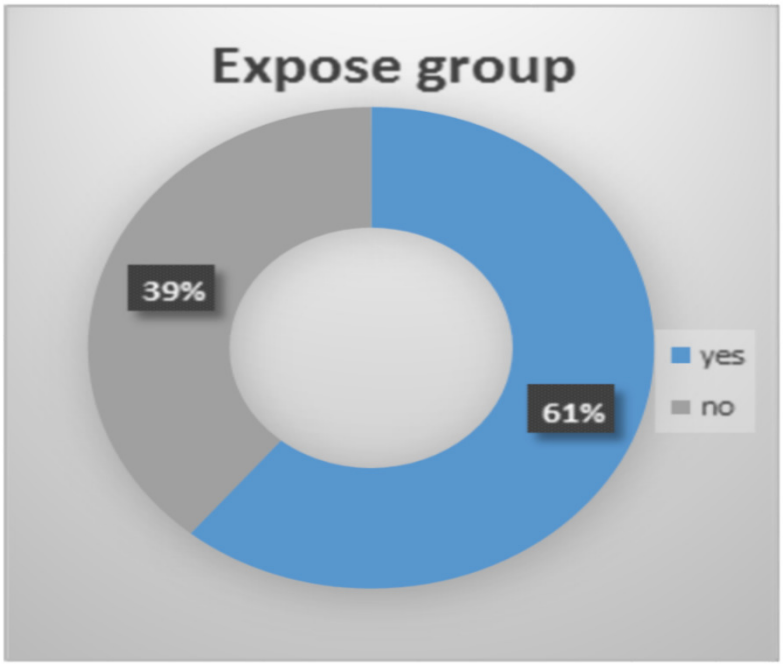




*Ae = 78 %*

*78 % of skin disease is attributed to exposure.*

# Infections of throat, chest, ear and fever

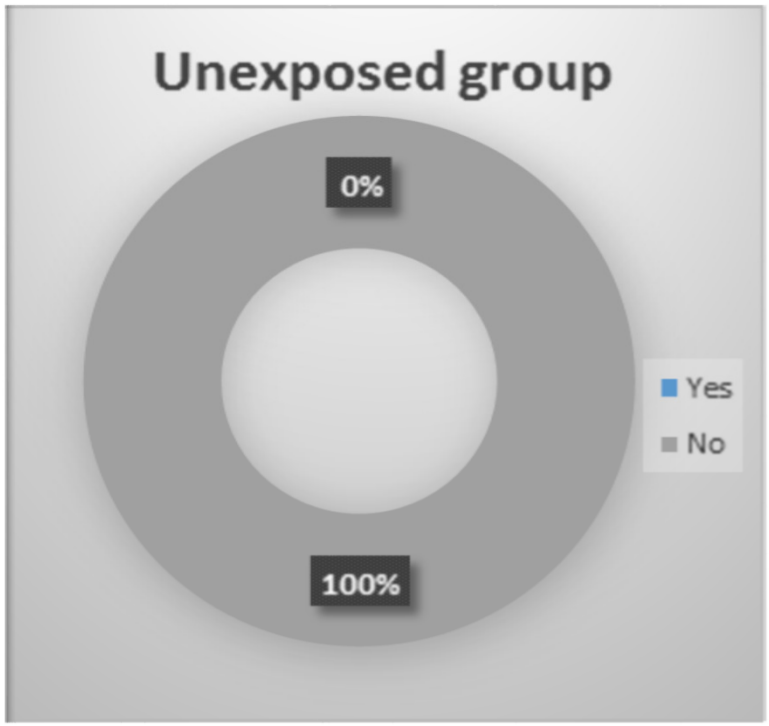


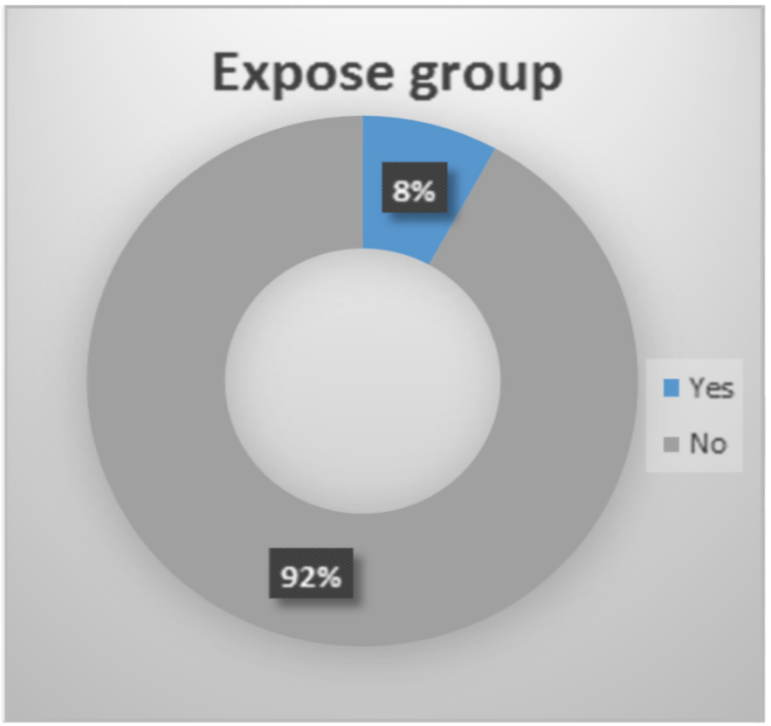




*Ae = 77 %*

*77 % of risk of throat, ear, chest and fever is attributable to exposure.*

# Diarrhea

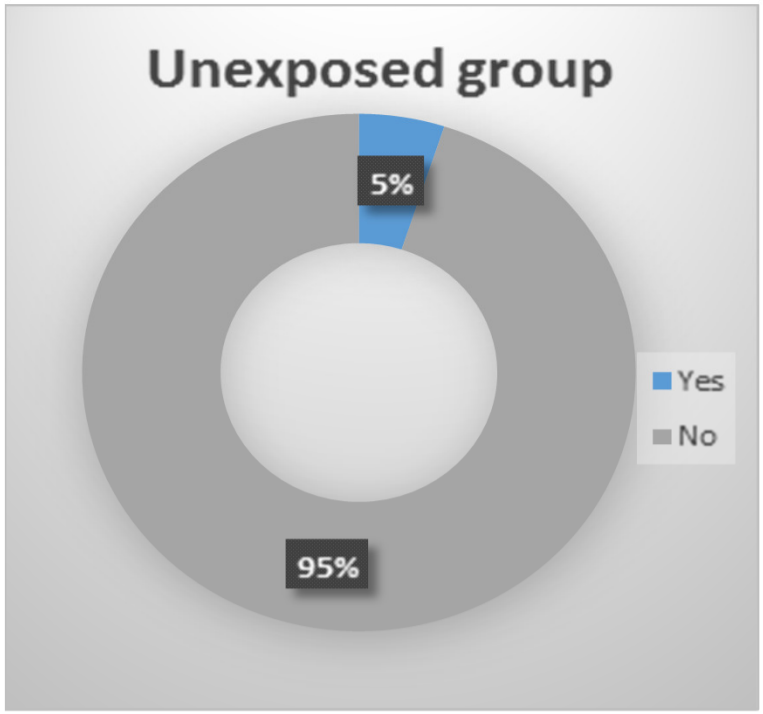


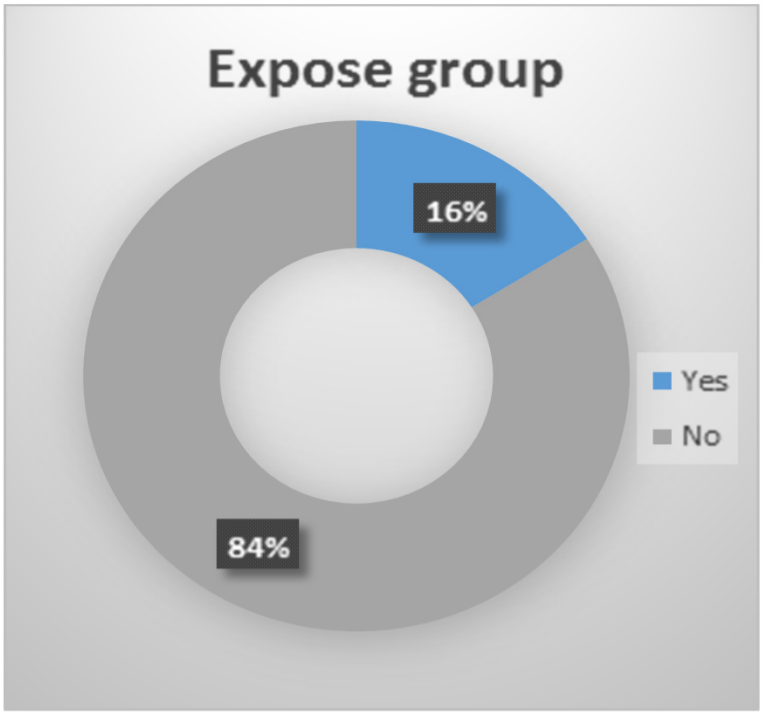




*Ae = 100 %*

*100 % diarrhea is attributable to exposure of E-waste.*

# Heart diseases

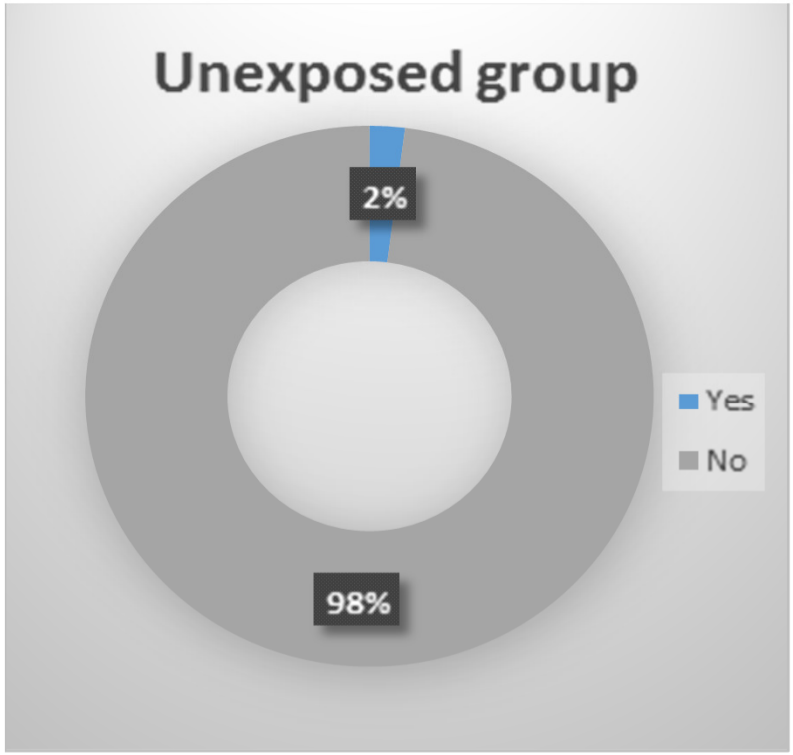


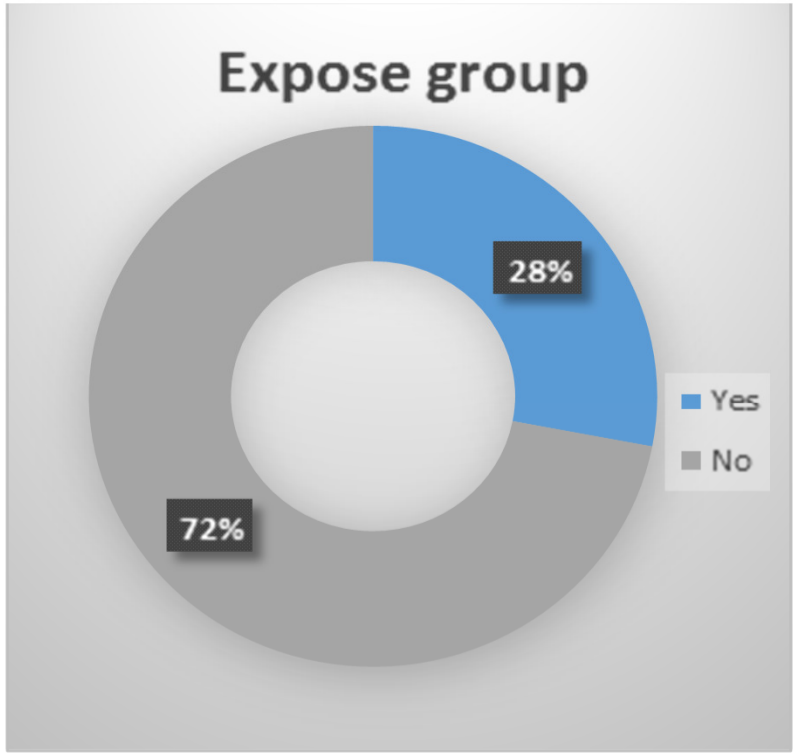




*Ae = 69 %*

*69 % of heart diseases is attributable to exposure.*

# Liver diseases

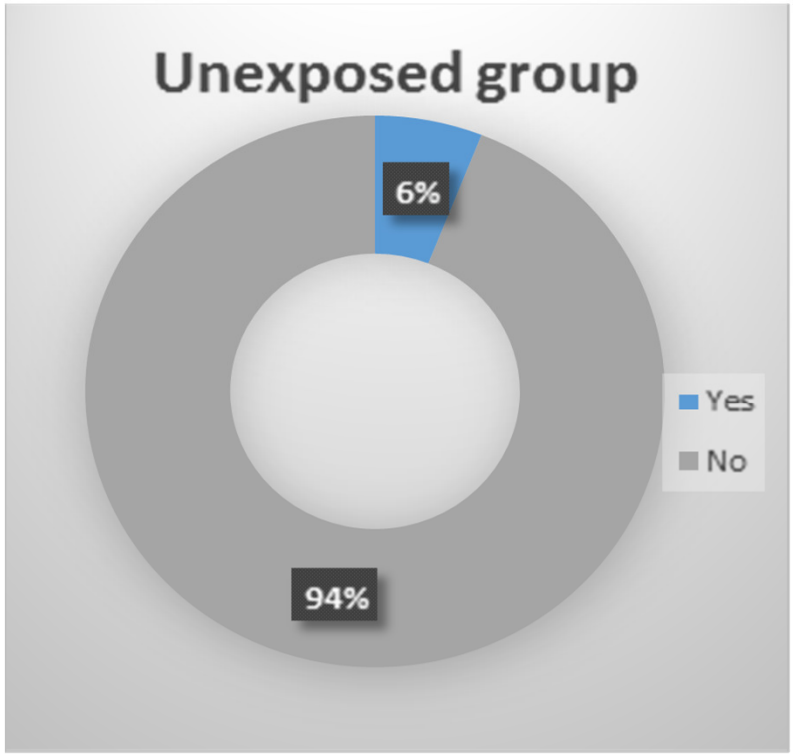


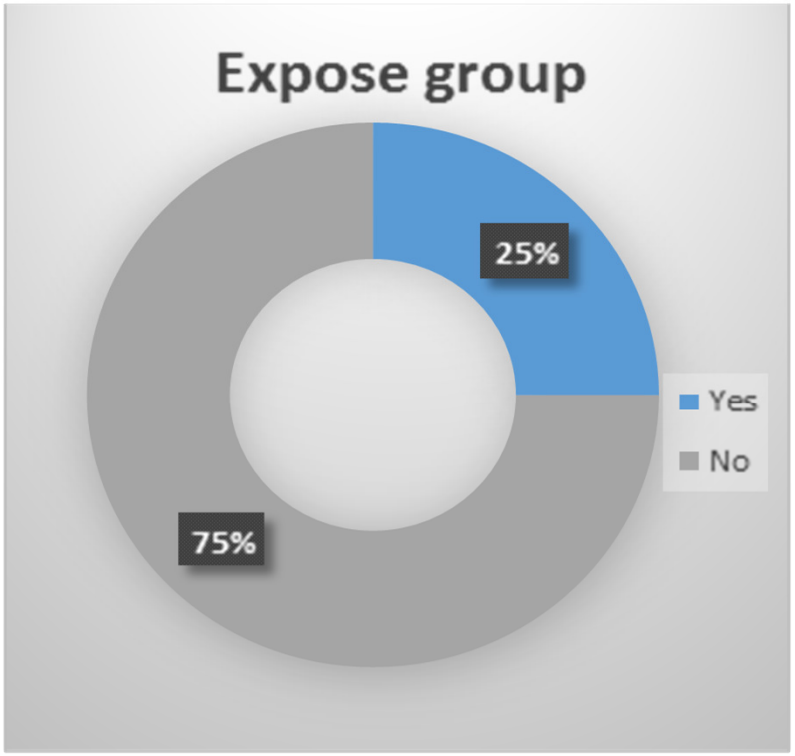




*Ae = 93 %*

*93 % of liver diseases are attributable to exposure.*

# Kidney infections

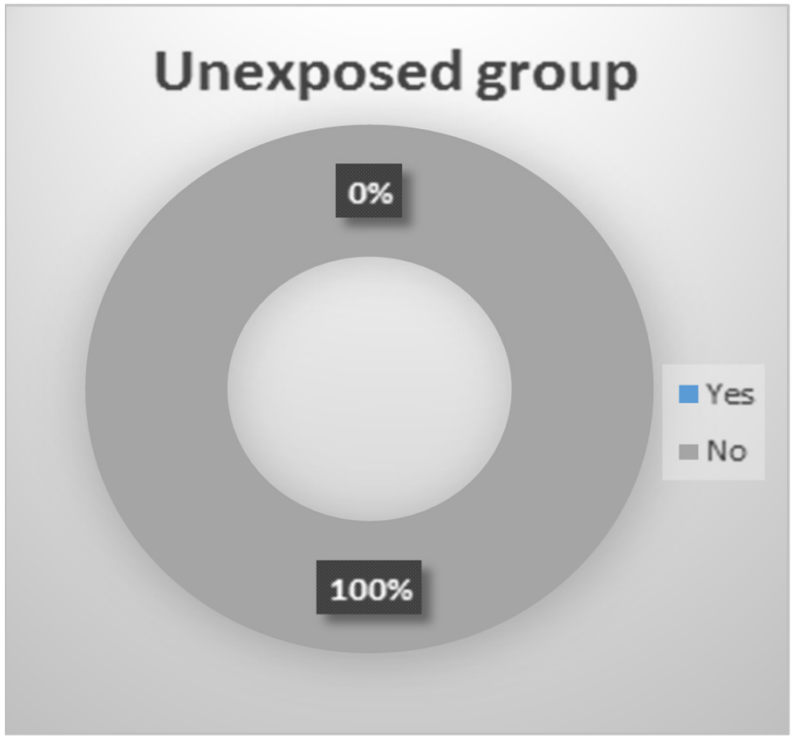


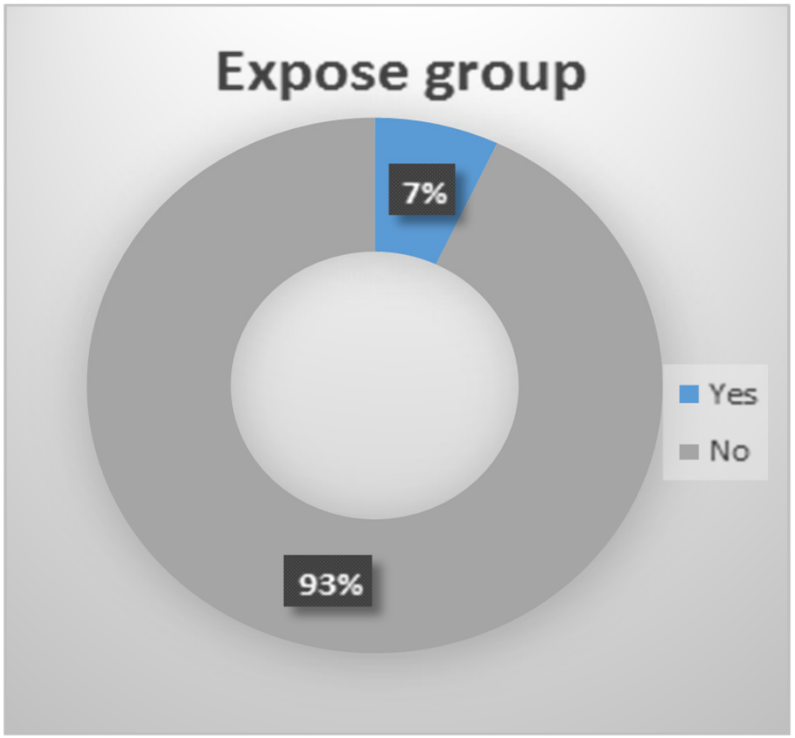




*Ae = 76 %*

*76 % of risk of kidney diseases is attributable to exposure.*

# Lung infection

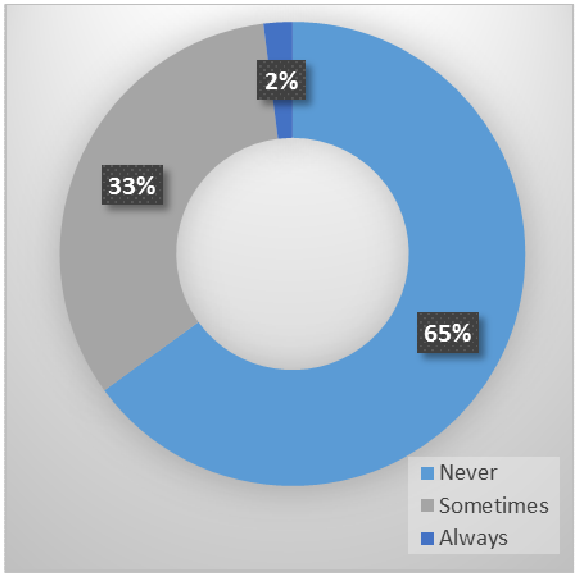


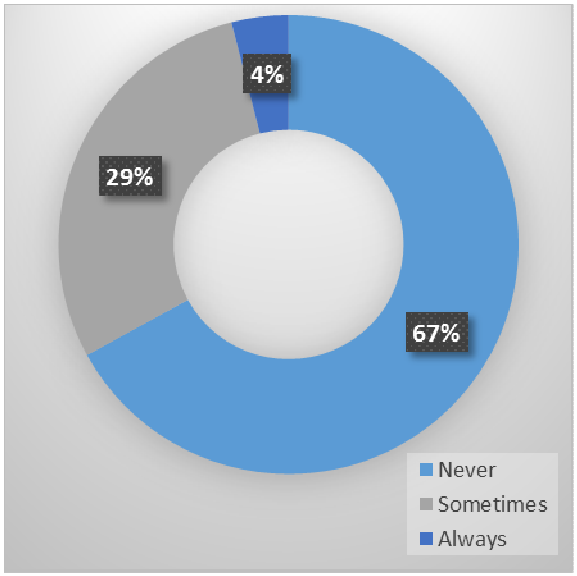



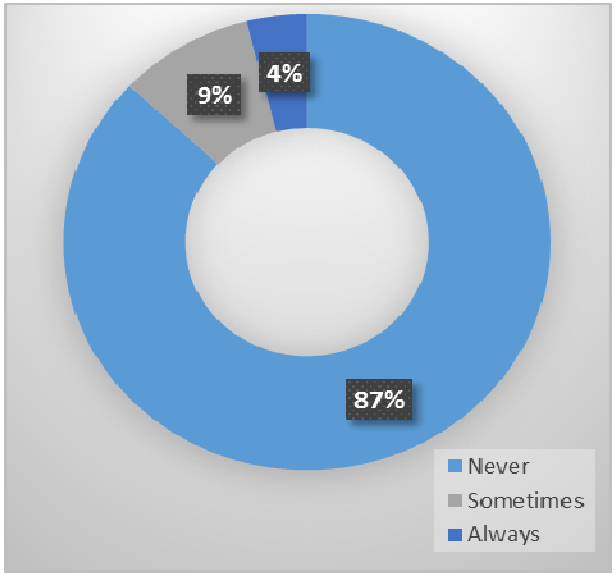

*Ae = 100 %*

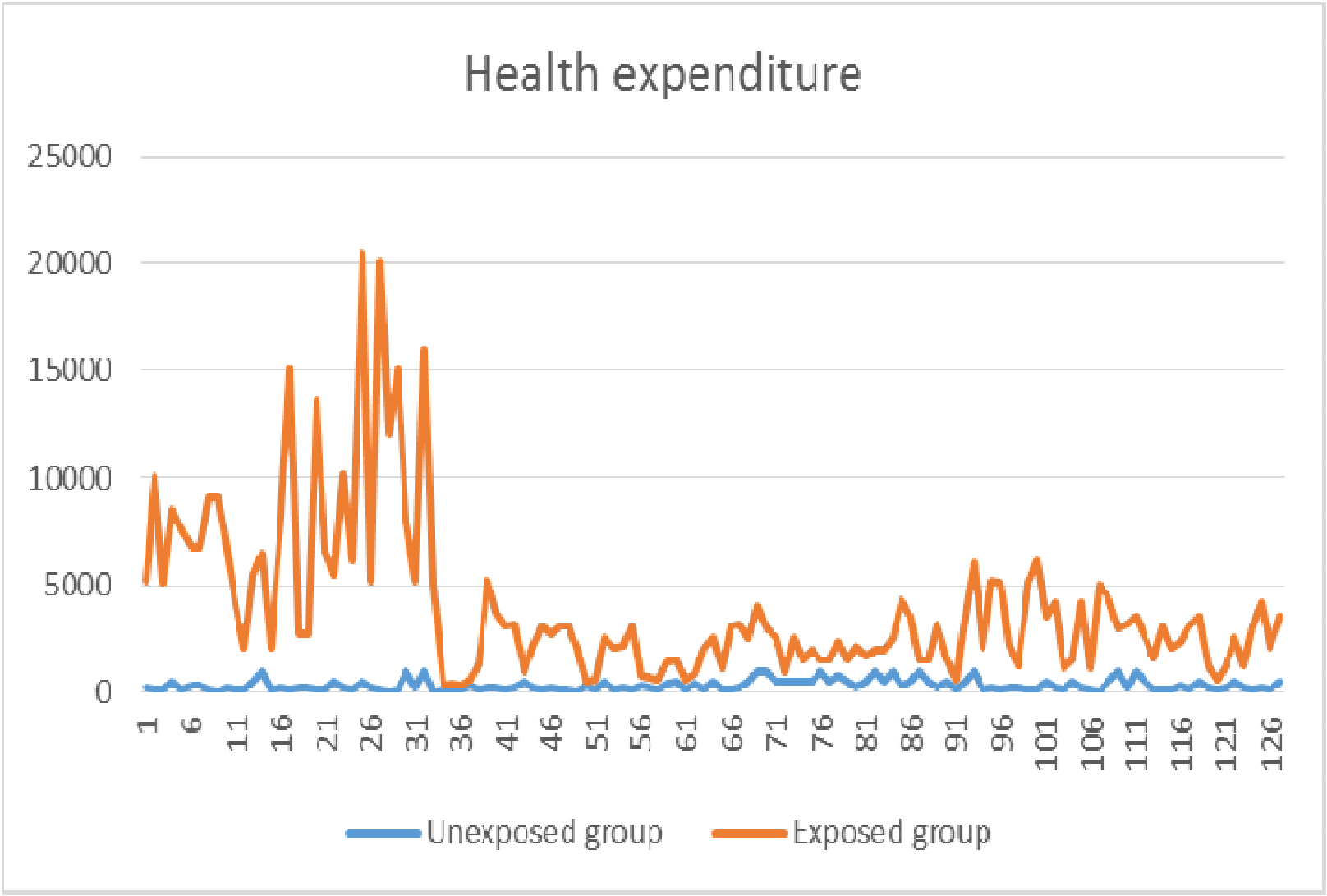
*100 % lung infections are attributable to exposure.*

# Gloves, Face mask & overall suits




Health expenditure
25000
20000
15000
10000
5000
0
1
6
11
16
21
26
31
36
41
46
51
56
61
66
71
76
81
86
91
96
101
106
111
116
121
126
Unexposed group
Exposed group

# Environmental Impacts

# Non-Market goods Valuation method
# Hedonic Price (focus on price response)

Environmental quality reflected in market prices (e.g., housing prices)

(Lancaster, 1966; Rosen, 1974; Steenland & Armstrong, 2006).

# Estimation method

- $P = f(H)$
- $P_i = f$ (L, S, N)
- $lnP = \beta_0 + \Sigma \beta_i L + \Sigma \beta_i S + \Sigma \beta_i N + \varepsilon_i$
- $lnP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_{18} X_{18} + \varepsilon_i$

***where***

- $\beta = \partial P / \partial H$

Source: Joseph, M. K. (2010). university of nairobi department of real estate and construction managemnt school of built environment real estate valuation based on hedonic price model Case study of Residential Housing in Nairobi.

Linear regression

| | |
|---|---|
| Number of obs | = 124 |
| F( 19, 104) | = 19.32 |
| Prob > F | = 0.0000 |
| R-squared | = 0.6875 |
| Root MSE | = .41015 |

| p1 | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| dist | .0750721 | .0351857 | 2.13 | 0.035 | .0052976 | .1448466 |
| rooms | .2195357 | .0589559 | 3.72 | 0.000 | .1026239 | .3364475 |
| bath | -.0209974 | .0781597 | -0.27 | 0.789 | -.1759911 | .1339962 |
| FA | 7.84e-06 | .0003807 | 0.02 | 0.984 | -.0007471 | .0007628 |
| BGL | -.0586185 | .0945728 | -0.62 | 0.537 | -.24616 | .1289229 |
| BS | .2033445 | .090876 | 2.24 | 0.027 | .023134 | .383555 |
| FL | .256448 | .1201146 | 2.14 | 0.035 | .0182562 | .4946397 |
| SQ | .2167021 | .1077978 | 2.01 | 0.047 | .0029351 | .4304691 |
| age | .0015195 | .0041146 | 0.37 | 0.713 | -.00664 | .009679 |
| IR | 8.27e-07 | 2.45e-07 | 3.38 | 0.001 | 3.41e-07 | 1.31e-06 |
| sch | -.0216718 | .0214053 | -1.01 | 0.314 | -.0641194 | .0207758 |
| hosp | -.0078619 | .0324941 | -0.24 | 0.809 | -.0722988 | .056575 |
| POW | .1293654 | .0897473 | 1.44 | 0.152 | -.0486069 | .3073376 |
| CRm | -.044964 | .0890056 | -0.51 | 0.615 | -.2214654 | .1315375 |
| TAPm | .1430212 | .0847674 | 1.69 | 0.095 | -.0250758 | .3111183 |
| shop | .0439073 | .0197437 | 2.22 | 0.028 | .0047549 | .0830598 |
| forest | 0 | (omitted) | | | | |
| EGW | 0 | (omitted) | | | | |
| envqua | .1023657 | .0956003 | 1.07 | 0.287 | -.0872134 | .2919447 |
| SW | -.1558334 | .0813741 | -1.92 | 0.058 | -.3172013 | .0055345 |
| DS | .1263349 | .0799871 | 1.58 | 0.117 | -.0322825 | .2849522 |
| _cons | -.2528502 | .1956099 | -1.29 | 0.199 | -.6407519 | .1350516 |

## Hedonic regression result

- $lnP = -.2528 + \beta_1.0750 + \beta_2.2195 - \beta_3.02099 +$

  $\beta_4 7.84 - \beta_5.0586 + \beta_6 0.2033 + \beta_7.25644 +$

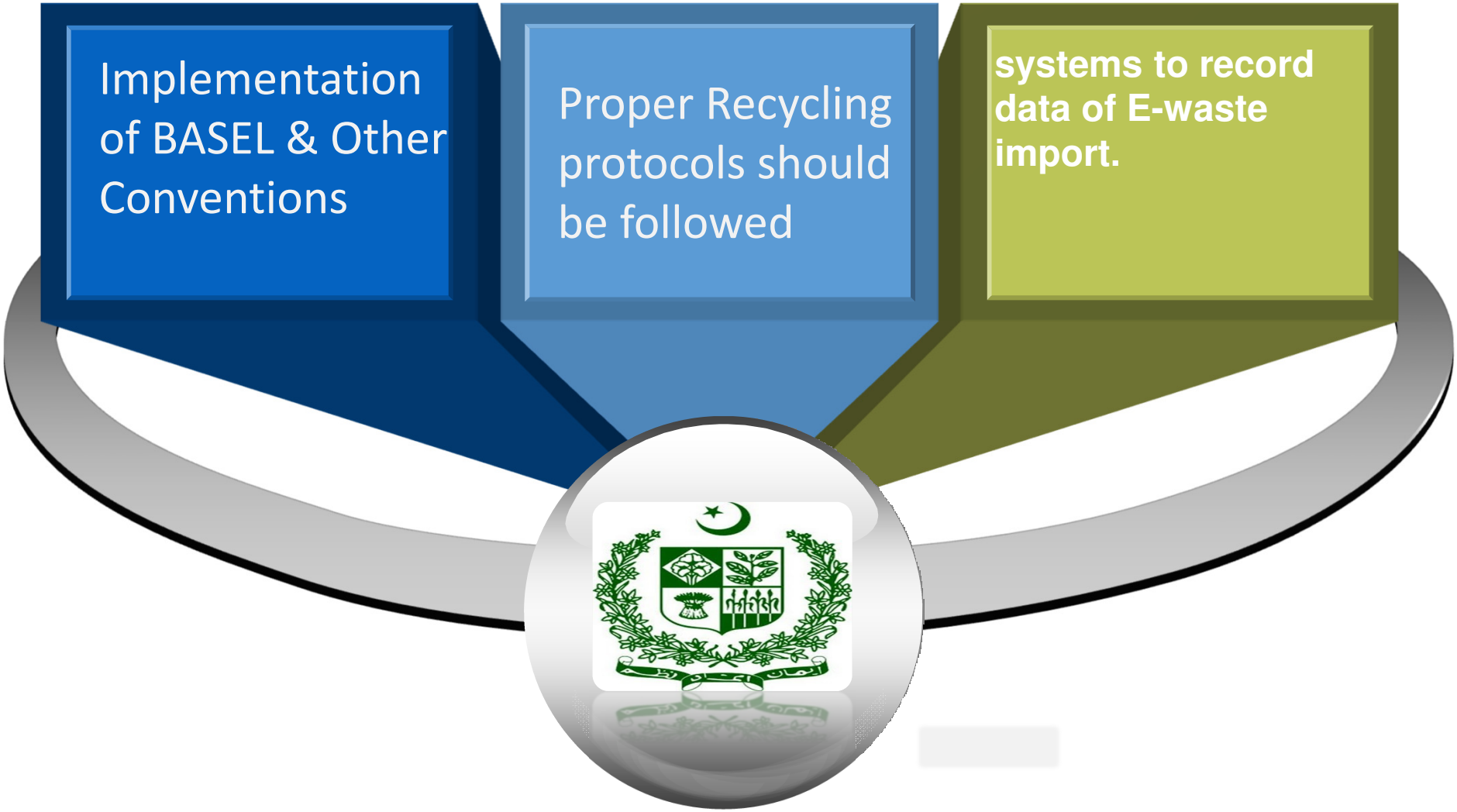
  $\beta_8.2167 + \beta_9 .0015 + \beta_{10} 8027 - \beta_{11}.0216 -$

  $\beta_{12}.0078 + \beta_{13}.1293 - \beta_{14}.04496 + \beta_{15}.04390 +$

  $\beta_{16}.10236 - \beta_{17}.1558\, \beta_{18}.12633 + \varepsilon_i$

  ***R-square = 0.6875***

# Suggestions and Recommendations for Government



# CONCLUSION

- *This Potential Threat of E-waste must be attended quickly, before it escalates to an unpreventable threat.*

- *Because management of E waste is costly, it is essential to educate and promote research in this matter.*

- Our estimation of attributable risk clearly showed that workers, working in E-waste are having more disease risk as compared to the controlled group.

- *Hedonic pricing reveled that e-waste recycling has significant impact on environment.*

- Overall E-waste cause hazardous possessions, which can be intensified throughout a person's lifetime and across generations

# Future research

- **More quantitative research is needed to Address this issue**
- **Quantitatively project and estimate the flows of E-waste worldwide**


…This is Our Only Home.



A Green

# THANK YOU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