Telemedicine's Utility in Reducing Carbon Footprint of Healthcare in Ecologically Fragile Hilly Region of Nepal

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Introduction & Background:

Eastern Sub-Himalayan Region of Nepal:

- Complex Climatic & Physiographic terrain that make it Ecologically More Fragile
- Providing Healthcare Services in this region is Challenging:

"Double Burden":

1. Difficult Geography
2. Understaffed Public Health Facility with Constrained Resources

"Triple Whammy":

1) High Cost of Travel for Consultation & Diagnostic Care
2) Transferred Expenses for Patients & their families
3) Dilemma of "Saving lives" vs "Saving livelihood"

Telemedicine Service Provided by B.P.Koirala Institute of Health Sciences (BPKIHS), a University Teaching Hospital in Nepal seems most appropriate for the delivery of Healthcare in this Region

Introduction & Background

Carbon Footprint; Carbon Dioxide Equivalent (CO_2e)

- Risk Multiplier & Affects Health Through Interdependent Pathways

Expressed as Carbon Dioxide Equivalent (CO_2e):

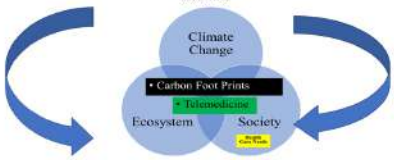
- Total Green-House Gas (GHG) Emissions Released into the Atmosphere as a result of the Human Activities

Aims & Objectives:

- To Explore the Adjunctive Utility of Telemedicine in Reducing Carbon Footprint of Healthcare in Ecologically Fragile Sub-Himalayan Region of Nepal

Study Design: Exploratory & Socio-Ecological Study Design

- Relationships between Natural Systems & Human Activities



- Environmental Impacts Operating at Multiple Levels & Time Scales

Methodology

Setting

- **Sites Availing Telemedicine Services**

- **eHealth & Telemedicine Center at B.P. Koirala Institute of Health Sciences (BPKIHS) Dharan**

Methodology

- Patients Availing the Telemedicine Service from our Sites
- **Study Period:**
  - January 2021- to December 2022
- **Estimated Distance:**
  - They would have travelled to visit our hospital Physically
- **Calculating the Distance Travelled:**
  - Google Maps with the option "Fastest Route"
- **Estimating Carbon Dioxide Equivalent (CO_2e):**
- **(Environmental Protection Agency (EPA) Emission Calculator)**
  - Transportation Carbon Emissions:
    - Multiplying the amount of fuel consumed by the Emission Factor of the Fuel type
    - Emission Factor =Amount of (CO_2) released per unit of fuel burned

Public Transport in Nepal:

- Buses

Type of Fuel Used:

- Diesel

Mileage:

- 3 Km /Liter;25-30 Liter/100Km

CO_2 Emission/ Liter of Diesel:

- 2.6Kg

Conclusions:

Telemedicine Service helps in **Conserving Trees ("Lungs of the World")**, has a **High Adjunctive Utility** in **Reducing Carbon Foot Prints of Healthcare, in Ecologically Fragile Hilly Region of Nepal** & protects the communities from **"Health Impacts of Climate Change"**

Results — Utility of Telemedicine in Reducing Carbon Footprint of Healthcare

Telemedicine Centers& Number of Patients Availing Services	Distance	Two-way Distance Travelled by each Patient if they had to Seek Health Care Physically	Average fuel (Diesel) Consumption (3 Km/Liter)	Carbon Emissions of the Transport (2.6 Kg of CO_2/liter)	Reduction in Carbon Emission due to Avoidance of Transport	Estimated Reduction in Carbon Footprint (CO_2e) of Telemedicine Services	Total Estimated Reduction in Carbon Footprint (CO_2e) of Telemedicine Services from number of patients from each center
PHC Dandabazar Dhankuta (212)	30 Kms	60 Kms	19 Liters	2.6X 20= 52 Kg of Carbon per travel	52Kg of Carbon per travel	52Kg of Carbon per travel x 212	212X 52=11024 Kg of Carbon
PHC Pyauli Bhojpur (24)	118 Kms	236Kms	79 Liters	2.6 X79= 205 Kg of Carbon per travel	205 Kg of Carbon per travel	205 Kg of Carbon per travel x 24	24 X 205 =4868 Kg of Carbon
Phakkal Hospital, Ilam (101)	143 Kms	284Kms	94 Liters	2.6X 94= 244 Kg of Carbon per travel	244 Kg of Carbon per travel	244 Kg of Carbon per travel x 101	101X 244=24,644 Kg of Carbon

Total Number of Patients Availing Telemedicine Services: 337

Reduction in Carbon Footprint (CO_2e) of Healthcare by Delivery of Telemedicine Service 40,516 Kg of Carbon (40 tons)

Results: Passenger Kilometers Saved by Delivery of Telemedicine

{Total Passengers (TPC)X Total Distance Covered (TDC}

Primary Health Care Center Dandabazar Dhankuta (212 x60= 12720 Km)

Primary Health Care Center Phakkal Hospital, Ilam (101x284=28,684Km)

Pyauli Primary Health Care Center Bhojpur (24 x236=5664Km)

Total Passenger Kilometers Saved by Delivery of Telemedicine: 47,0682 Km

Results:

- **Number of Patients availing Telemedicine Service:337**
- **Average Distance From Our Referral Center:100 KM**
- **Passenger Kilometers Saved by Delivery of Telemedicine:47,0682 Km**
- **Reduction in Carbon Footprint (CO_2e) of Healthcare by Delivery of Telemedicine Service 40,516 Kg of Carbon (40 tons)**

Results: Utility of Telemedicine in Reducing Carbon Footprint of Healthcare in Ecologically Fragile Sub-Himalayan Region of Nepal

- Equivalence of 1200 Mature Trees Saved
- Could have Absorbed 180,000 kg of CO_2
- 4500,000 liters of Rainfall in One year

Discussions

A Mature Tree

- Absorbs up to 150 kg of CO_2 Annually
- Offset 25 -30 kg CO_2 Annually
- Absorb up to 3700 liters of Rainfall Annually

Numbers of Mature Tree Needs to be Saved To offset one ton of CO_2 Annually :30

Discussions

- Telemedicine Service in Nepal:
  - High Value, Low Cost Intervention
  - Reduces Carbon Foot Prints of Healthcare in Ecologically Fragile Hilly Region of Nepal
    - Directly by Decreasing Transport-Associated Carbon Emissions
    - Indirectly by Speeding up Carbon Sequestration by Conserving Trees

- 52% Internet Penetration Rate
- 96% Households Access to a Mobile Phone
- 25% Population having no Access to Roads
- 55% Universal Health Service Coverage Index

References:

1. **Patel KB,** Gonzalez BD, Turner K, et al JAMA Netw Open. 2022;6(1)
2. **Heyworth** L,et al NEJM Catal. 2020;1(4)
3. **Purohit A, et al** Future Healthc J. 2021;8(1)
4. **Severin Rodler**, European Urology Focus, Volume 9, Issue 6,2023,Pages 873-887,
5. **Savoldelli, A**.; Landi, D.;Rizzi, et al Sustainability 2024, 16, 2438.
6. **Rajesh Rai**, Basant Pant, et al; Mani 2018 REDD Implementation Centre, Ministry of Forests and Environment, Government of Nepal
7. **Bal Ram Bhatta ;** ICIMOD Workshop Series Report of Seminar on Himalayan Community Forestry 1992
8. **Gupta PP**, et al J Family Med Prim Care. 2021 Dec;10(12):4531-4535.