How to Provide Affordable Hemodialysis in the Developing World

DR. JOHN BALL
International Society for Hemodialysis

WHAT WE DO:

Provide renal care access to patients in the developing world.
Re-build and warehouse Fresenius H’s for distribution to designated projects.
Repair equipment and install water systems as necessary.
Educate and support physicians, nurses, technicians, engineers and dieticians.
Provide supplies for at least 1/2 year of dialysis.
Assess needs and evaluate programs.

MEDICAL MISSIONS: BY THE NUMBERS

35 medical missions in 17 countries.
Provided 224 hemodialysis machines and replaced 1000 machines in existing units
Trained 17 doctors, 87 nurses, 111 technicians, and 16 biomechanics in hemodialysis.
1,200 patients on dialysis.
128,000 dialysis treatments.
PROBLEMS WE ENCOUNTERED

- Difficulty funding treatment cost in countries without government financial support.
- Inadequate maintenance resulting in a decreased number of functional machines.
- Lack of close follow-up in early projects to target and address problems and specific needs.
- Financial and logistical difficulty with customs clearance.
- Issues with electrical currents - power outages that damage machinery.
- Payment for maintenance and salaries is always a struggle.
Two thirds of the world has ACCESS TO DIALYSIS and the other third does not. One HALF of the world’s population lives in ASIA. The most common cause of death in dialysis patients worldwide is POVERTY. When the money runs out, they stop receiving treatments.

GLOBAL KIDNEY HEALTH CARE STATUS – QUESTIONNAIRE 2017

- Africa: 94% had Hemodialysis available but only 45% had PD available and 35% had some transplant
- Public Funding for some part of the treatment cost was available in only 42% of LMIC. Almost all had a mixture of public and “pay as you go” funding
- Renal Registries of disease burden in only 7%
- Only 18% of LMICs had CKD clinics. Only 20% had Pathology available

Assessment of Global Kidney Health Care Status: JAMA 2017; 317(18)1864-81

REALITIES OF THE DEVELOPING WORLD

- Hemodialysis is more expensive than in the developed world and only available in large cities.
- Only 5% of dialysis treatments are peritoneal.
- Patients lack electricity, clean water, trained nurses, and biomechanics.
- Hospitals are filled with broken machinery and disorder.
- There is no planning on a national level.
- There is no Kidney Foundation to advocate for patient needs.
With the exceptions of Iran and Cuba, countries with a median income lower than $7000 a year are unlikely to have governmental support of dialysis.

A recent article about the public hospital dialysis unit in the Tamil Nadu state of India, said that 65% of patients did not follow up with their treatments after only six months.

Not following up with dialysis treatment is essentially a death sentence.

In 2005, an estimated 269 million people were living in poverty in this region.
India

60 percent of patients seeking dialysis are turned away.

170,000 new potential dialysis patients appear yearly.

By 2030, India will have more cases of diabetes and diabetic nephropathy than any other country in the world.

Jha, Vivendra. RENAL FAILURE – Chapter 26 pg. 201-204
NEPAL PROGRESS

- Changes since 2010
- Then – 99 machines    Now 499 machines
- Then - 500 on HD        Now 2900 on HD
- Then - 50 Transplants Now 790 transplants

- Annual Cost of treatment $2300 per treatment
- Government is covering the cost of dialysis at $45 per treatment

- Geography still a major problem
- 50% of centers are located within the Capital city Katmandu


THE PEOPLE’S REPUBLIC OF CHINA

The estimated percentage of individuals who need dialysis treatment and receive it is about 50% inland and 70% on the coast.

Chinese herbal remedies may be contaminated with toxic weeds (birthwort) containing aristolochic acid. This causes interstitial scarring related renal failure. One Chinese nephrologist estimated 15 million cases of this complication. (one tenth of 1%)
TAIWAN

Taiwan has the highest national incidence of renal failure, but no one is quite sure why. Some possible explanations include:

- Herbal poisoning
- Lead poisoning from dinner plates and silverware
- Poor genetics

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The Philippines

150 private office small units averaging 2 patients per shift

150 times 2 patients per shift = 300 patients per private dialysis center

Only 5 units available for the public uninsured

PhilHealth insurance

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Table 1: Renal replacement therapy for ESRD in South East Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>CAPD</th>
<th>Hemodialysis</th>
<th>Transplantation</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Cost/1000</td>
<td>Initial cost</td>
<td>Cost/1000</td>
</tr>
<tr>
<td>Brunei</td>
<td>52</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Cambodia</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Indonesia</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Laos</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Malaysia</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Myanmar</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Philippines</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Singapore</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Thailand</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
<tr>
<td>Vietnam</td>
<td>51</td>
<td>18,800</td>
<td>255</td>
</tr>
</tbody>
</table>

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Visith Sitprija, Nephrology in Southeast Asia, Fact and Concept.
Areas close to the Mediterranean are the most dialyzed.

Very little dialysis between the Sub-Sahara and Johannesburg.

No facilities available for an estimated 160 million people.

Virtually no peritoneal dialysis.

No kidney foundations.

Racial screening and poverty are big problems.

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DIALYSIS SERVICES IN LIBYA

- 40 dialysis units serving 2417 patients
- Almost all centers in Northern part of the country 85% within sight of the Mediterranean Sea
- Median income $14,000
- Government payment for treatment so number of patients is double of neighbors
- Good results—equal to European areas with equal number of nephrologists as Europe per population

Hemodialysis International 2011, WA Alashke

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<table>
<thead>
<tr>
<th>Country</th>
<th>Dialysis population</th>
<th>Patients</th>
<th>Median</th>
<th>Population</th>
<th>Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Africa</td>
<td>234</td>
<td>75</td>
<td>40</td>
<td>137</td>
<td>HD</td>
</tr>
<tr>
<td>Mauritania</td>
<td>500</td>
<td>7</td>
<td>10</td>
<td>1.5</td>
<td>HD</td>
</tr>
<tr>
<td>Niger</td>
<td>250</td>
<td>27</td>
<td>40</td>
<td>120</td>
<td>HD</td>
</tr>
<tr>
<td>Kenya</td>
<td>150</td>
<td>10</td>
<td>20</td>
<td>120</td>
<td>HD</td>
</tr>
<tr>
<td>Uganda</td>
<td>100</td>
<td>5</td>
<td>35</td>
<td>135</td>
<td>HD</td>
</tr>
<tr>
<td>Ghana</td>
<td>50</td>
<td>10</td>
<td>40</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Cameroon</td>
<td>30</td>
<td>5</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Benin</td>
<td>30</td>
<td>5</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Senegal</td>
<td>25</td>
<td>5</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Mali</td>
<td>15</td>
<td>4</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Burkina</td>
<td>10</td>
<td>5</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
<tr>
<td>Nigeria</td>
<td>5</td>
<td>2</td>
<td>30</td>
<td>130</td>
<td>HD</td>
</tr>
</tbody>
</table>
NIGERIA

Most dialysis units are in the southern part of the country - close to the capital city of Abuja. Treatments cost $160 in a country where the median income is $7750 per year.

The government does not provide financial assistance for dialysis. Only 13% of patients achieve KT/V dialysis adequacy. Femoral catheters are common. Mortality rates are high. More men than women are dialyzed.

JAMAICA

In a large screening, 22% had GFR less than 60
Estimates are that only 60% receive dialysis if needed
Due to the high cost of dialysis, 40% of dialysis patients only receive 2 sessions weekly of HD
Cause of CKD: Hypertension 65%, Diabetes 28%
Stroke a common cause of death

RATIO OF NEPHROLOGISTS TO PATIENTS

- India: 1 : 2,400,000
- Nigeria: 1 : 1,000,000
- South Africa: 1 : 1,200,000
- Kenya: 1 : 330,000
- United States: 1 : 50,000

COST OF TREATMENT

In the US, the cost of hemodialysis treatment for one patient for one year is $28,000.

If a similar treatment could be provided for the reduced cost of $3,000-4,000 per year for one patient, the number of people who could receive dialysis worldwide would double.
Costs in the developing world are higher for disposables such as dialyzers, tubing, cleaning supplies, and concentrates. There are no bulk pricing deals in the developing world.

Disposables are imported.

**THE BANGLADESH MODEL**
- Reutilization of dialyzers and tubing with either paracetamol or citric acid.
- Reuse dialysis needles 6 times.
- Mix your own baths of bicarb and acid.
- Once a month erythropoetin 8000 units sq.
- Oral vitamin d and oral iron as needed.
- Calcium binder.
- Twice a week dialysis on a cot-bed for 6 hours per session.

Dialysis Unit of Bangladesh, Kidney Foundation

**SRI LANKA PUBLIC HOSPITAL DIALYSIS UNITS**
- Hemodialysis sessions cost $56 but 70% is the cost of consumables.
- Yearly cost 3 sessions a week - $8800.
- 2 sessions a week - $5800.
- In one unit doing reutilization of dialyzers costs were 33% less.

THE LACK OF ARTICLES ON METHODS OF DIALYSIS COST CUTTING

There is virtually no research available to show effective methods of cost cutting.

The last real impetus for this was in the 1980s.

Who gains if the costs continue to increase?

Who loses if affordable dialysis for the developing world is created?

HOW TO START DIALYSIS WITHIN A LMIC

• Initially, a small Portable Hemodialysis unit in the Capital City
• 1 year later, Expand that unit to 20 stations with a substantial Water system. Implement Reuse
• Develop Management Team and supply Logistics to make it truly cost effective
• When kinks in system corrected, and the unit is running smoothly, Expand with small satellite units using trained staff from the initial unit
• Lastly, Begin Peritoneal Dialysis at those centers and expand to rural areas

CONCLUSIONS

Hemodialysis is the key to providing renal programs in a developing country.

Transplant programs, peritoneal dialysis programs, and education will follow after hemodialysis awareness is raised.

Programs for transferring machinery from the developed world to the developing world are taking shape.
SOLUTIONS

ISHD needs to take an active role in formulating plans for the Ministers of Health in developing countries.

We need to negotiate with provider companies for better prices and cost-effective treatment.

We need to form Kidney Foundations with political wings to advocate for the middle class.

OUR APPROACH

Partner-centric.
Serving indigent patients.
Refurbished equipment.
Comprehensive training.
Follow-up/support.
Empower partners for success.

DaVita has committed to the Bridge of Life program and provides incredible resources to back up the program. As a Fortune 500 Company, it has a lot on the line.

Small projects were funded initially, but as the program gains momentum, large numbers of machines and reliable support will become available to areas of need.
CURRENT PROJECTS

Mexico - opened a new clinic in a public hospital - sourced equipment within the country.

Tanzania/Kenya - established new clinics.

Guatemala - opened a new pediatric dialysis unit screening.

South Africa - replaced dialysis machinery for the Nelson Mandela Hospital.

Jamaica - created a new fistula surgery mission.

DaVita’s Bridge of Life

info@bridgeoflifemm.org

Phone: 1-888-374-8185

How to Provide Affordable Hemodialysis and Peritoneal Dialysis
In India and Pakistan, Hemodialysis is done for $30 to $45 per treatment. In the developing world this makes the treatment available to a large part of the middle class.

**HARD COSTS**

- RO water system initial installation and maintenance.
- Dialyzers.
- Tubing.
- Needles.
- Acid Concentrate.
- Machine maintenance.
- Heparin.

**DIALYZER REPROCESSING:**
A practice that has withstood the test of time and scientific scrutiny.
Table I: In vivo urea clearances (ml/min - Q<sub>B</sub>: 200).

<table>
<thead>
<tr>
<th></th>
<th>First Use</th>
<th>Third reuse</th>
<th>Sixth reuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLF</td>
<td>143±2</td>
<td>137±4 (-4%)</td>
<td>136±6 (-5%)</td>
</tr>
<tr>
<td>Disscap</td>
<td>133±18</td>
<td>140±13 (+5%)</td>
<td>141±14 (+6%)</td>
</tr>
<tr>
<td>Tecni</td>
<td>133±20</td>
<td>134±16 (+1%)</td>
<td>122±16 (-8%)</td>
</tr>
<tr>
<td>Asahi</td>
<td>117±12</td>
<td>104±13 (-12%)</td>
<td>91±12** (-28%)</td>
</tr>
</tbody>
</table>

* P <0.05 vs. first use
** P<0.01 vs. first use

Table V: Average Monday predialysis biochemical values (covering a six-month period).

<table>
<thead>
<tr>
<th></th>
<th>Hematocrit</th>
<th>Urea</th>
<th>Creatinine</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>mg/dL</td>
<td>mg%/</td>
<td>mg%/</td>
</tr>
<tr>
<td>Before reuse</td>
<td>27±1</td>
<td>1.76 ± 0.33</td>
<td>11.74 ± 0.54</td>
<td>5.06 ± 0.32</td>
</tr>
<tr>
<td>During reuse</td>
<td>26±1</td>
<td>1.78 ± 0.42</td>
<td>12.48 ± 0.43</td>
<td>5.35 ± 0.41</td>
</tr>
</tbody>
</table>

HOW TO REUSE DIALYZERS

1) Prime the dialyzer – remove the air out of extracorporeal circuit using saline.

2) Give heparin to the patient before use of dialyzer- systemic heparinization.

3) Correct maintenance heparin dose programming on the dialysis delivery system for the amount and the time.

DIALYZERS BEST SUITED FOR REUSE

- Baxter CT109
- AM Bio 90
- Gambro 1.6 (adequate)

You may also consider only using one type of dialyzer per unit, and simply making the patient stay for longer, slower treatments.
Primary reasons for the non-acceptance of patients for renal replacement therapy.
With reuse, no errors are tolerable the system must be set up and
double checked for mistakes.


THE PERSON YOU HIRE FOR REUSE CLEANING
MUST BE PAID WELL

COST OF DIALYZER $20

100 REUSES = SAVINGS OF $2000 PER PATIENT

FOR 100 PATIENTS = $200,000 SAVINGS
COSTS OF DIALYSIS IN MEXICO
INSURED SOCIAL SECURITY SYSTEM

<table>
<thead>
<tr>
<th>Hemodialysis</th>
<th>Peritoneal Dialysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual $32,260</td>
<td>Annual $8,228</td>
</tr>
<tr>
<td>5 Years $156,300</td>
<td>5 Years $41,140</td>
</tr>
</tbody>
</table>

Instituto Mexico Social Seguridad (Reportage - 2012)

Cost of production for PD bag is $1.25.
Average cost in Mexico is $4, which is mainly transportation and profit, management fees.
In the Mexican system, no money is allocated to training.

HOW TO MINIMIZE HEMODIALYSIS SET-UP COSTS

- ReBuilt Machines (1/4 the cost – 3/4 the life span)
- Simple Portable RO’s with Carbon Tanks
- Cots and screens not expensive chairs
- Simple Plumbing
- Enough Space for supplies bought in bulk yearly
Only 20% of the population lives near Asuncion.
80% live in distant ranches and farms.
Transportation is difficult.
An ideal solution: peritoneal dialysis with nurses who travel to the outlying areas.
Central organization to monitor patients.

PD IN PARAGUAY

PD doesn’t exist in Paraguay, because the government charges 30% taxes on the importation of PD bags from Brazil.

| Table 4 |
|---|---|
| Career Development and Continuing Medical Education (CME) on Dialysis |
| Profession and activity | PD | HD |
| Physicians (board-certified in internal medicine) | ✓ | ✓ |
| 2-Year fellowship program | NA | ✓ |
| Registered nurses | | |
| Certification by NKF and RNAT | NA | ✓ (2005) |
| 4-Month intensive course in dialysis | 1 | >100 |
| Training institution(s) | 1 | 1 |
| Courses during the last 10 years (n) | >10 | >10 |
| Attendees (n) | 24 | >1000 |
| CME or workshop (2-day meeting) for physicians and nurses | | |
| Course (n) | 1/year | 1–2/year |
| Attendees (n, all courses combined) | 1500 | 5000 |

PD = peritoneal dialysis; HD = hemodialysis; NA = not available; NKF = Nephrology Society of Thailand; RNAT = Renal Nurse Association of Thailand.
A REASONABLE NATIONAL PLAN FOR A DEVELOPING COUNTRY

- Use Peritoneal Dialysis as the starting form of dialysis for all non-private patients
- Hemodialysis is the backup
- Aim for a 3 to 1 ratio of Peritoneal to Hemodialysis patients
- Spend money on Peritoneal Dialysis Training and promotion, meetings
- Keep payments for hemodialysis to less than $75 per treatment (take away profit incentive)
- PD supplies must be produced in country, locally

HOW COMPANIES HINDER INEXPENSIVE DIALYSIS

Provide expensive treatments with maintenance contracts
Sell the highest price machinery and dialyzers.

Never suggest PD, because it is less profitable.

Lobbyists influence the ministers to use only new machinery and single use dialyzers. (of course made by them)

Pre-determined legislation, which eliminates inexpensive dialysis for the poor

<table>
<thead>
<tr>
<th>Dialysis type</th>
<th>Professional fee (US$/patient/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nephrologists</td>
</tr>
<tr>
<td></td>
<td>Government</td>
</tr>
<tr>
<td>PD</td>
<td>Free</td>
</tr>
<tr>
<td>HD</td>
<td>Free</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THE NEED FOR KIDNEY FOUNDATIONS

No one speaks up for the patients if a kidney foundation doesn’t exist.

No one goes to the politicians and says “you need to provide dialysis to the middle class.”

No one gives the Minister of Health a detailed plan that he can follow to provide care at a reasonable cost.

The tragedy is that most of the countries which desperately need a kidney foundation don’t have one.

WHAT THE FUTURE COULD BE...

Kidney Foundations in Europe receive all the used machinery from Fresenius Europe and Gambro Sweden and rebuild it for use in the developing world.

The Bridge of Life and other similar programs and companies do the same in the USA.

5000 machines get transferred yearly.

Large Foundations (Gates, WHO) commit to help.

The International Society of Nephrology (ISN) actively increases the training of nephrologists in developing countries.

Trainees are sent to the nearest country with sufficient resources to train. All developed countries pull their share with the help of funds from the ISN.

How to do Inexpensive Hemodialysis in the Developing World

John T. Ball MD
Medical Director DaVita’s Kidney Trust- Bridge of Life
Treasurer, International Society for Hemodialysis
What parts make up a 
Hemodialysis

- Water System
- Hemodialysis Machine
- Blood Pump
- Proportioning system of Concentrate and 
  Dialysate
- Dialyzer
- Tubing

What are the components of Hemodialysis 
and how can we save money on each one?

- Water System- On an RhO system the 
  filter panels can be removed, scrubbed 
  and reused. With other types of more 
  complicated water systems, carbon filters, 
  and electrostatic plate mineral removal 
  systems need yearly maintenance and 
  filter screen replacement at intervals. It is 
  possible that these can be cleaned and 
  reused but you would have to check with 
  the manufacturer.
Costs

- RO water system initial and maintenance
- Dialyzers
- Tubing
- Needles
- Acid Concentrate
- Machine maintenance
- Heparin

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Buy Used Hemodialysis Machines instead of new!

Cost of new machine $22,000
Cost of Used Machine $4000
Internet Buying and trading of used Machinery in South America

- A lot of machinery is available used and normally we scout the internet for deals, bargains and the pieces we need.
- YOU should do the same
- We stockpile pieces we’ll need in the future
- YOU should do the same.

<table>
<thead>
<tr>
<th>ESRD Prevalence in 2004 (Data from Fresenius Medical Care™ 2005)</th>
<th>against gross national income per capita in purchasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>$100</td>
<td>$1,000</td>
</tr>
<tr>
<td>$10</td>
<td>$100</td>
</tr>
</tbody>
</table>

Population ~2.8 billion

Wealth Growth

5-10% p.a.

Reuse of Dialyzers

- Prime the Dialyzer – Get no air in the extracorporeal circuit and prime the air out with saline
- Give Heparin to the patient before use of dialyzer- systemic heparinization
- Correct maintenance heparin dose programming on the dialysis delivery system for the amount and the time.
Which dialyzers clean up best for reuse

- Baxter CT109
- AM Bio 90
- Gambro 1.6 not quite as good but adequate
- You may consider only using one type of dialyzer per unit, and simply making the Patient stay for longer slower treatments.
Checking for HIV, Hepatitis B and Hepatitis C only need be done once yearly. Patients will not convert unless there are errors in your sterile technique.

Labs checked only every 2 months.

Erythropoetin “knockoffs” can be purchased at much less cost.

Vit D is inexpensive and can be given IV.

Citrate can be used instead of heparin which is expensive as an anticoagulant.
Summary

• Hemodialysis is how to start dialysis in developing world country
• “Tricks” can be used to cut the cost but supplies are expensive and difficult to get
• Proper Understanding of the fixed cost of dialysis are necessary to undertake it

Headers of Dialyzers

• If you remove them to clean the dialyzer, the Rubber O ring needs to be taken out and dipped in sterilant. Care must be taken to get all the blood out of the connector and it must be scrubbed
• You may want to use only dialyzers that do not need the headers taken off to clean.
The filters in the sink

• The capped dialyzers are placed in the sink and rinsed with Hydrogen Peroxide and then water. Both compartments done separately. Finally the sterilant is placed in the dialyzer. If the caps are removed to clean the dialyzer, the rubber O rings which keep the cap tight need to be dipped completely in sterilant. Otherwise the blood against the O ring becomes a culture media.

The Cabinet

• Each filled with sterilant dialyzer is placed in an individual mail slot and clearly marked. We use tape on the outside of the filter and check it twice. We also mark the number of reuses. Many Latino patients have similar names so develop a fool-proof system for your unit.
• In preparation for the next treatment, rinse the sterilant from the dialyzer and fill with saline. Make sure you have rinsed double the volume of the sterilant with saline, such that you are absolutely sure, there is no sterilant remaining.

With Reuse, No errors are tolerable
The system must be set up with Double checking to make sure there are no mistakes. Precise, Organized, Error-proof
Blood Splatter and Hepatitis Infection

- There is always blood splatter from the needles and the occasional blood leak.
- The distance between patients and the nearest chair needs to be 8 feet.
- In the Hepatitis Room, the machine counter tops, the floor, the walls are culture positive for Hepatitis B; therefore, any Hepatitis B positive patient needs to be isolated in a separate room.
- For HIV and Hepatitis C only regular 8 foot precautions are necessary, but take extra care with the blood lines and dialyzers.

Reuse continued

Drip chambers both arterial and venous ¾ full.

Post treatment recirculation with injecting the remainder of the maintenance heparin into the circuit.

Not draining the dialysate and blood compartments when taking the set-up down.
Acid Concentrate

- Can be batch mixed with ultrapure water
- You can make your own—certain machines are more forgiving than others.
- Bicarbonate which is wonderful for the patients needs two containers to mix
- Lactate may be the ideal concentrate in the future—we are experimenting with it
Heparin Dosage

- To keep Dialyzers from clotting we use High Doses of Heparin, both in the patient and in the dialysis circuit
- Giving the patient a Heparin bolus and allowing the heparin to circulate in his bloodstream before hooking the dialyzer in for 2-3 minutes is key
- We use 2000 units to start then 1500 units every hour on dialysis
- After the treatment is done and the patient is taken off the machine, but with blood tinged saline still in the tubing, we add heparin 2000 units and circulate the heparinized saline through the dialyzer again so there is no clotting of the dialyzer. Then we take it off and put it in the refrigerator until cleaning time.
The person you hire for Reuse Cleaning must be paid well
Cost of dialyzer $20 US
100 reuses = savings of $2000 per patient
For 100 patients = $200,000 savings
The incidence of renal failure in poor countries has a direct correlation with the national investment in dialysis.

Visith Sitprija, Nephrology in Southeast Asia, Fact and Concept.

Poverty is the most formidable barrier to renal care access in the developing world.
RRT IN NEPAL

- 29 million population, $470 average income, 90% rural
- New cases of ESRD per year 2600
- 97 dialysis machines treating 490 patients
- 40 patients on PD
- 12 nephrologists

Hemodialysis International Oct 2010, P. Hirashan, J Bajil