PEDIATRIC ACUTE CARE IN EAST AFRICA

Goals / Objectives

- Review health statistics in East Africa
- Review common health problems in East Africa
- Review lessons learned in a rural Kenyan hospital 2011-2012

Who am I?

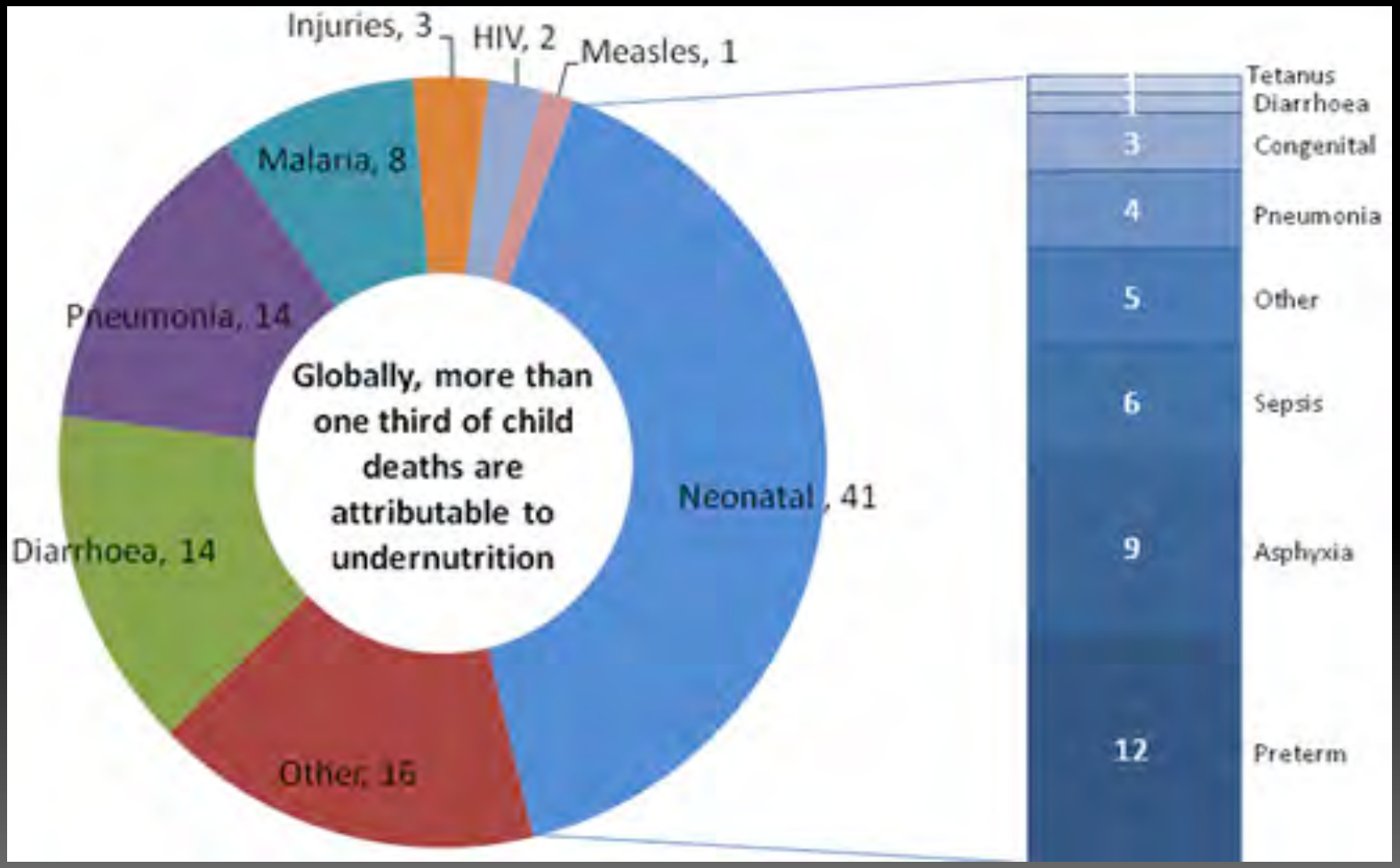
East African Healthcare

Pediatric Mortality Snapshot

	Neonatal (per 1000)	Infant (per 1000)	Under-5 (per 1000)
USA	4	7	8
Kenya	28	55	85
Uganda	26	63	99
Sudan	35	66	103
Ethiopia	35	68	106
Somalia	52	108	180
DRC	UNK		

www.unicef.org

Under-5 causes of death in East Africa



Healthcare Provision

	1 Doctor per…	1 Surgeon per… **WHO recommends 1/3500*
USA	416	2272
Kenya	7142	40,000
Uganda	8333	66,670
Sudan	3571	Unk
Ethiopia	5000	500,000
Somalia	28,571	Unk
DRC	9090	Unk

Source: WHO

Kenyan Healthcare

- 2 National Referral Centres
  - Kenyatta Hospital (1800 beds)
  - Moi Hospital (800 beds)
- Provincial & District hospitals
- Christian mission hospitals
  - Tenwek Hospital
  - Kijabe Hospital
- NHIF plus pay-as-you-go

Kijabe Hospital


MADEIRA ISL.
CANARY ISL.
MOROCCO
WESTERN SAHARA
ALGERIA
TUNISIA
MEDITERRANEAN SEA
LIBYA
EGYPT
RED SEA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
ERITREA
DJIBOUTI
SENEGAL
GAMBIA
GUINEA-BISSAU
GUINEA
BURKINA FASO
BENIN
NIGERIA
ETHIOPIA
SIERRA LEONE
COTE D'IVORE
GHANA
LIBERIA
TOGO
CNTRL. AFRICAN REP.
CAMEROON
EQUATORIAL GUINEA
SAO TOME & PRINCIPE
GABON
CONGO
UGANDA
KENYA
SOMALIA
DEMOCRATIC REPUBLIC OF CONGO
RWANDA
BURUNDI
SEYCHELLES
TANZANIA
ZANZIBAR
COMORES ISL.
ANGOLA
MALAWI
ZAMBIA
ZIMBABWE
MADAGASCAR
NAMIBIA
BOTSWANA
MOZAMBIQUE
REUNION
SWAZILAND
SOUTH AFRICA
LESOTHO
ATLANTIC OCEAN
INDIAN OCEAN
Lodwar
Moyale
Marsabit
Wajir
Eldoret
Meru
Nakuru
Garissa
NAIROBI
Machakos
Kijabe
Lamu
Malindi
Mombasa

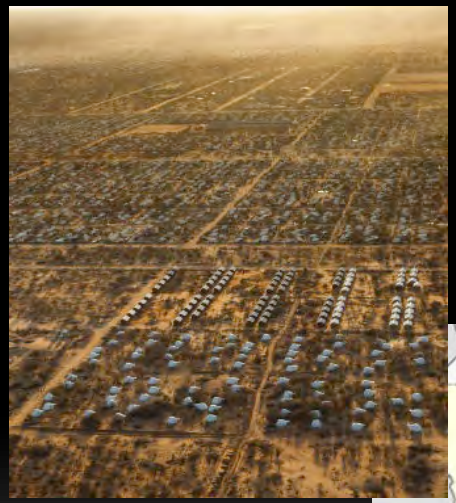

A.T.C. KIJABE HOSPITAL
NO PARKING

Kijabe Hospital

- Non-profit mission hospital
  - 6 bed ED / 25 bed OPD
  - 265 inpatient beds
- Adult medicine
  - Family medicine training program to start
  - HIV/AIDS care and TB
- Surgery - gen, orthopedic, ENT, ophth
  - 10,000 surgeries/ yr
  - General surgery training program
- East Africa's only nurse anesthesia program

- Obstetrics / Gynecology
  - 2000 deliveries / year
- Pediatric medicine, surgery, neurosurgery
  - Maternal child health clinic
  - 70 inpatient beds – medical / surgical
  - 20 nursery beds – NICU/SCBU
  - Pediatric surgical training
  - Pediatric neurosurgical training

- Mobile medical teams to refugee camps
  - Dadaab
    - 500,000 refugees
    - No specialty care
  - Kakuma
    - 100,000 refugees
- Nursing school
- Medical school support to the Horn of Africa



Staffing

- 600 staff
- 12-15 Kenyan attendings
- 12-15 volunteer attendings
- 3 general surgery residents
- 2 pediatric surgery residents
- 1 pediatric neurosurgical fellow
- 10 medical interns
- 10 clinical officer (PA) interns
- 10 clinical officers

Acute Care Statistics

- 110,000 OPD visits per year
- Statistics not broken down
  - Emergency department
  - General sick visits
  - Specialty clinics
    - New referrals and followup

Lessons learned:
Kijabe Hospital 2011-2012

Lesson 1:
- Unnecessary delays
- No triage

Delays in care

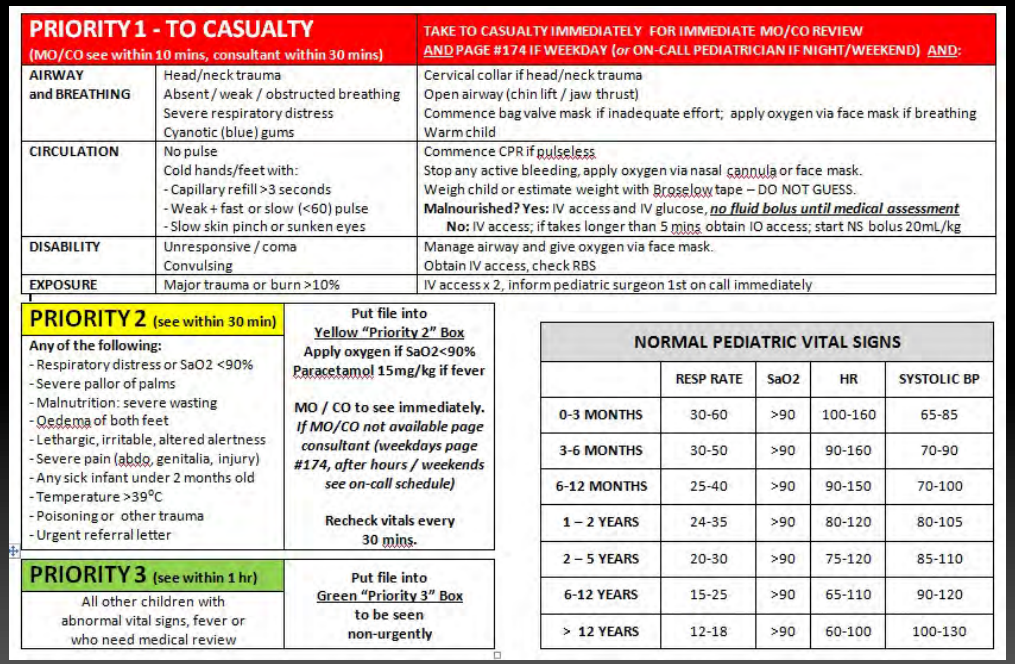
- OPD run on "first come first served" basis
- Flow of patients:
  - Registration – pay for file
  - Await file
  - Wait to see nurse for obs

- Nurse administer vaccines, if "sick visit" sent to pay for visit
- Wait for cashier
- No triage system
  - If nurse thinks critical, sent to ED while family gets file
- Wait to see doctor

Wait time & triage study

- Data on children coming to Maternal Child Health clinic collected for 2 weeks
- Data included
  - Arrival time
  - Time received file / registered
  - Time vitals done
  - Time seen by doctor
  - Age, weight, vital signs

- Retrospective triage category applied



PRIORITY 1 - TO CASUALTY (MO/CO see within 10 mins, consultant within 30 mins)		TAKE TO CASUALTY IMMEDIATELY FOR IMMEDIATE MO/CO REVIEW AND PAGE #174 IF WEEKDAY (*or* ON-CALL PEDIATRICIAN IF NIGHT/WEEKEND) AND:
AIRWAY and BREATHING	Head/neck trauma Absent / weak / obstructed breathing Severe respiratory distress Cyanotic (blue) gums	Cervical collar if head/neck trauma Open airway (chin lift / jaw thrust) Commence bag valve mask if inadequate effort; apply oxygen via face mask if breathing Warm child
CIRCULATION	No pulse Cold hands/feet with: - Capillary refill >3 seconds - Weak + fast or slow (<60) pulse - Slow skin pinch or sunken eyes	Commence CPR if pulseless Stop any active bleeding, apply oxygen via nasal cannula or face mask. Weigh child or estimate weight with Broselow tape – DO NOT GUESS. **Malnourished? Yes:** IV access and IV glucose, ***no fluid bolus until medical assessment*** **No:** IV access; if takes longer than 5 mins obtain IO access; start NS bolus 20mL/kg
DISABILITY	Unresponsive / coma Convulsing	Manage airway and give oxygen via face mask. Obtain IV access, check RBS
EXPOSURE	Major trauma or burn >10%	IV access x 2, inform pediatric surgeon 1st on call immediately

PRIORITY 2 (see within 30 min)	Put file into Yellow "Priority 2" Box Apply oxygen if SaO2<90% Paracetamol 15mg/kg if fever MO / CO to see immediately. *If MO/CO not available page consultant (weekdays page #174, after hours / weekends see on-call schedule)* Recheck vitals every 30 mins.
Any of the following: - Respiratory distress or SaO2 <90% - Severe pallor of palms - Malnutrition: severe wasting - Oedema of both feet - Lethargic, irritable, altered alertness - Severe pain (abdo, genitalia, injury) - Any sick infant under 2 months old - Temperature >39°C - Poisoning or other trauma - Urgent referral letter	

PRIORITY 3 (see within 1 hr)	Put file into Green "Priority 3" Box to be seen non-urgently
All other children with abnormal vital signs, fever or who need medical review	

NORMAL PEDIATRIC VITAL SIGNS

	RESP RATE	SaO2	HR	SYSTOLIC BP
0-3 MONTHS	30-60	>90	100-160	65-85
3-6 MONTHS	30-50	>90	90-160	70-90
6-12 MONTHS	25-40	>90	90-150	70-100
1 – 2 YEARS	24-35	>90	80-120	80-105
2 – 5 YEARS	20-30	>90	75-120	85-110
6-12 YEARS	15-25	>90	65-110	90-120
> 12 YEARS	12-18	>90	60-100	100-130

Results

- Data collected on 182 children
  - **PRIORITY 1** 3
  - **PRIORITY 2** 24
  - **PRIORITY 3** 135
  - *NURSING ONLY* (immunization, etc) 13
  - Unable to categorise 7

	P1	P2	P3	N
MINUTES WAITING FOR FILE	0h 20m *(10m-30m)*	0h 41m *(20m – 1h 45m)*	0h 20m *(5m – 2h 5m)*	0h 30m
MINUTES BETWEEN FILE AND VITALS	0h 13m	0h 19m	0h 18m	0h 16m
MINUTES SPENT IN VITALS	0h 8m	0h 21m	0h 21m	N/A
MINUTES BETWEEN VITALS AND DOCTOR SEEN	0h 26m *(5min – 70min)*	1h 55m *(40m – 2h 30m)*	1h 34m *(10m – 3h 5m)*	N/A
TOTAL MINUTES BETWEEN ARRIVAL AND DOCTOR SEEN	**1h 8m** *(20min – 2h 15m)*	**2h 54m** *(50min – 4h 30m)*	**2h 49m** *(20min – 5h 50m)*	N/A

A closer look

- **PRIORITY 1**
  - 3 children – all sent straight to casualty after vitals
- **PRIORITY 2**
  - 1 child - to casualty immediately after triage
  - 1 child – triage nurse found doctor for immediate assessment in MCH
  - 22 children – charts put in "first come, first served" pile
    - Tachycardia
    - SaO_2 <90%
    - Severe wasting
    - Sick under 2 months of age

Changes instituted

- Now: Triage of pediatric patients
  - **PRIORITY 1** straight to casualty
    #174 resus pager for all P1
  - PRIORITY 2 now a separate box into which P2 files are put – patients are seen first, doctor called if not present.
  - **PRIORITY 3** first come, first served

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Flow improvements

- Splitting of children at the door:
  - Immunisations and followups register and wait for file first, then to MCH for triage
  - "Sick" visits straight to triage
    - parents to pay for and retrieve file once triaged if stable
    - Immediate assessment without file if P2 or higher

Lesson 2:
- no peds resus training

Kijabe Hospital 2010

- Weights estimated by eyeball for sick children in ED
  - No length-based weight estimate
  - Parents asked for approximate weight
  - Scales in clinic area of the department and requested only if deemed necessary & stable
- No weight-based organisation of equipment


EMERGENCY BOX
ET TUBE
OXYGEN PRONGS/MASKS
OXYGEN TUBINGS

- IV access attempted for up to 3 hours, with calls to other departments for difficult lines
  - IO needles not sourced, not taught
  - Children sent to OR for IV access if failed in ED
- No pediatric resusciation protocols
  - Adult protocols amended for peds, especially in trauma
- No regular training for nursing or CO staff in resuscitation
  - Patriarchal society

Changes instituted 2011-12

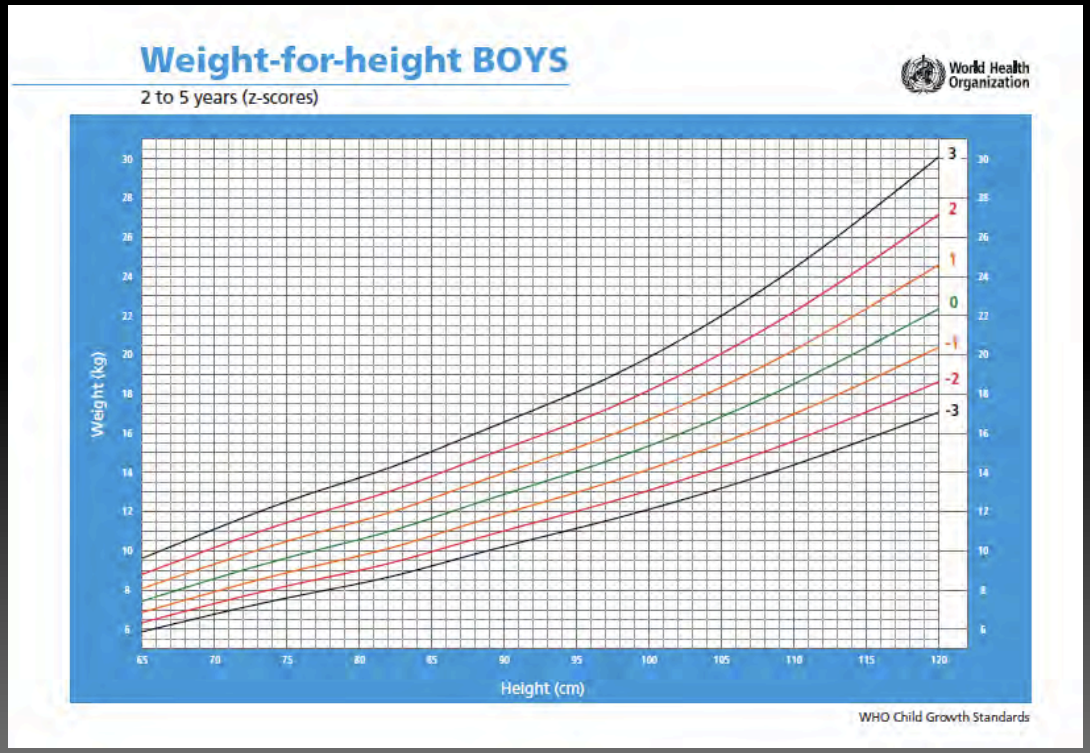
- Broselow tape for length-based weight estimate
- IO needles
  - Jamshidi needles sourced
  - Skills taught with 18G needles

- Restructure of crash cart with weight based organisation
  - Neonatal BVM removed from all areas of hospital except nursery
- Weekly mock codes with peds protocols for
  - ED staff
  - Pediatric ward staff
  - Nursery staff
- Mentoring and encouragement of nursing staff & physician extenders

Lesson 3:
Clinical challenges in resource-poor settings

Length based weight estimate

- Severe acute malnutrition in about 16% of children under 5



Fluid boluses

- Gold standard of resuscitation 10-20 mL/kg
- In severe acute malnutrition
  - may precipitate cardiogenic shock
  - sodium overload with normal saline
  - ½ strength Darrows solution given 15 ml/kg over 1 hour with further resus given slow IV or NG

- 2011 study of 3000 children in 3 African countries
  - Fever and shock
  - Malnutrition excluded
  - boluses ***increased*** mortality
  - 57% had malaria
    - ?cerebral edema or cardiogenic shock malaria-related contributors to mortality

- Maitland K, Kiguli S, Opoka RO, Engoru C, …, Levin M, Babiker AG, Gibb DM, FEAST Trial Group. Mortality after fluid bolus in African children with severe infection. N Engl J Med. 2011 Jun 30; 364 (26):2483-95

Late presentation

- 40% unemployment
- Average annual income $1400
- Money often spent on traditional healing before seeking modern medical assistance
- Late presentations with significant morbidity and mortality

Hypernatremic dehydration

- Babies under 2 weeks of age
- Breast feeding failure
- Weight loss 20-30%
- Present with:
  - Na >180 (often >200) 135-150
  - K > 7 3.5 - 5
  - Cr > 3 0.6-1.2
- Evidence-based treatment scant

- Textbooks recommend
  - Calculate FW deficit
    - ?accurate BW ?accurate length of symptoms
  - Treat shock, replace ½ over 8 hours, remainder over 16-48h
- Mortality >80%
  - Rapid fall in Na
  - Delays in realising as lab overloaded

- Kijabe protocol
  - Treat shock with 1-2 boluses NS 20mL/kg
  - Treat as per severe acute malnutrition
    - Combination of IVF / breast milk via NG at total fluid of 130 ml/kg/d
    - No calculation of FW deficit – unreliable
      - Na >180 D5NS
      - Na 165-180 1/3D10 2/3 NS
      - Na 150-165 1/2D10 1/2NS
    - Treat hyperkalemia
    - Monitor Na, K, Cr
      - Titrate Na in fluids to keep Na falling at <0.5 mmol/L/h
      - UOP, falling Cr and weight gain best indicators of success
  - Data collection underway, mortality likely <50%

Lesson 4:
Resource allocation and sustainability

Resource allocation

	Dollars spent (public and private) per capita per year
USA	8362
Kenya	37
Uganda	47
Sudan	84
Ethiopia	16
Somalia	unk
DRC	16

Resource allocation

- How many attending staff are necessary? Affordable?
- How can we retain doctors when trained?
- How can we best use physician extenders?
  - COs
  - KRNAs
- How can we continue to bring in resources
  - Human
  - Equipment

Resource allocation

- What is our goal?
  - Self-sustaining
  - Continued partnerships with resource-rich partners

Resource allocation: ICU

- 5 bed ICU
  - Admissions accepted based on likely mortality
  - 5 ventilators, 3 nurses
  - Billed at USD50/day (ward USD 5/day)
- Who should receive ICU care?

- Exclusions:
  - AIDS related severe illness
  - MSOF
  - ARDS
  - Prematurity with RDS >48 hours
- Withdrawal of care frequent
- Optimisation of pre- and post-ICU care

Cases:
Successes and failures

Ava

Ava

Michael

- Simon
  - Na 213
  - Cr 11.9
  - K 8.5
- 1 week in ICU and one on peds ward

Maria

Bundi

Challenges

- Poverty
  - Malnutrition underlying most illnesses
- Education
  - Brain drain
- Resource allocation
  - How do we pay to have health care systems in place?
  - Preventative health care vs. Tertiary healthcare

Challenges

- As one of the richest countries in the world, how can we contribute to global health?

Questions

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