

# Camera Phone Consults The Consult Service of the Future

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## Acknowledgements

- This work was primarily carried out by two of our residents, Adam Penstein MD and Jeffrey Ira Ellis MD with the generous support of our department chairman, Alan Shalita MD.

## Our Training Program

- Average of 1,500 inpatient consults per year at 5 hospitals spread over the borough of Brooklyn.

## Our Training Program

- All consults seen initially by residents.
- Attending Rounds daily.
- Urgent consultations discussed with an attending by phone.

## Do We Need Teledermatology?

- Enhance Attending supervision.
  - A telephone only discussion brings along the bias of the presenter.
  - Descriptions often include diagnosis specific jargon such as “violaceous flat topped papules” instead of more generic non-leading descriptors.

## Do We Need Teledermatology?

- Potential for improved patient care.
  - Non-urgent evaluations may be more focused with attending visual input.
  - Increase reliability over telephone discussion alone.

## Teledermatology is Reliable!

- Taylor P et al. Br J Dermatol. 2001 Feb;144(2):328-33. Evaluating a telemedicine system to assist in the management of dermatology referrals.
  - Diagnosis in agreement 77% of time (live vs. telederm)
  - Consultants using the system recommended fewer urgent appointments (32% compared with 64%)
  - Had the system been in use, 14% of patients conventionally assigned a non-urgent appointment would have been seen urgently.

## Do We Need Teledermatology?

- Residents get an opportunity to be exposed to teledermatology, which will be part of our practice in the near future.

## We might even get paid for it!

- AAD Policy Statement P-73.200 Telemedicine
    - Subsection on Reimbursement
  - Medicare reimburses for evaluation and management codes and consultation codes for office visits and consultations billed for patients located in non-metropolitan statistical areas (non-MSAs). This includes nearly all rural counties.
  - A definition and listing of qualified areas is available at [http://www.cms.hhs.gov/manuals/pm\\_trans/R1798B3.pdf](http://www.cms.hhs.gov/manuals/pm_trans/R1798B3.pdf). In some states, Medicaid reimburses as well, but many have restrictions. Private insurers vary in their policies, but most will reimburse services provided to patients in rural areas.
  - It is recommended that the provider write a letter of intent to the insurer informing them that the provider will be billing for telemedicine services. A model letter of intent can be found at <http://www.aadassociation.org>.
- <http://www.aad.org/professionals/policies/Policies.htm>

## Do We Need Teledermatology?

- Opportunity to research its utility for dermatology consultations and provide improved service.

- Scheinfeld N, Fisher M, Genis P, Long H Skinmed. 2003 May-Jun;2(3):159-62. Evaluating patient acceptance of a teledermatology link of an urban urgent-care dermatology clinic run by residents with board certified dermatologists.
  - Shortage of attending dermatology supervision.
  - Resident physicians took digital pictures of patients' lesions and downloaded the images onto a networked personal computer.
  - The images were stored on the hospital's server and then viewed within 5 minutes by an attending dermatologist
  - Resident and attending physicians discussed the cases over the telephone.
  - Patient acceptance of the teledermatology system was high (93%).

- Zelickson BD, Homan L. Arch Dermatol. 1997 Feb;133(2):171-4. Teledermatology in the nursing home.
  - Nursing home patients were evaluated both via tele-derm and a live visit.
  - When given only the HISTORY – diagnostic accuracy was 67%.
  - When given only the PHOTO – diagnostic accuracy was 85%.
  - With BOTH this history and the photo, diagnostic accuracy was 88%.
  - An appropriate treatment plan was achieved in 90% of consults.

- Aas IH. J Telemed Telecare. 2002;8(2):107-11. Learning in organizations working with telemedicine.

Table 1. Summary of the answers to three of the four qualitative questions (n=30)

	Yes		No		Don't know	
	n	%	n	%	n	%
Have you learnt anything new by using telemedicine?	25	83	5	17	0	0
Have you started to perform tasks yourself which you previously were seeking assistance for?	10	33	20	67	0	0
Could anything be done in telemedical work to promote your own learning?	20	67	9	30	1	3

**A nice series of articles and discussion on telederm with cell phones in the Archives is also supportive of the concept.**

- Arch Dermatol. 2005 Feb;141(2):254-8.
- Arch Dermatol. 2005 Nov;141(11):1470-1; author reply 1471-2.
- Arch Dermatol. 2005 Oct;141(10):1319-20.

# Why not standard “store and forward”

?

## Standard “Store and Forward” Disadvantages

- Not suitable for consultations throughout many hospitals.
  - Requires accessible computers in many locations to download images.
  - Requires internet connection for forwarding.
- Necessary equipment can be bulky.
  - Card readers – cables – etc.
  - Less of a concern than two years ago.

## Standard “Store and Forward” Disadvantages

- Can be complicated.
  - A bevy of residents.
  - A bevy of attendings.
  - A bevy of hospitals to interface with.
    - *"The number of lines of communications grow exponentially based on the number of people involved in a project."*  
- Bryce's Law

## Impediments to Store -Forward Teledermatology Implementation

- Desire of the attending to not be tied to a computer.
- Desire of the resident to not have to find a computer into which an image can be uploaded and emailed.
  - Hospitals are increasingly persnickety about people plugging in items not supplied by the hospital.

### *Potential role for Camera Phones*

- Ideal for consultation in many locations.
  - No wires or other connections needed.

### *Potential role for Camera Phones*

- Compact
  - Can replace another cell phone.
- Simple to use.
- No computers or internet connection needed.
  - No wires or other connections needed.

# Is a Cell Phone Camera Good Enough?

- Yamada M, Watarai H, Andou T, Sakai N. Neurosurgery. 2003 Apr;52(4):986-8. Emergency image transfer system through a mobile telephone in Japan: technical note. First reported application and usefulness of image transfer through a mobile telephone.
  - Brain CTs, MRIs, Angiograms from 100 emergency room patients.
  - Photographed, transmitted and analyzed using J-Phone SH07 mobile phone 110,000-pixel digital camera.
    - Useful for correct early diagnosis.



FIGURE 1. *A*, CT scan of a cerebellar hemorrhage being photographed by a mobile phone with a digital camera. *B*, mobile phone as combined with a 110,000-pixel digital camera used to transfer the CT scan. *C*, CT scan as received via a mobile phone with a thin-film transistor liquid crystal display, which can display up to 65,536 colors.

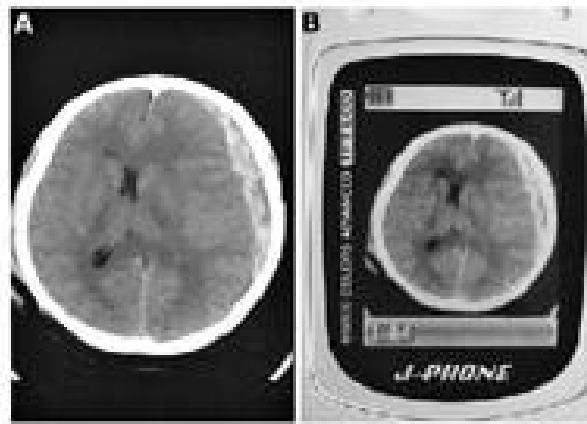


FIGURE 2. *A*, original CT scan of acute subdural hematoma. *B*, mobile phone-transmitted image.

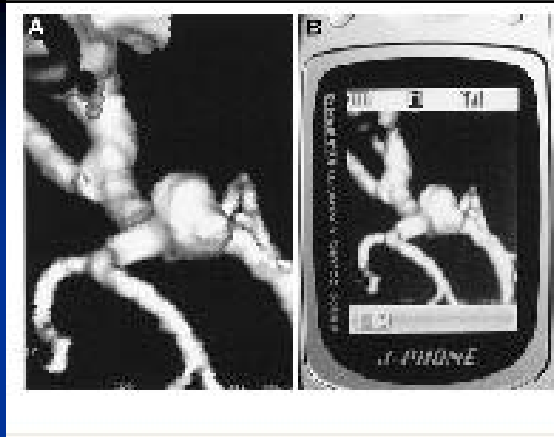


FIGURE 3. *A*, original three-dimensional computed tomographic angiogram of a cerebral aneurysm. *B*, mobile phone-transmitted image.

- Plast Reconstr Surg. 2004 Dec;114(7):1776-82.  
Teleconsultation with the mobile camera-phone in digital soft-tissue injury: a feasibility study. Hsieh CH, Tsai HH, Yin JW, Chen CY, Yang JC, Jeng SF.
  - 110,000-pixel camera phone
  - Evaluation and management of digital soft tissue injury
  - 45 patients with 81 digital injuries
  - Triage
    - I: Conservative management
    - II: Skin Grafting / Flap
    - II: Microsurgery
  - 80% agreement to actual treatment

- Ann Plast Surg. 2004 Dec;53(6):584-7.  
Teleconsultation by using the mobile camera phone for remote management of the extremity wound: a pilot study. Tsai HH, Pong YP, Liang CC, Lin PY, Hsieh CH.
  - 110,000-pixel camera phone
  - 82 wounds photographed
  - Surgeons graded wound as to presence of gangrene, necrosis, erythema, and cellulitis
  - Accuracy 80% gangrene, 76% necrosis, 66% erythema, and 74% cellulitis

# Tech Specs

- Vidmar DA, Cruess D, Hsieh P, Dolecek Q, Pak H, Gwynn M, Maggio K, Montemorano A, Powers J, Richards D, Sperling L, Wong H, Yeager J. *Telemed J.* 1999 Winter;5(4):375-83. The effect of decreasing digital image resolution on teledermatology diagnosis.
  - *Conclusion:* A 0.36 megapixel can be considered equivalent to a 1.5 megapixel for most store-and-forward teledermatology consultations.

- AAD Policy Statement P-73.200 Telemedicine
  - Subsection on Definition
- A consumer-grade digital camera with a minimum of 800 x 600 pixel (480,000) resolution is recommended.

<http://www.aad.org/professionals/policies/Policies.htm>

## Phone PM-8920



Phone: \$ 150  
Monthly: \$ 50



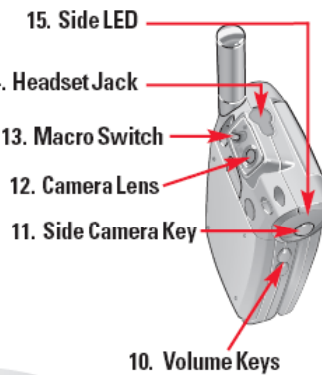
infosyncworld.com  
The PM-8920 is the first megapixel camera in the US

- **Settings** to enjoy various ways of taking pictures:
  - **Resolution** to select a file size (1280x960, 1024x768, 640x480, 320x240, or 160x120) for a picture.
  - **Quality** to select picture quality (**Fine, Normal, Economy**).

## Front View of Your Phone



- 19. Camera Flash
- 18. External Display
- 17. Status LED
- 16. Speaker



- 15. Side LED
- 14. Headset Jack
- 13. Macro Switch
- 12. Camera Lens
- 11. Side Camera Key
- 10. Volume Keys

## How we used them

- Camera Phones were provided to residents on in-patient consultation service.
- Patients were seen by residents and photographs were taken if the patient/family consented.

## How we used them

- For urgent consultations (when attendings not immediately available), photographs were transmitted to the covering dermatologist and cases discussed by telephone regarding appropriate management.
- All patients were seen in-person by an attending physician within 24 hours (as per hospital regulation).

# Quantification

## How Good Were We?

- 13 Consecutive cases were selected for evaluation. For each we had available:
  - History
  - Photographs
  - Definitive diagnosis

## How Good Were We?

- 9 Attendings / 14 Residents.
- Looked at projected images captured by the cellphones.
- First Without then with history.
- Asked to record up to 3 differential diagnoses in each circumstance.

Some  
Examples:

Age: 30y/o M  
Distribution: b/l hands, and b/l knees  
Asymptomatic Outpatient Visit  
Stable over past 3 months

Photo 86%  
Photo + History 86%

Case 1

Vitiligo



Case 2

46 year old woman admitted for fever and cough developed this generalized pruritic rash over the past 2 days.

Photo 92%  
Photo + History 96%

Acute Generalized Exanthematous Pustulosis



**Case  
3**

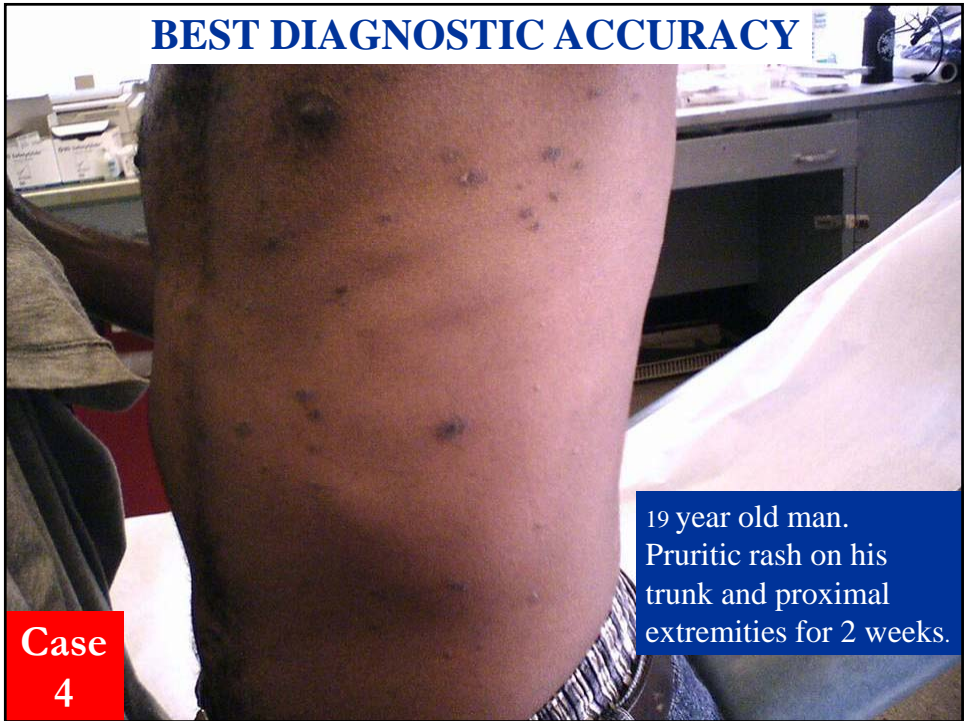


The right shoulder/ clavicle – looking down at this 8 year old boy with congenital HIV. Admitted for respiratory distress developed this painful rash on his trunk and extremities over the past 2 days.

**Toxic Epidermal Necrolysis**

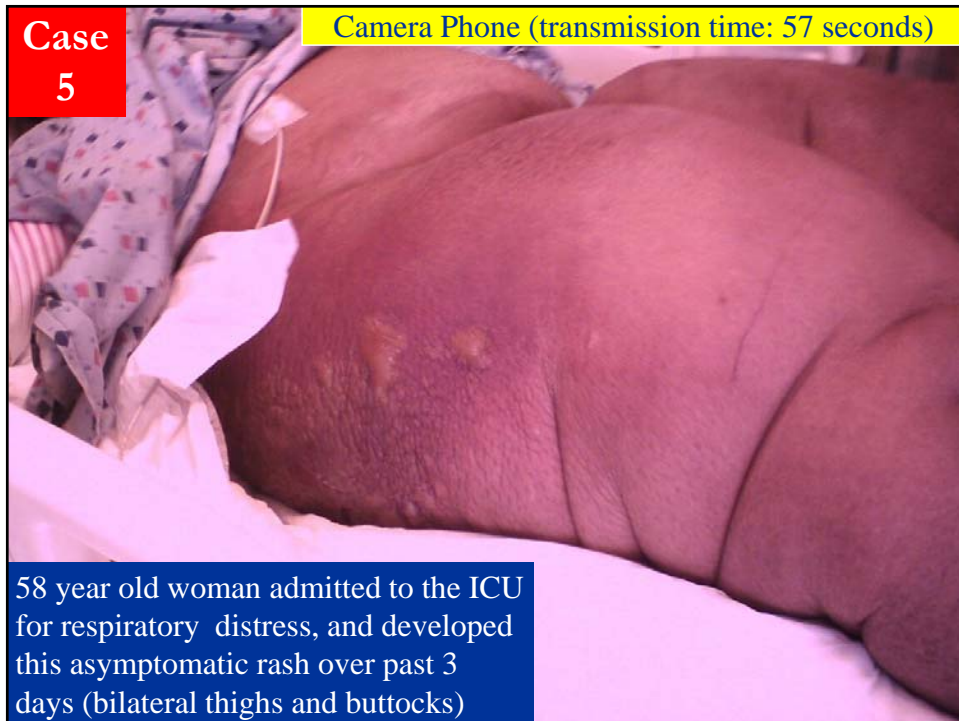
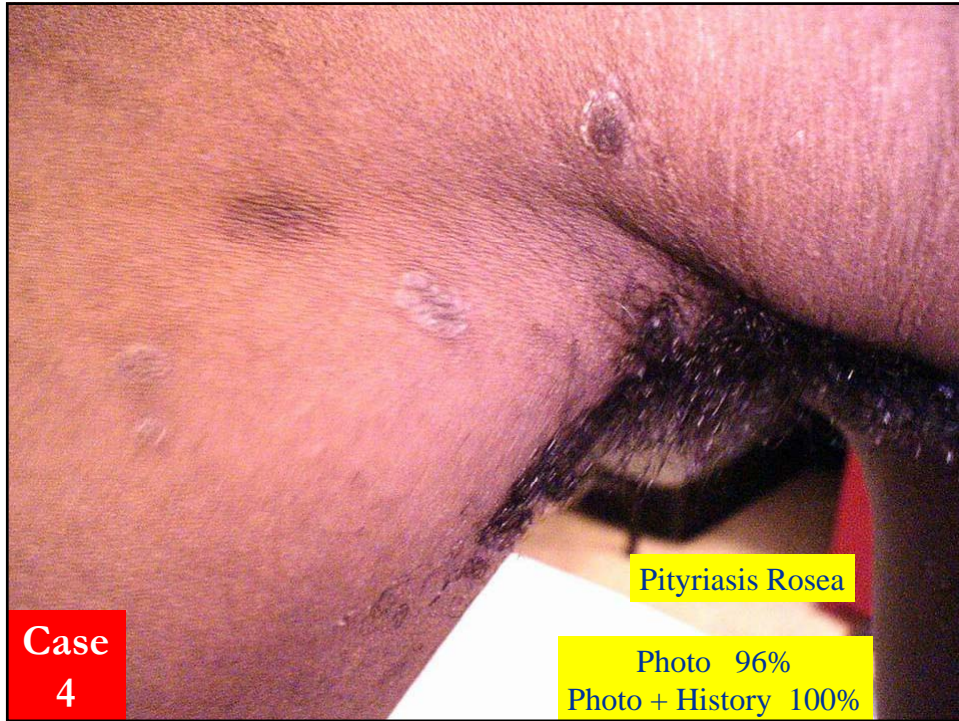
Photo **42%**  
Photo + History **71%**

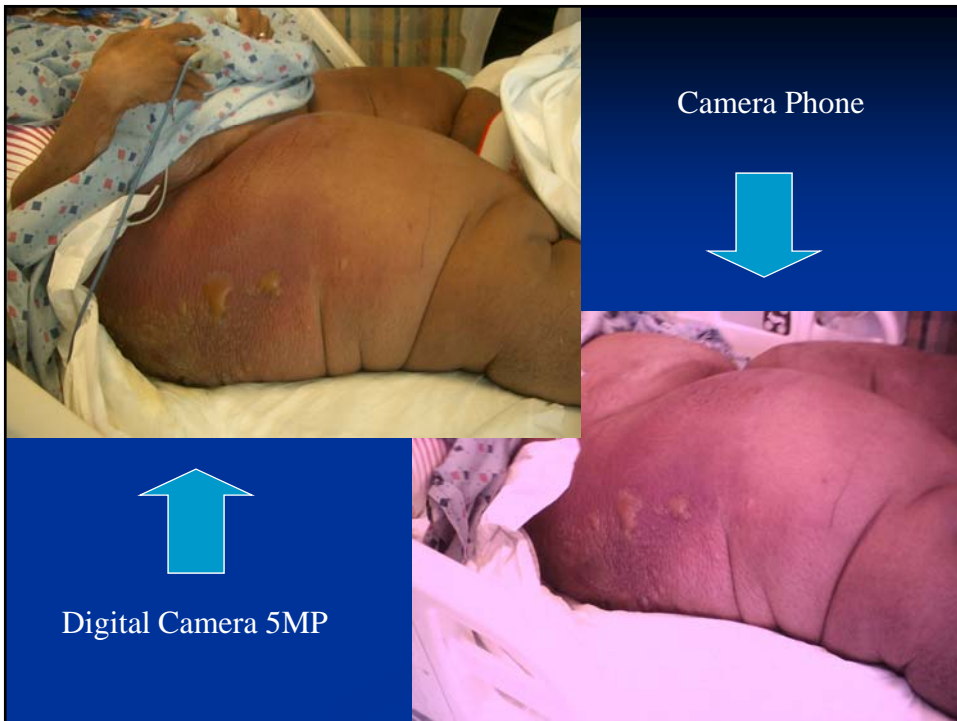
**BEST DIAGNOSTIC ACCURACY**



**Case  
4**

19 year old man.  
Pruritic rash on his trunk and proximal extremities for 2 weeks.





**Case  
5**

**This was the case with the  
WORST DIAGNOSTIC ACCURACY**



Lymphedema and Edema Blisters

Photo 38%  
Photo + History 50%

**Case  
6**

27 M  
Outpatient visit.  
Distribution: b/l hands  
Asymptomatic  
Developed over past 6  
mo.



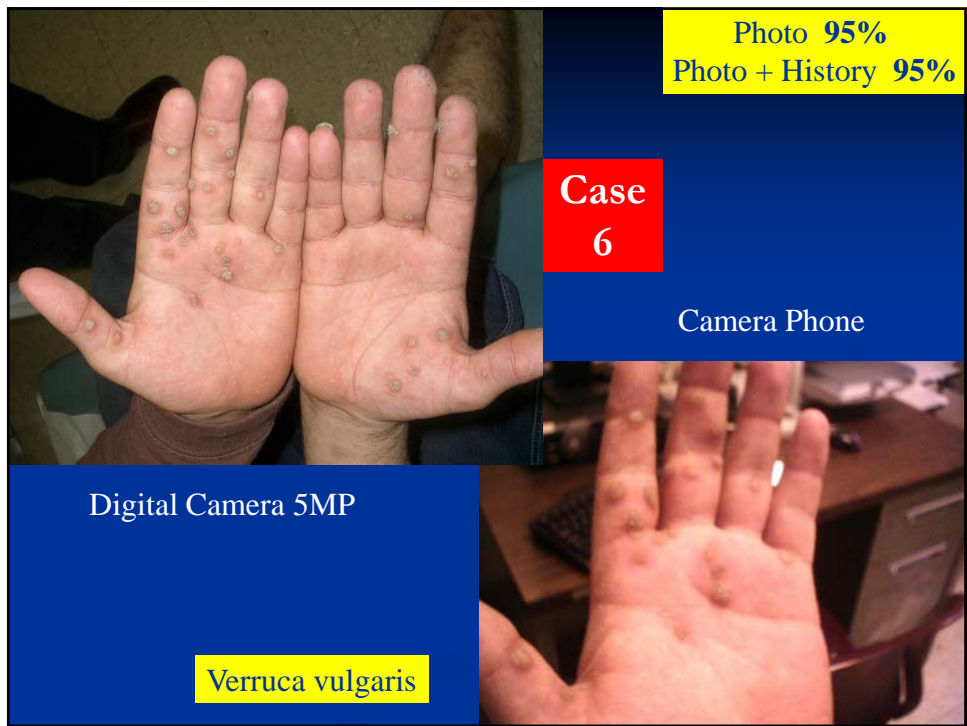


Photo 95%  
Photo + History 95%

Case 6

Camera Phone

Digital Camera 5MP

Verruca vulgaris

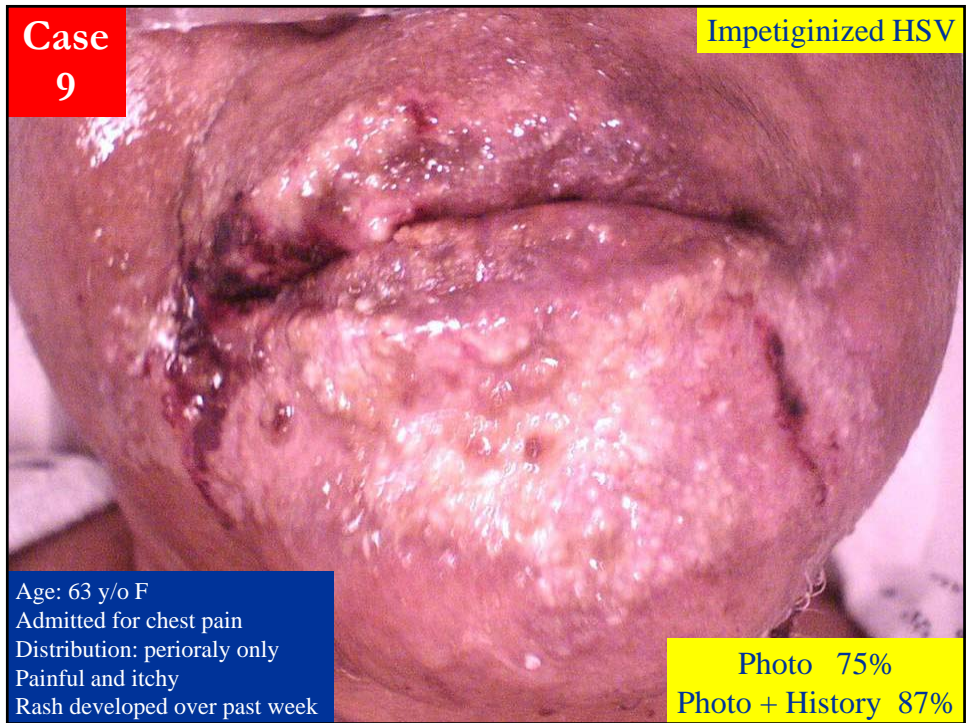
31 year old woman with HIV.  
Admitted for painful rash on her right hand.  
Worsening over the past 3 days.



Case 7

Bullous Cellulitis

Photo 86%  
Photo + History 92%



**Case 10**

**Acute Generalized Exanthematous Pustulosis**



Age: 32 y/o F  
Pt. admitted for fever and fatigue  
Distribution: Generalized, including face, abdomen, trunk, extrem x 4  
Asymptomatic  
Rash appeared over past 2 days

Photo 75%  
Photo + History 87%

**Case 11**

**Post Viral desquamation**



Age: 41 y/o M  
Pt. admitted for fever, PMHx: HIV  
Distribution: b/l hands only  
Itchy  
Rash appeared 1 week ago

Photo 54%  
Photo + History 70%

Post Viral desquamation

Case  
12



Age: 21 y/o M  
Pt. admitted for fever, HA  
Distribution: b/1 feet and hands  
Painful  
Rash appeared 4 days ago, with fever  
and HA



Digital Camera 5MP

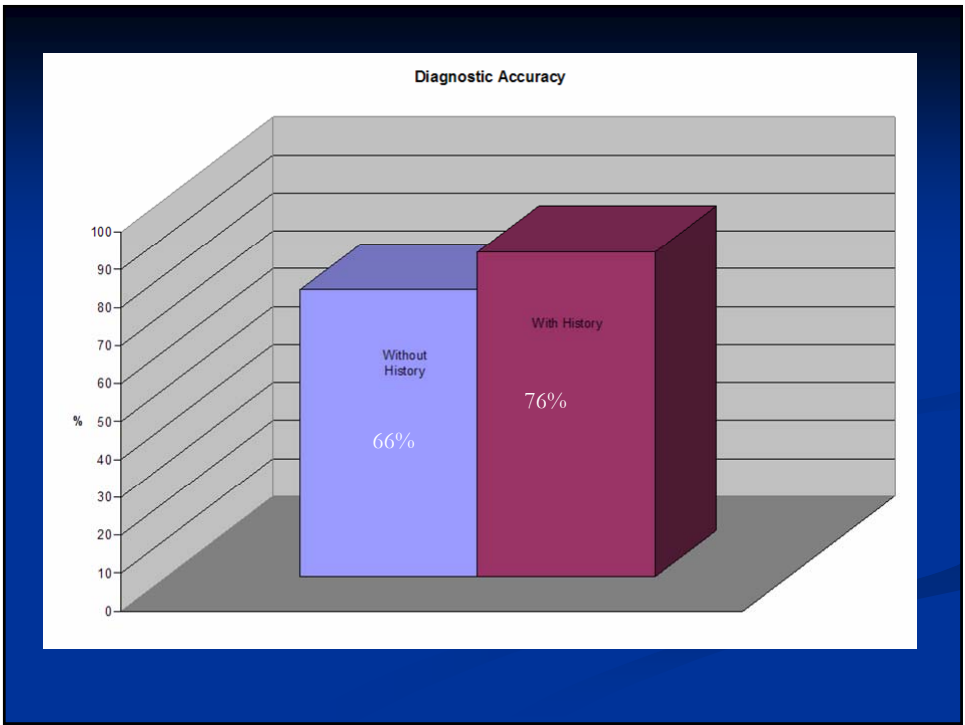


Age: 60 y/o M  
Pt. admitted for DM control  
Disturbtion: Rt. Toe  
Asymptomatic  
Rash developed over past 3 weeks

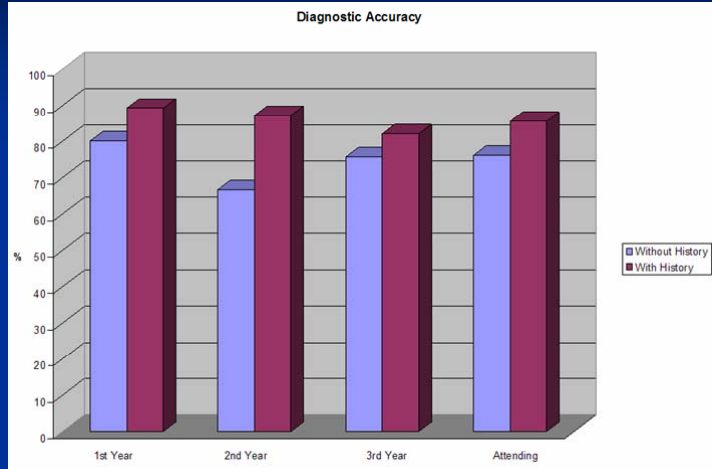


Diabetic foot with tinea pedis and possible SCC

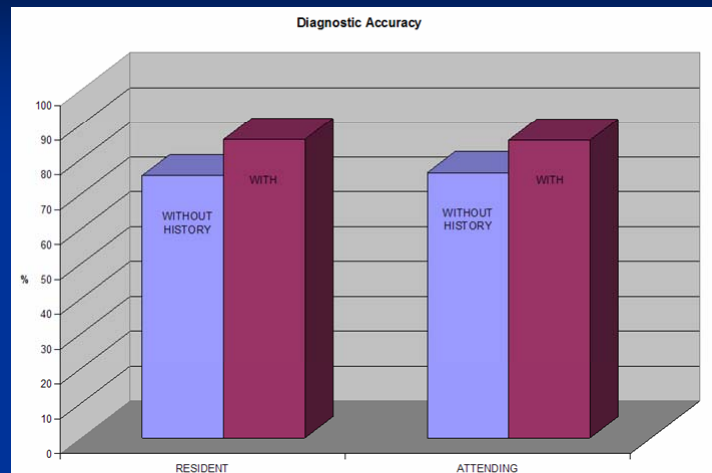
Photo 77%  
Photo + Hx 86%



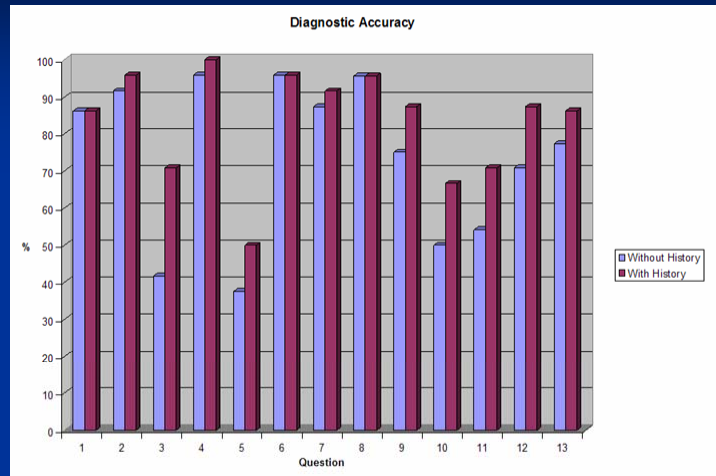
# Training Level



# Residents vs Attendings



## Each Question



## Conclusion

- We incorporated telemedicine into our inpatient consultation service.
- The camera phone assisted in urgent consults providing closer attending supervision and faster treatment recommendations.
- Our 1-megapixel camera photographs provided adequate diagnostic accuracy.
- As technology improves, camera phones may be suitable for other teledermatology applications.

# The Future is now!



<a href="#">Bluetooth</a>	Yes
<a href="#">Calculator</a>	Yes
<a href="#">Calendar</a>	Yes
<a href="#">Camera</a>	Resolution: 2+ megapixel 2x optical zoom / LED flash / business card scanner
<a href="#">Custom Graphics</a>	Yes
<a href="#">Custom Ringtones</a>	Yes
<a href="#">Data-Capable</a>	Yes
<a href="#">Digital TTY/TDD</a>	Yes
<a href="#">Expansion Card</a>	Card Type: microSD / TransFlash
<a href="#">Games</a>	Yes
<a href="#">GPS / Location</a>	Yes
<a href="#">Headset Jack (3.5 mm)</a>	Yes
<a href="#">High-Speed Data</a>	Technology: 1xEV-DO r0
<a href="#">Java (J2ME)</a>	Yes