Teledermatology for Diagnosis and Management of Skin Conditions:

A Systematic Review of the Evidence

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EVIDENCE-BASED SYNTHESIS PROGRAM (ESP)

- Funded by Health Services Research and Development (HSR&D)

- Purpose: Timely, focused evidence reviews to support VA policy and practice and to set directions for future research

- Veteran and VA-system focused

- Products:

    Evidence synthesis reports

    Succinct briefs for managers and leadership

    Web Site:
    http://www.hsrd.research.va.gov/publications/esp

OBJECTIVES

- Summarize evidence for diagnostic / management accuracy and concordance for teledermatology as compared to usual care

- Review data on clinical outcomes, costs and key implementation factors in teledermatology

TELEDERMATOLOGY

LIVE INTERACTIVE

STORE AND FORWARD

Univ of MN, Mercer Univ, US Military web sites

BACKGROUND

- Store and forward (SAF) more widely used in VA*
  - 44% (19/43) of responding VA derm chiefs use TD
  - Of those, 89% (17 of 19) use SAF
    - 1 live interactive (LI)
    - 1 both SAF and LI

- Despite implementation, info on diagnostic and management accuracy and concordance, cost-effectiveness, and impact on clinical management and patient outcomes are not well understood

*Informal survey of VA dermatology chiefs, December 2009

KEY QUESTIONS – DIAGNOSIS & MANAGEMENT

- 1. How does the ***accuracy*** and ***concordance*** of teledermatology compare to usual care (in-person dermatology) for the **diagnosis** of skin conditions?

- 2 How does the ***accuracy*** and ***concordance*** of teledermatology compare to usual care (in-person dermatology) for the **management** of skin conditions?

KEY QUESTIONS - OUTCOMES

- 3. How do <u>clinical outcomes</u> of teledermatology compare to usual care (in-person dermatology) for skin conditions?

- 4. How does the <u>cost</u> of teledermatology compare to usual care (in-person dermatology)?

- 5. What are the key structural and process elements associated with <u>successful implementation</u> of teledermatology and what are the barriers?

METHODS

- Topic nominated by Center for Chronic Disease Outcomes Research (CCDOR), Minneapolis VAMC
- Key questions developed with TEP
- Literature search (MEDLINE, Cochran Trials Registry, PubMed) for:
  - Clinical trials, systematic reviews, cost studies, implementation papers
  - 1990 to June 2009
  - Human subjects
  - Search terms: remote consult/consultation, electronic mail, telecommunications, telemedicine, telepathology, dermatology, teledermatology

METHODS

- **Inclusion Criteria:**
  - SAF or LI in English
  - controlled trial for Key Questions 1 and 2 (diagnosis, management)
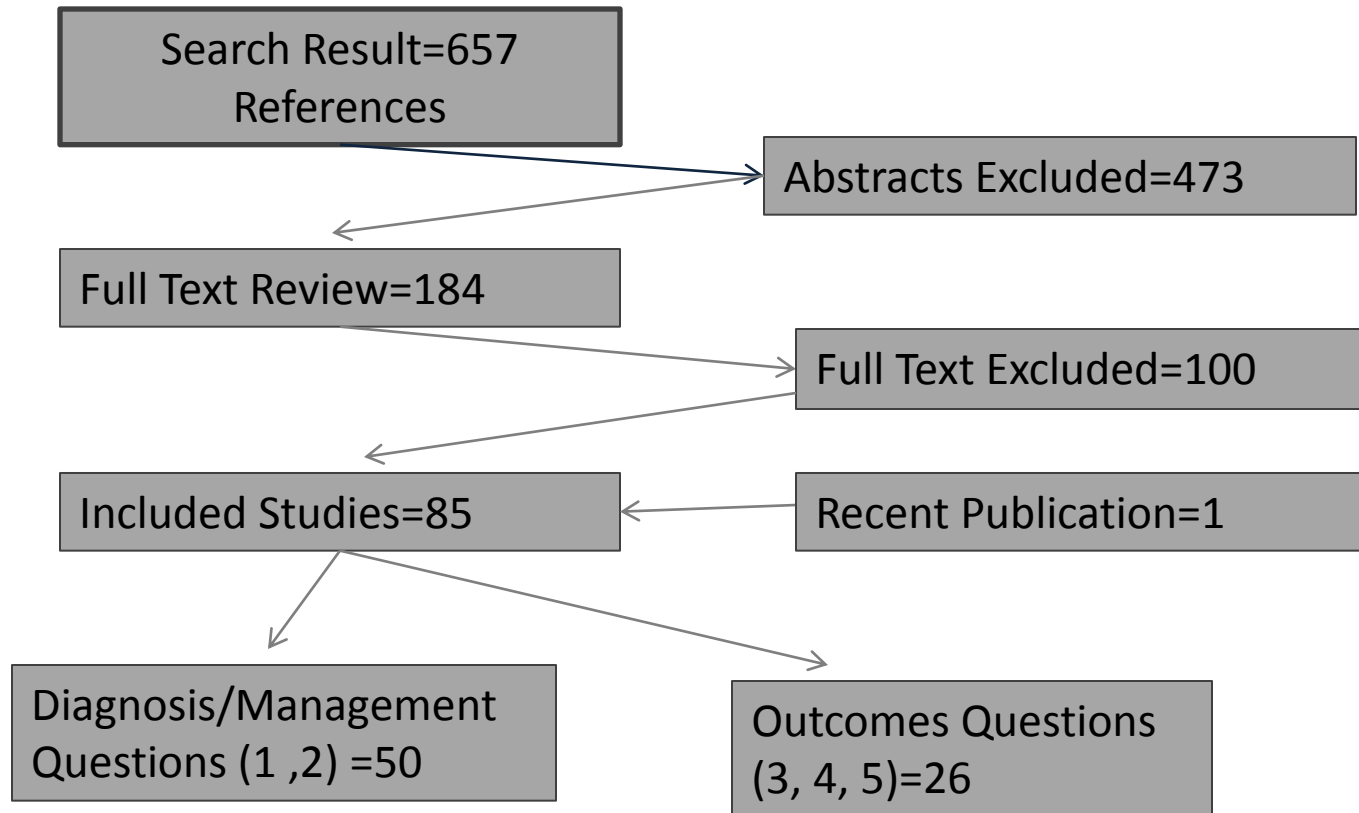
- **Exclusion Criteria:**
  - teledermatology using mobile phones
  - non-teledermatology settings
  - dermatopathology
  - computer-aided diagnoses only
  - survey studies with outcomes not related to questions
  - teledermatology as an educational tool
  - technology assessment only
  - remote monitoring of known diagnoses
  - patient-generated photos and/or history (no provider)
  - studies with one diagnosis only or only acne or warts
  - pediatric population only

METHODS

- Data extracted by 2 research associates , verified by PI
- Quality Assessment of Diagnostic Accuracy Studies (QUADAS)* instrument used to assess study quality of studies related to diagnostic accuracy and concordance
- Results presented by outcome and method of outcome reporting
  - stratified by SAF or LI technology
  - weighted mean differences where appropriate (limited pooling due to heterogeneity)

*Whiting et al., BMC Medical Research Methodology, 2003

RESULTS

Search Result=657 References

Abstracts Excluded=473

Full Text Review=184

Full Text Excluded=100

Included Studies=85

Recent Publication=1

Diagnosis/Management Questions (1 ,2) =50

Outcomes Questions (3, 4, 5)=26

DEFINITION - DIAGNOSTIC ACCURACY

- Match of TD or CD diagnosis with gold standard diagnosis (histopathology or other laboratory test)
  - *Aggregated*
    - match of primary or differential diagnoses with gold standard diagnosis
  - *Primary*
    - match of primary diagnosis with gold standard diagnosis

DEFINITION - MANAGEMENT ACCURACY

- Match of TD or CD management plan with gold standard management plan

DEFINITIONS - CONCORDANCE

- **<u>Diagnostic concordance:</u>**
  - *Aggregated* - agreement of TD primary or differential diagnoses with CD primary or differential diagnosis
  - *Primary* - agreement of primary TD diagnosis with primary CD diagnosis
- **<u>Management concordance:</u>**
 - agreement of TD and CD management plans

Results – Q1,2 Diagnosis &Management
41 SAF studies (42 publications)

- 40 repeated measures studies, 1 randomized trial
- 12 U.S., 9 U.K., 6 Italy, 4 Spain, 3 Australia/New Zealand, 2 Turkey
- 5 studies - U.S. Military Personnel or Veterans
- 12-882 subjects per study
- Mean age=53 years (19 studies)
- 43% female (21 studies)
- 93% Caucasian (5 studies)
- Rashes and lesions (14 studies)
- Lesions only (22 studies)

QUADAS RESULTS SAF
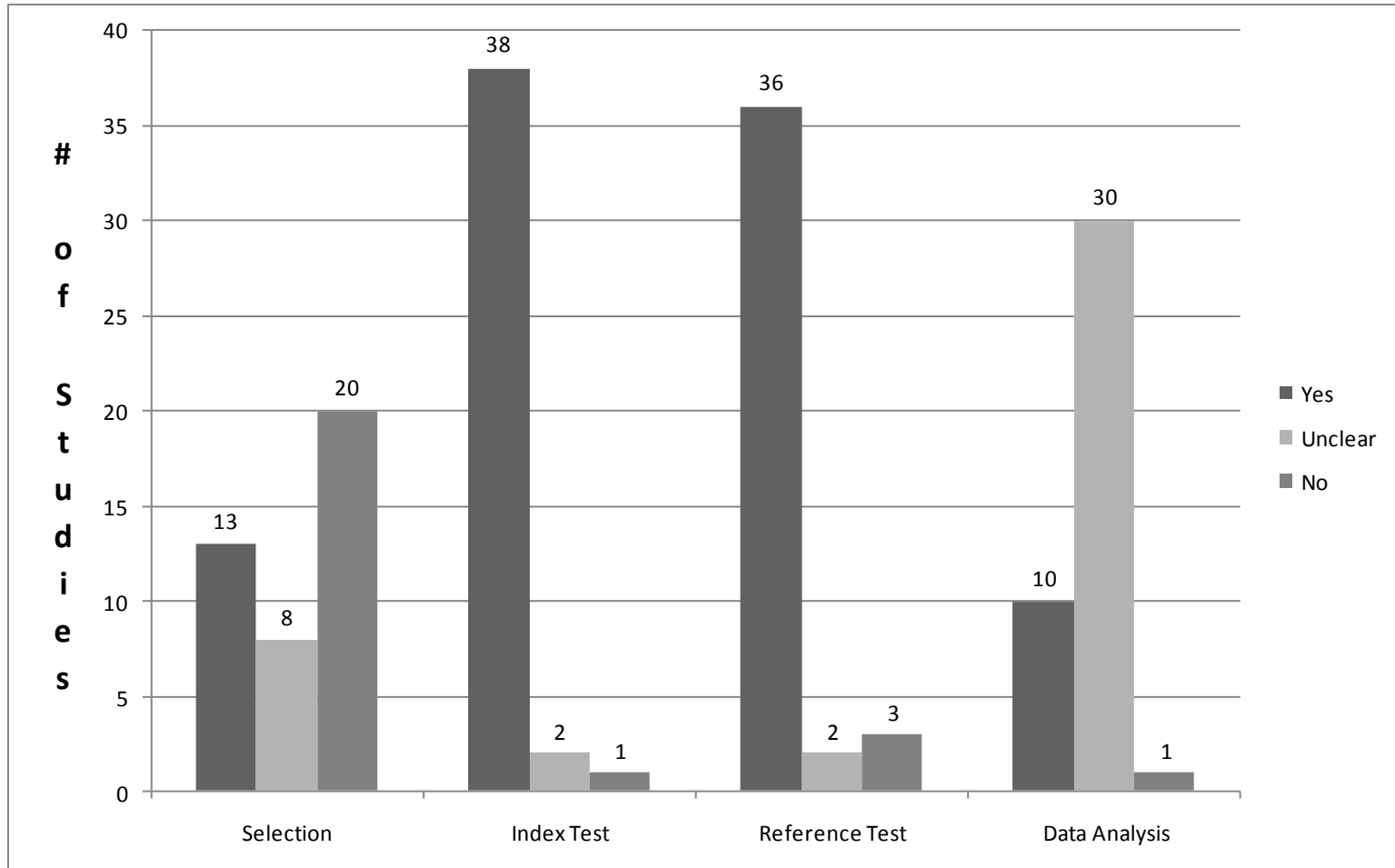
Aggregated Diagnostic Accuracy of Store and Forward Studies
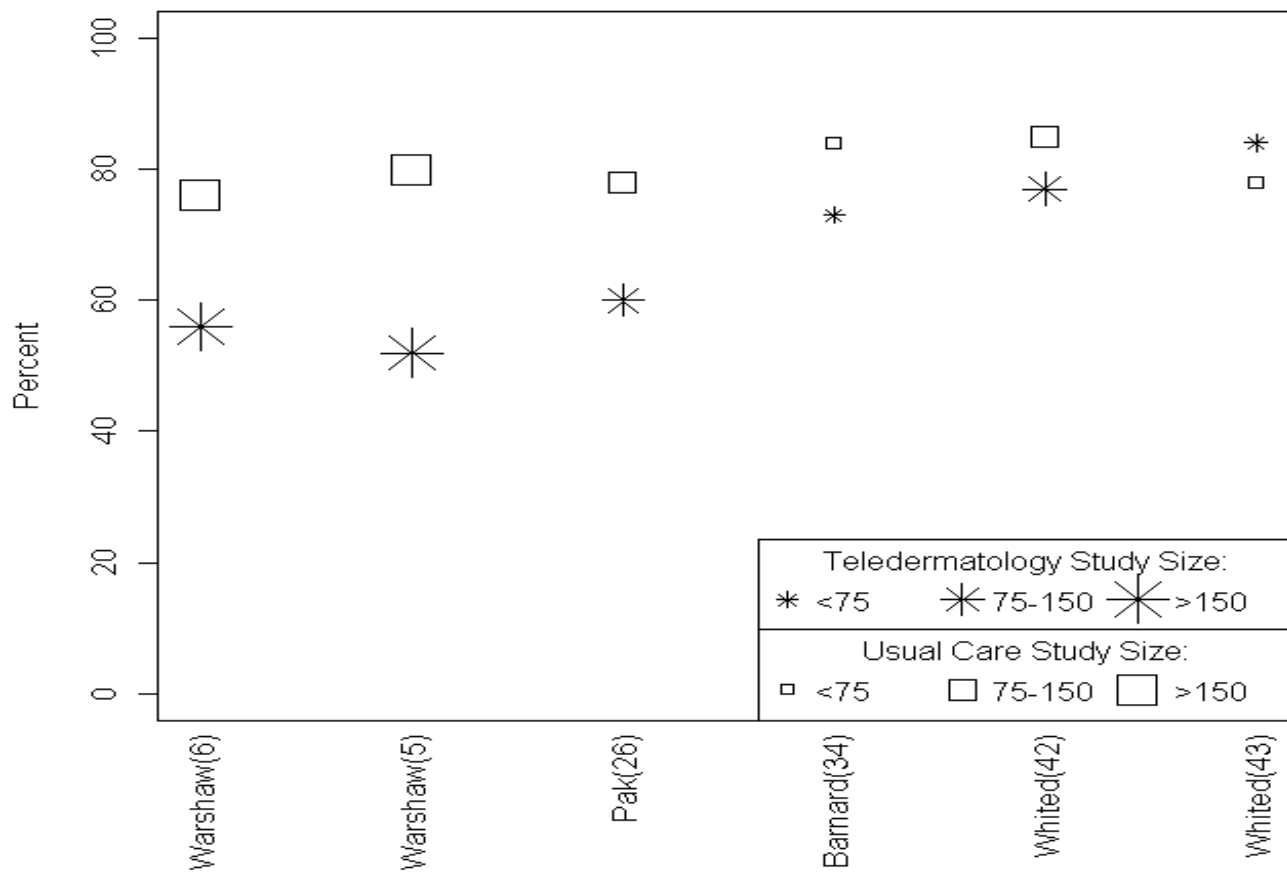
RESULTS – DIAGNOSTIC ACCURACY SAF

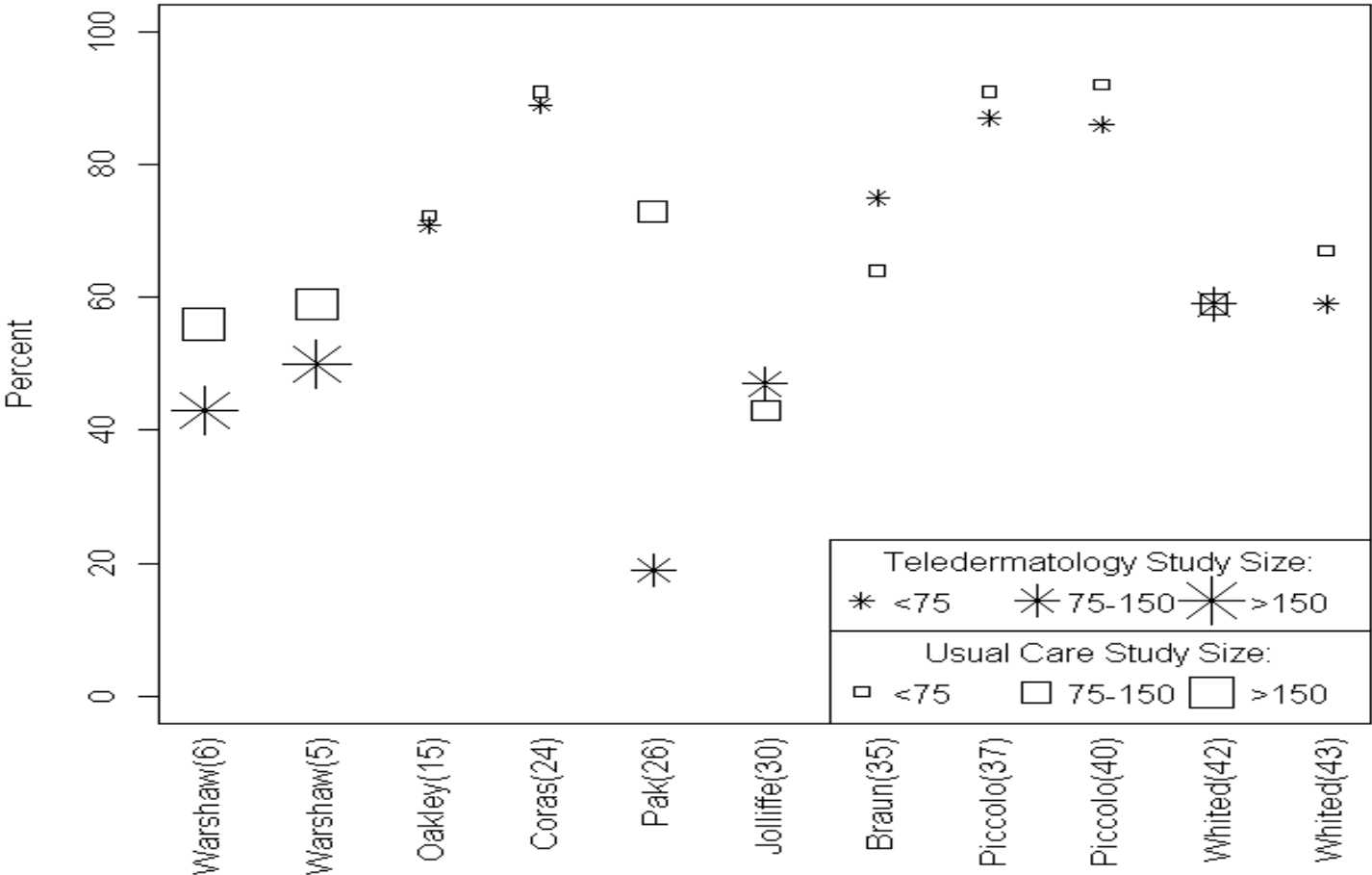TD Accuracy vs. CD Accuracy, Weighted
Mean Difference*

Aggregated Diagnostic Accuracy = -19%

range: -28% to 18%

6 studies

*Teledermatology minus Usual Care

Primary Diagnostic Accuracy of Store and Forward Studies

Figure: Scatter plot of Percent (y-axis, 0 to 100) versus study. Studies along x-axis: Warshaw(6), Warshaw(5), Oakley(15), Coras(24), Pak(26), Jolliffe(30), Braun(35), Piccolo(37), Piccolo(40), Whited(42), Whited(43).

Legend:
Teledermatology Study Size: * <75   75-150   >150
Usual Care Study Size: □ <75   □ 75-150   □ >150

RESULTS – DIAGNOSTIC ACCURACY SAF

TD Accuracy vs. CD Accuracy, Weighted Mean Difference*

Primary Diagnostic Accuracy = -11%

   range: -54% to 11%

   11 studies

Primary Diagnostic Accuracy, Pigmented Lesions
   Only = -5%

   range: -9% to 11%

    6 studies

*Teledermatology minus Usual Care

OTHER RESULTS – DIAGNOSTIC ACCURACY

Kappa Statistic SAF:

Teledermatology   k = 0.44 to 0.94   (4 studies)

Usual Care   k = 0.52 to 0.70   (1 study)

Sensitivity SAF   0.91   (1 study)

Specificity SAF   0.95   (1 study)

Live Interactive (1 study)

Aggregated diagnostic accuracy

Teledermatology=73%   Usual Care=64%

RESULTS – DIAGNOSTIC CONCORDANCE SAF
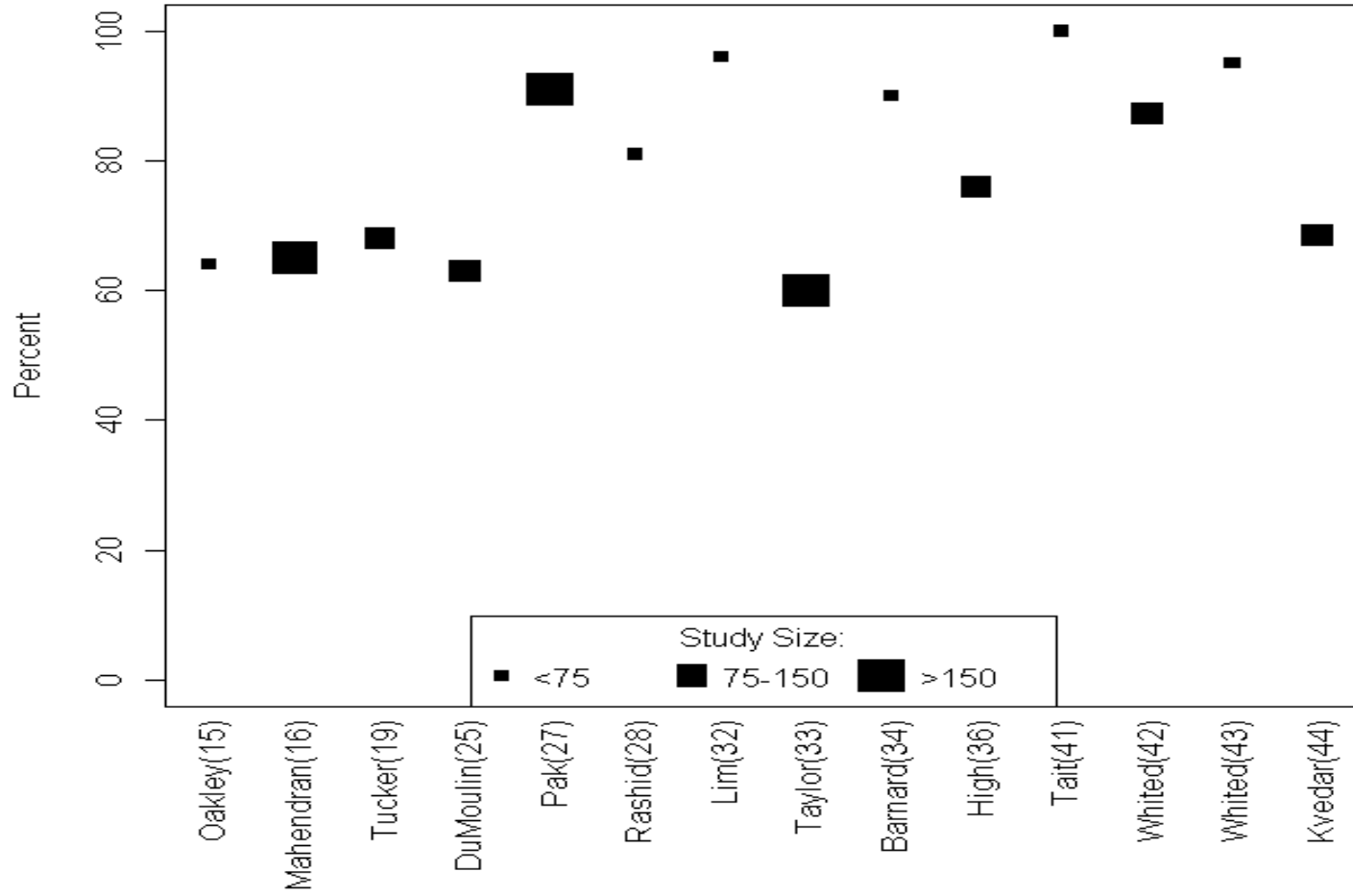
Primary Concordance

Pigmented skin lesions	91%	(1 study)
Skin lesions	53-80%	(5 studies)
General studies	46-88%	(14 studies)

Aggregated Concordance

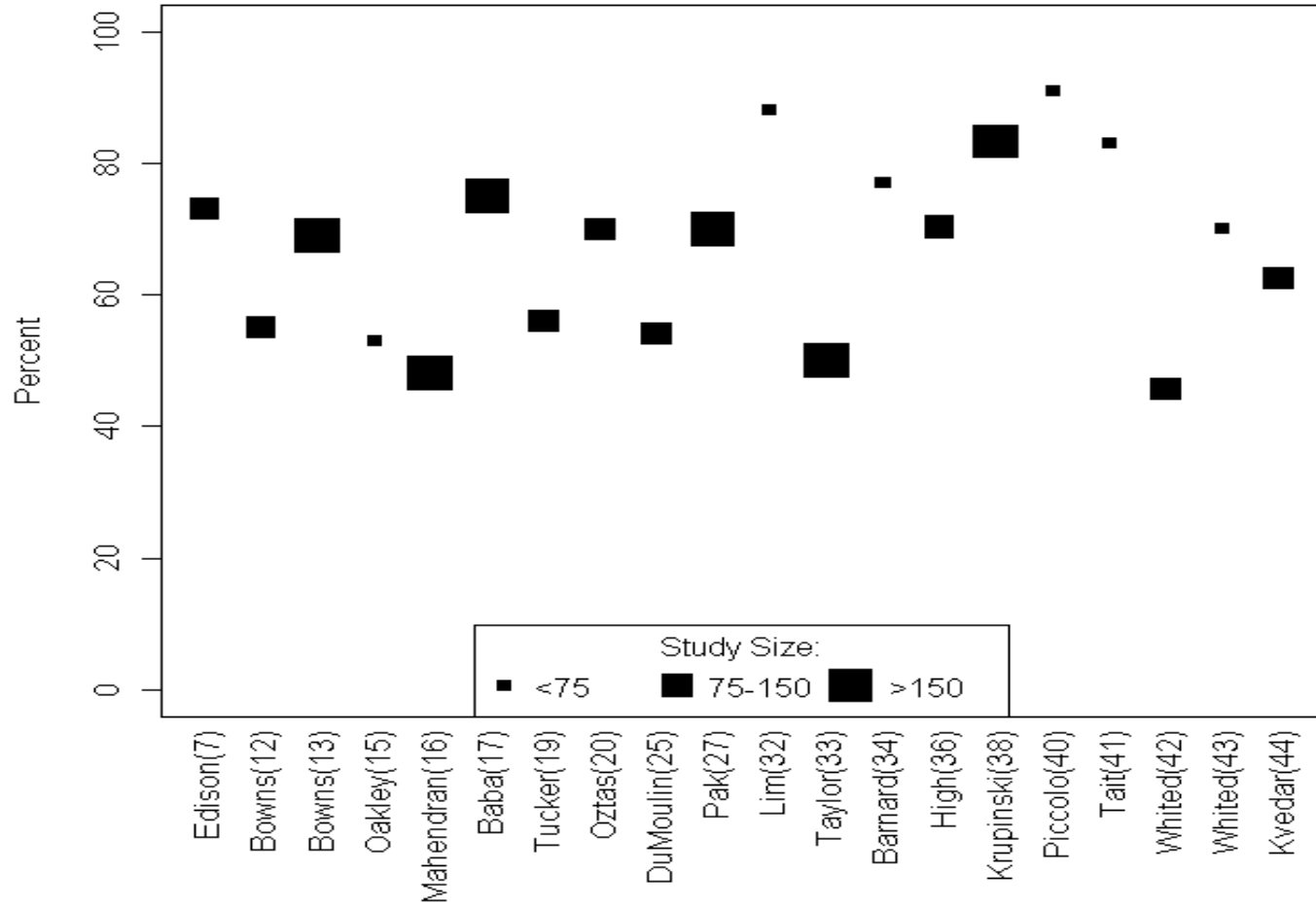|		
Skin lesions	64-100%	(4 studies)
General studies	60-100%	(10 studies)

Aggregated Diagnostic Concordance of Store and Forward Studies

Percent

100
80
60
40
20
0

Study Size:
■ <75   ■ 75-150   ■ >150

Oakley(15)
Mahendran(16)
Tucker(19)
DuMoulin(25)
Pak(27)
Rashid(28)
Lim(32)
Taylor(33)
Barnard(34)
High(36)
Tait(41)
Whited(42)
Whited(43)
Kvedar(44)

Primary Diagnostic Concordance of Store and Forward Studies

OTHER RESULTS – DIAGNOSTIC CONCORDANCE

Kappa statistic SAF   k = 0.71 to 0.93 (4 studies)

Sensitivity SAF   0.88-1.00 (3 studies)

Specificity SAF   0.39-0.98 (3 studies)

Live Interactive

  Aggregated   78-99% (5 studies)

  Primary   57-78% (7 studies)

  Kappa statistic   k = 0.62-0.79 (2 studies)

RESULTS – MANAGEMENT SAF

<u>Accuracy</u>
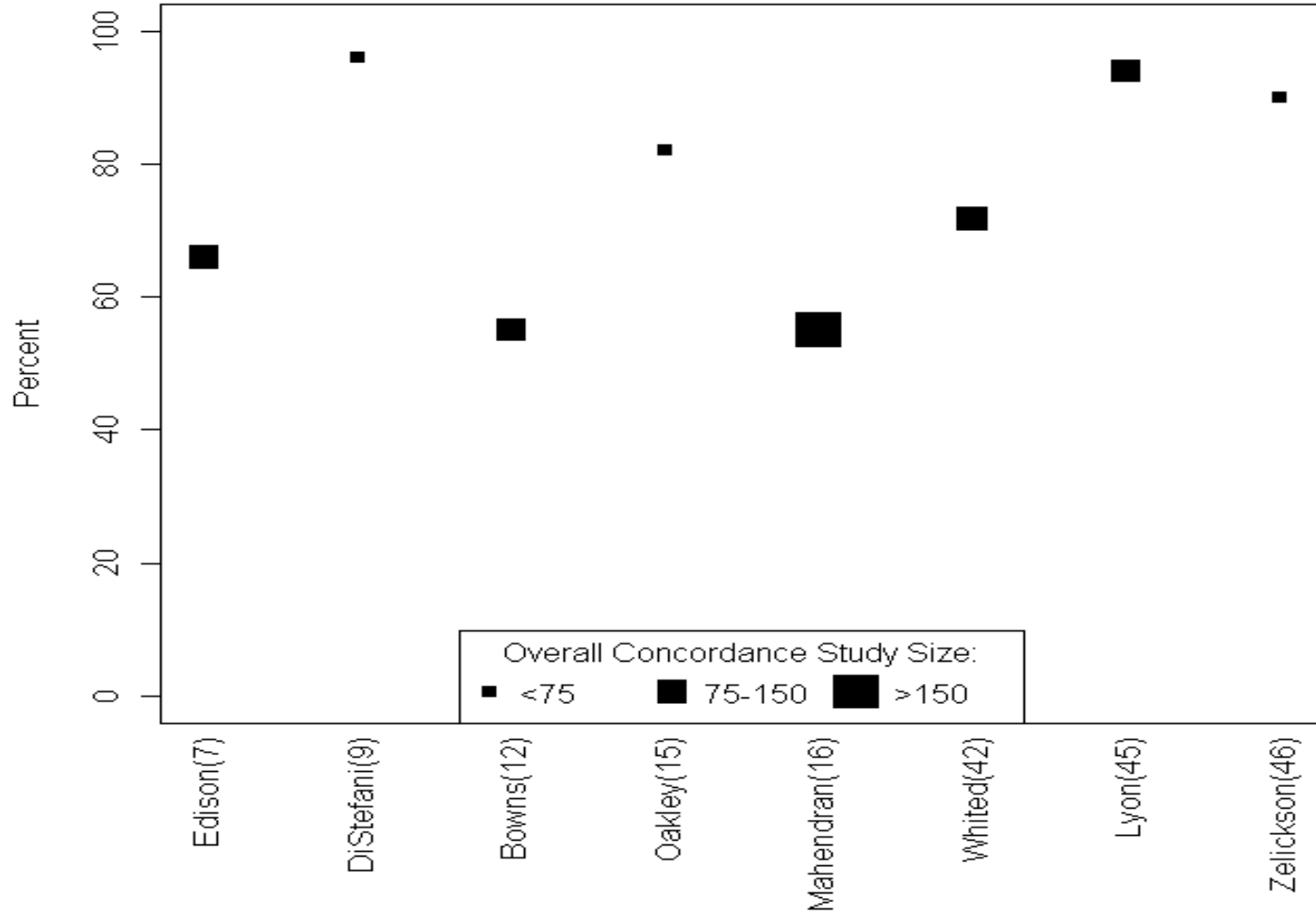
Teledermatology 75.3% vs. Usual Care 75.9%

Weighted Mean Diff* = -0.6%

range: -5% to 5%

2 studies

*Teledermatology minus Usual Care

Management Concordance of Store and Forward Studies

Percent

100

80

60

40

20

0

Overall Concordance Study Size:
■ <75   ■ 75-150   ■ >150

Edison(7)
DiStefani(9)
Bowns(12)
Oakley(15)
Mahendran(16)
Whited(42)
Lyon(45)
Zelickson(46)

OTHER RESULTS – MANAGEMENT

Concordance

Percent concordant	55-96% (8 studies)
Kappa statistic	k = 0.68-0.75 (4 studies)
Sensitivity & Specificity	1.0 (1 study)

Live Interactive

Percent Concordant	64-75% (3 studies)
Kappa statistic	k = 0.71 (1 study)

CONCLUSIONS – DIAGNOSIS & MANAGEMENT

1. Diagnostic accuracy of in-person dermatology is better than SAF teledermatology.

2. Diagnostic concordance of SAF teledermatology with in-person dermatology is acceptable.

3. There is limited data on management accuracy; two studies show equivalence

4. Management concordance is moderate to very good.

KEY QUESTION 3 – CLINICAL COURSE

Three studies (2 SAF, 1 LI)

- two suggested more favorable clinical course following TD compared to UC

- third study (VA/DoD n=508) reported no difference

Different methods for determining clinical course

- clinic visit, photos, questionnaire

Clinical course assessed at different time points

- first clinic visit, 4 months, 6 months

PATIENT SATISFACTION

Four SAF studies with usual care comparison group

Teledermatology	Usual Care
3.8/5 (5 point scale)*	3.8/5 (5 point scale)*
84% satisfied overall*	87% satisfied overall*
86% very satisfied**	98% very satisfied**
79% excellent or very good**	78% excellent or very good**

*randomized controlled trial

**VA studies

PATIENT PREFERENCE

Four SAF studies

Teledermatology	Usual Care
76% preferred TD over waiting for UC*	
42% preferred TD over UC**	37% preferred UC over TD**
68% TD as good as UC	40% prefer UC to TD
42% preferred TD over waiting for UC	38% prefer UC

*randomized controlled trial   **VA studies

Similar findings for live interactive studies

CLINIC VISITS AVOIDED

SAF: % of pts <u>not</u> requiring derm clinic visit (2 studies)

Teledermatology	Usual Care	Difference
39.0%	18.3%	20.7%
66.0%	38.0%	28.0%

Percentage of visits avoided in studies with no comparison group: 12.8% to 53.3% (7 studies)

LI: 14% and 1% differences reported (2 studies)
     72.0% did not need follow-up (1 study)

SUMMARY – CLINICAL OUTCOMES

1. There is insufficient data to determine whether clinical course is impacted by SAF teledermatology vs. in-person dermatology.

2. Waiting time for usual care (in-person dermatology) appointments was a factor in patient preference for teledermatology.

3. In-person dermatology visits can be avoided when teledermatology is used.

KEY QUESTION 4: COST

- **<u>SAF</u>** (3 studies)
  - 1 VA (Whited 275 pts RCT)
    - cost-effective but not cost-saving
  - 1 DoD (Pak 698 pts RCT)
    - cost savings of $32/pt accounting for lost productivity
- **<u>LI</u>** (6 studies)
  - 2 US (Burgiss 87 pts; Armstrong 451 TD visits)
    - cost less or was cost efficient, if pts had long travel or if met criteria for volume and usual care costs
- **<u>LI vs. SAF</u>** (1 study, UK; Loane 102 pts):
  - SF less expensive but less clinically efficient than LI

KEY QUESTION 4: SUMMARY - COST

- Limited by various parameters and perspectives (societal, health service or patient)
- Most found telederm to be cost effective if:
  - Far patient distance
  - High telederm volume
  - High costs of usual care

KEY QUESTION 5: BARRIERS AND KEY ELEMENTS OF SUCCESSFUL IMPLEMENTATION

- Lessons learned from mature functioning teledermatology systems
- Descriptions of programs
- Finch: longitudinal study of 12 TD services in UK
  - MDs, nurses, pts, PCPs, administrators, technologists
  - "the original…vision of how TD would be utilized, as a technological fix for long waiting lists and consultant shortages, failed to be realized."
- General recommendations – Pak military

EVALUATE THE SETTING & DEFINE OBJECTIVES

- **Intrasite** (Site with dermatology): triage

- **Intersite** (Site with access to distant VA derm clinic): decrease travel, specialist costs

- **New Service** (Site with no VA derm access): decrease outsourcing costs, access

UNDERSTAND ORGANIZATIONAL ISSUES

- **Intrasite & Intersite**
  - Derm workload stable
  - Primary care workload increases

- **New Site**
  - Workload increases for both derm and primary care
  - Outsource costs for procedures still needed

EVALUATE & PROVIDE REQUIRED RESOURCES

- **Intrasite & Intersite:**
  - liquid nitrogen
  - ? support for minor procedures – KOH, scabies prep
  - otherwise TD simply triage, only eliminating visits for benign growths or simple rashes
  - Informal survey - 3 sites d/c'ed TD because most pts needed to come to the clinic anyway
- **New Site:**
  - NP or PA with dermatology training important
  - Biopsies, KOH, scabies prep,
  - On site surgical resources vs. outsourcing for malignancies

COST ANALYSIS, ASSESS ALTERNATIVES

- Cost of TD is mostly personnel, not equipment
  - Imager
  - Consult manager
  - Likely to fail if primary care MD serves in these roles

- Evaluate needs
  - If high volume of skin cancer, TD may not be cost-saving

- Compare TD costs to costs of consultant dermatologist, dermatology resident, transportation services

OBTAIN ORGANIZATIONAL SUPPORT

- Medical Center Leadership
- Primary Care – "market" educational benefit
- Surgical Subspecialties
- Dermatology
- Pharmacy
- Intersite and New Service
  - Add'l derm meds, CPRS quick orders
- Important to incorporate TD into normal oper

PROVIDE SPECIFIC TD TRAINING

- Imager
- Resources
  - American Telemedicine Association
    - http://www.americantelemed.org/i4a/pages/index.cfm?pageid=3325
  - VA intranet
    - http://vaww.telehealth.va.gov/telehealth/sft/tdrm/index.asp
  - American Academy of Dermatology Position Statement
    - http://www.aad.org/Forms/Policies/Uploads/PS/PS-Telemedicine%206-15-07.pdf
- Hands on training, usually by dermatologist
- Periodic refresher training

IMPORTANCE OF ONGOING SUPPORT

- TD more than equipment
- Personnel
- Refresher training
- Upgrades
- Periodic evaluation
- Travel

SUMMARY – IMPLEMENTATION

1. Important
2. Identifying key factors for success and barriers are highly dependent on intended setting and specific sites

OVERALL CONCLUSIONS

1. Diagnostic accuracy of in-person dermatology is better than SAF teledermatology

2. Diagnostic concordance of SAF teledermatology with in-person dermatology is acceptable

3. Management concordance is moderate to very good

4. Limited data on management accuracy, clinical outcomes

5. Pt satisfaction/preference good; dep on distance

6. Cost-effectiveness also dep on cost usual care, distance, & volume

7. Many key factors in planning implementation

THANK YOU FOR YOUR ATTENTION!

COMMENTS, QUESTIONS WELCOME !