ORIGINAL RESEARCH

Handoff Delays in Teledermatology Lengthen Timeline of Care for Veterans With Melanoma

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Background: Store-and-forward teledermatology (SFT) involves sending clinical images and patient information to a dermatologist for evaluation and is widely used in US Department of Veterans Affairs (VA) Veterans Integrated Service Network 20. While SFT has increased access to dermatologic care, its impact on timely treatment is less well known. This study compares the timeline of care for melanoma treatment between SFT and face-to-face (FTF) dermatologic care and identifies potential areas for SFT improvement.
Methods: This study at the VA Puget Sound Health Care System included 107 patients in the FTF group and 87 patients in the SFT group. Electronic health record data were reviewed and key dates were extracted for patients in each group, including entry into episode of care (EEC), biopsy, and definitive excision. Median and mean intervals were compared between groups. To further analyze the groups, the FTF group was subdivided into where melanomas were entered into care, either at a dermatology clinic (FTF dermatology) or a primary care/nondermatology setting (FTF primary care).
Results: The median intervals from EEC to definitive excision for patients in the FTF and SFT groups were 58 and 73 days (P = .004), respectively. The median intervals from EEC to definitive excision in the FTF dermatology and FTF primary care groups were 37 and 78 days, respectively. Handoffs in SFT accounted for 6 to 12 days of the total timeline of care.
Conclusions: The fastest timeline of care for primary cutaneous melanoma is obtained when FTF dermatology is the EEC. The SFT timeline is significantly longer than that of FTF. Facilitating handoffs in SFT presents an opportunity for process improvement. The SFT timeline could be improved if the EEC, imaging, and SFT consultation requests all occurred on the same day.

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Store-and-forward teledermatology (SFT) allows clinical images and information to be sent to a dermatologist for evaluation. In fiscal year (FY) 2018, 117,780 SFT consultations were completed in the Veterans Health Administration. Continued growth is expected since SFT has proven to be an effective method for improving access to face-to-face (FTF) dermatology care.[1] In the same period, the US Department of Veterans Affairs (VA) Puget Sound Health Care System (VAPSHCS) completed 12,563 consultations in a mean 1.1 days from entry into episode of care (EEC), according to data reported by VA Teledermatology Program Administrator Chris Foster.

Obtaining a prompt consultation is reported to be an overwhelming advantage of using SFT.[2-5] Rapid turnaround may appear to make SFT specialist care more accessible to veterans, yet this is an oversimplification. The process of delivering care (rather than consultation) through SFT is more complex than reading the images and reporting the findings. When a skin condition is identified by a primary care clinician and that person decides to request an SFT consultation, a complex set of tasks and handoffs is set into motion. A swim-lane diagram illustrates the numerous steps and handoffs that go into delivering care to a patient with a malignant melanoma on the SFT platform compared to FTF care, which requires fewer handoffs (Figure).

This process improvement project examined whether handoffs necessitated by SFT care lengthened the timeline of care for biopsy-proven primary cutaneous malignant melanoma. The stakes of delay in care are high. A 2018 study using the National Cancer Database found that a delay of > 30 days from biopsy to definitive excision (the date definitive surgical procedure for the condition is performed) resulted in a measurable increase in melanoma-related mortality.[6] This study sought to identify areas where the SFT timeline of care could be shortened.

METHODS

This retrospective cohort study was approved by the VAPSHCS Institutional Review Board. The study drew from secondary data obtained from VistA, the VA Corporate Data Warehouse, the Veterans Integrated Service Network (VISN) 20 database, the American Academy of Dermatology Teledermatology Program database, and the VA Computerized Patient Record System.

Patients registered for ≥ 1 year at VAPSHCS with a diagnosis of primary cutaneous malignant melanoma by the Pathology service between January 1, 2006, and December 31, 2013, were included. Patients with metastatic or recurrent melanoma were excluded.

Cases were randomly selected from a melanoma database previously validated and used for another quality improvement project.[7] There

TABLE. Time Elapsed Comparisons

Timeframe	0-20 d	21-40 d	41-60 d	61-80 d	81-100 d	101-120 d	121-140 d	141-160 d	161-180 d	> 180 d
EEC to excision, %										
SFT	3	10	23	20	14	8	9	8	3	2
FTF	10	29	13	20	11	4	4	2	3	5
EEC to biopsy, %										
SFT	38	31	14	8	1	3	2		3[a]	
FTF	65	18	4	6	1	1	1		4[a]	
Primary care	34	33	9	12	2	2	2		6[a]	
Dermatology	96	2	0	0	0	0	0		2[a]	
Biopsy to definitive excision, %										
SFT	16	41	22	8	6	4	3		0[a]	
FTF	12	44	21	9	7	3	2		2[a]	
EEC to consultation request, %										
SFT	1	48	22	17			6[b]			
FTF-primary care	82	4	4	0			8[b]			

Abbreviations: EEC, entry into episode of care; FTF, face-to-face; SFT, store-and-forward teledermatology.
[a]Elapsed time > 140 d.
[b]Elapsed time > 80 d.

were initially 115 patient cases extracted from this database for both the FTF and SFT groups. Eighty-seven SFT and 107 FTF cases met inclusion criteria. To further analyze these groups, we split the FTF group into 2 subgroups: FTF dermatology (patients whose melanomas were entered into care in a dermatology clinic) and FTF primary care (patients whose melanomas were entered into care in primary care or a nondermatology setting).

The timeline of care was divided into 2 major time intervals: (1) entry into episode of care (EEC; the date a lesion was first documented in the electronic health record) to biopsy; and (2) biopsy to definitive excision. The SFT process was divided into the following intervals: EEC to imaging request (the date a clinician requested imaging); imaging request to imaging completion (the date an imager photographed a patient's lesion); imaging completion to SFT consultation request (the date the SFT consultation was requested); SFT consultation request to consultation completion (the date an SFT reader completed the consultation request for a patient); and SFT consultation completion to biopsy. Mean and median interval lengths were compared between groups and additional analyses identified steps that may have contributed to delays in care.

To address potential bias based on access to care for rural veterans, SFT and FTF primary care cases were categorized into groups based on their location: (1) EEC and biopsy conducted at the same facility; (2) EEC and biopsy conducted at different facilities within the same health care system (main health care facility and its community-based outpatient clinics); and (3) EEC and biopsy conducted at different health care systems.

Statistics

Means, medians, and SDs were calculated in Excel. The Mann-Whitney *U* test was used to compare SFT medians to the FTF data and χ^2 test was used to compare proportions for secondary analyses.

RESULTS

The median (mean) interval from EEC to definitive excision was 73 days (85) for SFT and 58 days (73) for FTF ($P = .004$) (Table). To understand this difference, the distribution of intervals from EEC to biopsy and biopsy to definitive excision were calculated. Only 38% of SFT cases were biopsied within 20 days compared to 65% of FTF cases ($P < .001$). The difference in time from biopsy to definitive excision distributions were not statistically significant, suggesting that the difference is actually a reflection of the differences seen in the period between EEC and biopsy.

EEC and biopsy occurred at the same facility in 85% and 82% of FTF primary care and SFT cases, respectively. EEC and biopsy occurred at different facilities within the same health care system in 15% and 16% of FTF primary care and SFT cases, respectively. EEC and biopsy occurred at different health care systems in 0% and 2% of FTF primary care and SFT cases, respectively. Geographic bias did not impact results for either group of veterans.

The interval between EEC and biopsy was shorter for FTF dermatology cases than for FTF primary care cases. For FTF dermatology cases, 96% were biopsied within 20 days compared with 34% of FTF primary care cases ($P < .001$).

To further analyze the difference in the EEC to biopsy interval duration between SFT and FTF primary care the timeline was divided into smaller steps: EEC to imaging completion, imaging completion to SFT consult completion, and SFT consult completion to biopsy. From EEC to SFT consult completion, SFT cases took a median of 6.0 days and a mean of 12.3 days, reflecting the administrative handoffs that must occur in SFT. A total of 82% of FTF primary care cases were entered into care and consultation was requested on the same day, while this was true for only 1% of SFT cases.

Since mortality data were not collected, the frequency of in situ melanomas and invasive melanomas (pathologic stage pT1a or greater) was used as a proxy for comparing outcomes. No significant difference was found in the frequency of in situ vs invasive melanomas in the SFT and FTF dermatology groups; however, there was a much higher frequency of invasive melanomas in the FTF primary care group ($P = .007$).

DISCUSSION

This study compared the time to treatment for SFT vs FTF and identified important differences. The episode of care for melanomas diagnosed by SFT was statistically significantly longer (15 days) than those diagnosed by FTF. The interval between biopsy and definitive excision was a median of 34 and 38 days, and a mean of 48 and 44 days for SFT and FTF, respectively, which were not statistically significant. The difference in the total duration of the interval between EEC and definitive excision was accounted for by the duration of the interval from EEC to biopsy. When excluding dermatology clinic cases from the FTF group, there was no difference in the interval between EEC and biopsy for SFT and FTF primary care. The handoffs in SFT accounted for a median of 6 days and mean of 12 days, a significant portion of the timeline, and is a target for process improvement. The delay necessitated by handoffs did not significantly affect the distribution of in situ and invasive melanomas in the SFT and FTF dermatology groups. This suggests that SFT may have better outcomes than FTF primary care.

There has been extensive research on the timeline from the patient initially noticing a lesion to the EEC.[8-11] There is also a body of research on the timeline from biopsy to definitive excision.[6,12-16] However, there has been little research on the timeline between EEC and biopsy, which comprises a large portion of the overall timeline of both SFT care and FTF care. This study analyzed the delays that can occur in this interval. When patients first enter FTF dermatology care, this timeline is quite short because lesions are often biopsied on the same day. When patients enter into care with their primary or nondermatology clinician, there can be significant delays.

Since the stakes are high when it comes to treating melanoma, it is important to minimize the overall timeline. A 6-day median and 12-day mean were established as targets for teledermatology handoffs. Ideally, a lesion should be entered into an episode of care, imaged, and sent for consultation on the same day. To help further understand delays in administrative handoffs, we stratified the SFT cases by VISN 20 sites and spoke with an administrator at a top performing site. Between 2006 and 2013, this site had a dedicated full-time imager as well as a backup imager that ensured images were taken quickly, usually on the same day the lesion was entered into care. Unfortunately, this is not the standard at all VISN 20 sites and certainly contributes to the overall delay in care in SFT.

Minimizing the timeline of care is possible, as shown by the Danish health system, which developed a fast-track referral system after recognizing the need to minimize delays between the presentation, diagnosis, and treatment of cutaneous melanomas. In Denmark, a patient who presents to a general practitioner with a suspicious lesion is referred to secondary care for excision biopsy within 6 days. Diagnosis is made within 2 weeks, and, if necessary, definitive excision is offered within 9 days of the diagnosis. This translates into a maximum 20-day EEC to biopsy timeline and maximum 29-day EEC to definitive excision timeline. Although an intervention such as this may be difficult to implement in the United States due to its size and decentralized health care system, it would, however, be more realistic within the VA due to its centralized structure. The Danish system shows that with appropriate resource allocation and strict timeframes for treatment referrals, the timeline can be minimized.[17]

Despite the delay in the SFT timeline, this

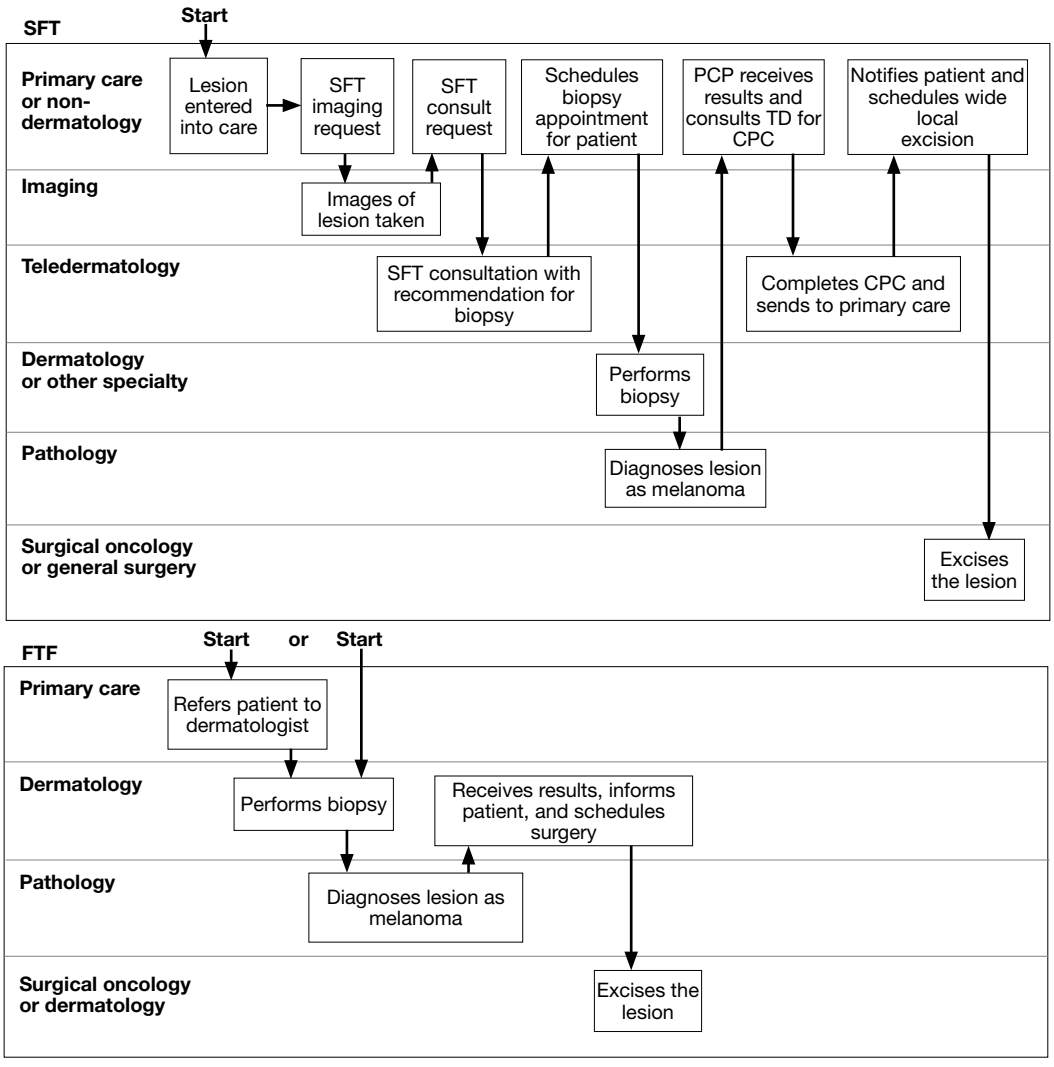

FIGURE. Proper Handoff Protocol Comparing SFT and FTF Care

Abbreviations: CPC, clinical pathologic correlation; FTF, face-to-face care; PCP, primary care practitioner; SFT, store-and-forward; TD, teledermatology.

study found no significant difference between the distribution of in situ vs invasive melanomas in FTF dermatology and SFT groups. One possible explanation for this is that SFT increases access to dermatologist care, meaning clinicians may be more willing to consult SFT for less advanced–appearing lesions.

The finding that SFT diagnosed a larger proportion of in situ melanomas than FTF primary care is consistent with the findings of Ferrándiz et al, who reported that the mean Breslow thickness was significantly lower among patients in an SFT group compared to patients in an FTF group consisting of general practitioners.[18] However, the study population was not randomized and the results may have been impacted by ascertainment bias. Ferrándiz et al hypothesized that clinicians may have a lower threshold for consulting teledermatology, resulting in lower mean Breslow thicknesses.[18] Karavan et al found the opposite results, with a higher mean Breslow thickness in SFT compared to a primary care FTF group.[19] The data presented here suggest that SFT has room for process improvement yet is essentially equivalent to FTF dermatology in terms of outcomes.

Limitations

The majority of patients in this study were aged > 50 years, White, and male. The results may not be representative for other populations. The study was relatively small compared to studies that looked at other aspects of the melanoma care timeline. The study was not powered to

ascertain mortality, the most important metric for melanoma.

CONCLUSIONS

The episode of care was significantly longer for melanomas diagnosed by SFT than those diagnosed by FTF; however, timelines were not statistically different when FTF lesions entered into care in dermatology were excluded. A median 6-day and mean 12.3-day delay in administrative handoffs occurred at the beginning of the SFT process and is a target for process improvement. Considering the high stakes of melanoma, the SFT timeline could be reduced if EEC, imaging, and SFT consultation all happened in the same day.

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Disclaimer

The opinions expressed herein are those of the authors and do not necessarily reflect those of *Federal Practitioner*, Frontline Medical Communications Inc., the US government, or any of its agencies.

Ethics and consent

This study was determined to be exempt by the Veterans Affairs Puget Sound Health Care System Institutional Review Board.

References

1. Raugi GJ, Nelson W, Miethke M, et al. Teledermatology implementation in a VHA secondary treatment facility improves access to face-to-face care. *Telemed J E Health*. 2016;22(1):12-17. doi:10.1089/tmj.2015.0036
2. Moreno-Ramirez D, Ferrandiz L, Nieto-Garcia A, et al. Store-and-forward teledermatology in skin cancer triage: experience and evaluation of 2009 teleconsultations. *Arch Dermatol*. 2007;143(4):479-484. doi:10.1001/archderm.143.4.479
3. Landow SM, Oh DH, Weinstock MA. Teledermatology within the Veterans Health Administration, 2002–2014. *Telemed J E Health*. 2015;21(10):769-773. doi:10.1089/tmj.2014.0225
4. Whited JD, Hall RP, Foy ME, et al. Teledermatology's impact on time to intervention among referrals to a dermatology consult service. *Telemed J E Health*. 2002;8(3):313-321. doi:10.1089/15305620260353207
5. Hsiao JL, Oh DH. The impact of store-and-forward teledermatology on skin cancer diagnosis and treatment. *J Am Acad Dermatol*. 2008;59(2):260-267. doi:10.1016/j.jaad.2008.04.011
6. Conic RZ, Cabrera CI, Khorana AA, Gastman BR. Determination of the impact of melanoma surgical timing on survival using the National Cancer Database. *J Am Acad Dermatol*. 2018;78(1):40-46.e7. doi:10.1016/j.jaad.2017.08.039
7. Dougall B, Gendreau J, Das S, et al. Melanoma registry underreporting in the Veterans Health Administration. *Fed Pract*. 2016;33(suppl 5):55S-59S.
8. Xavier MHSB, Drummond-Lage AP, Baeta C, Rocha L, Almeida AM, Wainstein AJA. Delay in cutaneous melanoma diagnosis: sequence analyses from suspicion to diagnosis in 211 patients. *Medicine (Baltimore)*. 2016;95(31):e4396. doi:10.1097/md.0000000000004396
9. Schmid-Wendtner MH, Baumert J, Stange J, Volkenandt M. Delay in the diagnosis of cutaneous melanoma: an analysis of 233 patients. *Melanoma Res*. 2002;12(4):389-394. doi:10.1097/00008390-200208000-00012
10. Betti, R, Vergani R, Tolomio E, Santambrogio R, Crosti C. Factors of delay in the diagnosis of melanoma. *Eur J Dermatol*. 2003;13(2):183-188.
11. Blum A, Brand CU, Ellwanger U, et al. Awareness and early detection of cutaneous melanoma: An analysis of factors related to delay in treatment. *Br J Dermatol*. 1999;141(5):783-787. doi:10.1046/j.1365-2133.1999.03196.x
12. Brian T, Adams B, Jameson M. Cutaneous melanoma: an audit of management timeliness against New Zealand guidelines. *N Z Med J*. 2017;130(1462):54-61. https://pubmed.ncbi.nlm.nih.gov/28934768
13. Adamson AS, Zhou L, Baggett CD, Thomas NE, Meyer AM. Association of delays in surgery for melanoma with Insurance type. *JAMA Dermatol*. 2017;153(11):1106-1113. doi:https://doi.org/10.1001/jamadermatol.2017.3338
14. Niehues NB, Evanson B, Smith WA, Fiore CT, Parekh P. Melanoma patient notification and treatment timelines. *Dermatol Online J*. 2019;25(4)13. doi:10.5070/d3254043588
15. Lott JP, Narayan D, Soulos PR, Aminawung J, Gross CP. Delay of surgery for melanoma among Medicare beneficiaries. *JAMA Dermatol*. 2015;151(7):731-741. doi:10.1001/jamadermatol.2015.119
16. Baranowski MLH, Yeung H, Chen SC, Gillespie TW, Goodman M. Factors associated with time to surgery in melanoma: an analysis of the National Cancer Database. *J Am Acad Dermatol*. 2019;81(4):908-916. doi:10.1016/j.jaad.2019.05.079
17. Jarjis RD, Hansen LB, Matzen SH. A fast-track referral system for skin lesions suspicious of melanoma: population-based cross-sectional study from a plastic surgery center. *Plast Surg Int*. 2016;2016:2908917. doi:10.1155/2016/2908917
18. Ferrándiz L, Ruiz-de-Casas A, Martin-Gutierrez FJ, et al. Effect of teledermatology on the prognosis of patients with cutaneous melanoma. *Arch Dermatol*. 2012;148(9):1025-1028. doi:10.1001/archdermatol.2012.778
19. Karavan M, Compton N, Knezevich S, et al. Teledermatology in the diagnosis of melanoma. *J Telemed Telecare*. 2014;20(1):18-23. doi:10.1177/1357633x13517354