

Alzheimer's disease and Related Disorders Behavioral Profile

Once the patients become lost they are generally found close to the PLS. This data supports the few anecdotal case studies reported in the literature. In addition, it supports the personal experience of the author reported elsewhere. This finding is somewhat surprising considering Alzheimer's sufferers may be healthier than other age controlled elderly and by definition only suffer initially from a loss in cognitive domains. It is expected that the Alzheimer's patient may get lost shortly after leaving the point last seen. While the investigators have heard many reports of Alzheimer's patients walking great distances (10-15 miles), no such case appeared in the Virginia retrospective case load. It is possible that as a larger data pool develops the mean distance of 0.6 miles will increase. The median distance of 0.5 miles will most likely remain stable. During three different studies by the author (n=24, n=42, n=87) both the median and mean have remained the same with additional data points. However, a limited prospective study, which included searches not involving law enforcement or state resources did include several statistical outliers that traveled 12, 8, and 4 miles. In fact if investigative finds are included then distances over 1000 miles could be included (subject boarded a plane to Panama).

The data shows important differences between normal elderly and Alzheimer's subjects. The means and medians are essentially the same. The significant differences arise after the 75%. With Alzheimer's subjects 94% of all subjects will be found within 1.5 miles, but only 65% of the elderly will be found at that distance. Those elderly subjects found within 0.5 miles in many cases were not actually lost. Instead, they became a subject of a search after suffering a fatal heart attack or suffering a trauma often while working in a rural location. For this reason the term "healthy elderly" was avoided (although it would be an accurate description of their mental state). The normal subjects that went further than the mean were typically engaged in activities such as hiking or hunting. The distance they covered were identical to the expected distances of all subjects in those profiles. In fact, when looking for elderly subjects with normal cognitive skills use the behavioral profile that matches their activity.

Distance off Travel-Aid: A travel-aid was defined as a road, trail, or other feature that would aid travel. The find location was recorded in 56 searches. Fourteen of these searches (25%) resulted with a find along a travel-aid. The distance from a travel aid was recorded in 23 searches. The distance was calculated by measuring the shortest distance from a travel aid to the find location. The descriptive statistics are reported in the table below. The important point is for those subjects not found on a road or travel aid 50% of them may be found within 33 yards of a travel aid. When faced with a subject who has a previous history of wandering great distances the search planner may elect to search 100 yards off all roads and travel aids beyond the normal statistical max zone of 1.5 miles.

| Statistical measure | Distance off Travel Aid in Yards (meters) |
|---------------------|---|
| n | 23 cases |
| Median (50%) | 33 (30) |
| Mean | 100 (91) |
| (s) | 138 (126) |
| Range | 1-500 (1-457) |

Find Location

| Location | Alzheimer's |
|--------------|-------------|
| Structure | 15% |
| Yard (field) | 18% |
| Drainage | 18% |
| Woods | 7% |
| Brush/Briar | 29% |
| Road | 7% |
| Other Linear | - |
| Other | 4% |

The considerable number (18%) of DAT patients found in drainages or creeks supports the following a path of least resistance hypothesis. This indicates they walked downhill. Another 29% of the patients appear to have become stuck in thick brush or briars (a feature untrained searchers often avoid). Together (47%), both terrain features indicate a scenario of the patient traveling a path of least resistance till they reach a creek or get stuck in briars. This as lead to a rather simple but true statement that can be used in search planning:

They go until they get stuck

In 26 cases (54%), the patient lived in their own residence or with family in a residential setting. In 32 cases (46%) the patient lived in a nursing care facility. Only one search occurred at a Alzheimer's special care unit. That subject was located within the facility in another residents bed. Using Discriminant analysis there was no significant differences in age ($p=0.65$), time required to find ($p=0.68$), time elapsed till SAR resources were contacted ($p=0.30$), or distance from the point last seen ($p=0.64$) between those living in a care facility or in the community.

Fifty-one (67%) of the searches were rural, sixteen urban (21%), and nine suburban (12%). ANOVA indicates no differences between the three settings when analyzing age ($p=0.40$), time required to find ($p=0.83$), time elapsed until resources called ($p=0.70$), or the distance from the point last seen ($p=0.87$). The most notable differences occurred among the percentages of subjects found by searchers, thru investigative efforts, or suspended searches. The greatest difference is between rural and urban searches for percentage of investigative finds. In rural settings only 8% of Alzheimer's subjects are found through investigative efforts (in a hospital, shelter, boarded public transportation, etc). While in urban settings 25% of finds occur in this fashion. Due to the nature of the data collection, it is fully expected that this number is in fact even higher.

Timing

Time of day: The times at which patients were last seen by caregivers or a member of the general public are distributed equally over the daylight hours. No critical wanderers departed between 0001 and 0530. This indicates a cluster during the hours of 0700 and 2400. The Rayleigh test for significant clustering indicates this clustering is significant ($r=0.45$, $p < 0.001$) compared to random clustering with a vector at 1500 (225E).

The data suggests critical wanderers are last seen between 06:00 and 24:00. There was no particular tight cluster of time, supporting Martine-Saltzman *et al.* findings and suggesting the critical wanderers in this study suffer from severe dementia. Although no case was reported between 00:01 and 06:00 this does not preclude nocturnal wandering. Several cases of critical wandering were initiated after sunset. Furthermore, in one case while the patient was last seen at 22:30 the caregiver also reported hearing the patient leave the house at 02:30. The small sample size may have resulted in the lack of critical wanderers between 0001 and 0600. Finally, care-givers or institutional staff may not be present or awake to see the patient depart during these times.

Time of year: The table below depicts the occurrence of critical wanderer searches in Virginia by month. The warm season or frost-free period for Virginia starts in April and runs to October. Fifty-nine (69%) of the searches occurred during the frost-free period. While 31% of the searches occurred during the five cold months, accounting for 47% of the fatalities. The difference in case distribution of cold versus warmer months just missed standard statistical significance ($P^2=3.73$, $p < 0.053$). The cold versus warm distribution of fatalities also just missed standard statistical significance ($P^2 = 2.57$, $p < 0.10$). This lack of reaching statistical significance can be attributed to data collected during September. While technically a frost-free period, significant transitions occur in weather often producing "classic" hypothermia weather of a warm day that rapidly changes to one with temperatures in the low 40's (F), significant winds, and rain.

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| # (n) | 4 | 8 | 4 | 3 | 6 | 8 | 10 | 12 | 12 | 8 | 3 | 7 |
| % DOA | 50% | 12% | - | 33% | 17% | | 10% | | 33% | 12% | 33% | 43% |

The greatest number of searches occurred during the warm season. We defined the warm season as the frost free period and the cool season is the period in which freezing temperatures are likely to occur. The number of searches generally increased during the warm season and decreased during the cool season. We observed a slight increase in searches during February. Due to the small sample size no conclusions are drawn. Virginia's February often experience warm spells after protracted periods of cold. This increased wandering in February agrees with the undocumented observation of an increase in wandering after a cold period.

Direction of Travel

Documentation of a direction of travel only occurred for nine searches. The direction of travel was usually established by a combination of the Initial Planning Point (IPP) and a verifiable clue. Bloodhound trails were not considered a verifiable clue. Once a direction of travel was obtained it was normalized to represent a vector of 0 degrees. The location of the subject is expressed as an angle off the direction of travel. Five of the nine finds (56%) occurred within 30° degrees of the direction of travel. The Rayleigh test for significant clustering indicates this is non-random ($p < 0.001$). In the one case where the subject was located in nearly the opposite direction of the predicted direction of travel, the subject was located 83 yards (75m) from the clue and 33 yards (30m) from the IPP.

Directionally Twenty-three cases had sufficient documentation to plot the compass vector and distance the subject was found relative to the IPP. The plots of the find location are shown in the table below. Five subjects (22%) were found north of the IPP, while eighteen (78%) of the subjects were found south of the IPP. This distribution is outside expected distributions ($P^2 = 8.2, p < 0.01$). No significant East-West difference was seen ($P^2 = 1.4, p = 0.24$). A closer examination of the South-East and the South-West quadrants found that 75% of the subjects found in each quadrant was last seen in the afternoon.

| | |
|---------|----------|
| NW 1 | NE 4 |
| 6 SW | 12 SE |

This tendency to travel south as been nicknamed the "Florida factor". I currently have two working hypothesis as what causes this behavior. The first involves traveling towards the sun or light. In the northern hemisphere above the tropic of Cancer (which Virginia is well north of) the sun will always be found in the south. If a person heads toward the sun at any time they will also be found south of their initial position. Alzheimer's patients in more clinical settings are known to be drawn towards light. To conclude this in fact the cause additional searches where the person was missing for a few hours in only the morning or afternoon will be required. The second hypothesis also indirectly involves the sun. Many of the searches that make up the database (73%) are from rural houses. It is a common practice in rural Virginia to build the front porch facing the south. Many Alzheimer's patients may simply head out the front door and continue in that direction. In search planning I tend to look at the person's unique history, then topology in deciding where to deploy initial resources. Only after all things being equal will I tend to put additional emphasis on the southern direction.

Survivability

There was a significant increase in morbidity and mortality as the total time elapsed to find the patient increased. There was also a significant increase in morbidity and mortality as the time increased from when trained SAR resources were notified and the

patient was located. The two uninjured ADRD patients located after a considerable delay were in an uninhabited former residence. Among those patients located within 12 hours of being last seen, no deaths occurred. Weather will have a significant impact on these numbers. In six cases the search was suspended without the patient being found. These searches are not included in the time to find analysis though in five cases the body was eventually located within the search area.

| | <12 hrs | >12 hrs | > 24 hrs | > 48 hrs | > 72 hrs |
|------------------------|------------|------------|------------|------------|------------|
| Walk-out | 93% | 48% | 32% | 40% | 20% |
| Evacuated | 7% | 33% | 35% | 20% | 0% |
| Dead on Arrival | 0% | 20% | 32% | 40% | 80% |

| Mean SAR Contact time | Hours |
|--------------------------------|--------------|
| Subject Dead on Arrival | 50 |
| Subject uninjured | 12 |

SAR contact time was calculated from the time the person was last seen until state SAR resources were requested by local law enforcement. The time includes the amount of time until a caregiver or family member notices the subject is missing, the time they might spend looking, and the time local law enforcement spends investigating and looking until they contacted state SAR resources. The records did not allow an analysis of these times.

Behavioral Profile

- “They go until they get stuck.”
- Appear to lack ability to turnaround.
- Subject oriented to the past, degree of the disease sends them back in time
- Subject usually found in a creek, or drainage and/or caught in briars/bushes (63%)
- Leaves own residence or nursing home, possibly with last sighting on a roadway
- Coexisting medical problems that limit mobility are common.
- Has previous history of wandering (72%)
- May cross or depart from roads (67%).
- Usually (89%) found within one mile of IPP, half found within 0.5 miles.
- Subject usually found a short distance from road (50% within 33 yards)
- Subject may attempt to travel to former residence or favorite place.
- Subject will not leave many verifiable clues.
- Will not cry-out for help (1%) or respond to shouts (only 1% response rate).
- Succumbs to the environment (hypothermia, drowning, dehydration).

Reflex Tasks

- Highly systematic search of residence/nursing home and grounds required by law enforcement.
- Send patrols to areas the subject has been previously located
- Investigative task of canvassing neighborhood.
- Patrol along roads. This should extend to the theoretical search area, especially in urban environments.
- Establish containment points
- Early use of trackers at point last seen (IPP)
- Early use of tracking dogs at IPP, along roadways, or clues
- Deploy air-scent dog teams into drainages and streams, starting nearest IPP.
- Early deployment of hasty ground teams into drainages and streams nearest the IPP
- Cut for sign along roadways.
- Dog teams and ground sweep teams (in separate sectors) expanding from IPP. Ensure teams search heavy briars/bushes.
- Air scent dog teams and ground sweep teams tasked 100 yards (initially) parallel to roadways.
- Search nearby previous home sites and the region between home sites and IPP
- Repeat search of residence/nursing home grounds at least twice a day
- Post flyers in appropriate locations
- After initial task search should expand outward from IPP

These sections are excerpts from a book in progress on wandering and Alzheimer's.

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