

SPeech Recognition In Noise Test (SPRINT) for H-3 Profile

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October, 1992

BACKGROUND

Despite the Army's extensive hearing conservation program, noise-induced hearing loss remains a significant health hazard to the soldier. Currently, more than fifty thousand active duty Army personnel are rated permanent H-3 under the Army's physical profiling system. Soldiers with H-3 profiles may be required to go before a Military Medical Retention Board (MMRB) which makes a determination to retain, reclassify, or separate the soldier from active duty, ostensibly on the basis of the soldier's ability to perform his/her duties. However, it is clear that soldiers with H-3 profiles vary considerably in their ability to perform their mission. Further, MMRB's vary considerably in their decisions when assessing soldiers with H-3 profiles. As a result, there has long been concern among Army audiologists, as well as local commanders, that some soldiers have been unnecessarily reclassified or separated from the Army, while others have been retained in assignments which may further jeopardize the soldier's fitness for duty and, therefore, mission accomplishment.

Although many soldiers with H-3 profiles experience little difficulty in favorable communication situations, there is great inter-subject variability in the amount of difficulty experienced by these soldiers when communicating in noisy listening environments such as are experienced in combat training or on the battlefield. The degree of communication difficulty experienced by an individual soldier cannot be predicted with accuracy from traditional clinical audiometric measures such as pure-tone thresholds or speech recognition in quiet. A clinical test that evaluates speech recognition ability in noise should have greater validity predicting communication handicaps that would impinge on mission accomplishment than the traditional audiometric indices that are currently provided to the MMRB.

A simple clinical test of speech recognition in noise has been developed and standardized which can be easily implemented by Army audiologists to provide MMRB's with information regarding a hearing-impaired soldier's potential communication handicap on the job. The information provided should allow the Board to make more informed and equitable decisions regarding an individual soldier's fitness for duty.

TEST DEVELOPMENT

The SPeech Recognition in Noise Test (SPRINT) consists of 200 monosyllabic words (Form C of the NU-6 lists) pre-recorded in a background of multi-talker babble noise. The speech-to-

babble ratio (+9 dB) is such that normal-hearing soldiers are little affected by the background noise; that is, they can identify 95-100% of the monosyllabic words correctly. However, the performance of soldiers with H-3 profiles varies considerably. Administration of the SPRINT allows the performance of an individual soldier to be compared with that of a large random sample of soldiers with H-3 profiles.

During the development of the SPRINT, a total of 319 soldiers with H-3 profiles were tested at 12 different Army audiology clinics within CONUS. The data obtained were sent to WRAMC to be compiled and analyzed. Initially, the data from the 12 test sites were compared to determine if systematic differences existed among the test facilities. An analysis of variance indicated no significant differences. Consequently, data were pooled for all subsequent analyses. The mean score for the 319 soldiers was 163 (out of a possible 200) with a range of 65 to 196 words correct. A frequency distribution of the scores (i.e., number of words correct) for the 319 H-3 profile soldiers is shown in Fig. 1.

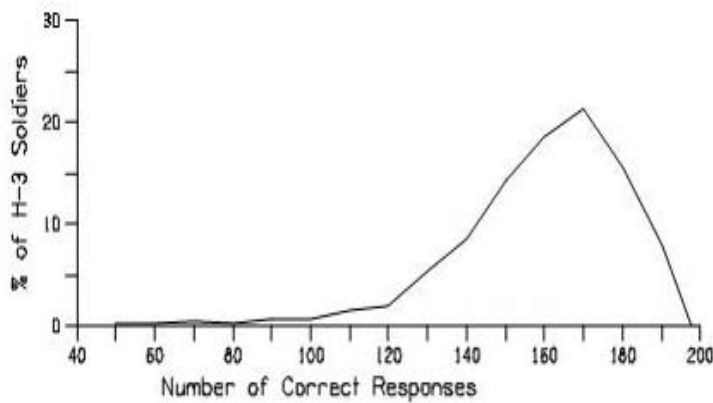


Fig 1. Frequency distribution of scores for 319 H-3 profile soldiers

TEST ADMINISTRATION

The SPRINT should be administered by an audiologist or by a technician under an audiologist's supervision.

Who to test:

The SPRINT is to be administered to all active duty soldiers who are seen through your clinic and are identified as having a permanent H-3 profile. Additionally, all H-3 soldiers are to be retested with the SPRINT whenever a significant permanent threshold shift has occurred. According to Army hearing conservation guidelines, this is defined as a decrease of more than 10 dB for the pure-tone average of 2000, 3000, 4000 Hz in either ear.

Test Procedures:

The SPRINT is administered through an audiometer under earphones with the signal (i.e., monosyllabic words presented in a multi-talker babble) delivered to the right and left ear simultaneously. Because the monosyllabic words and the background babble are pre-recorded at the proper speech-to-babble ratio on the same channel of the tape, the audiologist need only set the overall presentation level of the recording.

- Set audiometer attenuator to **50 dB HL**.
- Route signal to **both right and left earphones**.
- Start tape and adjust VU to **0 (zero) for calibration tone**.
- Turn down tape monitor and turn up talk-back to hear patient responses more clearly; position talk-back microphone close enough to patient that responses can be clearly heard.

Instructions to soldier:

"You will be hearing a tape recording of a man's voice saying some words. In the background, there will be the sound of several people talking at once. I want you to repeat back the words that the man is saying. Some of the words may be difficult for you to hear. If you're not sure what the word is, take a guess. There are 4 lists containing 50 words each for a total of 200 words. This will take about 20 minutes. You will be hearing the words and the background talk in both earphones."

- Be sure to encourage guessing.
- If more than one answer is given (such as "It was either map or mat") take the first response.
- Write down the incorrect responses on the response form.
- The complete 200 word test must be administered for this test to be valid. Interpolating a total score from the first 50 or 100 words invalidates the test.

SCORING

A soldier's SPRINT score is simply the number of monosyllabic words that were correctly identified (i.e., 0-200). In order for an individual soldier's score to be ranked in comparison with the standardization sample, it is necessary to convert the soldier's score to a percentile ranking within the frequency distribution depicted in Figure 1. This is accomplished using the table given in Appendix 1. For example, if an individual soldier correctly identifies 133 of the 200 monosyllabic words, s/he falls in the 10th percentile and, therefore, 90% of all soldiers with H-3 profiles in the Army will score higher than s/he on the SPRINT. Similarly, if a soldier got 182 of the 200 words correct, s/he falls in the 83rd percentile. In this case, only 17% of all soldiers with H-3 profiles in the Army will score higher.

RECOMMENDATIONS TO MMRB

The percentile score derived from the soldier's raw score indicates how s/he compares with all other soldiers in the Army with H-3 profiles. Although this is useful information, it is not sufficient to make a recommendation to the MMRB. Many other factors might be considered (e.g., age, progression of the hearing loss, military rank, duty assignment, etc.). Typically, however, the most important consideration in addition to the SPRINT score will be the soldier's length-in-service. For example, a soldier who falls in the 50th percentile who has just completed basic training must be considered differently from a soldier with the same percentile ranking who has 18 years on active duty. At a minimum, therefore, the recommendation to the MMRB will be based on a combination of the soldier's percentile ranking and his/her length of service on active duty. These two factors are combined to make a single recommendation, using the table depicted in Appendix 2. This table defines five recommendation categories. To determine the appropriate recommendation for an individual soldier, enter his/her percentile score along the horizontal axis. Next, enter his/her length in service (in years) along the vertical axis. The intersection of these two points within the table indicates the appropriate recommendation. For example, if a soldier scored at the 55th percentile on the SPRINT and has 11.5 years of active duty service, s/he would fall within the "C" category. A recommendation of "Re-assignment to non-noise hazardous duty," therefore, would be made. As is apparent from the table in Appendix 2, soldiers who perform better on the SPRINT and who have more years on active duty are more likely to be recommended for retention than are soldiers who perform poorly on the SPRINT and have less time in service.

The audiologist's recommendation is to be recorded in the soldier's permanent medical records on a Standard Form 600 which should be attached to the most recent Physical Profile (DA Form 3349). The suggested format for an overprint can be seen in Appendix 3. Your command may require approval of overprints; check with your medical records department for guidance. The SPRINT response form should be filed in the soldier's sub-specialty chart in the Audiology clinic. The SPRINT response form is not a DA Form and therefore should not be filed in the soldier's permanent medical record.

RELIABILITY

The reliability of the recommendations that result from using the SPRINT and the table in Appendix 2 was assessed by obtaining test-retest scores on the SPRINT from 30 soldiers. The mean score for the initial administration of the SPRINT was 164.6 words correct (S.D. = 15.46), and the mean score for the retest was 166.8 words correct (S.D. = 14.21). A product-moment correlation coefficient of .93 ($p < .01$) indicates a strong positive association between the test and retest scores. As was apparent from the mean SPRINT scores for the two administrations seen in Figure 2, there was a tendency for scores to improve on retest. This was likely due to learning effects since, in most cases, retest occurred within 4 days of the initial test. Although additional improvement in SPRINT scores may have resulted from further administrations of the test, it must be kept in mind that the sampling distribution upon which the percentile ranks are computed is based on a single administration of the SPRINT to the standardization sample. There is no apparent reason to assume that the relative ranking of an individual soldier in comparison to all other soldiers with H-3 profiles would change with repeated administrations of the test.

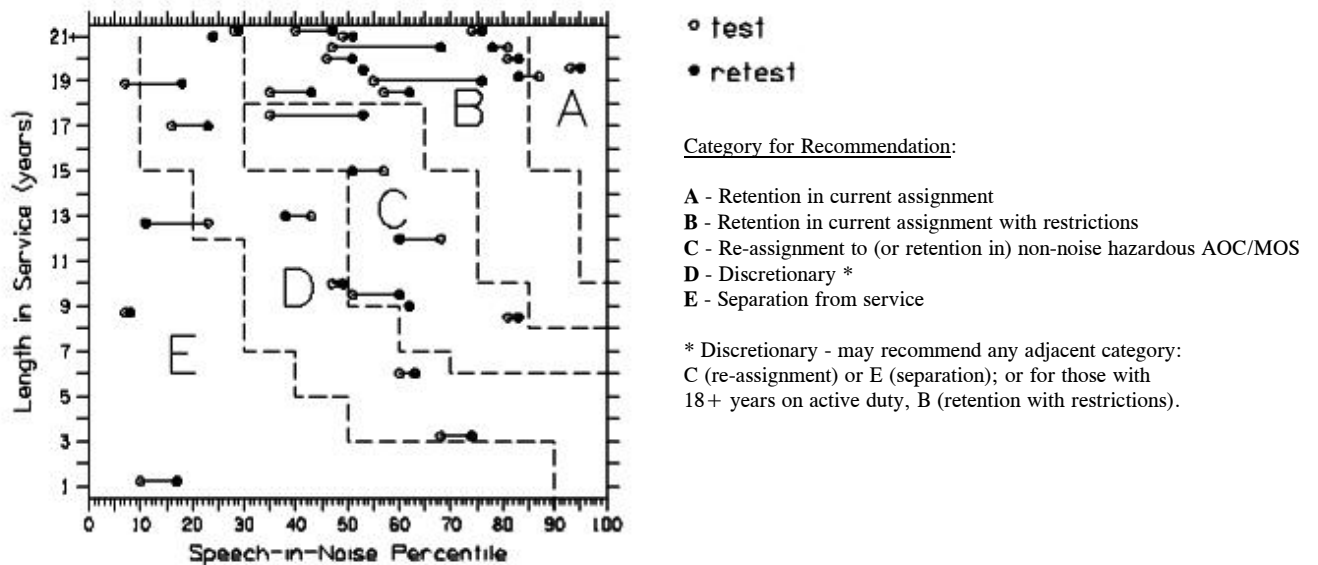


Figure 2: Test-Retest Scores for 30 H-3 Soldiers

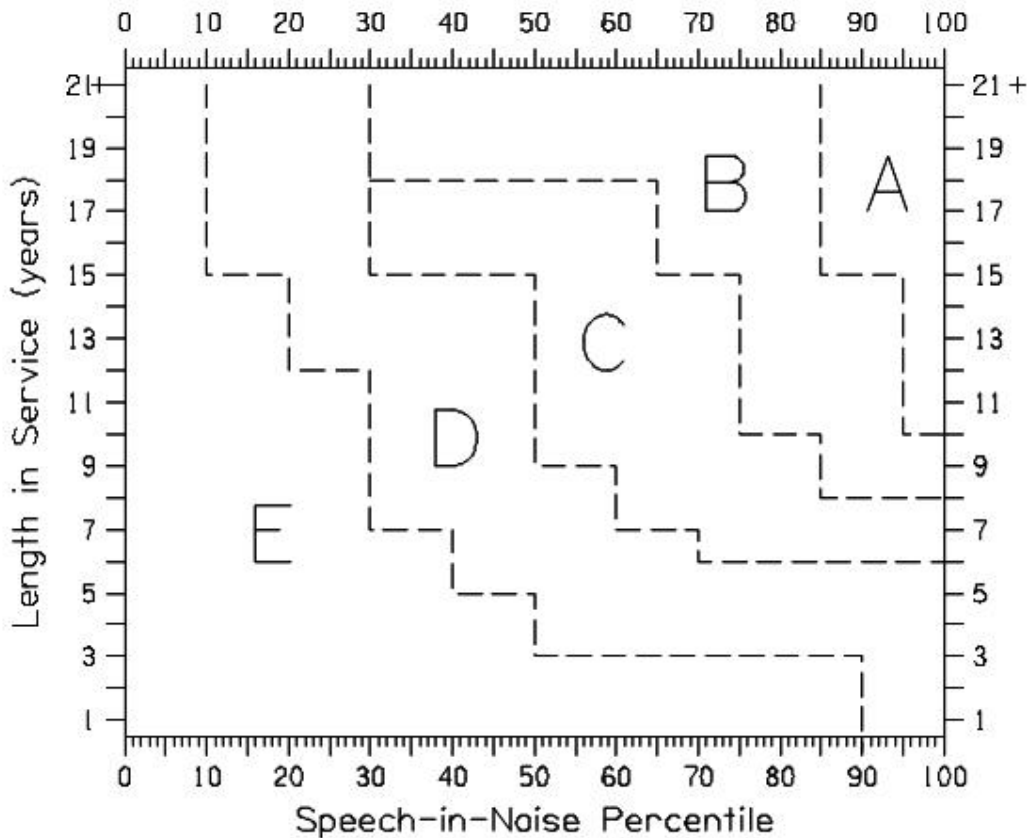
PERCENTILES for SPRINT

<u>SCORE</u>	<u>PERCENTILE</u>	<u>SCORE</u>	<u>PERCENTILE</u>
0-75	1	162	37
76-100	2	163	40
101-107	3	164	42
108-116	4	165	45
117-122	5	166	48
123-124	6	167	49
125-126	7	168	51
127-128	8	169	53
129-130	9	170	55
131-135	10	171	57
136-138	11	172	59
139-140	12	173	62
141	13	174	64
142	14	175	67
143-144	16	176	70
145	17	177	72
146	18	178	74
147	19	179	76
148	21	180	78
149-150	22	181	80
151-152	23	182	83
153	24	183	86
154	26	184	89
155-156	28	185	92
157	29	186-187	95
158	30	188	96
159	32	189	97
160	34	190	98
161	35	191	99

Appendix 2

CATEGORY	RECOMMENDATION
A	Retention in current assignment
B	Retention in current assignment with restrictions
C	Re-assignment to (or retention in) non-noise hazardous AOC/MOS
D	Discretionary **
E	Separation from service

** For soldiers falling in category D, the audiologist can make a recommendation associated with any category adjacent to Category D. Except for patients with 18+ years on active duty (for which a Category B recommendation could be made), this choice will be between Category C (re-assignment) or Category E (separation). The decision of which recommendation to make should be based on such factors as stability of loss, potential for further noise exposure, the soldier's AOC/MOS, and the recommendation of the local commander.



SPRINT (SPeech Recognition In Noise Test) for soldiers with H-3 Profile

Name: _____

Date: _____

SSN: _____ Rank: _____

Date of Birth: _____

Total number correct out of 200: _____ (raw score)

Percentile: _____
(see Appendix 1 to convert raw score to %ile score)

Length in Service: _____ yrs. _____ mos.

Category for Recommendation: *(see Appendix 2)*

_____ **A** - Retain in current assignment

_____ **B** - Retain in current assignment with restrictions

_____ **C** - Re-assign to (or retain in) non-noise hazardous
AOC/MOS

_____ **D** - Discretionary*

_____ **E** - Separation from service

* Discretionary - may recommend any adjacent category: C (re-assignment) or E (separation); or for those with 18+ years on active duty, B (retention with restrictions).

Comments:

Audiologist: _____

LIST 1C

1. raise
2. door
3. tip
4. sure
5. hurl
6. met
7. burn
8. sell
9. reach
10. dime
11. jar
12. death
13. which
14. third
15. pool
16. moon
17. fat
18. king
19. chalk
20. yes
21. week
22. whip
23. bean
24. choice
25. rag
26. fall
27. vine
28. jail
29. home
30. boat
31. mode
32. tough
33. lot
34. raid
35. take
36. page
37. keen
38. laud
39. limb
40. goose
41. gap
42. sub
43. nag
44. size
45. hash
46. love
47. knock
48. puff
49. shout
50. kite

LIST 2C

1. dead
2. juice
3. merge
4. young
5. calm
6. bite
7. rain
8. match
9. book
10. loaf
11. nice
12. bought
13. ton
14. shawl
15. white
16. hate
17. shack
18. pike
19. shall
20. rot
21. gin
22. pad
23. gaze
24. live
25. room
26. south
27. mill
28. which
29. tool
30. numb
31. haze
32. pick
33. turn
34. goal
35. voice
36. keep
37. thought
38. far
39. read
40. hush
41. chair
42. chief
43. keg
44. soap
45. said
46. dab
47. wag
48. deep
49. learn
50. lore

LIST 3C

1. mop
2. tell
3. germ
4. seize
5. good
6. base
7. search
8. ring
9. half
10. mess
11. late
12. when
13. gun
14. name
15. sour
16. ditch
17. rat
18. hire
19. shall
20. cheek
21. pole
22. life
23. date
24. road
25. talk
26. cause
27. youth
28. bar
29. lid
30. hit
31. cool
32. five
33. rush
34. phone
35. mouse
36. thin
37. pearl
38. beg
39. walk
40. luck
41. team
42. soup
43. dodge
44. chat
45. sheep
46. note
47. void
48. jug
49. wire
50. cab

LIST 4C

1. perch
2. bath
3. back
4. bone
5. wife
6. fit
7. shirt
8. wash
9. neat
10. tire
11. make
12. mob
13. doll
14. pass
15. sour
16. dog
17. vote
18. time
19. near
20. lease
21. rose
22. kill
23. came
24. food
25. lose
26. should
27. check
28. kick
29. long
30. tape
31. yearn
32. lean
33. gas
34. sail
35. red
36. wheat
37. have
38. mood
39. dip
40. such
41. hall
42. rough
43. peg
44. get
45. chain
46. join
47. ripe
48. judge
49. hole
50. thumb