

## Appendix 3: Summary Score Calculations

NOTE: Recode 95–99 = missing

### HABITUATION (nhabit)

Mean of the following 3 variables:

- B. Habituation (States 1 and 2)
  - 2. Response decrement to light (NNHALIT) not recoded
  - 3. Response decrement to rattle (NNHARAT) not recoded
  - 4. Response decrement to bell (NNHABEL) not recoded

### ATTENTION (norient)

Mean of at least 4 of the following variables:

- I. Neonatal Intensive Care Unit Network Neurobehavioral Scale Attention (States 4 and 5)
  - 35. Orientation: inanimate visual (NNISLIV) not recoded
  - 36. Orientation: inanimate auditory (NNISLIA) not recoded
  - 37. Orientation: inanimate visual and auditory (NNISLIB) not recoded
  - 38. Orientation: animate visual (NNISLAV) not recoded
  - 39. Orientation: animate auditory (NNISLAA) not recoded
  - 40. Orientation: animate visual and auditory (NNISLAB) not recoded
- L. Summary Items
  - 47. Alertness (states 4 and 5) (NNSIALR) not recoded

### AROUSAL (narousal)

Mean of at least 5 of the following variables:

- C. Unwrap and Supine
  - 8. Movement (states 1–4) (NNSMOV) not recoded
- L. Summary Items
  - 51. Peak of excitement (all states) (NNSIEXC) not recoded
  - 53. Irritability (all states) (NNSIRRT) 1 = no fussing not recoded
  - 54. Spontaneous activity (NNSISPO) not recoded
  - 55. Elicited activity (NNSIACT) not recoded
  - 62. First predominant state (NNSIFPR) not recoded
  - 63. Second predominant state (NNSISPR) not recoded

### REGULATION (nselfre3)

Mean of at least 10 of the following variables:

- E. Upper Extremity and Face
  - 25. Pull to sit (states 4 and 5) (NNUEFPS) (SRUEFPS) recoded (1,11 = 1) (2,10 = 2) (3 = 3) (4 = 4) (5 = 5) (6 = 6) (7 = 7) (8 = 8) (9 = 9)
- H. Pick up Infant (States 4 and 5)
  - 33. Cuddle in arm (NPUICA) (SRPUICA) not recoded
  - 34. Cuddle on shoulder (NNPUICS) (SRPUICS) not recoded
- K. Infant Supine in Crib (States 3–5)
  - 43. Defensive response (NNSCRDR) (SRSCRDR) not recoded
- L. Summary Items
  - 47. Alertness (states 4 and 5) (NNSIALR) (RSIALR) not recoded
  - 48. General tone/predominant tone (states 4 and 5) (NNSITON) (RSITON) recoded (9 = 1) (8,10 = 2) (7 = 3) (6 = 5) (5 = 6) (1 = 1) (2 = 2) (3 = 3) (4 = 4)
  - 49. Motor maturity (states 4 and 5) (NNSIMOT) (RSIMOT) not recoded
  - 50. Consolability with intervention (states 6–4 and below) (NNSICON) (RSICON) not recoded
  - 52. Rapidity of build-up (all states with state 6 at least 15 seconds) (NNSIRAP) (RSIRAP) recoded (RSIRAP = 13-srsirap)
  - 56. Tremulousness (all states) (NNSITRE) (RSITRE) recoded (RSITRE = 10-SRSITRE)
  - 57. Amount of startle (states 3–6) (NNSISTA) (RSISTA) recoded (RSISTA = 10-SRSISTA) (9 = MISSING)
  - 58. Lability of skin (as infant moves from state 1 to 6) (NNSISKN) (RSISKN) recoded (1 = MISSING) (2 = 7) (3,7,10 = 3) (4 = 5) (5 = 6) (6 = 4) (8 = 2) (9,11 = 1)
  - 59. Lability of states (all states) (NNSILAB) (RSILAB) recoded (1,7,8,9 = 1) (5,6 = 2) (4 = 3) (3 = 4) (2 = 5)
  - 60. Self-quieting activity (states 6 and 5 to 4–1) (NNSIQUI) (RSIQUI) not recoded
  - 61. Hand-to-mouth facility (all states) (NNSIHMD) (RSIHMD) recoded (10 = 6) (6 = 7) (7 = 8) (8 = 9) (9 = 10) (1 = 1) (2 = 2) (3 = 3) (4 = 4) (5 = 5)

### Handling (nhandle)

Mean of at least 7 of the following variables:

- L. Summary Items
  - 46. Orientation handling procedures
    - a. Repeated time out (NNSIOTO) yes/no recoded (2 = 0)

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- b. Hand-holding/ventral pressure (NNSIOHV) yes/no recoded (2 = 0)
- c. Auditory stimulation (NNSIOAS) yes/no recoded (2 = 0)
- d. Jiggling/vertical rocking (NNSIOJR) yes/no recoded (2 = 0)
- e. Covering/wrapping (NNSIOCW) yes/no recoded (2 = 0)
- f. Swaddling (NNSIOSW) yes/no recoded (2 = 0)
- g. Rocking/walking (NNSIORW) yes/no recoded (2 = 0)
- h. Sucking/pacifier (NNSIOSP) yes/no recoded (2 = 0)

### QUALITY OF MOVEMENT (nqmove)

Mean of at least 4 of the following variables:

- C. Unwrap and Supine
  - 8. Movement (states 1–4) (NNUSMOV) recoded (3 = 1) (1,2 = 2)
- L. Summary Items
  - 49. Motor maturity (states 4 and 5) (NNSIMOT) not recoded
  - 54. Spontaneous activity (states 3–5) (NNSISPO) recoded (1,2,3 = 4) (4 = 3) (5 = 2) (6 = 1)
  - 55. Elicited activity (states 3–5) (NNSIACT) recoded (2,3 = 4) (4 = 3) (1,5 = 2) (6 = 1)
  - 56. Tremulousness (all states) (NNSITRE) recoded (9 = 1) (8 = 2) (7 = 3) (6 = 4) (5 = 5) (4 = 6) (3 = 7) (2 = 8) (1 = 9)
  - 57. Amount of startle (states 3–6) (NNSISTA) recoded (9 = 1) (8 = 2) (7 = 3) (6 = 4) (4 = 6) (3 = 7) (2 = 8) (1 = MISSING)

### EXCITABILITY (nhextcot)

Sum of all variables:

- H. Pick up Infant (States 4 and 5)
  - 33. Cuddle in arm (NNPUICA) recoded ( $\geq 1$  and  $< 3 = 1$ ) ( $\geq 3 = 0$ ) renamed (NNPUICAE) (0,1)
  - 34. Cuddle on shoulder (NNPUICS) recoded ( $\geq 1$  and  $< 3 = 1$ ) ( $\geq 3 = 0$ ) renamed (NNPUICSE) (0,1)
- L. Summary Items
  - 48. General tone/predominant tone (states 4 and 5) (NNSITON) recoded ( $> 6 = 1$ ) ( $\geq 1$  and  $\leq 6 = 0$ ) renamed (NNSITONE) (0,1)\*
  - 49. Motor maturity (states 4 and 5) (NNSIMOT) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNSIMOTE) (0,1)
  - 50. Consolability with intervention (states 6 to 4 and below) (NNSICON) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNSICONE) (0,1)
  - 51. Peak of excitement (all states) (NNSIEXC) recoded ( $\geq 7 = 1$ ) ( $\geq 1$  and  $< 7 = 0$ ) renamed (NNSIEXCE) (0,1)
  - 52. Rapidity of build-up (all states with state 6 at least 15 seconds) (NNSIRAP) recoded ( $> 6 = 1$ ) ( $\geq 1$  and  $\leq 6 = 0$ ) renamed (NNSIRAPE) (0,1)
  - 53. Irritability (all states) (NNSIRRT) recoded ( $> 5 = 1$ ) ( $\geq 1$  and  $\leq 5 = 0$ ) renamed (NNSIRRTE) (0,1)

- 54. Spontaneous activity (states 3–5) (NNSISPO) recoded ( $> 6 = 1$ ) ( $\geq 1$  and  $\leq 6 = 0$ ) renamed (NNSISPOE) (0,1)
- 55. Elicited activity (states 3–5) (NNSIACT) recoded ( $> 6 = 1$ ) ( $\geq 1$  and  $\leq 6 = 0$ ) renamed (NNSIACTE) (0,1)
- 56. Tremulousness (all states) (NNSITRE) recoded ( $> 5 = 1$ ) ( $\geq 1$  and  $\leq 5 = 0$ ) renamed (NNSITREE) (0,1)
- 57. Amount of startle (states 3–6) (NNSISTA) recoded ( $> 4 = 1$ ) ( $\geq 1$  and  $\leq 4 = 0$ ) renamed (NNSISTAE) (0,1)
- 58. Lability of skin (as infant moves from state 1 to 6) (NNSISKN) recoded ( $> 7 = 1$ ) ( $\geq 1$  and  $\leq 7 = 0$ ) renamed (NNSISKNE) (0,1)
- 59. Lability of states (all states) (NNSILAB) recoded ( $> 3 = 1$ ) ( $\geq 1$  and  $\leq 3 = 0$ ) renamed (NNSILABE) (0,1)
- 60. Self-quieting activity (states 6 and 5 to 4–1) (NNSIQUI) recoded ( $\geq 1$  and  $< 3 = 1$ ) ( $\geq 3 = 0$ ) renamed (NNSIQUIE) (0,1)\*

\*If (NNSICON) and (NNSIQUI) are missing and (NNSIEXC)  $> 0$  and (NNSIEXC)  $< 7$ , then (NNSITONE) and (NNSIQUIE) = 0

### LETHARGY (ndeprtot)

Sum of all variables:

- E. Upper Extremity and Face (States 3–5)
  - 25. Pull to sit (states 4 and 5) (NNUEFPS) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) rename (NNUEFPSD) (0,1)
- I. Infant Supine on Examiner's Lap (States 4 and 5)
  - 35. Orientation: inanimate visual (NNISLIV) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLIVD) (0,1)\*
  - 36. Orientation: inanimate auditory (NNISLIA) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLIAD) (0,1)\*
  - 37. Orientation: inanimate visual and auditory (NNISLIB) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLIBD) (0,1)\*
  - 38. Orientation: animate visual (NNISLAV) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLAVD) (0,1)\*
  - 39. Orientation: animate auditory (NNISLAA) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLAAD) (0,1)\*
  - 40. Orientation: animate visual and auditory (NNISLAB) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNISLABD) (0,1)\*
- K. Infant Supine in Crib (States 3–5)
  - 43. Defensive response (NNSCRDR) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNSCRDRD) (0,1)
- L. Summary Items
  - 47. Alertness (NNSIALR) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNSIALRD) (0,1)\*
  - 48. General tone/predominant tone (states 4 and 5) (NNSITON) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed (NNSITOND) (0,1)
  - 51. Peak of excitement (all states) (NNSIEXC) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed

52. Rapidity of build-up (all states with state 6 at least 15 seconds) (NNSIRAP) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed NNSIRAPD (0,1)
53. Irritability (all states) (NNSIRRT) recoded ( $\geq 1$  and  $< 3 = 1$ ) ( $\geq 3 = 0$ ) renamed NNSIRRTD (0,1)
54. Spontaneous activity (states 3–5) (NNSISPO) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed NNSISPOD (0,1)
55. Elicited activity (states 3–5) (NNSIACT) recoded ( $\geq 1$  and  $< 4 = 1$ ) ( $\geq 4 = 0$ ) renamed NNSIACTD (0,1)

\*If (NNSIALR) is missing or = 1 or 2 and (NNISLIV or NNISLIA or NNISLIB or NNISLAV or NNISLAA or NNIALB) is missing, then ALOR.SUB = 1; else ALOR.SUB = 0.

If ALOR.SUB = 1, nnsialrd = 1  
 If ALOR.SUB = 1 and NNISLIV is missing, then NNISLIVD = 1.  
 If ALOR.SUB = 1 and NNISLIA is missing, then NNISLIAD = 1  
 If ALOR.SUB = 1 and NNISLIB is missing, then NNISLIBD = 1  
 If ALOR.SUB = 1 and NNISLAV is missing, then NNISLAVD = 1  
 If ALOR.SUB = 1 and NNISLAA is missing, then NNISLAAD = 1  
 If ALOR.SUB = 1 and NNISLAB is missing, then NNISLABD = 1

#### NONOPTIMAL REFLEXES (nbadref1)

Count zeros for the following variables:

- D. Lower Extremity Reflexes (States 3–5)
  10. Plantar grasp (NNLERPG) recode (3 = 1) (1,2 = 0) (4 = 0)
  11. Babinski (NNLERBA) recode (3 = 1) (1,2 = 0) (4 = 0)
  12. Ankle clonus (NNLERAC) recode (1,2,3 = 1) (4 = 0)
- E. Upper Extremity and Face (States 3–5)
  21. Rooting (NNUEFRT) recode (3 = 1) (1,2 = 0) (4,5 = 0)
  22. Sucking (NNUEFSU) recode (3 = 1) (1,2 = 0) (4,5,6,7 = 0)
  23. Grasp of hands (NNUEFGH) recode (3 = 1) (1,2 = 0) (4 = 0)
- F. Upright Responses (States 3–5)
  26. Placing (NNUPRPL) recoded (3 = 1) (1,2 = 0)
  27. Stepping (NNUPRST) recoded (4 = 1) (1,2,3 = 0) (5,6,7 = 0)
  28. Incurvation (NNUPRIN) recoded (3 = 1) (1,2 = 0) (4 = 0)
- G. Infant Prone (States 3–5)
  30. Crawling (NNINPCR) recoded (3 = 1) (1,2 = 0) (4 = 0)
  32. Head raise in prone (NNINPHR) recoded (4 = 1) (1,2,3 = 0) (5,6 = 0)
- J. Infant Spin (States 3–5)
  41. Tonic deviation of head and eyes (NNSPNTD) recoded (4 = 1) (1,2,3 = 0) (5,6 = 0)

41. Nystagmus (NNSPNNY) recoded (1,2 = 1) (3,4 = 0)

- K. Infant Supine in Crib (States 3–5)
  44. Asymmetrical tonic neck reflex (NNSCRTN) recoded (1,2,3 = 1) (4 = 0)
  45. Moro reflex (NNSCRMOR) recoded (4 = 1) (1,2,3 = 0) (5 = 0)

#### ASYMMETRICAL REFLEXES (nasymtot)

Sum of all variables:

- D. Lower Extremity Reflexes (States 3–5)
  10. Plantar grasp (NNLEAPG) recoded (1,2,3,4 = 1)
  11. Babinski (NNLEABA) recoded (1,2,3,4 = 1)
  12. Ankle clonus (NNLEAAC) recoded (1,2,3,4 = 1)
  13. Leg resistance (NNLEALR) recoded (1,2,3,4 = 1)
  14. Leg recoil (NNLEALC) recoded (1,2,3,4 = 1)
  15. Power of active leg movements (NNLEAAL) recoded (1,2,3,4 = 1)
  16. Popliteal angle (NNLEAPA) recoded (1,2,3,4 = 1)
- E. Upper Extremity and Face (States 3–5)
  17. Scarf sign (NNUEASS) recoded (1,2,3,4 = 1)
  18. Forearm resistance (NNUEAFR) recoded (1,2,3,4 = 1)
  19. Forearm recoil (NNUEAFC) recoded (1,2,3,4 = 1)
  20. Power of active arm movements (NNUEAAA) recoded (1,2,3,4 = 1)
  21. Rooting (NNUEART) recoded (1,2,3,4 = 1)
  23. Grasp of hands (NNUEAGH) recoded (1,2,3,4 = 1)
- F. Upright Responses (States 3–5)
  26. Placing (NNUPAPL) recoded (1,2,3,4 = 1)
  27. Stepping (NNUPAST) recoded (1,2,3,4 = 1)
  29. Incurvation (NNUPAIN) recoded (1,2,3,4 = 1)

#### HYPERTONICITY (nhypetot)

Sum of all variables:

- C. Unwrap and Supine
  5. Posture (states 1–5) (NNUSPOS) recoded (5 = 1) (1,2,3,4 = 0)
- D. Lower Extremity Reflexes (States 3–5)
  13. Leg resistance (NNLERLR) recoded (5 = 1) (1,2,3,4 = 0)
  16. Popliteal angle (NNLERPA) recoded (6 = 1) (1,2,3,4,5 = 0)
- E. Upper Extremity and Face (States 3–5)
  17. Scarf sign (NNUEFSS) recoded (4 = 1) (1,2,3 = 0)
  18. Forearm resistance (NNUEFFR) recoded (5 = 1) (1,2,3,4 = 0)
  24. Truncal tone (NNUEFTT) recoded (5 = 1) (1,2,3,4 = 0)
  25. Pull to sit (states 4 and 5) (NNUEFPS) recoded (10 = 1) (1,2,3,4,5,6,7,8,9,11 = 0)

- F. Upright Responses (States 3–5)  
 27. Stepping (NNUPRST) recoded (6 = 1) (1,2,3,4,5,7 = 0)  
 28. Ventral suspension (NNUPRVS) recoded (5 = 1) (1,2,3,4,6 = 0)
- L. Summary Items  
 48. General tone/predominant tone (states 4 and 5) (NNSITON) recoded (8 = 1) (9 = 1) (1,2,3,4,5,6,7,10 = 0)

### HYPOTONICITY (nhypotot)

Sum of all variables:

- C. Unwrap and Supine  
 5. Posture (states 1–5) (NNUSPOS) recoded (1 = 1) (2,3,4,5 = 0)
- D. Lower Extremity Reflexes (States 3–5)  
 13. Leg resistance (NNLERLR) recoded (1 = 1) (2,3,4,5 = 0)  
 16. Popliteal angle (NNLERPA) recoded (1 = 1) (2,3,4,5,6 = 0)
- E. Upper Extremity and Face (States 3–5)  
 17. Scarf sign (NNUEFSS) recoded (1 = 1) (2,3,4 = 0)  
 18. Forearm resistance (NNUEFFR) recoded (1 = 1) (2,3,4,5 = 0)  
 24. Truncal tone (NNUEFFT) recoded (1 = 1) (2,3,4,5 = 0)  
 25. Pull to sit (NNUEFPS) recoded (1 = 1) (2,3,4,5,6,7,8,9,10,11 = 0)
- F. Upright Responses (States 3–5)  
 27. Stepping (NNUPRST) recoded (1 = 1) (2,3,4,5,6,7 = 0)  
 28. Ventral suspension (NNUPRVS) recoded (1 = 1) (2,3,4,5,6 = 0)
- L. Summary Items  
 48. General tone/predominant tone (states 4 and 5) (NNSITON) recoded (1 = 1) (2,3,4,5,6,7,8,9,10 = 0)

### STRESS/ABSTINENCE (nstress)

Mean of at least 40 of the following variables:

- M. Physiologic  
 66. Labored breathing (NNPHLAB) yes/no recoded (2 = 0)  
 67. Nasal flaring (NNPHNAS) yes/no recoded (2 = 0)
- N. Autonomic  
 68. Sweating (NNAUSWE) yes/no recoded (2 = 0)  
 69. Spit-up (NNAUSPT) yes/no recoded (2 = 0)  
 70. Hiccoughing (NNAUHIC) yes/no recoded (2 = 0)  
 71. Sneezing (NNAUSNZ) yes/no recoded (2 = 0)  
 72. Nasal stuffiness (NNAUSTF) yes/no recoded (2 = 0)  
 73. Yawning (NNAUYAW) yes/no recoded (2 = 0)
- O. Central Nervous System  
 74. Abnormal sucking (NNCNASU) yes/no recoded (2 = 0)

75. Choreiform movements (NNCNCHO) yes/no recoded (2 = 0)  
 76. Athetoid postures and movements (NNCNATH) yes/no recoded (2 = 0)  
 77. Tremors  
 a. Low frequency/high amplitude (NNC-NTRL) yes/no recoded (2 = 0)  
 b. High frequency/low amplitude (NNC-NTRH) yes/no recoded (2 = 0)  
 78. Cogwheel movements (NNCNCOG) yes/no recoded (2 = 0)  
 79. Startles (NNCNSTA) yes/no recoded (2 = 0)  
 80. Hypertonia (NNCNHYP) yes/no recoded (2 = 0)  
 81. Back arching (NNCNBAR) yes/no recoded (2 = 0)  
 84. Myoclonic jerks (NNCNJRK) yes/no recoded (2 = 0)  
 85. Generalized seizures (NNCNSEZ) yes/no recoded (2 = 0)  
 86. Abnormal posture (NNCNAPO) yes/no recoded (2 = 0)
- P. Skin  
 87. Pallor (NNSKPAL) yes/no recoded (2 = 0)  
 88. Mottling (NNSKMOT) yes/no recoded (2 = 0)  
 89. Paroxysmal cyanosis (NNSKPCY) yes/no recoded (2 = 0)  
 90. Overall cyanosis (NNSKOCY) yes/no recoded (2 = 0)  
 91. Circumoral cyanosis (NNSKCCY) yes/no recoded (2 = 0)  
 92. Periocular cyanosis (NNSKRCY) yes/no recoded (2 = 0)
- Q. Visual  
 93. Gaze aversion during orientation (NNVIAVR) yes/no recoded (2 = 0)  
 94. Pull down during orientation (NNVIPUL) yes/no recoded (2 = 0)  
 95. Fuss/cry during orientation (NNVICRY) yes/no recoded (2 = 0)  
 96. Obligatory following during orientation (NNVIFOL) yes/no recoded (2 = 0)  
 97. End-point nystagmus during orientation (NNVIENY) yes/no recoded (2 = 0)  
 98. Sustained spontaneous nystagmus (NNVISNY) yes/no recoded (2 = 0)  
 99. Visual locking (NNVILOC) yes/no recoded (2 = 0)  
 100. Hyperalertness (NNVIHYP) yes/no recoded (2 = 0)  
 101. Setting-sun sign (NNVISUN) yes/no recoded (2 = 0)  
 102. Roving eye movements (NNVIEYE) yes/no recoded (2 = 0)  
 103. Strabismus (NNVISTR) yes/no recoded (2 = 0)  
 104. Tight blinking (NNVIBLN) yes/no recoded (2 = 0)  
 105. Other abnormal eye signs (NNVIOTH) yes/no recoded (2 = 0)

R. Gastrointestinal

- 106. Gagging/choking (NNGACHK) yes/no recoded (2 = 0)
- 107. Loose or watery stools (NNGASTL) yes/no recoded (2 = 0)
- 108. Excessive gas or bowel sounds (NNGAGAS) yes/no recoded (2 = 0)

S. State

- 109. High-pitch cry (NNSTHCR) yes/no recoded (2 = 0)

- 110. Monotone-pitch cry (NNSTMCR) yes/no recoded (2 = 0)

- 111. Weak cry (NNSTWCR) yes/no recoded (2 = 0)

- 0. No Cry (NNSTNCR) yes/no recoded (2 = 0)

- 1. Extreme irritability (NNSTIRR) yes/no recoded (2 = 0)

- 114. Abrupt state changes (NNSTCHN) yes/no recoded (2 = 0)

- 2. Inability to achieve quiet awake state (4) (NNSTQUA) yes/no recoded (2 = 0)