Missing Values handling proposed methods

Thoughts: There might be longitudinal dropouts means a patient stopped showing up for some reason (need to explore data)

Other records : fill using records of the same patient from some other visit

1. **SEX**: Other records
2. **PRIMLANG**: Other records
3. **EDUC**: Other records
4. **MARISTAT**: check co participants relation
5. **INDEPEND**: ?
6. **RESIDENC**: can be derived from NACCNURP (moved to nursing home permanently)
7. **NACCAGE**: be calculated using BIRTHMO, BIRTHYR, VISITDAY, VISITYR, VISITMO
8. **INRELTO**: check if NEWINF is 0 or 1, if 0 use previous record
9. **INKNOWN**: check if NEWINF is 0 or 1, if 0 calculate using VISITDAY, VISITYR, VISITMO
10. **INLIVWTH**: ?
11. **NACCFAM**: Other records
12. **NACCFADM**: Other records
13. **NACCFFTD**: Other records
14. **NACCOM**: Other records
15. **ANYMEDS**: If there are values in drug1 up till drug40 then set as 1 else 0
16. **NACCAHTN**: User previous records as people rarely stop BP meds
17. **NACCHTNC**: if values in naccacei, naccaaas, naccbeta, naccccbs, naccdiur, naccvasd, nacchtnc, or naccangi then 1 else 0
18. **NACCACEI**: User previous records (helps relax and widen blood vessel means BP med)
19. **NACCAAAS**:? -antiadrenergic agents are typically continued for chronic conditions but may be adjusted or discontinued more frequently than core cardiovascular medications. Maybe we can: Carry-forward for 1-2 visits, then assume discontinuation if still missing
20. **NACCBET**: (Beta blockers): Strong carry-forward
21. NACCCCBS: (Calcium channel blockers): Strong carry-forward
22. NACCDIUR: (Diuretics): Strong carry-forward
23. NACCVASD
24. NACCANGI
25. NACCLIPL: Strong carry-forward (statins rarely discontinued specially if the patient’s age is > 65 or has diabetes or hypertension, patient has had a heart attack or stroke)
26. NACCNSD
27. NACCAC: (Anticoagulants) Strong carry-forward, medications that prevent blood clots from forming or growing larger
28. NACCADEP:
29. NACCAPSY: (Antipsychotics) Strong carry-forward in dementia patients
30. NACCAANX: anti anxiety, mostly temporary

Imputation analysis for actual missing data in our dataset:

1. BPSYS 389
2. HRATE 389
3. BPDIAS 389
4. POSTINST 13
5. SOMATR 13
6. CVDMOTL 13
7. CORTVISR 13
8. POSTCORT 13
9. CORTVISL 13
10. BRADY 13
11. CVDMOTR 13
12. SOMATL 13
13. SIVDFIND 13
14. CVDSIGNS 13
15. CORTDEF 13
16. PARKSIGN 13
17. GAITNPH 13
18. ALSFIND 13
19. OTHNEUR 13
20. PARKGAIT 13
21. PSPCBS 13
22. DECAGE 3
23. DIABET 1
24. URINEINC 1
25. HYPOSOM 1
26. ANGIOCP 1
27. THYDIS 1
28. ARTYPE 1
29. SLEEPOTH 1
30. ANGINA 1
31. CONGHRT 1
32. ANTIENC 1
33. ARTH 1
34. BOWLINC 1
35. REMDIS 1
36. VB12DEF 1
37. AFIBRILL 1
38. HVALVE 1
39. HYPERT 1
40. MYOINF 1
41. PACEMAKE 1
42. ANGIOPCI 1
43. HYPCHOL 1
44. SLEEPAP 1
45. CANCER 1

**HRATE, BPDIAS, BPSYS have the highest missing values i.e 389, Imputation strategy:**

* Use individual patient's historical average ± normal variation
* Adjust for age progression (slight decrease with age)
* Medication effects

**NACCBETA - Beta blocker** - If the user is taking any beta-blockers, then we can adjust these three values from their previous visit:

'HRATE': -12 : Decrease HR by ~12 bpm

'BPSYS': -10: Decrease systolic by ~10 mmHg

'BPDIAS': -8 :Decrease diastolic by ~8 mmHg

Supporting research paper:

* <https://www.ncbi.nlm.nih.gov/books/NBK75816/#:~:text=Results%20of%20the%20review,increased%20as%20heart%20rate%20decreased>.
* <https://pmc.ncbi.nlm.nih.gov/articles/PMC6486283/#:~:text=On%20average%2C%20beta%E2%80%901%20blockers,inhibitors%20and%20angiotensin%20receptor%20blockers>.

**NACCACEI - ACE Inhibitors** - If the user is taking any ACE Inhibitors, then we can adjust these three values from their previous visit:

'HRATE': 0 : no effect

'BPSYS': -10,

'BPDIAS': -6,

Supporting research paper:

* <https://consensus.app/questions/do-ace-inhibitors-affect-heart-rate/#:~:text=A%20comprehensive%20review%20of%20randomized%20controlled%20trials%20has%20reinforced%20the%20finding%20that%20ACE%20inhibitors%20do%20not%20significantly%20affect%20heart%20rate>.
* <https://academic.oup.com/ajh/article-abstract/18/7/935/221053?redirectedFrom=fulltext#:~:text=Using%20sitting%20or%20supine%20BP,systolic%20and%20diastolic%20BP%2C%20respectively>.
* <https://pmc.ncbi.nlm.nih.gov/articles/PMC7156914/#:~:text=Combining%20the%20effects%20of%201,about%2011/6%20mm%20Hg>.

**NACCDIUR - Diuretics** - If the user is taking any Diuretics, then we can adjust these two values from their previous visit:

'BPSYS': -8,

'BPDIAS': -5,

https://pmc.ncbi.nlm.nih.gov/articles/PMC7156893/#:~:text=with%20systolic%20pressure%20lowered%20by%208%20mmHg%20and%20diastolic%20pressure%20by%204%20mmHg.

**-4 Values**

-4 = Not available: UDS form submitted did not collect data in this way, or a skip pattern precludes response to this question.

1. ALCFREQ 145132
2. HATTMULT 145018
3. CVHVALVE 144923
4. INSOMN 144923
5. BIPOLAR 144923
6. OCD 144923
7. OTHSLEEP 144923
8. ARTHRIT 144923
9. CVANGINA 144923
10. ANXIETY 144923
11. CVPACDEF 144923
12. ALCOCCAS 144923
13. SCHIZ 144923
14. RBD 144923
15. APNEA 144923
16. NPSYDEV 144923
17. ARTHTYPE 144923
18. TIAMULT 144923
19. PTSD 144923
20. STROKMUL 144923
21. INKNOWN 141373
22. MOMOPARK 115285
23. SOMATR 96255
24. ALSFIND 96255
25. CVDMOTR 96255
26. OTHNEUR 96255
27. CORTVISL 96255
28. PSPCBS 96255
29. PARKGAIT 96255
30. POSTCORT 96255
31. GAITNPH 96255
32. CORTVISR 96255
33. CVDMOTL 96255
34. PARKSIGN 96255
35. CVDSIGNS 96255
36. POSTINST 96255
37. BRADY 96255
38. SIVDFIND 96255
39. SOMATL 96255
40. CORTDEF 96255
41. ALSAGE 90406
42. COGFLAGO 90203
43. BEREMAGO 90158
44. BEVHAGO 90139
45. PARKAGE 89923
46. MOMOALS 88656
47. MOAGE 88656
48. BEANX 87012
49. BEAGE 87012
50. COGORI 86020
51. ARTYPE 81668
52. CVPACE 80958
53. NCOTHR 80958
54. LBDEVAL 80742
55. NACCPPAG 80742
56. VB12DEF 80742
57. AFIBRILL 80742
58. FTLDEVAL 80742
59. MSA 80742
60. AMNDEM 80742
61. REMDIS 80742
62. SLEEPOTH 80742
63. DIABET 80742
64. FTLDMO 80742
65. ANGIOCP 80742
66. THYDIS 80742
67. DELIR 80742
68. ANXIET 80742
69. URINEINC 80742
70. EPILEP 80742
71. DECCLCOG 80742
72. HIV 80742
73. NAMNDEM 80742
74. ANTIENC 80742
75. ARTH 80742
76. CONGHRT 80742
77. HYPOSOM 80742
78. CANCER 80742
79. MYOINF 80742
80. PTSDDX 80742
81. PCA 80742
82. HVALVE 80742
83. DECCLBE 80742
84. ANGIOPCI 80742
85. DECCLMOT 80742
86. PACEMAKE 80742
87. CVD 80742
88. BIPOLDX 80742
89. HYPERT 80742
90. HYPCHOL 80742
91. SLEEPAP 80742
92. BOWLINC 80742
93. ANGINA 80742
94. BEVWELL 68346
95. PSYCDIS 64181
96. DIABETES 64181
97. PACKSPER 64181
98. ALCOHOL 64181
99. CVBYPASS 64181
100. SEIZURES 64181
101. HYPERCHO 64181
102. CVAFIB 64181
103. CBTIA 64181
104. CVHATT 64181
105. DEPOTHR 64181
106. PDOTHR 64181
107. PD 64181
108. SMOKYRS 64181
109. TOBAC100 64181
110. CVOTHR 64181
111. ABUSOTHR 64181
112. INCONTU 64181
113. THYROID 64181
114. QUITSMOK 64181
115. DIABTYPE 64181
116. CVANGIO 64181
117. CVCHF 64181
118. TOBAC30 64181
119. DEP2YRS 64181
120. CBSTROKE 64181
121. INCONTF 64181
122. B12DEF 64181
123. NACCTBI 64181
124. HYPERTEN 64181
125. BEREM 47486
126. COGFLUC 47480
127. NACCOM 47378
128. VISWCORR 22490
129. HEARWAID 22444
130. NACCNREX 20965
131. BPSYS 20603
132. HEARING 20603
133. BPDIAS 20603
134. HRATE 20603
135. VISION 20603
136. NACCBMI 20603
137. HEARAID 20603
138. VISCORR 20603
139. COMPORT 18330
140. CDRLANG 18330
141. NITESEV 10517
142. HALLSEV 8720
143. DEPDSEV 8702
144. DELSEV 8685
145. APPSEV 8667
146. MOTSEV 8644
147. ANXSEV 8594
148. APASEV 8584
149. DISNSEV 8500
150. IRRSEV 8465
151. ELATSEV 8444
152. AGITSEV 8392
153. APA 8117
154. HALL 8117
155. AGIT 8117
156. IRR 8117
157. DEL 8117
158. ANX 8117
159. NITE 8117
160. APP 8117
161. DISN 8117
162. ELAT 8117
163. DEPD 8117
164. MOT 8117
165. INRELTO 5162
166. INLIVWTH 5162
167. TRAVEL 4848
168. EVENTS 4848
169. MEALPREP 4848
170. TAXES 4848
171. GAMES 4848
172. STOVE 4848
173. REMDATES 4848
174. BILLS 4848
175. SHOPPING 4848
176. PAYATTN 4848
177. NACCDBMD 843
178. NACCEMD 843
179. NACCAPSY 843
180. NACCCCBS 843
181. NACCADMD 843
182. NACCDIUR 843
183. NACCADEP 843
184. NACCAC 843
185. NACCHTNC 843
186. NACCNSD 843
187. NACCANGI 843
188. NACCAAAS 843
189. NACCAANX 843
190. NACCBETA 843
191. NACCEPMD 843
192. NACCPDMD 843
193. NACCVASD 843
194. NACCAHTN 843
195. NACCLIPL 843
196. ANYMEDS 843
197. NACCACEI 843
198. NACCFAM 310