Code for Model 2B: First Responders’ willingness to triage patients with radioactive contamination with radiation subject matter experts present

breed [doctors doctor] ;; designates the first responder agents
breed [SMEs SME] ;; designates the radiation subject matter experts (SME)
breed [civilians civilian] ;; designates the civilian agents
doctors-own [
  my-neighbors
  nearest-neighbor
  flockmates
  mineRadiationTolerance
  triage-willing
]

SMEs-own [
  my-neighbors
  nearest-neighbor
  flockmates
  mineRadiationTolerance
]

civilians-own [
  health
  triage-status
  mineRadiationTolerance
]

patches-own [] ;; in this model patches are not assigned specific variables
to setup
clear-all
reset-ticks
setup-patches
setup-doctors
setup-SMEs
setup-civilians
doctor

;; this command series determines the visual characteristics of the first responder agents and restricts generation of only one agent per patch area also determines the “mineradiationtolerance” numerical value representative of the assigned personal perception radiation risk
to setup-doctors
set-default-shape doctors "person doctor"
ask n-of initial-number-FirstResponders
patches with [ pcolor = 45 ]
[ sprout-doctors 1 ]

ask doctors [  
  set color green  
  set triage-willing 0  // this sets a base value for the "triage-willing variable" at 0 (baseline)  
  set mineRadiationTolerance random-poisson 2.5  
  if mineRadiationTolerance < 1  
    [set mineRadiationTolerance 1]  
  if mineRadiationTolerance > 5  
    [set mineRadiationTolerance 5]  
]
end

;; this command series determines the visual characteristics of the SME agents and restricts generation
of only one agent per patch area
;; SME have a baseline "mineRadiationTolerance of 10

to setup-SMEs ;; (SMEs)  
set-default-shape SMEs "person doctor"
ask n-of initial-number-SMEs
patches with [ pcolor = 45 ]
[ sprout-SMEs 1 ]

ask SMEs [  
  set color red  
  set mineRadiationTolerance 10  
]
end

;; this command series determines the visual characteristics of the civilian agents and restricts
generation of only one agent per patch area

to setup-civilians
set-default-shape civilians "person"
ask n-of initial-number-civilians
(patches with [ pxcor < -10 ])
[ sprout-civilians 1 ]

ask civilians [  
  set color blue  
  set mineRadiationTolerance 0  // this sets a base value for the "triage-willing variable" at 0
  set health random-Poisson 50  // this sets the range for the "health" variable of civilian agents
  set triage-status .1  // this sets the "triage-status" variable at .1 (baseline)
]
end
;;this command series determines the background setup of the model and includes a series of commands affecting patches

to setup-patches
  ask patches [ set pcolor 69 set plabel-color black ask patch 35 28 [set plabel "Triage Area"] setup-triageEnd setup-triage_area ]
end

to go
  move-civilians move-doctors move-SMEs health_status triage end_triage leave-the-model check-death tick end

;;this directs movement of the civilian agents- it first tells them to orient their movement toward the right side of the model
;;if they form a link they must stop movement
;;if their "health" variable is >= 75 it tells them to move to the right along the path of patches colored white and if their "health" variable is < 75 they are directed to stop and wait at the right side of the model

to move-civilians
  ask civilians [ face min-one-of patches with [ pcolor = 45.1 ] [ distance myself ] if any? my-links [stop] if health >= 75 [set heading towards min-one-of patches with [ pcolor = 49 ] [distance myself]] if health >= 75 and [pcolor] of patch-here = 49 [set heading towards min-one-of patches with [pcolor = 45.1] [distance myself]] if health < 75 and pxcor = 36 [stop] forward .1 ]
end
to move-doctors
  ask doctors [  
    if any? my-links [stop]  
    right random 5 forward .03  
  ]
end

to move-SMEs
  ask SMEs [    
    if any? my-links [stop]    
    right random 5 forward .03  
  ]
end

to-report average_mineRadiationTolerance
  let myRT mean [mineRadiationTolerance] of flockmates
  report mean myRT
end

to find-flockmates
  let FirstResponders turtles with [mineRadiationTolerance >= 1]  
  set flockmates FirstResponders in-radius Communication
end

;;this command series tells the first responder or SME agents to triage civilian agents with health < 75  
;;it also reports whether the first responders are "triage-willing" based on their mineRadiationTolerance score  
;;if they are already triage-willing (mineRadiationTolerance >=4 they report "triage-willing" as 1 (TRUE)  
;;if they are triage-willing (TRUE) and have not already formed a link they will move towards the nearest  
;;if they are triage-willing (FALSE) (mineRadiationTolerance < 4) they are directed to look around at their  
;;if that subsequent mean is >= 4 then they will engage in the same triage algorithm listed above
to triage
ask doctors [set my-neighbors (civilians with [health < 75]) in-radius 2];; removed "other" civilians
ask doctors with [mineRadiationTolerance >= 4]
  [set triage-willing 1]
ask doctors with [mineRadiationTolerance >= 4 and count my-links < 1]
  [if any? civilians with [health < 75 and triage-status < 1] in-radius 6
    [set heading towards min-one-of civilians with [health < 75 and triage-status < 1] [distance myself]]
    forward .1
    if any? my-neighbors with [triage-status < 1] [create-links-with n-of 1 my-neighbors with [triage-status < 1]]]

ask doctors with [mineRadiationTolerance <= 3 and count my-links < 1]
  [find-flockmates
    if any? flockmates
      [let F count flockmates
      if F > 0
        [let myRT mean [mineRadiationTolerance] of flockmates
          if myRT >= 4
            [set triage-willing 1]
          if myRT >= 4
            [if any? civilians with [health < 75 and triage-status < 1] in-radius 6
              [set heading towards min-one-of civilians with [health < 75 and triage-status < 1] [distance myself]]
              forward .1
              if any? my-neighbors with [triage-status < 1] [create-links-with n-of 1 my-neighbors with [triage-status < 1]]
            ]]]]

ask SMEs [set my-neighbors (civilians with [health < 75]) in-radius 2];; removed "other" civilians
ask SMEs with [count my-links < 1]
  [if any? civilians with [health < 75 and triage-status < 1] in-radius 6
    [set heading towards min-one-of civilians with [health < 75 and triage-status < 1] [distance myself]]
    forward .1
    if any? my-neighbors with [triage-status < 1] [create-links-with n-of 1 my-neighbors with [triage-status < 1]]
]

ask links [set color red]
tick

;; this directs civilian agents who have formed a link/interaction with a first responder to report they have been triaged

ask civilians with [
count my-links >= 1] [set triage-status 1]
;;this tells the first responders or SMES who have formed links to increase the health score of civilian agents with a starting health score >30 thus if an agent has a health score too low- they will be quickly triaged and then released but additional time will not be spent on that agent to increase their health

```
ask doctors [if any? my-links
    [ask my-neighbors with [count my-links >= 1]
        [if health < 75 and health > 30
            [set health health + .1]
        ]
    ]
]
ask SMEs [if any? my-links
    [ask my-neighbors with [count my-links >= 1]
        [if health < 75 and health > 30
            [set health health + .1]
        ]
    ]
]}
tick
end
```

;;this breaks the links

to end_triage
    ask civilians with [count my-links >= 1 and health <= 30] [ask my-links [die]]
    ask civilians with [count my-links >= 1 and health >= 75] [ask my-links [die]]
end

;;this changes the color of the civilian based on their health score
;;the higher the health score the darker the blue color

to health_status
    ask civilians [if pcolor = 69 and count my-links = 0 and triage-status = .1 [set health health - .1]]
    ask civilians [ set color scale-color blue health 100 0]
end

;;this stops the triaged civilian agents at the far edge of the model

to leave-the-model
    ask civilians [if pxcor = 39 [stop]]
end

;;this directs a civilian agent with a very low health score to "die"
to check-death
   ask civilians [ if health <= 5 [die]]
end

;;these are patch commands which help setup the model background

to setup-triageEnd
   if pxcor = 39
      [set pcolor 45.1]
   end

;;these are patch commands which help setup the model background

to setup-triage_area
   if pxcor >= -10 and pxcor <= 38
      [set pcolor 45]
   if pxcor > -8 and (pycor = 14 or pycor = -1 or pycor = -19)
      [set pcolor 49]
   end