Loess\_curve\_ChildRespiratoryInfectionRate.R

Anand

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#Loess   
load(url("http://www.users.muohio.edu/hughesmr/sta333/respiratory.RData"))  
attach(respiratory)  
  
head(respiratory)

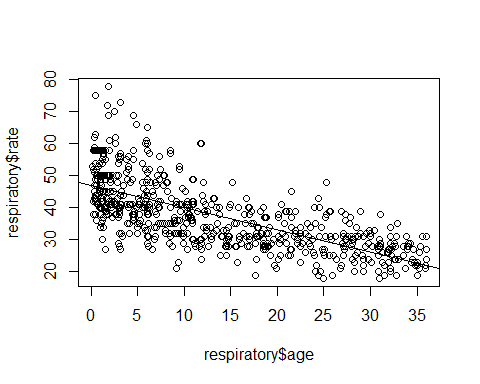
## age rate  
## 1 0.1 53  
## 2 0.2 38  
## 3 0.3 58  
## 4 0.3 52  
## 5 0.3 42  
## 6 0.4 62

#plot(x = respiratory$age,y = respiratory$rate)  
  
plot(respiratory$rate~respiratory$age,data=respiratory)  
fit <- lm(respiratory$rate~respiratory$age,data=respiratory)  
#summary(fit)  
  
predict(fit, newdata=data.frame(age=18), int="conf")

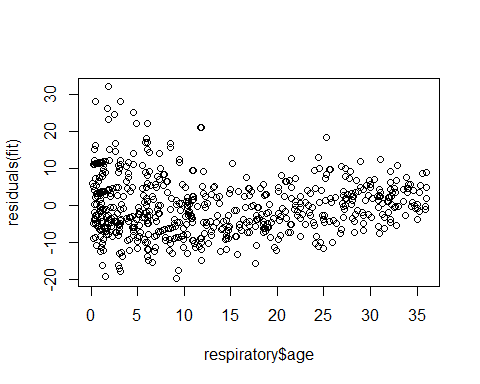
## Warning: 'newdata' had 1 row but variables found have 618 rows

## fit lwr upr  
## 1 46.98259 45.99689 47.96829  
## 2 46.91302 45.93180 47.89424  
## 3 46.84345 45.86670 47.82020  
## 4 46.84345 45.86670 47.82020  
## 5 46.84345 45.86670 47.82020  
## 6 46.77388 45.80158 47.74618  
## 7 46.77388 45.80158 47.74618  
## 8 46.77388 45.80158 47.74618  
## 9 46.77388 45.80158 47.74618  
## 10 46.77388 45.80158 47.74618  
## 11 46.77388 45.80158 47.74618  
## 12 46.77388 45.80158 47.74618  
## 13 46.77388 45.80158 47.74618  
## 14 46.70431 45.73645 47.67217  
## 15 46.70431 45.73645 47.67217  
## 16 46.70431 45.73645 47.67217  
## 17 46.70431 45.73645 47.67217  
## 18 46.70431 45.73645 47.67217  
## 19 46.70431 45.73645 47.67217  
## 20 46.70431 45.73645 47.67217  
## 21 46.70431 45.73645 47.67217  
## 22 46.70431 45.73645 47.67217  
## 23 46.63474 45.67130 47.59817  
## 24 46.63474 45.67130 47.59817  
## 25 46.63474 45.67130 47.59817  
## 26 46.63474 45.67130 47.59817  
## 27 46.63474 45.67130 47.59817  
## 28 46.63474 45.67130 47.59817  
## 29 46.56516 45.60614 47.52419  
## 30 46.56516 45.60614 47.52419  
## 31 46.56516 45.60614 47.52419  
## 32 46.56516 45.60614 47.52419  
## 33 46.56516 45.60614 47.52419  
## 34 46.49559 45.54097 47.45022  
## 35 46.49559 45.54097 47.45022  
## 36 46.49559 45.54097 47.45022  
## 37 46.49559 45.54097 47.45022  
## 38 46.42602 45.47578 47.37627  
## 39 46.42602 45.47578 47.37627  
## 40 46.42602 45.47578 47.37627  
## 41 46.42602 45.47578 47.37627  
## 42 46.42602 45.47578 47.37627  
## 43 46.35645 45.41057 47.30233  
## 44 46.35645 45.41057 47.30233  
## 45 46.35645 45.41057 47.30233  
## 46 46.35645 45.41057 47.30233  
## 47 46.35645 45.41057 47.30233  
## 48 46.35645 45.41057 47.30233  
## 49 46.35645 45.41057 47.30233  
## 50 46.35645 45.41057 47.30233  
## 51 46.35645 45.41057 47.30233  
## 52 46.35645 45.41057 47.30233  
## 53 46.35645 45.41057 47.30233  
## 54 46.35645 45.41057 47.30233  
## 55 46.28688 45.34535 47.22841  
## 56 46.28688 45.34535 47.22841  
## 57 46.28688 45.34535 47.22841  
## 58 46.28688 45.34535 47.22841  
## 59 46.28688 45.34535 47.22841  
## 60 46.28688 45.34535 47.22841  
## 61 46.28688 45.34535 47.22841  
## 62 46.21731 45.28012 47.15450  
## 63 46.21731 45.28012 47.15450  
## 64 46.21731 45.28012 47.15450  
## 65 46.21731 45.28012 47.15450  
## 66 46.21731 45.28012 47.15450  
## 67 46.21731 45.28012 47.15450  
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## 69 46.21731 45.28012 47.15450  
## 70 46.21731 45.28012 47.15450  
## 71 46.14774 45.21487 47.08061  
## 72 46.14774 45.21487 47.08061  
## 73 46.14774 45.21487 47.08061  
## 74 46.14774 45.21487 47.08061  
## 75 46.14774 45.21487 47.08061  
## 76 46.14774 45.21487 47.08061  
## 77 46.14774 45.21487 47.08061  
## 78 46.14774 45.21487 47.08061  
## 79 46.07816 45.14960 47.00673  
## 80 46.07816 45.14960 47.00673  
## 81 46.00859 45.08432 46.93287  
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## 83 46.00859 45.08432 46.93287  
## 84 46.00859 45.08432 46.93287  
## 85 46.00859 45.08432 46.93287  
## 86 46.00859 45.08432 46.93287  
## 87 45.93902 45.01902 46.85902  
## 88 45.93902 45.01902 46.85902  
## 89 45.86945 44.95371 46.78520  
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## 91 45.79988 44.88837 46.71138  
## 92 45.79988 44.88837 46.71138  
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## 94 45.73031 44.82303 46.63759  
## 95 45.73031 44.82303 46.63759  
## 96 45.73031 44.82303 46.63759  
## 97 45.73031 44.82303 46.63759  
## 98 45.73031 44.82303 46.63759  
## 99 45.73031 44.82303 46.63759  
## 100 45.66074 44.75766 46.56381  
## 101 45.66074 44.75766 46.56381  
## 102 45.66074 44.75766 46.56381  
## 103 45.66074 44.75766 46.56381  
## 104 45.59117 44.69228 46.49005  
## 105 45.59117 44.69228 46.49005  
## 106 45.59117 44.69228 46.49005  
## 107 45.52159 44.62688 46.41631  
## 108 45.52159 44.62688 46.41631  
## 109 45.52159 44.62688 46.41631  
## 110 45.45202 44.56146 46.34259  
## 111 45.45202 44.56146 46.34259  
## 112 45.38245 44.49602 46.26888  
## 113 45.31288 44.43057 46.19519  
## 114 45.31288 44.43057 46.19519  
## 115 45.31288 44.43057 46.19519  
## 116 45.24331 44.36510 46.12152  
## 117 45.24331 44.36510 46.12152  
## 118 45.24331 44.36510 46.12152  
## 119 45.24331 44.36510 46.12152  
## 120 45.17374 44.29960 46.04787  
## 121 45.17374 44.29960 46.04787  
## 122 45.17374 44.29960 46.04787  
## 123 45.10417 44.23409 45.97424  
## 124 45.10417 44.23409 45.97424  
## 125 45.03459 44.16856 45.90063  
## 126 45.03459 44.16856 45.90063  
## 127 45.03459 44.16856 45.90063  
## 128 45.03459 44.16856 45.90063  
## 129 45.03459 44.16856 45.90063  
## 130 45.03459 44.16856 45.90063  
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## 132 44.96502 44.10301 45.82703  
## 133 44.96502 44.10301 45.82703  
## 134 44.96502 44.10301 45.82703  
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## 139 44.89545 44.03744 45.75346  
## 140 44.89545 44.03744 45.75346  
## 141 44.89545 44.03744 45.75346  
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## 143 44.89545 44.03744 45.75346  
## 144 44.82588 43.97185 45.67991  
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## 147 44.82588 43.97185 45.67991  
## 148 44.75631 43.90624 45.60638  
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## 151 44.68674 43.84061 45.53287  
## 152 44.61717 43.77496 45.45938  
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## 154 44.40845 43.57787 45.23904  
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## 157 44.33888 43.51213 45.16563  
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## 162 44.26931 43.44637 45.09225  
## 163 44.26931 43.44637 45.09225  
## 164 44.19974 43.38058 45.01890  
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## 167 44.13017 43.31477 44.94556  
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## 169 43.99102 43.18308 44.79897  
## 170 43.99102 43.18308 44.79897  
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## 177 43.85188 43.05130 44.65247  
## 178 43.78231 42.98537 44.57925  
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## 180 43.64317 42.85343 44.43290  
## 181 43.64317 42.85343 44.43290  
## 182 43.57360 42.78743 44.35977  
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## 185 43.50403 42.72139 44.28666  
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## 187 43.43445 42.65533 44.21357  
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## 191 43.36488 42.58925 44.14052  
## 192 43.22574 42.45699 43.99449  
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## 195 43.15617 42.39082 43.92151  
## 196 43.08660 42.32462 43.84857  
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## 199 43.08660 42.32462 43.84857  
## 200 43.01703 42.25840 43.77565  
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## 206 42.94745 42.19214 43.70277  
## 207 42.94745 42.19214 43.70277  
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## 212 42.87788 42.12585 43.62991  
## 213 42.87788 42.12585 43.62991  
## 214 42.87788 42.12585 43.62991  
## 215 42.80831 42.05954 43.55709  
## 216 42.80831 42.05954 43.55709  
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## 228 42.59960 41.86041 43.33879  
## 229 42.46046 41.72749 43.19342  
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## 232 42.32131 41.59445 43.04817  
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## 240 42.11260 41.39464 42.83056  
## 241 42.11260 41.39464 42.83056  
## 242 42.11260 41.39464 42.83056  
## 243 42.04303 41.32797 42.75809  
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## 249 41.90388 41.19451 42.61325  
## 250 41.83431 41.12774 42.54089  
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## 253 41.69517 40.99407 42.39627  
## 254 41.62560 40.92718 42.32402  
## 255 41.62560 40.92718 42.32402  
## 256 41.55603 40.86025 42.25180  
## 257 41.55603 40.86025 42.25180  
## 258 41.48646 40.79329 42.17962  
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## 260 41.41688 40.72629 42.10748  
## 261 41.34731 40.65924 42.03538  
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## 263 41.27774 40.59216 41.96332  
## 264 41.20817 40.52504 41.89130  
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## 266 41.13860 40.45788 41.81932  
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## 275 40.79074 40.12147 41.46002  
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## 282 40.58203 39.91911 41.24495  
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## 328 39.12103 38.49098 39.75109  
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## 385 36.12946 35.49580 36.76313  
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## 391 35.57289 34.92794 36.21784  
## 392 35.50332 34.85674 36.14990  
## 393 35.43375 34.78549 36.08200  
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## 395 35.36418 34.71420 36.01416  
## 396 35.29461 34.64286 35.94635  
## 397 35.22504 34.57147 35.87860  
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## 400 35.22504 34.57147 35.87860  
## 401 35.22504 34.57147 35.87860  
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## 404 34.94675 34.28548 35.60803  
## 405 34.73804 34.07051 35.40556  
## 406 34.73804 34.07051 35.40556  
## 407 34.66847 33.99877 35.33816  
## 408 34.66847 33.99877 35.33816  
## 409 34.66847 33.99877 35.33816  
## 410 34.59889 33.92699 35.27080  
## 411 34.59889 33.92699 35.27080  
## 412 34.52932 33.85516 35.20348  
## 413 34.45975 33.78329 35.13621  
## 414 34.39018 33.71138 35.06898  
## 415 34.32061 33.63943 35.00178  
## 416 34.18147 33.49541 34.86752  
## 417 34.18147 33.49541 34.86752  
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## 419 34.18147 33.49541 34.86752  
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## 421 34.11189 33.42335 34.80044  
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## 423 34.04232 33.35124 34.73341  
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## 426 33.97275 33.27909 34.66641  
## 427 33.97275 33.27909 34.66641  
## 428 33.90318 33.20690 34.59946  
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## 430 33.83361 33.13468 34.53254  
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## 432 33.69447 32.99012 34.39881  
## 433 33.62490 32.91779 34.33200  
## 434 33.55532 32.84542 34.26523  
## 435 33.41618 32.70057 34.13179  
## 436 33.34661 32.62809 34.06513  
## 437 33.20747 32.48304 33.93190  
## 438 33.06832 32.33785 33.79880  
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## 447 32.58133 31.82867 33.33398  
## 448 32.51175 31.75581 33.26770  
## 449 32.51175 31.75581 33.26770  
## 450 32.44218 31.68292 33.20145  
## 451 32.44218 31.68292 33.20145  
## 452 32.30304 31.53705 33.06903  
## 453 32.23347 31.46407 33.00287  
## 454 32.16390 31.39106 32.93673  
## 455 32.16390 31.39106 32.93673  
## 456 32.09433 31.31803 32.87062  
## 457 32.09433 31.31803 32.87062  
## 458 32.09433 31.31803 32.87062  
## 459 32.09433 31.31803 32.87062  
## 460 32.09433 31.31803 32.87062  
## 461 31.88561 31.09876 32.67246  
## 462 31.81604 31.02562 32.60646  
## 463 31.74647 30.95245 32.54048  
## 464 31.74647 30.95245 32.54048  
## 465 31.60733 30.80604 32.40861  
## 466 31.60733 30.80604 32.40861  
## 467 31.39861 30.58624 32.21098  
## 468 31.39861 30.58624 32.21098  
## 469 31.39861 30.58624 32.21098  
## 470 31.39861 30.58624 32.21098  
## 471 31.39861 30.58624 32.21098  
## 472 31.25947 30.43959 32.07935  
## 473 31.05076 30.21944 31.88207  
## 474 31.05076 30.21944 31.88207  
## 475 30.91161 30.07256 31.75067  
## 476 30.84204 29.99909 31.68500  
## 477 30.70290 29.85208 31.55372  
## 478 30.63333 29.77854 31.48811  
## 479 30.63333 29.77854 31.48811  
## 480 30.49418 29.63141 31.35696  
## 481 30.42461 29.55781 31.29142  
## 482 30.35504 29.48420 31.22589  
## 483 30.35504 29.48420 31.22589  
## 484 30.28547 29.41056 31.16038  
## 485 30.28547 29.41056 31.16038  
## 486 30.21590 29.33691 31.09489  
## 487 30.07676 29.18954 30.96397  
## 488 30.07676 29.18954 30.96397  
## 489 30.00719 29.11583 30.89854  
## 490 30.00719 29.11583 30.89854  
## 491 29.93761 29.04210 30.83313  
## 492 29.86804 28.96836 30.76773  
## 493 29.72890 28.82081 30.63699  
## 494 29.65933 28.74702 30.57164  
## 495 29.65933 28.74702 30.57164  
## 496 29.58976 28.67320 30.50631  
## 497 29.58976 28.67320 30.50631  
## 498 29.52019 28.59937 30.44100  
## 499 29.52019 28.59937 30.44100  
## 500 29.45061 28.52552 30.37571  
## 501 29.45061 28.52552 30.37571  
## 502 29.24190 28.30388 30.17992  
## 503 29.24190 28.30388 30.17992  
## 504 29.17233 28.22997 30.11469  
## 505 29.17233 28.22997 30.11469  
## 506 29.10276 28.15605 30.04947  
## 507 29.03319 28.08211 29.98427  
## 508 28.96362 28.00815 29.91908  
## 509 28.82447 27.86019 29.78875  
## 510 28.75490 27.78620 29.72361  
## 511 28.40704 27.41599 29.39810  
## 512 28.33747 27.34191 29.33303  
## 513 28.33747 27.34191 29.33303  
## 514 28.26790 27.26782 29.26799  
## 515 28.19833 27.19371 29.20295  
## 516 28.19833 27.19371 29.20295  
## 517 28.19833 27.19371 29.20295  
## 518 28.19833 27.19371 29.20295  
## 519 28.12876 27.11959 29.13793  
## 520 28.05919 27.04546 29.07291  
## 521 28.05919 27.04546 29.07291  
## 522 28.05919 27.04546 29.07291  
## 523 28.05919 27.04546 29.07291  
## 524 27.98962 26.97132 29.00792  
## 525 27.92005 26.89716 28.94293  
## 526 27.71133 26.67462 28.74804  
## 527 27.64176 26.60042 28.68310  
## 528 27.57219 26.52621 28.61817  
## 529 27.57219 26.52621 28.61817  
## 530 27.50262 26.45198 28.55325  
## 531 27.50262 26.45198 28.55325  
## 532 27.50262 26.45198 28.55325  
## 533 27.43305 26.37775 28.48834  
## 534 27.36347 26.30350 28.42345  
## 535 27.36347 26.30350 28.42345  
## 536 27.29390 26.22924 28.35856  
## 537 27.29390 26.22924 28.35856  
## 538 27.22433 26.15497 28.29369  
## 539 27.15476 26.08070 28.22883  
## 540 27.08519 26.00641 28.16397  
## 541 26.94605 25.85780 28.03429  
## 542 26.94605 25.85780 28.03429  
## 543 26.80690 25.70915 27.90466  
## 544 26.73733 25.63481 27.83985  
## 545 26.73733 25.63481 27.83985  
## 546 26.66776 25.56046 27.77506  
## 547 26.66776 25.56046 27.77506  
## 548 26.52862 25.41174 27.64550  
## 549 26.45905 25.33736 27.58073  
## 550 26.31990 25.18859 27.45122  
## 551 26.31990 25.18859 27.45122  
## 552 26.25033 25.11418 27.38648  
## 553 26.18076 25.03977 27.32175  
## 554 26.18076 25.03977 27.32175  
## 555 26.11119 24.96535 27.25703  
## 556 26.04162 24.89092 27.19232  
## 557 25.90248 24.74204 27.06291  
## 558 25.62419 24.44418 26.80420  
## 559 25.55462 24.36969 26.73955  
## 560 25.55462 24.36969 26.73955  
## 561 25.55462 24.36969 26.73955  
## 562 25.48505 24.29520 26.67490  
## 563 25.48505 24.29520 26.67490  
## 564 25.48505 24.29520 26.67490  
## 565 25.41548 24.22070 26.61025  
## 566 25.41548 24.22070 26.61025  
## 567 25.41548 24.22070 26.61025  
## 568 25.27633 24.07168 26.48099  
## 569 25.27633 24.07168 26.48099  
## 570 25.13719 23.92263 26.35176  
## 571 25.13719 23.92263 26.35176  
## 572 24.92848 23.69899 26.15796  
## 573 24.85891 23.62444 26.09338  
## 574 24.85891 23.62444 26.09338  
## 575 24.85891 23.62444 26.09338  
## 576 24.78934 23.54987 26.02880  
## 577 24.71976 23.47530 25.96423  
## 578 24.65019 23.40072 25.89966  
## 579 24.65019 23.40072 25.89966  
## 580 24.65019 23.40072 25.89966  
## 581 24.65019 23.40072 25.89966  
## 582 24.58062 23.32614 25.83510  
## 583 24.58062 23.32614 25.83510  
## 584 24.51105 23.25155 25.77055  
## 585 24.37191 23.10235 25.64147  
## 586 24.37191 23.10235 25.64147  
## 587 24.30234 23.02774 25.57693  
## 588 24.30234 23.02774 25.57693  
## 589 24.23276 22.95312 25.51241  
## 590 24.23276 22.95312 25.51241  
## 591 24.16319 22.87850 25.44789  
## 592 24.09362 22.80387 25.38337  
## 593 23.74577 22.43064 25.06089  
## 594 23.74577 22.43064 25.06089  
## 595 23.53705 22.20664 24.86746  
## 596 23.46748 22.13196 24.80300  
## 597 23.39791 22.05728 24.73854  
## 598 23.39791 22.05728 24.73854  
## 599 23.32834 21.98259 24.67409  
## 600 23.32834 21.98259 24.67409  
## 601 23.18919 21.83319 24.54520  
## 602 23.11962 21.75848 24.48076  
## 603 23.05005 21.68377 24.41633  
## 604 22.98048 21.60906 24.35190  
## 605 22.91091 21.53434 24.28748  
## 606 22.84134 21.45961 24.22306  
## 607 22.70220 21.31015 24.09424  
## 608 22.70220 21.31015 24.09424  
## 609 22.70220 21.31015 24.09424  
## 610 22.49348 21.08591 23.90105  
## 611 22.49348 21.08591 23.90105  
## 612 22.42391 21.01116 23.83666  
## 613 22.28477 20.86164 23.70789  
## 614 22.07605 20.63733 23.51478  
## 615 22.07605 20.63733 23.51478  
## 616 22.00648 20.56255 23.45042  
## 617 22.00648 20.56255 23.45042  
## 618 22.00648 20.56255 23.45042

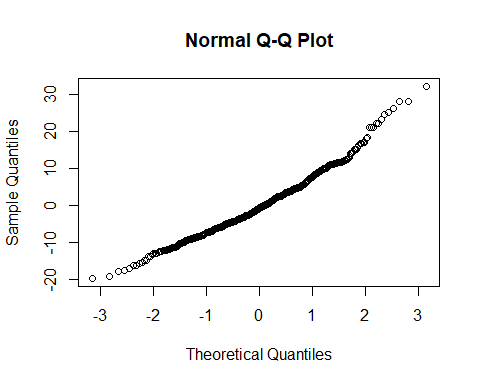
abline(fit)



#Par(mfrow=c(1,2))  
plot(respiratory$age,residuals(fit))



qqnorm(residuals(fit))

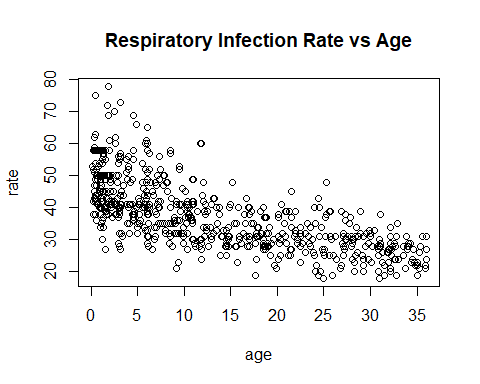


plot(rate~age, data=respiratory, main="Respiratory Infection Rate vs Age")  
out = list()  
i=1  
for(s in c(0.10,0.25,0.5,0.75)){  
 loes <- loess(rate~age, data=respiratory,span=s)  
 print(loes)  
 out[[i]] <- predict(loes)  
 i=i+1  
}

## Call:  
## loess(formula = rate ~ age, data = respiratory, span = s)  
##   
## Number of Observations: 618   
## Equivalent Number of Parameters: 29.63   
## Residual Standard Error: 7.71   
## Call:  
## loess(formula = rate ~ age, data = respiratory, span = s)  
##   
## Number of Observations: 618   
## Equivalent Number of Parameters: 11.83   
## Residual Standard Error: 7.677   
## Call:  
## loess(formula = rate ~ age, data = respiratory, span = s)  
##   
## Number of Observations: 618   
## Equivalent Number of Parameters: 6.22   
## Residual Standard Error: 7.657   
## Call:  
## loess(formula = rate ~ age, data = respiratory, span = s)  
##   
## Number of Observations: 618   
## Equivalent Number of Parameters: 4.25   
## Residual Standard Error: 7.649

#print(out)  
library(ggplot2)

## Warning: package 'ggplot2' was built under R version 3.5.1



#curve(predict(out, newdata=data.frame(age = x)), add=TRUE)  
  
plot(rate, x=age, type="p", main="Loess Smoothing and Prediction",   
 xlab="Child Age", ylab="Respiratory Infection Rate")  
print(length(out))

## [1] 4

color = c("red","blue","green","black")  
for(k in 1:length(out)){  
 lines(out[[k]], x=respiratory$age, col=color[k])   
   
}

