Improving access to public physical activity events for disadvantaged communities in Australia: Supplementary Material

Smith, Reece, Rose & Owen

For our online map resource, white circles indicate the location of current parkrun events (at July 2021); red circles indicate the centroid of the SA2s selected in the first step of the analysis, together with the name of the SA2. Yellow circles indicate the location of the SA1 closest to the SA2 centroid, weighted by IRSD, while green circles indicate the most densely populated SA1 within the selected SA2 area. Numbers indicate the order in which the SA2 was selected, and all are also labelled by the name of the SA2.

Supplementary Table 1 shows the location of current events and proposed events by state and greater capital city/regional designation.

**Supplementary Table 1.** Predicted 2020 population, number of existing Australian 5 km parkrun events (at July 2021), and number of proposed parkrun events, in greater capital city and regional areas for each state.

| State                        | Population | Number of current events | Number of new events |
|------------------------------|------------|--------------------------|----------------------|
|                              | Capital city | Regional | Total | Capital city | Regional | Total | Capital city | Regional | Total |
| New South Wales              | 5,367,206  | 2,800,326 | 8,167,532 | 36 | 64 | 100 | 4 | 27 | 31 |
| Victoria                     | 5,159,211  | 1,537,459 | 6,696,670 | 42 | 50 | 92 | 3 | 5 | 8 |
| Queensland                   | 2,560,720  | 2,615,466 | 5,176,186 | 44 | 64 | 108 | 0 | 14 | 14 |
| Western Australia            | 2,125,114  | 538,447  | 2,663,561 | 29 | 12 | 41 | 2 | 15 | 17 |
| South Australia              | 1,376,601  | 393,774  | 1,770,375 | 19 | 16 | 35 | 0 | 10 | 10 |
| Tasmania                     | 238,834    | 301,946  | 540,780  | 5 | 12  | 17 | 0 | 3 | 3 |
| Australian Capital Territory | 431,380    | 0        | 431,380  | 7 | -   | 7 | 0 | 0 | 0 |
| Northern Territory           | 147,231    | 98,912   | 246,143  | 3 | 0   | 3 | 0 | 14 | 14 |
| Other territories            | 0          | 4,671    | 4,671    | - | 0   | 0 | - | 3 | 3 |
| **TOTAL**                    | 17,406,297 | 8,291,001 | 25,697,298 | 185 | 218 | 403 | 9 | 91 | 100 |
Supplementary Figure 1a. Map of current and proposed events for the greater capital city (Sydney) region of New South Wales. For this and all subsequent figures, numbered locations correspond to the order of selection by the location-allocation algorithm listed in Supplementary Table 2; the same population density scale has been used for all figures.
Supplementary Figure 1b. Map of current and proposed events for regional New South Wales (NSW). Note for this and subsequent regional maps, event locations in the greater capital city are suppressed because of heavy clustering. Note also that the locations selected by the algorithm represent only the centroid of the SA2 area; sometimes this coincides with a regional town, but often the nearest town is visible as a darker purple area indicating higher population density. See the online interactive map for further details.
**Supplementary Figure 2.** Map of current and proposed events for the Northern Territory (NT).
Supplementary Figure 3. Map of current and proposed events for Queensland (QLD).
Supplementary Figure 4. Map of current and proposed events for South Australia (SA).
Supplementary Figure 5. Map of current and proposed events for Tasmania (TAS).
Supplementary Figure 6a. Map of current and proposed events for the greater capital city (Melbourne) region of Victoria.
**Supplementary Figure 6b.** Map of current and proposed events for regional Victoria (VIC).
Supplementary Figure 7a. Map of current and proposed events for the greater capital city (Perth) region of Western Australia.
Supplementary Figure 7b. Map of current and proposed events for regional Western Australia (WA).
Supplementary Figure 8. Map of current events for the Australian Capital Territory (ACT). Note that no new events were proposed.
### Supplementary Table 2. Locations of new events selected by the location-allocation algorithm.

| Order | State | SA4                       | SA3                        | SA2                      | Town, Method 1*                               | Catchment population, Method 1* | Town, Method 2*                 | Catchment population, Method 2* |
|-------|-------|---------------------------|----------------------------|--------------------------|-----------------------------------------------|---------------------------------|----------------------------------|----------------------------------|
| 1     | NT    | Northern Territory - Outback | Alice Springs              | Flynn (NT)               | Larapinta Valley (Alice Springs)             | 30,642                          | Gillen (Alice Springs)           | 27,751                           |
| 2     | NT    | Northern Territory - Outback | East Arnhem                | East Arnhem              | Gan Gan                                      | 6,981                           | Galiwinku                        | 6,656                            |
| 3     | WA    | Western Australia - Outback (North) | Kimberley                  | Derby - West Kimberley   | Yungngora                                    | 4,680                           | Derby                            | 7,270                            |
| 4     | SA    | South Australia - Outback | Outback - North and East   | APY Lands                | Kaltji                                        | 4,280                           | Pukatja                          | 6,188                            |
| 5     | QLD   | Queensland - Outback      | Far North                  | Torres Strait Islands    | Yam Island                                    | 3,435                           | Coconut Island                   | 3,195                            |
| 6     | OT    | Other Territories         | Christmas Island           | Christmas Island         | Flying Fish Cove                             | 1,966                           | Flying Fish Cove                 | 1,966                            |
| 7     | NT    | Northern Territory - Outback | Barkly                     | Tennant Creek            | Nyrinkkanyunu (Tennant Creek)                | 5,570                           | Tennant Creek                    | 5,570                            |
| 8     | WA    | Western Australia - Outback (South) | Esperance                  | Esperance                | Nilsen (Esperance)                           | 15,956                          | Windabout (Esperance)            | 15,956                           |
| 9     | WA    | Western Australia - Outback (North) | Kimberley                  | Broome                   | Broome                                        | 20,534                          | Djungan (Broome)                 | 15,709                           |
| 10    | WA    | Western Australia - Outback (South) | Gascoyne                  | Carnarvon                | Morgantown (Carnarvon)                       | 6,447                           | Brockman (Carnarvon)             | 6,447                            |
| 11    | NT    | Northern Territory - Outback | Katherine                  | Katherine                | Katherine                                     | 12,122                          | Katherine East                   | 11,649                           |
| 12    | WA    | Western Australia - Outback (North) | East Pilbara               | Newman                   | Newman                                        | 12,920                          | Newman                           | 12,589                           |
| 13    | OT    | Other Territories         | Norfolk Island             | Norfolk Island           | Norfolk Island                               | 1,734                           | Norfolk Island                   | 1,734                            |
| 14    | SA    | South Australia - Outback | Outback - North and East   | Coober Pedy              | Coober Pedy                                  | 2,489                           | Coober Pedy                      | 2,489                            |
| 15    | SA    | South Australia - Outback | Eyre Peninsula and South West | Whyalla                | Whyalla                                       | 21,918                          | Whyalla                          | 21,918                           |
| 16    | WA    | Western Australia - Outback (North) | Kimberley                  | Halli Creek              | Billiluna                                     | 3,141                           | Halli Creek                      | 5,772                            |
| 17    | QLD   | Queensland - Outback      | Outback - North            | Carpentaria              | Doomadgee                                     | 5,124                           | Normanton                        | 5,641                            |
| 18    | WA    | Western Australia - Wheat Belt | Albany                     | Katanning                | Katanning                                     | 11,690                          | Katanning                        | 12,134                           |
| 19    | NSW   | Far West and Orana        | Bourke - Cobar - Coonamble | Walgett - Lightning Ridge | Walgett                                       | 6,145                           | Lightning Ridge                  | 5,674                            |
| 20    | SA    | South Australia - Outback | Eyre Peninsula and South West | Ceduna                | Ceduna                                        | 6,313                           | Ceduna                           | 6,313                            |
| 21    | NT    | Northern Territory - Outback | Katherine                  | Gulf                      | Borroloola                                    | 1,717                           | Borroloola                       | 1,717                            |
| 22    | QLD   | Cairns                    | Innisfail - Cassowary Coast | Innisfail                | Innisfail                                     | 23,491                          | Innisfail                        | 22,906                           |
| 23    | QLD   | Townsville                | Charters Towers - Ay - Ingham | Charters Towers         | Charters Towers                              | 11,103                          | Charters Towers                  | 10,871                           |
| 24    | OT    | Other Territories         | Cocos (Keeling) Islands    | Cocos (Keeling) Islands  | Bantam                                        | 573                             | Bantam                           | 573                              |
| 25    | NSW   | Riverina                  | Wagga Wagga                | Cootamundra              | Cootamundra                                   | 9,140                           | Cootamundra                      | 9,140                            |
| 26    | NT    | Northern Territory - Outback | Alice Springs              | Yuendumu - Anmatjere     | Willowra                                     | 1,424                           | Nturiya                          | 2,665                            |
| 27    | SA    | Barossa - Yorke - Mid North | Mid North                  | Port Pirie               | Port Pirie                                   | 25,481                          | Port Pirie                       | 25,481                           |
| 28    | WA    | Western Australia - Wheat Belt | Wheat Belt - North         | Merredin                  | Bruce Rock                                    | 13,559                          | Merredin                         | 11,475                           |
| Order | State | SA4                          | SA3           | SA2                        | Town, Method 1* | Catchment population, Method 1* | Town, Method 2* | Catchment population, Method 2* |
|-------|-------|------------------------------|---------------|----------------------------|----------------|--------------------------------|----------------|--------------------------------|
| 29    | WA    | Western Australia - Outback (South) | Mid West      | Meekatharra                | Wiluna         | 2,697                          | Meekatharra     | 1,871                          |
| 30    | NSW   | Riverina                      | Tumut - Tumbarumba | Tumut                     | Tumut          | 17,291                         | Tumut           | 17,291                         |
| 31    | QLD   | Cairns                        | Port Douglas - Daintree | Daintree                | Mossman Gorge Aboriginal Community | 20,069                      | Mossman         | 20,069                         |
| 32    | TAS   | West and North West           | West Coast     | West Coast (Tas.)          | Zeehan         | 4,395                          | Queenstown      | 4,415                          |
| 33    | QLD   | Central Queensland            | Biloela        | Biloela                    | Biloela        | 15,480                         | Biloela         | 15,480                         |
| 34    | NSW   | Far West and Orana            | Dubbo          | Gilgandra                  | Gilgandra      | 4,390                          | Gilgandra       | 4,974                          |
| 35    | NT    | Northern Territory - Outback  | Daly - Tiwi - West Arnhem | West Arnhem               | Oenpelli       | 6,936                          | Maningrida      | 6,667                          |
| 36    | NT    | Northern Territory - Outback  | Katherine      | Victoria River             | Kalkarindji    | 2,050                          | Lajamanu        | 2,158                          |
| 37    | TAS   | Launceston and North East     | North East     | St Helens - Scamander      | St Helens      | 9,436                          | St Helens       | 9,436                          |
| 38    | SA    | Barossa - Yorke - Mid North   | Yorke Peninsula | Moonta                    | Moonta         | 20,662                         | Moonta Bay      | 20,662                         |
| 39    | WA    | Western Australia - Outback (North) | East Pilbara  | East Pilbara              | Punmu          | 959                             | Nullagine       | 3,089                          |
| 40    | WA    | Western Australia - Wheat Belt | Wheat Belt - North | Northam                   | Northam        | 21,483                         | Northam         | 22,219                         |
| 41    | NSW   | Sydney - Parramatta           | Merrylands - Guildford | Guildford West - Merrylands West | Merrylands West | 273,430                     | Merrylands West | 307,090                       |
| 42    | WA    | Western Australia - Outback (South) | Goldfields     | Leinster - Leonora        | Warburton      | 2,491                          | Leinster        | 3,700                          |
| 43    | NT    | Northern Territory - Outback  | Daly - Tiwi - West Arnhem | Thamarrurr               | Wadeye         | 4,560                          | Wadeye          | 4,560                          |
| 44    | NSW   | Murray                        | Upper Murray exc. Albury | Deniliquin              | Deniliquin     | 10,533                         | Deniliquin      | 10,533                         |
| 45    | SA    | South Australia - Outback     | Outback - North and East | Roxby Downs              | Roxby Downs    | 5,340                          | Roxby Downs     | 5,340                          |
| 46    | NSW   | New England and North West    | Tamworth - Gunnedah | Gunnedah                | Gunnedah       | 15,536                         | Gunnedah        | 15,536                         |
| 47    | WA    | Mandurah                      | Mandurah       | Mandurah                  | Mandurah       | 93,472                         | Mandurah        | 93,622                         |
| 48    | NSW   | Mid North Coast               | Kempsey - Nambucca | Kempsey                  | Kempsey        | 22,396                         | Kempsey         | 22,396                         |
| 49    | QLD   | Queensland - Outback          | Far North      | Kowanyama - Pormpuraaw    | Kowanyama      | 2,328                          | Kowanyama       | 1,957                          |
| 50    | VIC   | Warrnambool and South West    | Colac - Corangamite | Colac                  | Colac          | 20,709                         | Colac           | 20,870                         |
| 51    | NT    | Northern Territory - Outback  | East Arnhem    | Nhulunbuy                 | Nhulunbuy      | 4,869                          | Nhulunbuy       | 5,101                          |
| 52    | NSW   | Southern Highlands and Shoalhaven | Shoalhaven    | Nowra                     | Nowra          | 52,590                         | Worrigee (Nowra)| 52,972                         |
| 53    | NSW   | Sydney - South West           | Fairfield      | Bonnyrigg Heights - Bonnyrigg | Bonnyrigg      | 205,235                        | Bonnyrigg       | 201,598                        |
| 54    | VIC   | North West                    | Murray River - Swan Hill | Robinvale                | Robinvale      | 8,331                          | Robinvale       | 8,513                          |
| 55    | NT    | Northern Territory - Outback  | Alice Springs  | Sandover - Plenty         | Engawala       | 2,250                          | outside Alice Springs | 3,086                         |
| 56    | QLD   | Queensland - Outback          | Far North      | Torres                    | Thursday Island | 8,891                        | Thursday Island | 9,131                          |
| 57    | NT    | Northern Territory - Outback  | East Arnhem    | Anindilyakwa              | Angurugu       | 3,554                          | Alyangula       | 3,747                          |
| 58    | NSW   | Central West                  | Lachlan Valley | Condobolin                | Condobolin     | 6,889                          | Condobolin      | 6,889                          |
| Order | State       | SA4              | SA3               | SA2               | Town, Method 1* | Catchment population, Method 1* | Town, Method 2* | Catchment population, Method 2* |
|-------|-------------|------------------|-------------------|-------------------|----------------|---------------------------------|----------------|---------------------------------|
| 59    | NSW         | Southern Highlands and Shoalhaven | Shoalhaven       | Ulladulla         | Ulladulla       | 23,075                          | Ulladulla       | 22,795                          |
| 60    | VIC         | Mornington Peninsula | Frankston       | Frankston North   | Frankston North | 173,328                        | Frankston       | 176,999                        |
| 61    | NSW         | Sydney - Inner South West | Canterbury     | Punchbowl         | Punchbowl       | 246,554                        | Punchbowl       | 240,957                        |
| 62    | QLD         | Queensland - Outback | Outback - North | Northern Highlands | Richmond        | 2,610                          | Hughenden       | 2,557                          |
| 63    | VIC         | Hume              | Upper Goulburn Valley | Seymour         | Seymour         | 23,220                          | Seymour         | 23,009                          |
| 64    | NSW         | Capital Region    | Young - Yass    | Young             | Young           | 19,377                          | Young           | 19,377                          |
| 65    | WA          | Western Australia - Wheat Belt | Wheat Belt - South | Narrogin        | Narrogin        | 13,081                          | Narrogin        | 14,325                          |
| 66    | NSW         | Far West and Orana | Dubbo           | Coonabarabran     | Binnaway        | 8,635                          | Coonabarabran   | 6,271                          |
| 67    | WA          | Western Australia - Outback (South) | Mid West    | Morowa           | Morowa          | 4,456                          | Three Springs   | 4,385                          |
| 68    | NSW         | New England and North West | Inverell - Tenterfield | Glen Innes    | Glen Innes      | 9,491                          | Glen Innes      | 9,491                          |
| 69    | NSW         | Capital Region    | South Coast    | Narooma - Bermagui | Wallaga Lake Heights | 14,031                     | Kianga         | 14,643                          |
| 70    | NSW         | Riverina          | Wagga Wagga    | Temora            | Temora          | 12,157                          | Temora          | 12,157                          |
| 71    | NSW         | Murray            | Upper Murray exc. Albury | Corowa       | Corowa          | 19,374                          | Corowa         | 18,421                          |
| 72    | VIC         | Melbourne - West  | Brimbank        | Cairnlea          | Cairnlea        | 220,735                        | Cairnlea        | 213,507                        |
| 73    | NSW         | Illawarra         | Dapto - Port Kembla | Berkeley - Lake Heights - Cringila | Berkeley | 87,052                        | Cringila        | 91,979                          |
| 74    | SA          | South Australia - South East | Murray and Mallee | Barmera        | Barmera         | 23,571                          | Barmera         | 23,571                          |
| 75    | NSW         | Far West and Orana | Broken Hill and Far West | Far West    | Wilcannia       | 1,700                          | Wilcannia       | 1,700                          |
| 76    | NSW         | Richmond - Tweed  | Richmond Valley - Coastal | Brunswick Heads - Ocean Shores | Brunswick Heads | 36,366                        | South Golden Beach | 34,399                     |
| 77    | TAS         | West and North West | West Coast     | Smithton          | Smithton        | 9,138                          | Smithton        | 9,138                          |
| 78    | SA          | South Australia - South East | Limestone Coast | Millicent        | Millicent      | 11,132                          | Millicent       | 10,222                          |
| 79    | NT          | Northern Territory - Outback | Katherine     | Elsey            | Jilkminggan     | 4,302                          | Wugularr        | 4,825                          |
| 80    | VIC         | North West        | Grampians       | St Arnaud        | St Arnaud       | 8,608                          | St Arnaud       | 8,608                          |
| 81    | NT          | Northern Territory - Outback | Alice Springs | Tanami           | Nyrrirpi        | 3,353                          | Papunya         | 4,059                          |
| 82    | NSW         | Murray            | Lower Murray    | Hay               | Hay             | 2,969                          | Hay             | 2,969                          |
| 83    | NSW         | Far West and Orana | Dubbo           | Wellington       | Wellington      | 9,935                          | Wellington      | 10,399                         |
| 84    | QLD         | Wide Bay          | Burnett          | Gin Gin          | Gin Gin         | 12,464                          | Gin Gin         | 12,464                         |
| 85    | QLD         | Mackay - Isaac - Whitsunday | Bowen Basin - North | Moranbah    | Moranbah        | 14,012                         | Moranbah        | 14,012                         |
| 86    | NSW         | Capital Region    | Snowy Mountains | Cooma            | Cooma           | 10,527                         | Cooma           | 10,260                         |
| 87    | NSW         | Far West and Orana | Bourke - Cobar - Coonamble | Coonamble | Coonamble     | 5,367                          | Coonamble       | 4,853                          |
| 88    | QLD         | Wide Bay          | Gympie - Cooloola | Cooloola        | Cooloola Cove   | 7,143                          | Cooloola Cove   | 7,143                          |
| Order | State          | SA4                  | SA3       | SA2                  | Town, Method 1* | Catchment population, Method 1* | Town, Method 2* | Catchment population, Method 2* |
|-------|----------------|----------------------|-----------|----------------------|-----------------|--------------------------------|-----------------|--------------------------------|
| 89    | WA             | Perth - North West   | Stirling  | Balga - Mirrabooka  | Balga           | 136,919                        | Balga           | 145,879                        |
| 90    | NSW            | Hunter Valley exc Newcastle | Upper Hunter | Muswellbrook     | Muswellbrook   | 16,860                         | Muswellbrook   | 16,860                        |
| 91    | VIC            | Melbourne - Outer East | Yarra Ranges | Yarra Valley   | Millgrove       | 28,045                         | Millgrove       | 28,045                        |
| 92    | NSW            | Sydney - Parramatta  | Auburn    | Auburn - Central  | Auburn          | 161,148                        | Auburn          | 143,445                        |
| 93    | SA             | South Australia - South East | Limestone Coast | Tatiara     | Bordertown      | 9,106                          | Bordertown      | 9,106                          |
| 94    | WA             | Western Australia - Wheat Belt | Albany    | Plantagenet     | Kendenup        | 7,214                          | Mount Barker    | 13,679                        |
| 95    | NSW            | Richmond - Tweed     | Tweed Valley | Murwillumbah   | Murwillumbah    | 20,428                         | Murwillumbah    | 19,970                        |
| 96    | VIC            | North West           | Grampians | Yarrambiack     | Beulah          | 7,874                          | Warracknabeal   | 7,679                          |
| 97    | QLD            | Cairns               | Cairns - South | Edmonton | Edmonton       | 51,815                         | Edmonton        | 56,264                        |
| 98    | QLD            | Queensland - Outback | Outback - South | Far South West | Cunnamulla     | 1,874                          | Cunnamulla      | 1,874                          |
| 99    | NSW            | Mid North Coast      | Kempsey - Nambucca | Nambucca Heads | Nambucca Heads | 18,685                         | Nambucca Heads | 18,685                        |
| 100   | NSW            | Richmond - Tweed     | Richmond Valley - Hinterland | Kyogle | Kyogle         | 11,597                         | Kyogle          | 11,597                        |

Order represents the order in which the algorithm selected the site; locations are given by state, the higher-level SA3 and SA4 areas, name of the SA2 area selected, towns selected by each method, and the catchment population for an event held at that location. Served population represents the number of people for whom this event would be the closest, after all 100 events had been set up, and in addition to the current 403 events. SA3s group whole SA2s with similar regional characteristics, while SA4s, made of whole SA3 areas, represent labour markets within each state or territory; for further detail see https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1270.0.55.001~July%202016~Main%20Features~Main%20structure~10002

* Method 1: deprivation-weighted distance; Method 2: highest density.

To assess the sensitivity of the algorithm, we also ran analyses which only minimised distance to the nearest event (i.e., unweighted by IRSD) and found largely similar results to the analyses presented above: 156 of the 200 SA2 areas selected as locations for new events were the same in both analyses. The two analyses differed in the ordering of many locations, and many of the new locations selected in this analysis are close to areas selected above.