Back-to-the-future potential for autochthonous transmission of *Aedes aegypti*-transmitted viruses in eThekwini and urban coastal KwaZulu-Natal Province, South Africa

The *Aedes aegypti* (Linnaeus) mosquito transmits several important arboviruses, principally chikungunya (CHIKV), dengue (DENV), yellow fever (YFV) and Zika (ZIKV).

Ninety years ago this journal featured an account of the DENV-1 epidemic that crippled Durban during the summer of 1926/27. Summary estimates described 50,000 sufferers and 60 attributed deaths along the coast between Kelso Junction and Stanger (KwaDukuza) and inland as far as Pinetown. Some residents suffered haemorrhagic manifestations now associated with repeat infections involving another of the four DENV types.

A 1996 *SAMJ* editorial suggested that the 1926/27 epidemic occurred during a brace of remarkably wet years when the rainfall was five and eight times greater than the historical average. However, the Durban rainfall during 1925/26 was the lowest then on record and drought persisted through the first months of the 1927 epidemic, before plentiful March rains. Empty skies compounded structural water supply challenges later relieved by completion of the Shongweni Water Scheme.

The 1926/27 epidemic was not an anomaly. In the early 1870s, a pandemic often identified as ‘dengue’ – but more likely in fact chikungunya – swept through Indian Ocean ports. The pandemic reached Mauritius in 1873. In late January 1874, an epidemic resembling chikungunya took hold in Durban: ‘a low fever, accompanied by rheumatic pain, affecting black and white populations alike, “almost put a stop to business”.’ The first symptoms of the attack are stiffness and soreness in the legs and joints, pains in the head, and tightness in the chest, *The Natal Mercury* detailed. ‘Then the fever soon shows itself and prostrates the victim. There is nothing of fatal character about the sickness but it completely knocks up those it attacks, for at least two or three days.’ Four summers later, in March 1878, the port town’s district surgeon reported that ‘this is the first time dengue has shown itself epidemically in this Colony’ and *The Natal Mercury* observed that ‘at least every other person has suffered.’

In addition to the epidemics in 1874 and 1878, medical observers reported disease events they described as ‘dengue’ during 10 additional summers over the next 50 years. Eight of those 12 years saw rainfall in Durban below the historical average (Table 1), often coincident with El Niño-associated drought. While the precise viral aetiologies of outbreaks and epidemics prior to 1926/27 are elusive, the better documented occurrences of probable chikungunya or dengue point to the presence of human-biting, virus-transmitting *Ae. aegypti* populations and recurring intersections with water stress.

In 2016, during a summer marked by El Niño drought, eThekwini’s dengue history went unmentioned after the World Health Organization declared Zika a public health emergency of international concern. Leading South African health officials made statements to the press and Parliament’s Portfolio Committee on Health, dismissing the vector capacity and competence of the country’s *Ae. aegypti* populations, regardless of region. All six populations from both ends of KZN – a forest population from Ndumu and another from Glenmore Beach – were readily infected with CHIKV at viral titres >5.3 logs and capably transmitted the virus. *Ae. aegypti* from eThekwini were competent vectors of DENV-1 and DENV-2, albeit with lower efficiency than seen in South America and *Ae. aegypti* from eThekwini were relatively poor vectors of YFV.

Less competent vectors still warrant consideration. From November through April, eThekwini summers favour *Ae. aegypti* abundance, with average high temperatures of 25–28°C, relative humidity around 80%, and summer rainfall. If the city’s *Ae. aegypti* mosquitoes obtain bloodmeals containing CHIKV, DENV or ZIKV from infected visitors or returning residents – and subsequently survive beyond the virus’s extrinsic incubation period (EIP) within mosquitoes – local transmission could result. Most of eThekwini’s 3.5 million residents presumably have no acquired immunity to these viruses.

Entrenched inequality deprives many eThekwini residents of protection against blood-feeding *Ae. aegypti* afforded by good-quality dwelling construction, in-house piped water, and air-conditioning. A third of eThekwini households are located in informal settlements. Barely 60% of city households enjoy in-house piped water. Where piped water is present, residents...
may still collect and store water to hedge against prohibitive costs or restrictions and interruptions. This is not to suggest that eThekwini’s well-to-do are unlikely to be affected. Their disposable income and international travel make them candidates for virus importation. As in 1927 – when dengue beset Berea households – water-holding receptacles and vegetation prised in the gardens of the wealthier classes can foster and shelter Ae. aegypti, while outdoor living areas can increase vector exposure during peak morning and evening biting times.\[301]\[303]\[305]\[307]\[309]\[311]\[313]\[315]\[317]\[319]\[321]\[323]\[325]\[327]\[329]\[331]\[333]\[335]\[337]\[339]\[341]\[343]\[345]\[347]\[349]\[351]\[353]\[355]\[357]\[359]\[361]\[363]\[365]\[367]\[369]\[371]\[373]\[375]\[377]\[379]\[381]\[383]\[385]\[387]\[389]\[391]\[393]\[395]\[397]\[399]\[401]\[403]\[405]\[407]\[409]\[411]\[413]\[415]\[417]\[419]\[421]\[423]\[425]\[427]\[429]\[431]\[433]\[435]\[437]\[439]\[441]\[443]\[445]\[447]\[449]\[451]\[453]\[455]\[457]\[459]\[461]\[463]\[465]\[467]\[469]\[471]\[473]\[475]\[477]\[479]\[481]\[483]\[485]\[487]\[489]\[491]\[493]\[495]\[497]\[499]\[501]\[503]\[505]\[507]\[509]\[511]\[513]\[515]\[517]\[519]\[521]\[523]\[525]\[527]\[529]\[531]\[533]\[535]\[537]\[539]\[541]\[543]\[545]\[547]\[549]\[551]\[553]\[555]\[557]\[559]\[561]\[563]\[565]\[567]\[569]\[571]\[573]\[575]\[577]\[579]\[581]\[583]\[585]\[587]\[589]\[591]\[593]\[595]\[597]\[599]\[601]\[603]\[605]\[607]\[609]\[611]\[613]\[615]\[617]\[619]\[621]\[623]\[625]\[627]\[629]\[631]\[633]\[635]\[637]\[639]\[641]\[643]\[645]\[647]\[649]\[651]\[653]\[655]\[657]\[659]\[661]\[663]\[665]\[667]\[669]\[671]\[673]\[675]\[677]\[679]\[681]\[683]\[685]\[687]\[689]\[691]\[693]\[695]\[697]\[699]\[701]\[703]\[705]\[707]\[709]\[711]\[713]\[715]\[717]\[719]\[721]\[723]\[725]\[727]\[729]\[731]\[733]\[735]\[737]\[739]\[741]\[743]\[745]\[747]\[749]\[751]\[753]\[755]\[757]\[759]\[761]\[763]\[765]\[767]\[769]\[771]\[773]\[775]\[777]\[779]\[781]\[783]\[785]\[787]\[789]\[791]\[793]\[795]\[797]\[799]\[801]\[803]\[805]\[807]\[809]\[811]\[813]\[815]\[817]\[819]\[821]\[823]\[825]\[827]\[829]\[831]\[833]\[835]\[837]\[839]\[841]\[843]\[845]\[847]\[849]\[851]\[853]\[855]\[857]\[859]\[861]\[863]\[865]\[867]\[869]\[871]\[873]\[875]\[877]\[879]\[881]\[883]\[885]\[887]\[889]\[891]\[893]\[895]\[897]\[899]\[901]\[903]\[905]\[907]\[909]\[911]\[913]\[915]\[917]\[919]\[921]\[923]\[925]\[927]\[929]\[931]\[933]\[935]\[937]\[939]\[941]\[943]\[945]\[947]\[949]\[951]\[953]\[955]\[957]\[959]\[961]\[963]\[965]\[967]\[969]\[971]\[973]\[975]\[977]\[979]\[981]\[983]\[985]\[987]\[989]\[991]\[993]\[995]\[997]