Investigating the health impacts of the Ranger uranium mine on Aboriginal people

Stillbirth and cancer rates are significantly elevated among Aboriginal people living near the Ranger uranium mine

Stillbirth and cancer incidence rates are significantly higher among Aboriginal people living near the Ranger uranium mine than among Aboriginal people elsewhere in the Top End of the Northern Territory, with a stillbirth rate over twice as high and cancer incidence almost 50% higher.[1] The NT Chief Health Officer commissioned an investigation into the excess stillbirths and cancers in 2014, but a November 2020 report found no explanatory cause.[1] The Ranger uranium mine ceased operations as planned in January 2021.[2]

Communities expect health departments to respond to reports of clusters of adverse health outcomes such as the excess stillbirths and cancers among Aboriginal people living near the Ranger uranium mine.[3] However, investigating clusters of health outcomes which have complex aetiologies rarely provides definitive answers.[3] Even when associations are identified, cluster investigations cannot demonstrate that these associations are responsible for the disease cluster. Nonetheless, important environmental, public health and social problems may be identified through cluster investigations, enabling health education and promotion, and potentially, mitigation of contributing causes.[3]

The Ranger mine cluster investigation focused on ionising radiation as a potential cause of the excess stillbirths and cancers because this was considered the worst-case scenario.[1] There are well established causative associations between ionising radiation and increased rates of some cancers, particularly lung, head and neck, thyroid cancer in childhood and leukaemia, and fetal malformations that lead to stillbirth.[1]

Tobacco and alcohol consumption likewise contribute to stillbirths and cancers, and these were also examined in the cluster investigation, together with markers of poor nutrition.[1] High levels of alcohol consumption by Aboriginal people in the Ranger mine region have long been a concern.[4,5]

The Ranger uranium mine in Kakadu National Park

Uranium mining began at a location labelled "Ranger" in 1980 on land excised from the Kakadu National Park World Heritage site.[6] Aboriginal rights to veto mining were overridden in legislation, and detrimental impacts on Aboriginal people were anticipated, but market prospects for uranium appeared strong and the mine was considered to be in the national interest. Mining was allowed to proceed, with recommendations to monitor and reduce harmful impacts on the region's Aboriginal people.[4,7]

Health, social and ecological aspects of the Ranger uranium mine were explored in a 1984 report, whose authors recognised that their immersion into Aboriginal communities gave them deep concern about how uranium mining could affect Aboriginal people.[5] They recommended that uranium mining not expand without interventions to mitigate harmful and strengthen positive effects of mining on Aboriginal people.[5]

Mining continued for 40 years, and the Ranger uranium mine contributed up to $388 million annually to the NT economy before its 2021 closure.[2,8] During the period of mine operation, more than 200 leaks, spills and other incidents were documented.[9] Five major incidents are outlined in Box 1, highlighting threats to ecosystems and employees more than radiation exposure among Aboriginal community residents.[9,10]

The Gundjeihmi Aboriginal Corporation represents the Mirarr people of the region and for decades has expressed grave concerns about continuing incidents and the lack of effective government response.[7] While the Mirarr people maintain the right to live on their lands, their lives are disrupted by mining operations and incidents that threaten biodiversity, landscapes and livelihoods.[7,9]

In 2014, the mine operators lodged a proposal to expand. A submission on the proposal by the NT Department of Health noted that rates of stillbirth and cancer among Aboriginal people in the region were elevated.[1]

NT Department of Health investigation

In 2014, the NT Chief Health Officer commissioned an investigation into stillbirth and cancer rates in long term Aboriginal residents around the Ranger mine. The investigation aimed to quantify rates and identify exposures that may have contributed to the excess stillbirths and cancers. Stakeholders including Aboriginal health and land corporations and public health and politics experts oversaw the investigation to ensure transparency, while independent epidemiologists scrutinised the investigation's scope, design and conduct. The investigation report was released publicly in November 2020.[1]

The investigation identified all Aboriginal people who had spent more than half of their lives in the mine region during the 1991–2014 study period, with an exposed cohort of about 2200 people. The focus was ionising radiation because this exposure was considered the worst-case scenario.[1] The mine employed few local Aboriginal people, so occupational

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1 Major incidents at the Ranger uranium mine, 1979–2013[9,10]

Date	Location	Incident	Outcome	Risk minimisation
December 1995	Retention pond 2 at power station	12 000 litres of diesel fuel spilled	World's richest tropical waterbird breeding ground threatened; 40 identified waterbirds perished	Office of Supervising Scientist designated this as unacceptable environmental impact. Increases in monitoring not implemented due to mine operator's other commitments
January–April 2002	Headwaters of Corridor Creek, southern side of mine	Incorrect stockpiling of low grade uranium ore	Water contaminated by leakage of uranium	Remedial works undertaken in February 2002. No source found for ongoing run-off identified in April
March 2004	Ranger mine utility site	Process water connected to drinking water, leading to water uranium levels 400 times Australian standards	159 workers potentially exposed to contaminated water for drinking and washing	Mine operator prosecuted and fined $150 000
January–June 2011	Region wide	Extreme wet season	Risk of overflow from tailings dam	Uranium mill was shut for duration of wet season
December 2013	Ranger mine site	Collapse of acid leach tank	1 million litres of radioactive ore slurry spilled	Area was evacuated until spill contained

2 Total cancer incidence rate ratios for Aboriginal people living near the mine compared with other Aboriginal people in the Top End of the Northern Territory, by selected risk factors*[1]

Risk factor	Cancer incidence rate ratio (95% CI)
Tobacco smoking	1.53 (0.75–3.12)
Alcohol use	1.54 (0.76–3.15)
Infrequent vegetable intake	1.49 (0.73–3.06)

* Poisson regression model adjusted for age and sex. ◆

exposures were not considered.[1,2] The comparison group comprised all other Aboriginal people in the Top End.[1]

Elevated stillbirth and cancer incidence rates among Aboriginal people living near the Ranger mine compared with other Aboriginal people in the Top End were confirmed. Stillbirth was over twice as common (odds ratio, 2.17; 95% CI, 1.13–3.82) and cancer about 50% more common (total cancer incidence ratio, 1.48; 95% CI, 1.17-1.85).[1]

Examination of the cancer types showed that no specific cancer was responsible for the excess of total cancers. Cancers of the lip, mouth and pharynx together were the most common cancers and made up 42% of the excess: 16 cases, compared with 5.5 expected. These cancers are not considered to be caused by ionising radiation, but they are associated with tobacco smoking and alcohol consumption.[1]

The Aboriginal people living near the mine had higher prevalence of tobacco smoking (prevalence ratio, 1.08; 95% CI, 1.04–1.13), alcohol use (prevalence ratio, 1.21; 95% CI, 1.13–1.31) and infrequent intake of vegetables indicating poor nutrition (prevalence ratio, 1.08; 95% CI, 1.02–1.24) compared with other Aboriginal people in the Top End. Other risk factors were not statistically different between the groups. Multivariable analysis did not show that these risk factors contributed to the excess cancer incidence in the people living near the mine (Box 2). However, this analysis had low statistical power because of a lack of risk factor data.[1]

The investigation found "little evidence that the risk factors investigated … were associated with increased risk of cancer in study participants" in the period for which risk factor data were available.[1] Despite this statistical conclusion, higher rates of tobacco smoking and alcohol use and poor diets among Aboriginal people in the mine region were highlighted in relation to the excess stillbirths and cancers. The investigation concluded by recommending that Aboriginal people follow advice about smoking, alcohol and diet.[1]

Discussion

The Ranger uranium mine has had an impact on surrounding Aboriginal communities for over 40 years. The investigation by the NT Department of Health into the rates of stillbirths and cancers among people in the region invested significant resources and expertise in gathering data on stillbirths, cancers, ionising radiation and behavioural risk factors. It focused on cause–effect relationships between possible exposure to ionising radiation and behavioural risk factors, and the increased stillbirth and cancer rates.

The investigation was not designed to consider the impact of the imposition of uranium mining on

Aboriginal lands, as was recommended when the mine was proposed and developed.[4,5] Development of the Ranger mine entailed nullification of veto rights, disempowering Aboriginal communities and threatening their livelihoods.[7] With mining came royalty money, expensive commodities, money-hunger and alcohol.[5]

Economic development from the mine has increased inequity among Aboriginal people in the region.[5] Inequity may contribute to both stillbirths and cancer, although this would not be detected in a cluster investigation.[3,11,12] Employment and educational opportunities associated with the Ranger mine did not promote socio-economic development of the Aboriginal community; rather, Aboriginal wellbeing deteriorated through people relying on royalty income.[2,7] Aboriginal people's rights were ignored, and their expertise, authority and lifeways were devalued by the mine.[7]

Aboriginal community perspectives, knowledge and research methodologies may offer important insights into adverse Aboriginal health outcomes, while marginalising Aboriginal expertise perpetuates the impacts of colonisation.[13] Excess stillbirths and cancers may be associated with a web of interrelationships between individuals, communities and wider ecological, sociological and political environments, which a biomedically focused investigation may overlook.[14] Further research is needed to unravel this web, and explain the disparity in stillbirth and cancer rates between Aboriginal people in the region of the mine and the other Aboriginal people in the Top End.

The NT Department of Health stillbirth and cancer cluster investigation recommended that Aboriginal people in the region reduce their tobacco and excessive alcohol consumption, although these were not considered the causes of the raised stillbirth and cancer rates.[1] This response could be strengthened by a foundational approach to improve understanding and relationships between government, mining companies and Aboriginal community members.[2]

Conclusion

The investigation by the NT Department of Health into the excess stillbirths and cancers among Aboriginal people living near the Ranger uranium mine was transparent, detailed and publicly available. High level expertise was engaged, although stronger Aboriginal contribution to the investigation's grounding and methodology may have enhanced two-way intercultural learning.[13]

Research from Aboriginal community perspectives that focuses on improving health and wellbeing may lead to possible interventions. While the mine is now closed and undergoing rehabilitation, there is an opportunity for further research to better understand and close the gap in health risk exposures and outcomes between Aboriginal people in the region of the mine and other Aboriginal people in the Top End.

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