Impact of three annual tobacco tax rises on tobacco sales in remote Australian Aboriginal community stores

David P Thomas [1], Emma McMahon,[2] Zhiqiang Wang,[1] Michelle M Scollo,[3] Sarah J Durkin [3]

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[1]Menzies School of Health Research, Charles Darwin University, Darwin, Northern Territory, Australia
[2]Menzies School of Health Research, Charles Darwin University, Brisbane, Queensland, Australia
[3]Centre for Behavioural Research, Cancer Council Victoria, Melbourne, Victoria, Australia

Correspondence to
Professor David P Thomas, Menzies School of Health Research, Charles Darwin University, Darwin, Northern Territory, Australia; david.thomas@menzies.edu.au

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ABSTRACT

Background There is strong evidence from many settings that tobacco tax rises which increase prices reduce tobacco consumption, but only limited evidence from Indigenous settings.

Methods We analysed 3 years (2016–2018) of weekly sales data from 32 stores in remote Aboriginal communities. We used interrupted time series analysis to estimate the immediate impact of the price rice following annual 12.5% tobacco tax rises on sales on (A) stick equivalents of tobacco and (B) fruit and vegetables (kg) per $A1000 of grocery sales, and on the trend in sales between price rises.

Results We detected 5.8% and 8.2% immediate declines in tobacco sales following the price rises associated with annual 12.5% tax rises in 2016 and 2018, and a non-significant decline (1.6%) following the 2017 tax rise. Decreased sales were mainly driven by declines in mainstream and premium factory-made cigarettes. Fruit and vegetable sales did not change at the time of tobacco price rises.

Conclusion For the first time, we demonstrated evidence of price-sensitivity and the immediate impact of price rises from tobacco tax rises on tobacco sales in remote Aboriginal communities. We acknowledge that Australia already has very high tobacco taxation and prices, but recommend further increases to the taxation of roll-your-own (RYO) tobacco to prevent smokers and industry using cheaper RYO cigarettes to undermine this impact of high tobacco taxes and prices.

INTRODUCTION

Tobacco tax increases are an essential element of a comprehensive national approach to tobacco control.[1] Tobacco tax rises which increase prices reduce tobacco consumption and reduce smoking prevalence, intensity and initiation and increase cessation, with greater impacts among young people.[2 3] Several reviews have concluded that tobacco tax increases reduce tobacco-related disparities as they have a greater impact on lower socioeconomic populations, with their higher smoking prevalence, although the evidence is not entirely consistent.[3–6]

Recent tobacco tax rises have led to Australia now having the highest cigarette prices in the world.[7] Australia has both specific (per-unit) tobacco excise duty and an ad valorem (value-based) goods and services tax (GST) which applies to tobacco products. Excise duty increased by 25% on 30 April 2010.[8] Four annual 12.5% tobacco excise duty increases were announced in 2013, with the first on 1 December 2013 and the rest on 1 September each subsequent year. These annual increases were continued for another 4 years until 1 September 2020.[8] In 2016, duty per kilogram of roll-your-own (RYO) tobacco was equivalent to factory-made cigarettes (FMCs) assuming 0.8 g of RYO was used in each cigarette. This changed incrementally on 1 September each year until it becomes 0.7 g in 2020.[8] On 1 September 2019, tobacco excise duty was 94 c per cigarette and $A1.29 per gram of loose tobacco.[9] The tobacco excise duty is also indexed every 6 months to ensure tobacco does not become more affordable.[8 9] In addition, a GST of 10% is added to the pre-GST price.[8]

The introduction of the sudden 25% tax rise and of the series of annual 12.5% tax rises were associated with immediate decreases and sustained downward trends in smoking prevalence in the five largest Australian cities.[10] Immediate decreases were greater among those in lower socioeconomic position (based on income, education and occupation) and the tax changes were estimated to cause a small reduction in the difference in the smoking prevalence between high and low socioeconomic groups.[10 11] There were differences between high and low socioeconomic groups in the smoking prevalence trends of FMCs and cheaper RYO tobacco; shifts to RYO did not entirely mitigate the declines in use of FMCs so that overall smoking prevalence declined.[10] An earlier study found no socioeconomic differences in quit attempts following the 25% tax rise, but more smokers from low than high socioeconomic groups had cut down, changed to cheaper brands or started using RYO.[12] The tobacco industry uses many strategies to enable smokers to mitigate the impact of tax rises, for example, introducing new cheaper products and new pack sizes, and temporarily absorbing the impact of tax rises on the prices of the cheapest brands.[13]

Australians are also supported by other advanced tobacco control policies and programmes, with mass media antitobacco campaigns, smoke-free regulation and legislation, graphical health warning labels on plain packaging, restrictions of tobacco industry activities and advertising, and access to cessation services. National adult smoking prevalence is low (14%), however, some groups still have much higher smoking prevalence.[14 15] Adult daily smoking prevalence is 40% among Aboriginal and Torres Strait Islander peoples, the Indigenous peoples of Australia.[16] While Aboriginal and Torres

Strait Islander smoking prevalence is falling in non-remote areas (from 49% in 2004/2005 to 37% in 2018/2019) it has not changed in remote areas (52%), warranting more research to understand how tobacco control activities are and are not supporting Aboriginal and Torres Strait Islander cessation in remote areas.[16] Nineteen per cent of Aboriginal and Torres Strait Islander people live in remote areas, which include many very small towns referred to as 'communities'.[17]

The Tackling Indigenous Smoking (TIS) programme is an Australian government initiative to reduce the prevalence of tobacco use among Aboriginal and Torres Strait Islander people.[18] The largest element of this programme is the funding of 37 non-government organisations, mainly Aboriginal Community Controlled Health Services, to host regional teams to conduct population health tobacco control activities (not individual cessation support) across all Australian states and territories, in cities, regional towns and remote areas. However, not all Aboriginal and Torres Strait Islander people live in a region served by one of these teams.

Most (83%) of a national sample of Aboriginal and Torres Strait Islander smokers and recent quitters reported that the price of cigarettes was a reason for them quitting or thinking about quitting, more than all other reasons except concern for personal health.[19] The same study found only non-significant increases in the proportions of smokers who made a quit attempt and who sustained a quit attempt in the year following baseline if that year included the first 12.5% annual tax rise compared with those followed up before the tax rise. Similarly, only a non-significant 2% average reduction in tobacco sales was found in 18 stores in remote Aboriginal communities in the 7 months after the 2010 25% tax rise compared with the 7 months before.[20] The price of leading brands increased by more than 20% after the tax rise. The 2% reduction in sales was much less than the 10% predicted from international estimates of price elasticity.[20 21] This paper extends that research using more stores over 3 years to assess whether annual 12.5% tax rises reduced tobacco sales in remote Aboriginal communities.

METHODS

The authors recognise the importance of engaging with Indigenous communities when undertaking research on their experience of tobacco control interventions. The research question has been discussed for some years with Aboriginal researchers and representatives of Aboriginal and Torres Strait Islander communities (some of whom were involved in an unsuccessful grant application to answer this question). The impetus for the current project came from discussions at the Board of Outback Stores, which includes Aboriginal members (including the current Chair). Outback Stores is owned by the Australian government, and has an explicit mission to improve the health of those living in remote Aboriginal communities—including via the monitoring and reporting of food (and tobacco) sales.

Outback Stores managed 38 stores in remote Australia in 2018.[22] Most food and many household items in these communities are purchased from these stores. The company provided 3 years (2016–2018) of weekly sales data to the researchers for the 35 stores it managed in 34 communities over this period. We excluded data from two stores which mainly served passing tourists rather than the nearby Aboriginal communities. The two stores from the same community were treated as a single store, as one was primarily a typical grocery store and the other was primarily a club open during the evening, selling meals, drinks and tobacco products. Therefore, data from 32 stores were analysed. We excluded the first week of sales in 2016 due to full sales not being available for one of the stores.

The 32 communities were small, with a median estimated resident population at the 2016 Census of 236, with three having fewer than 100 residents and two having more than 1000 (and another small community with no available Census data).[23] Twenty were in the Northern Territory, nine in Western Australia and three in South Australia. Seventeen of the communities were served by TIS teams, which we determined by review of the TIS website and the websites of the organisations hosting the teams.[18]

For each week at each store, Outback Stores provided electronic sales data for all tobacco items (each product's description, quantity sold and value of sales), the total quantity (kg) of fruit and vegetables sold and the total dollar value of all grocery sales of dry or preserved food items (excluding tobacco). The latter was used as a proxy for the fluctuating population in each community. All prices are Consumer Price Index (CPI) adjusted to reflect April–June 2017 $A.

Each tobacco product was categorised as being either premium, mainstream, value or super value factory-made cigarettes (FMCs) or loose RYO tobacco.[24] Tobacco sales were converted to cigarette stick equivalents, with 0.525 g of RYO tobacco equivalent to one cigarette, based on the reported mean weight of tobacco in cigarettes rolled by 13 Aboriginal smokers from similar remote communities.[25] Sensitivity analyses used the weight of tobacco in the most-sold FMC (Winfield Blue, 0.64 g) and the weight of tobacco assumed by the Australian Tax Office to align the tax paid on RYO tobacco and FMCs (0.7 g).[8 26]

Our primary outcome variable was weekly number of sticks or stick equivalents of tobacco sold per $A1000 grocery sales, summed across all stores (ie, total tobacco sold controlling for variation in the proxy for population size). We also separately examined stick equivalents of RYO, premium or mainstream FMCs, value or super value FMCs and kilograms of fruit and vegetables sold because 23% of Aboriginal and Torres Strait Islander smokers reported that money spent of cigarettes left not enough for food and other essentials.[27]

Statistical analysis

First, we described the weekly average price/stick over the 3-year period. Preliminary analyses, adjusted for grocery sales, examined the trend in total weekly sales of tobacco products, fruit and vegetables sales and grocery sales over the whole period using linear regression.

Our main analyses used interrupted time series analyses (ITSA) for each outcome variable. Checks for autocorrelation indicated using Prais-Winsten regression models would be appropriate to account for one lag of autocorrelation detected between total weekly sales, as in similar previous research.[10 28] The three September tobacco tax rises split the period into four segments. As the impact of the tax rise was only fully realised in the actual price paid in the third week of each September, the cut-points used were 25 September 2016, 24 September 2017 and 23 September 2018. The model estimated the immediate effect of each price rise and the trend (slope) within each segment. We also used the model estimated values immediately before and after each price rise, and at the beginning and end of each segment, to calculate the relative percentage change in sales. Interaction analyses examined if there were differences between the volume of product types sold (mainstream or premium FMCs, value or super value FMCs and RYO) and between communities served by a TIS team or not, at each price rise and in the trend (slope) between each price rise. Subsequent analyses then repeated the

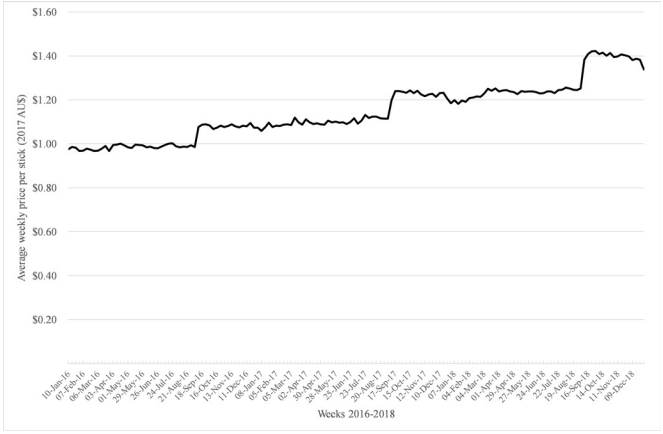

Figure 1 Average weekly price per stick (2017 $A). Assumes 0.525 g RYO tobacco per stick. RYO, roll-your-own tobacco.

overall ITSA separately for each tobacco product type and for the communities served by a TIS team or not.

All analyses were conducted with Stata V.14.

RESULTS

The average price of all tobacco products sold in remote stores increased steeply between the week prior to and the third full week following each tax rise on 1 September (CPI adjusted price increases: 9.63% in 2016; 11.33% in 2017; 14.23% in 2018) (figure 1). The CPI adjusted average price per stick sold increased by 42.8% ($A0.98–$A1.39) from the first quarter in 2016 to the fourth quarter in 2018.

The 32 stores sold 27.333 (95% CI 26.976 to 27.691) million cigarette stick equivalents from week 2 of 2016 to week 51 of 2018. Linear regression estimated total sales decreased on average by 197.9 (95% CI 171.6 to 224.1, p<0.001) sticks each week across the 3 years. This is equivalent to 30 872 fewer sticks sold over the 156 weeks, or 48.2 (95% CI 41.8 to 54.6) fewer packs of 20 being sold weekly in each store at the end of 2018 compared with the start of 2016. Sales of mainstream or premium FMCs decreased by 202.9 (95% CI 190.55 to 215.2, p<0.001) sticks each week, and sales of value or super value FMCs decreased by 48.1 (95% CI 36.8 to 59.4, p<0.001) sticks each week. RYO increased by 35.0 (95% CI 17.8 to 52.3, p<0.001) sticks each week, or 28.7 (95% CI 14.6 to 42.9, p<0.001) and 26.3 (95% CI 13.4 to 39.2, p<0.001) each week, if we assumed 0.64 g or 0.7 g of RYO tobacco per stick.

Linear regression found a non-significant increase in sales of fruit and vegetables of 2.0 kg (95% CI −0.5 to 4.5, p=0.123) each week, with 1.209 million kg of fruit and vegetables sold over the 3 years. Grocery sales showed a non-significant increase each week when adjusted for CPI ($A102.70, 95% CI −$A27.30 to $A232.69, p=0.12), with $A77.031 (unadjusted $A77.023) million total grocery sales over the 3 years.

The ITSA indicated the ratio of cigarette stick equivalents sold for each $A1000 of grocery sales increased with borderline significance in the 8 months before the 2016 price rise (table 1 and figure 2, p=0.053) equating to +6.66% change from January 2016 to early September 2016. There was a significant immediate drop of 23.04 sticks sold per $A1000 grocery sales associated with the 2016 price rise (representing a relative drop of −5.84%), then an ongoing decline in the 12 months between the 2016 and 2017 price rises (−5.63%). We did not detect any significant immediate effect of the 2017 price rise (−1.55%), nor any significant ongoing declines in the 12 months between the 2017 and 2018 price rises (−2.35%). There was a large immediate drop of 27.47 sticks sold per $A1000 grocery sales associated with the 2018 price rise (a relative drop of −8.20%), and an apparent ongoing increase in the 3 months thereafter was not significant (+7.91%; table 1 and figure 2).

The ITSA was also conducted separately for each cigarette type given significant interactions between product types and the immediate and ongoing trend effects of each price rise (online supplemental table 1). The borderline increase in stick equivalents sold for each $A1000 of grocery sales in the 9 months before the 2016 price rise was driven by increases in sales of RYO and value or super value FMCs (table 1 and figure 3). The immediate drop in sticks sold after the 2016 price rise was driven by drops in both types of FMC sales. The ongoing weekly

Table 1 Interrupted time series analysis of changes in weekly sales of cigarette stick equivalents (0.525 g RYO per stick) and fruit and vegetables (kg) per $A1000 grocery sales (2017 $A)

	Trend January 2016 to August 2016	Change at September 2016	Trend September 2016 to August 2017	Change at September 2017	Trend September 2017 to August 2018	Change at September 2018	Trend September 2018 to December 2018
Cigarette sticks equivalents	**Coefficient (95% CI)**	**Coefficient (95% CI)**	**Coefficient (95% CI)**	**Coefficient (95% CI)**	**Coefficient (95% CI)**	**Coefficient (95% CI)**	**Coefficient (95% CI)**
Total sticks	0.68 (−0.01 to 1.38)	−23.73 (-37.09, to 10.36)**	−0.41 (−0.66 to -0.16)**	−5.03 (−18.17 to 8.11)	−0.16 (−0.59 to 0.28)	−27.47 (-53.40, to -1.54)*	1.75 (−0.55 to 4.04)
Total FMCs	0.26 (−0.28 to 0.79)	−19.27 (-30.60 to -7.95)**	−0.36 (−0.60 to to -0.13)**	−4.40 (−14.41 to 5.61)	−0.46 (−0.72 to -0.20)*	8.44 (−0.52 to 17.39)	−1.19 (−2.49 to 0.11)
Mainstream-premium FMCs	−0.17 (−0.52 to 0.17)	−8.34 (−14.57 to -2.11)**	−0.49 (−0.60 to -0.37)*	−2.02 (−6.98 to 2.94)	−0.25 (−0.38 to to -0.13)*	4.87 (−0.28 to 10.02)	−0.39 (−1.28 to 0.50)
Value-super value FMCs	0.32 (0.10 to 0.54)**	−10.46 (−16.20 to -4.72)*	0.01 (−0.11 to 0.13)	−4.45 (−11.42 to 2.51)	−0.15 (−0.33 to 0.04)	0.17 (−8.12 to 8.47)	−0.33 (−1.02 to 0.37)
RYO	0.45 (0.14 to 0.76)**	−3.30 (−10.88 to 4.29)	−0.07 (−0.22 to 0.08)	−0.43 (−8.49 to 7.64)	0.30 (0.03 to 0.58)*	−35.48 (-54.36, to -16.60)*	2.79 (0.88 to 4.70)**
Total sticks where TIS team	0.78 (−0.04 to 1.60)	−28.93 (−47.63 to -10.24)**	−0.24 (−0.54 to 0.61)	−11.87 (−27.30 to 3.56)	0.22 (−0.15 to 0.58)	−25.80 (−0.50 to 2.47)	1.20 (−0.21 to 2.61)
Total sticks where no TIS team	0.63 (−0.18 to 1.43)	−18.72 (−35.78 to -1.67)*	−0.60 (−0.92 to -0.27)*	−1.96 (−15.70 to 19.62)	−0.58 (−1.16 to 0.00)	−31.93 (-61.53 to -2.34)*	2.50 (−0.04 to 5.04)
Fruit and vegetable (kg)	0.02 (−0.46 to 0.09)	−1.40 (−3.07 to 0.28)	−0.03 (−0.01 to -0.08)	−0.68 (−2.29 to 0.93)	0.01 (−0.03 to 0.05)	−0.15 (−1.29 to 1.59)	0.03 (−0.01 to 0.80)

*P<0.05, **P<0.01, ***P<0.001.
FMCs, factory-made cigarettes; RYO, roll-your-own tobacco; TIS, Tackling Indigenous Smoking.

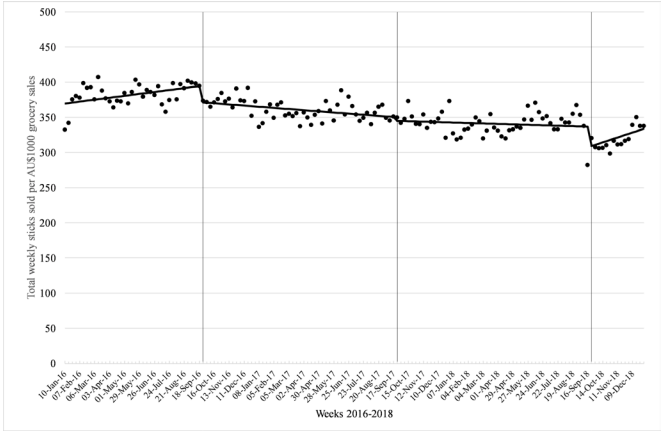

Figure 2 Total weekly sticks sold per $A1000 grocery sales (2017 $A). Assumes 0.525 g RYO tobacco per stick. Vertical lines represent the third week in September when price rises from annual 12.5% tax rise were observed. Dots represent observed values and lines represent values predicted by Interrupted Time Series Analysis. RYO, roll-your-own tobacco.

decline between the 2016 and 2017 price rises was driven by declining mainstream and premium FMC sales. There were non-significant immediate drops in sales of all tobacco types after the 2017 price rise. The ongoing weekly decline in sales of mainstream and premium FMCs between the 2017 and 2018 price rises was counteracted by increasing RYO sales over this period. The immediate decline after the 2018 price rise was driven by a large drop in RYO sales which was somewhat mitigated by non-significant increases in sales of all FMCs. In the 3 months following the 2018 price rise, RYO sales increased but these were somewhat counteracted by non-significant ongoing declines in sales of all FMCs.

We did not detect any effect modification of the immediate impact of the 2016 and 2018 price rise by the presence or absence of TIS teams (table 1, online supplemental table 1, online supplemental figure 1). However, the 2017 price rise resulted in a borderline non-significant interaction (p=0.073), with a larger drop in sticks sold per $A1000 grocery sales in

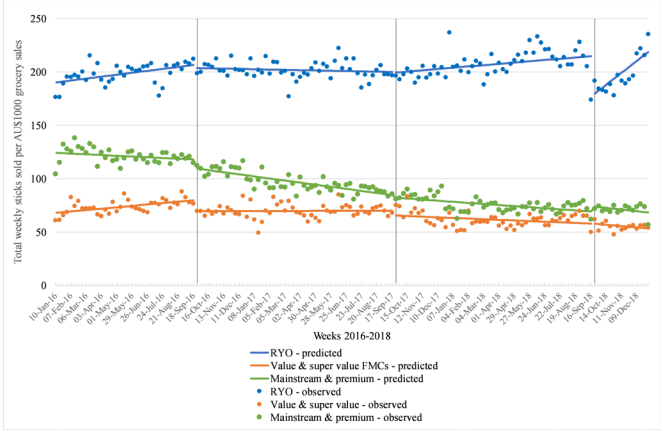

Figure 3 Total weekly sticks sold per $A1000 grocery sales (2017 $A) by product type. Assumes 0.525 g RYO tobacco per stick. Vertical lines represent the third week in September when price rises from annual 12.5% tax rise were observed. Dots represent observed values and lines represent values predicted by interrupted time series analysis. FMCs, factory-made cigarettes; RYO, roll-your-own.

stores in communities with teams than in communities without teams. In contrast, ongoing declines were only evident in communities without teams between the 2016 and 2017 price rises (interaction p=0.028), and between 2017 and 2018 price rises (interaction p=0.012).

The pattern of effects was the same when we assumed 0.64 g or 0.7 g of RYO tobacco per stick. We found no change in the volume of fruit and vegetable sales per $A1000 of grocery sales between tobacco tax rises nor immediately at the time of any of the tax rises (table 1).

DISCUSSION

Three annual 12.5% tax rises were fully passed on in 32 remote Aboriginal community stores as price rises of similar magnitude. The slightly different increases in the average price each year could be explained by the increased taxation of RYO. We detected a 5.8% and 8.2% immediate decline in tobacco sales in 32 remote Aboriginal community stores following the price rises associated with annual 12.5% tax rises in 2016 and 2018, but no significant immediate decline (−1.6%) with the 2017 tax rise. This equates to an average immediate decline of 5.2% following each price rise. This is broadly consistent with estimates of the impact of price rises in high-income countries which now converge around price elasticities of 0.4, or a 4.7% drop in consumption from the average 11.7% price rise associated with the three tax rises, and could even be consistent with the observation that elasticity tends to be higher in low-income populations.[3]

Foreshadowed annual tax rises might also be contributing to downward trends between tax rises with smokers quitting in anticipation of these tax rises, not just after the rises.[10] We detected a significant and non-significant downward trend in the second and third period, respectively. The non-significant trends in the first and last periods must be interpreted with more caution as these periods do not include a full year; they may just reflect seasonal changes at the beginning and end of the calendar year.

Our finding of an immediate impact of the price rises contrasts with previous research which found only a much smaller non-significant impact following the 2010 25% tax rise in this setting.[20] Our larger number of stores increased study power and use of grocery sales as a proxy for population allowed us to separate out changes due to tax rises from those due to population changes. However, our proxy may not fully account for changes in population size which would reduce the precision of each of our estimates and so could explain the variation in the magnitude of the estimates of the impact of the three tax rises. The previous research suggested increased requests to share cigarettes may have mitigated the impact of the 2010 tax rise. It is possible that cigarettes are now so much more expensive due to annual tax rises since 2013 that this sharing of cigarettes can no longer effectively mitigate the impact of the tax as median incomes in these very remote areas have not significantly increased since 2002.[29] There is some supporting evidence from New Zealand, where most research on the effects of annual 10% tobacco tax rises since 2010 has demonstrated significant reductions in Māori and Pacific Islander cigarette consumption.[30–33]

We found that decreased sales were largely driven by declines in the most expensive form of tobacco, mainstream and premium FMCs, suggesting these decreases were a response to higher prices, rather than some other cause. Price sensitivity is more apparent now with the availability of cheaper FMCs than

in research in this setting at the time of the 2010 tax rise when 97% of FMCs sold were mainstream brands.[20]

While the immediate impact of the 2016 price rise was driven by decreases in FMC sales, the immediate impact of the 2018 price rise was due to a fall in RYO sales, although this was preceded and followed by increases in RYO sales. The 2017 and 2018 tax rises were associated with greater increases in taxation of RYO compared with FMCs, which may have contributed to the immediate fall in RYO sales at the time of the 2018 rise.[8] However, even the final conversion weight of 0.7 g is likely to be greater than the actual weight of tobacco in RYO cigarettes, resulting in comparably less taxation of RYO than of FMCs.

While we conducted sensitivity analyses with different conversion factors, our conversion factor of 0.525 g of RYO for each stick equivalent is much less than the Australian Tax Office conversion factor and based on a small sample 20 years ago, it is consistent with recent Australian research, and may even be an overestimate as the amount of tobacco in each RYO cigarette is decreasing. The estimated average weight of tobacco in each Australian RYO cigarette declined from 0.59 g in 2006 to 0.48 g in 2014.[34] This apparent use of less tobacco in RYO cigarettes is corroborated by the tobacco industry's release of thinner filters and smaller papers.[35] Further, the industry has released smaller pouch sizes to reduce the upfront purchase price of RYO tobacco to further attract price-sensitive smokers, used 'natural' terms to promote misconceptions about the relative harm of RYO cigarettes, and released RYO versions of popular brands of FMCs to encourage switching to RYO.[35] We are not aware of any recent research evidence of significant health benefits of smoking RYO cigarettes with less tobacco.

Our finding of a decline in sales of tobacco is welcome news when national surveys report no decline in Aboriginal and Torres Strait Islander smoking prevalence in remote areas.[16 36] However, while this reflects promising changes in purchasing and smoking behaviour, it is not possible from sales data to determine how much of the decline is due to increased cessation, reduced intensity or reduced initiation. While national surveys have found increasing proportions of Aboriginal and Torres Strait Islander smokers in remote areas report having made a quit attempt in the past year, there has been no increase in the proportion of ever-smokers who have successfully become ex-smokers.[36] National surveys demonstrated declines in the numbers of Aboriginal and Torres Strait Islander people smoking more than 20 cigarettes per day from 1994 to 2008, in both remote and non-remote areas.[37] Our results suggest these declines may have continued. Similarly, national surveys have reported declines in smoking initiation among Aboriginal and Torres Strait Islander young people, in both remote and non-remote areas, since 1994.[16 36 38] Even if the tax and price rises have only had a limited impact on cessation, there will still be health benefits of reducing smoking initiation and smokers never smoking heavily, although there are only limited benefits of smokers reducing the numbers of cigarettes smoked per day beyond increasing the likelihood of future cessation success.[39 40]

The immediate declines at the time of the 2016 and 2018 price rises cannot be merely attributed to the impact of the TIS teams operating in half the communities: we did not detect different impacts in communities with and without teams. Similarly, a national Aboriginal and Torres Strait Islander mass media campaign 'Don't make smokes your story' was only broadcast around May and June in each of the 3 years, not at the time of the price rises. While clarifying the independent impact of tax rises in this setting, this was a missed opportunity for campaigns to build on the impact of the tax rises. The teams could also increase their local campaigns at the time of tax rises. It is unlikely that the immediate impact of the price rises is due to smokers purchasing tobacco from other sources. The nearest alternative outlet may be long distances away over unsealed roads, an unrealistic option for a purchase made most days.

Finally, it is reassuring that tobacco price rises were not associated with declines in fruit and vegetable sold, as has been reported anecdotally. In addition to reduced quantities of tobacco purchased, items other than fruit and vegetables must have been forgone to accommodate higher tobacco prices.

CONCLUSIONS

Higher prices and tobacco taxes can be a useful strategy in reducing the harms caused by tobacco in Indigenous populations. For the first time, we demonstrated evidence of price-sensitivity and the immediate impact of price rises from tobacco tax rises on tobacco sales in remote Aboriginal and Torres Strait Islander communities. While qualitative research in similar remote Aboriginal communities after the 2010 25% tax rise found unanimous support for price rises as part of comprehensive approach to tobacco control, the last legislated rise on 1 September 2020 will have been the eighth such annual tax rise since then.[20] Australian cities now have world-leading high tobacco prices, higher still in remote Aboriginal community stores where tobacco accounts for 21% of all food and tobacco sales.[41] While further tax increases may not be warranted in the immediate future, Australia could fix remaining anomalies in tobacco taxation. We recommend the Australian Tax Office first consider further changes to the conversion weight for taxation of loose tobacco to more closely reflect the weight of tobacco in RYO cigarettes, and to prevent smokers and the industry using RYO cigarettes to undermine the impact of tobacco price rises on smoking prevalence and health.

What this paper adds

- Tobacco tax rises which increase prices reduce tobacco consumption and reduce smoking prevalence, intensity and initiation and increase cessation, with greater impacts on young people and people in lower socioeconomic position.
- Smoking prevalence among Aboriginal and Torres Strait Islander people living in remote Australia is high and has not improved, unlike the improvements seen in non-remote areas.
- There was only limited empirical evidence of a negligible impact of tax rises in Aboriginal communities in Australia, but contrasting evidence of reduced consumption after tax rises by Māori and Pacific peoples in New Zealand.
- For the first time, we demonstrated evidence of price-sensitivity and the immediate impact of price rises from tobacco tax rises on tobacco sales in remote Aboriginal communities in Australia.

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Contributors DPT drafted the manuscript, with contributions from all authors. SJD conducted the analyses. ZW advised on the statistical analyses. All authors contributed to research design and interpretation of findings, reviewed and approved the final manuscript.

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Competing interests SD and MS are employed by a non-profit organisation that conducts public health interventions and advocacy aimed at reducing the harms of tobacco in the community, especially those pertaining to cancer.

Patient consent for publication Not required.

Ethics approval Human Research Ethics Committee of the Northern Territory Department of Health and Menzies School of Health Research (#2018-3210).

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ORCID iDs
David P Thomas http://orcid.org/0000-0002-8653-0621
Sarah J Durkin http://orcid.org/0000-0002-2795-6454

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