

National increase in the community supply of take-home naloxone associated with a mass media campaign in Scotland: a segmented time series analysis

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Abstract

Background

Take-home naloxone (THN) programmes have been associated with reductions in opioid-related mortality. In response to high rates of drug-related deaths in Scotland, the Scottish Government commissioned the 'How to save a life' (HTSAL) mass media campaign to: (1) increase awareness of drug-related deaths and how to respond to an overdose, and (2) increase the supply of THN. The aim of this study was to assess the effect of the campaign on the supply of THN.

Methods

We used an interrupted time series design to assess the effect of the HTSAL mass media campaign on the national community supply of THN. The study time period was August 2020 – December 2021. We modelled two key dates: the start of the campaign (week beginning (w/b) 30th of August 2021) and after the end of the main campaign (w/b 25th of October 2021).

Results

The total number of THN kits distributed in the community in Scotland during the study period was 27,064. The mean number of THN kits distributed per week (relative to the pre-campaign period), increased by 126% during the campaign and 57% post-campaign. In segmented regression analyses, the pre-campaign trend in the number of THN kits supplied was increasing by an average of 1% each week (RR=1.01, 95% CI 1.01 to 1.01, $p<0.001$). Once the campaign started, a significant change in level was observed, and the number of kits increased by 75% (RR=1.75, 95% CI 1.29 to 2.40, $p<0.001$). The trend during the campaign was stable (i.e. not increasing or decreasing) but a significant change in level was observed when the campaign ended, and the number of THN kits supplied decreased by 32% (RR=0.68, 95% CI 0.46 to 0.98, $p=0.042$). The trend during the post-campaign period was stable.

Conclusions

The HTSAL campaign had a short term, but large and significant impact, on the community supply of THN in Scotland. Mass media campaigns could be combined with other interventions and strategies to maintain the increased uptake of THN outside of campaign periods.

Introduction

Drug-related mortality is increasing internationally (United Nations Office on Drugs and Crime, 2022). Scotland is currently experiencing a drug-related deaths crisis, where rates have been rapidly increasing and are now amongst the highest in Europe (National Records of Scotland, 2022; Official Office for National Statistics, 2022). Opioids are implicated in the majority of drug-related deaths in Scotland (National Records of Scotland, 2022), however, polydrug use and, in particular, increased use of benzodiazepines are a key contributing factor in the record levels of mortality (McAuley et al., 2022).

Naloxone is an opioid antagonist that is effective in reducing the likelihood of an opioid-related death when administered immediately following an opioid overdose. Overdoses most frequently occur in the presence of people who use drugs or family members (World Health Organization, 2014). Community take home naloxone (THN) programmes aim to train people who are both at risk of an overdose themselves, or likely to witness an overdose, in two key areas: (1) how to recognise the signs and symptoms of an overdose, and (2) how to respond appropriately including assessing the persons airway and ventilation, and correct administration of naloxone (Clark et al., 2014). There is evidence that THN programmes are both cost-effective and effective at reducing opioid-related mortality at a population level (Coffin and Sullivan, 2013; Walley *et al.*, 2013; McDonald and Strang, 2016; Irvine *et al.*, 2019).

Scotland was the first country to introduce a national naloxone programme in 2011, which has been associated with significant reductions in opioid-related deaths following release from prison (Bird et al., 2016; Bird and McAuley, 2019). Research has shown that THN supply and coverage can be increased by policy changes (such as the relaxation of prescribing rules), expanding distribution to beyond PWUD to the general public and first responders, and expanding the number of settings where THN can be accessed (e.g. drug-treatment settings, hospitals, prisons, homelessness services, outreach, etc.) (Haegerich et al., 2019; Keane et al., 2018; Smart et al., 2021; Townsend et al., 2020). Increasing the supply of THN in Scotland has been an integral response to the drug-related death epidemic, interventions have included peer supply and training programmes; relaxation of legal rules to allow the expansion of distribution to non-drug treatment settings; the distribution and carriage from and among first responders including police, fire service and ambulance personnel; and the introduction of intranasal naloxone kits (Hillen et al., 2022; Public Health Scotland, 2022).

As part of the response to drug-related deaths in Scotland, the Scottish Government commissioned the “How to Save a Life” (hereafter HTSAL) mass media campaign. A full description of the campaign can be found elsewhere (Trayner, et al., 2022). The primary objectives of the campaign were to: (1)

increase public awareness of drug-related deaths, the signs and symptoms of an overdose and how to respond to an overdose, and (2) increase the supply of THN. Campaign materials (Supplementary material S1) directed people to the main campaign 'Stop the Deaths' website (<https://www.stopthedeaths.com/home>), which provided educational information on how to recognise and respond to an overdose, an e-learning course on how to administer naloxone, and a link to order a THN kit supplied by an online postal service run by a primary third sector supplier (Scottish Families Affected by Alcohol and Drugs) (<https://www.sfad.org.uk/support-services/take-home-naloxone>). The official campaign ran for eight weeks from the 30th August 2021 to 24th October 2021. This was followed by a booster campaign, which ran from 13th December 2021 to 13th January 2022. This research was part of a larger multi-method evaluation of the HTSAL campaign, combining data from media sources, a national survey of the Scottish general public, and an assessment of the campaign on THN supplies (Trayner et al, 2022).

Mass media campaigns are used to deliver public health messages as they can be implemented at a population level to reach large numbers of people for a relatively low cost (Stead et al., 2019; Wakefield et al., 2010). However, although they have been utilised extensively, there is limited evidence on the effectiveness of mass media campaigns in driving individual behaviour change (Allara et al., 2015; Stead et al., 2019). There is mixed evidence regarding their impact on engagement with healthcare, but one systematic review reported a positive effect on engagement with interventions including vaccination, cancer screening, and HIV testing (Grilli et al., 2002). The aim of this study was to assess the impact of the HTSAL campaign on the supply of THN during the campaign, and compare any differences relating to means by which THN was accessed (community, prison and the online postal service that campaign materials directed individuals to). To the best of our knowledge, there is no research that has assessed the impact of mass media campaigns on promoting the uptake of harm reduction services, or THN. We hypothesised that THN supplies in Scotland would be slightly increasing or stable prior to the start of campaign due to the focus on the supply of THN as part of the response to drug-related deaths and mitigation measures implemented during the COVID-19 pandemic (Public Health Scotland, 2022). Research into the effectiveness of mass media campaigns suggests short term effects on intended outcomes (Abrams and Maibach, 2008; Allara et al., 2015), therefore we also expected to observe a temporary increase in the supply of THN for the duration of the HTSAL campaign that would return to slightly increasing/stable after the campaign finished.

Methods

Study design

We used an interrupted time series design to assess the effect of the HTSAL mass media campaign on THN supplies in Scotland (Wagner et al., 2002). The study time period was from August 2020 to December 2021 (the booster campaign run December/January 2021 was excluded). We modelled two key dates: the start of the campaign (week beginning (w/b) 30th of August 2021) and after the end of the main campaign (w/b 25th of October 2021).

Data sources

The primary data source was the Naloxone Monitoring Database held by Public Health Scotland (PHS), which contains a record of THN distributed in the community (this includes through harm reduction services (including community pharmacies) and third sector organisations) and prison in Scotland. A secondary data source was also available, the number of THN kits ordered online and delivered by post ('online postal') via the primary third sector supplier: Scottish Families Affected by Alcohol and Drugs (referred to as third sector data hereafter), which is a subset of the PHS Naloxone Monitoring Database. We compared these distribution sources, and assessed the community distribution of THN including the online postal supplies, excluding the online postal supplies and supplies distributed through prison to evaluate the impact of the campaign.

Some data duplication needed to be managed. During September 2021, there was a reduced supply of intranasal THN kits available via the online postal service due to an issue with the supplier. People who had requested an intranasal kit during this period were supplied with an injectable THN kit and added to a waitlist. The supply issue was resolved in October 2021, and people who were on the waitlist were supplied with an intranasal THN kit. Thus, the database contained some double counting. The duplicate online postal kits were removed from the third sector data during w/b 11th of October (n=66) and 18th of October (n=538). However, it was not possible to identify these duplicates in the demographic data.

Outcomes and exposures

A summary of key outcomes and exposures can be viewed in Table 1. The primary outcome measure was counts of the number of THN kits distributed. Key exposure variables were campaign period and distribution source. Campaign period was defined as; pre-campaign: week beginning (w/b) 3rd August 2020 – w/b 23rd August 2021; main campaign: w/b 30th Aug 21 – w/b 18th October 2021; post-main campaign: w/b 25th October 2021 – w/b 20th December 2021. Distribution source was assessed by community (including online postal supplies), community (excluding online postal supplies) and

prison. Firstly, the number of THN kits and the mean number of THN distributed per week by distribution source and campaign period was calculated. The supply of THN characterised by demographic variables and campaign period (Table 1; Supplementary material S2) and by indicators relating the campaign within the third sector data (Table 1; Supplementary material S3).

Statistical analysis

Segmented negative binomial regression was utilised to assess the primary outcome - change in the distribution of THN (Wagner et al., 2002). The model equation can be found in Supplementary material S4. The model generated five estimates:

1. ***Pre-campaign trend:*** the trend in the number of THN kits distributed pre-campaign (counterfactual value – the trend in the number of THN kits if the campaign never happened)
2. ***Change in level when the campaign started:*** the change or ‘increase’ in the number of THN kits when the campaign was launched
3. ***Campaign trend:*** trend in the number of THN kits for the duration of the campaign
4. ***Change in level when the campaign finished:*** the change or ‘decrease’ in the number of THN kits when the campaign finished
5. ***Post-campaign trend:*** trend in the number of THN kits in the post-campaign period

Results are presented as rate ratios (RR) with 95% confidence intervals (CI) and associated p-values. Analyses were conducted using Stata 13 and R 3.6.1.

Results

Take-home naloxone distribution by campaign period

The total number of THN kits distributed in the community in Scotland during the study period was 27,064, and the number of online postal kits supplied by third sector was 3,823 (14% of total). The majority of online postal kits were supplied to members of the public (51%, n=1,940), and were issued as a first supply (83%, n=3,168) (Supplementary material S2 and S3).

The mean number of THN kits distributed per week (relative to the pre-campaign period), increased by 126% during the campaign and 57% post-campaign. The mean number of THN kits distributed per week via the community (including online postal supplies) increased by 133% during the campaign and 52% post-campaign. A smaller increase in the mean number of THN kits supplied per week was observed via community distributed kits (not including online postal kits) (26% increase during the campaign, 14% post-campaign) and via prison (12% increase during the campaign, 69% increase post-campaign) (Table 2). The number of online postal kits distributed to members of the public, and as a

first supply increased by over 90% per week during the main campaign and in the post campaign period (relative to the pre-campaign period) (Supplementary material S3).

Impact of the 'How to save a life' mass media campaign on the distribution of take-home naloxone: segmented regression analysis

We observed a temporary increase in the overall supply of THN. In segmented regression analyses, during the pre-campaign period, the trend in the number of THN kits supplied increased by an average of 1% each week (RR=1.01, 95% CI 1.01 to 1.01, $p<0.001$). Once the campaign started, a significant change in level was observed, and the number of kits increased by 75% (RR=1.75, 95% CI 1.29 to 2.40, $p<0.001$). The trend during the campaign was stable (i.e. not increasing or decreasing) but a significant change in level was observed when the campaign ended, and the number of THN kits supplied decreased by 32% (RR=0.68, 95% CI 0.46 to 0.98, $p=0.042$). The trend in the post-campaign period was stable (Table 3, Figure 1). We also observed a temporary level increase in community distribution (including online postal supplies) (Table 3).

We did not observe the same findings in the community distribution (excluding online postal supplies) and prison distribution of THN. Relating to community distribution (excluding online postal supplies), during the pre-campaign period the number of THN kits was increasing by an average of 1% each week (RR=1.01, 95% CI 1.00 to 1.01, $p<0.001$). However, the change in level when the campaign started, trend during the campaign, change in level when the campaign ended and the post-campaign trend were stable. The same findings as community distribution (excluding online postal supplies) were observed relating to prison THN supplies (i.e. increasing trend in the pre-campaign period and stable thereafter) (Table 3).

Discussion

We used an interrupted time series design to assess the effect of the HTSAL campaign on the national community supply of THN in Scotland. The HTSAL campaign achieved its primary objective of increasing the supply of THN. Reflecting experiences from other mass media campaigns (Abroms and Maibach, 2008; Allara et al., 2015), the effect of the campaign on intended outcomes (i.e. THN supplies) was short lived and lasted for the duration of the campaign. Therefore, the use of booster interventions and other community distribution methods (e.g. ensuring low threshold access through a wide range of services) should be investigated to assess whether the supply of THN outside of campaign periods can be maintained. Although our model showed that the trend in the supply of THN was stable in the post-campaign period, we also found that the mean number of kits distributed per

week increased in the post-campaign period (relative to the pre-campaign period), overall and for all distribution sources assessed.

The main distribution of THN related to the campaign was the online postal naloxone service implemented by the campaign's primary third sector distribution partner (Scottish Families Affected by Alcohol and Drugs). These online postal supplies are included within the national community distribution source. We assessed and compared different distribution sources to evaluate the impact of the campaign, including the number of THN kits distributed overall, community including, and excluding, these online postal supplies and prison distribution. We observed a temporary increase (i.e. increase when the campaign started followed by a decrease when the campaign ended) in the overall number of THN kits distributed, and through community distribution that included the online postal supplies. We did not observe the same temporary increase in community distribution that excluded the online postal supplies and THN kits that were supplied through prison. This would suggest that the increase in THN observed over the study was driven by the HTSAL campaign, and distribution via the online postal service.

A recent review of THN provision in the UK by the Advisory Council on the Misuse of Drugs stated that more needs to be done to widen access to THN within community partnerships in the UK to reduce opioid-related mortality (Advisory Council on the Misuse of Drugs, 2022). The success of the HTSAL campaign in increasing the supply of THN may also reflect the distribution model associated with the campaign, where people could order an online postal THN kit directly to their home. Prior to the COVID-19 pandemic, THN was generally only available through drug treatment services or upon release from prison (Public Health Scotland, 2022). In response to concerns over disruptions in THN supply as a result of the COVID-19 pandemic a 'letter of comfort' was issued from the Lord Advocate in Scotland, which meant non drug treatment services, including third sector partners, could supply THN (Crown Office & Procurator Fiscal Service, 2020). While other harm reduction services for people who inject drugs in Scotland reduced, including needle and syringe provision and BBV testing (Trayner et al., 2022), evidence suggests that the supply of THN increased over the course of the pandemic (McDonald et al., 2022; Public Health Scotland, 2022). The success of the HTSAL campaign and pandemic responses underline the benefits of ensuring low threshold and convenient access to THN.

Increasing the supply and access to THN is an important component of national policy responses to drug-related deaths in Scotland (McAuley et al., 2015; McDonald and Strang, 2016; Walley et al., 2013). Whilst the number of observed overdose events in Scotland is unknown, modelling has suggested that a high distribution of naloxone is required (at least 20 times the rate of drug-related deaths), to ensure that naloxone is present at every overdose (Bird et al., 2015). During the study

period, we found that over 27,000 THN kits were distributed via community distribution methods. Furthermore, nearly 4000 online postal THN kits were also supplied, with the vast majority being issued to members of the public and as a first supply. Findings from the wider evaluation of the campaign underlined that nearly 3,000 people completed the naloxone training likely as a result of exposure to HTSAL materials (Trayner, et al., 2022). The HTSAL campaign thus not only increased the distribution THN nationally, but equipped a new cohort of trained first responders who had not previously accessed naloxone or undergone training in Scotland to respond to an overdose.

Our study assessed the overall distribution of naloxone, however, other indicators relating to naloxone are also important to consider, including ownership, carriage and confidence to administer naloxone (Burton et al., 2021; Dayton et al., 2019; Giglio et al., 2015). A recent meta-analysis found that ownership of THN was moderate (>50%) and carriage of rates of THN were generally low (20-28%) among people who use drugs (Burton et al., 2021). Furthermore, a study from the USA found that insufficient overdose response training was associated with a reduced likelihood to intervene (Dayton et al., 2019). Within the wider evaluation, we found a high awareness of the HTSAL campaign among the Scottish general public (30% unprompted and 60% when prompted with campaign materials), but low levels of follow up action after exposure to campaign materials. The HTSAL campaign promoted the distribution of THN among the general public, however, less than 2% had ordered naloxone and 3% had undertaken naloxone training. Furthermore, despite high support for harm reduction more generally and naloxone policies among the general public, we also found evidence of misconceptions about naloxone, typically that increased provision could increase opioid use (Trayner et al., 2022). This view has been reported in international studies (Agley et al., 2022; Rudski, 2016), but there is no evidence for this in the scientific literature (Tse et al., 2022).

Misconceptions relating to naloxone use and effectiveness among the general public; and encouraging naloxone ownership, carriage and confidence to administer naloxone among people who use drugs could be addressed through the segmentation of campaign messages (Noar et al., 2010; Stead et al., 2019). Future campaigns could focus specific campaign messages for people who use or inject drugs, and other groups who are most likely to witness an overdose (including professionals, friends and family, etc.) (Latkin et al., 2018; Rowe et al., 2015; World Health Organization, 2014) and the general public. For those more likely to witness an overdose, this could include information on how and where to access naloxone, promotion of naloxone and overdose response training, and the importance of naloxone carriage/ownership (Release, 2021). These types of messages have been associated with a greater confidence to administer naloxone and to respond to an overdose (Dayton et al., 2019; Razaghizad et al., 2021). Segmented campaign messages for the general public could focus on reducing stigma towards people who use drugs, such as a recent (unevaluated) Scottish Government

commissioned anti-stigma campaign (Scottish Government, 2022), and addressing misconceptions and increasing awareness of the effectiveness of harm reduction interventions (including naloxone) to increase public support for drug and harm reduction policy (Reynolds et al., 2020). It is also fundamental that peers and members of the community are included in the design and delivery of campaigns, to ensure the most targeted and effective harm reduction messages (Jozaghi, 2021).

To the best of our knowledge, there have been no published evaluation findings that are similar to HTSAL, that aimed to assess the impact of a mass media campaign on the distribution of THN. In the USA, the HEALing (Helping to End Addiction Long-term) Communities study is currently underway, which aims to implement a number of evidence-based practices to reduce overdose related deaths, including overdose awareness and education, naloxone distribution, improving access to OAT through mass media communication campaigns. There is a published protocol for this trial (Consortium, 2020) but no current evaluation findings. Our research has highlighted that media campaigns can be successfully used to increase the supply of THN, and thus could be a useful response to localised spikes in overdoses and deaths, where there is a need to rapidly increase the distribution of naloxone or other harm reduction interventions.

Strengths and limitations

A strength of this study was the use of national administrative dataset on THN supplies, allowing sufficient power to model the impact of the campaign on community THN distribution in Scotland. However, we could not assess THN distributed through prescribing distribution sources as these data are only available aggregated monthly, which would not be sensitive enough to assess the impact of the campaign (Public Health Scotland, 2022). Furthermore, we could not meaningfully assess THN distribution on demographic variables, given the high proportion of missing data (~50%). We also did not have data at an individual level, so we could not quantify the number of individuals who received a THN kit. This would have been useful to assess the scale of THN uptake associated with the HTSAL campaign. Our results may also have been affected by the implementation of other (local) interventions to increase the distribution of THN in Scotland. We think this will be minimal given the use of specific time points relating to the campaign in our segmented regression model (Wagner et al., 2002) and we are not aware of any other interventions targeting THN being implemented during these periods, but we cannot determine absolute causality due to the absence of a control group. However, we did also assess other distribution sources, and we did not see the same effect (i.e. community supplies excluding online postal distribution and prison).

This study was part of a larger, multi-method, evaluation of the HTSAL campaign. Other areas used a cross-sectional survey to assess awareness of the campaign among the general public using a national survey and descriptive analysis to assess the reach and engagement with the campaign in both media and with naloxone training (Trayner, et al., 2022). A Cochrane review stated that new mass media campaigns should be implemented in a framework of rigorous evaluation, and should utilise interrupted time series study designs to assess their effectiveness (Allara et al., 2015). We conducted an interrupted time series, to assess the impact of the campaign on THN supplies. Furthermore, a key strength of the overall HTSAL evaluation was the triangulation of multiple data sources and research methodologies, to broadly assess the campaign. Each evaluation strand was conducted concurrently, with findings being used to inform each other, strengthening the validity of each study.

Conclusion

Increasing the supply of THN is an important component of the response to the drug-related death crisis in Scotland. We found that the HTSAL mass media campaign had a temporary, but large and significant impact on the community supply of THN in Scotland. Mass media campaigns could be combined with other interventions and strategies to maintain the increased uptake of THN outside of campaign periods.

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Table 1. Data sources and key outcomes to assess the impact of the ‘How to save a life’ mass media campaign on the supply of take-home naloxone.

Data source	Description	Outcomes and exposures
Naloxone Monitoring Database	Data on take-home naloxone (THN) distributed through the community and prison are submitted to naloxone leads in NHS Boards which are collated by Public Health Scotland Aggregated weekly August 2020 – December 2021	By, campaign period^a: <ul style="list-style-type: none"> • Total number of THN kits • Total number of THN kits, by: <ul style="list-style-type: none"> ○ Gender (male/female) ○ Age group (<25/25-34/35-44/45-54/55+) ○ Distribution source (community (including online postal supplies)/community (excluding online postal supplies/prison)^b ○ Health board (Ayrshire and Arran/Borders/Dumfries and Galloway/Fife/Forth Valley/Greater Glasgow and Clyde/Highland/Lanarkshire/Lothian/Orkney/Shetland/Tayside/Western Isles)
Scottish Families Affected by Alcohol and Drugs (online postal supplies)	Subset of the Naloxone Monitoring Database, included within the ‘community’ distribution source ^b Weekly supplies of online postal naloxone distribution August 2020 – December 2021	By, campaign period^a: <ul style="list-style-type: none"> • Total number of THN kits • Total number of THN kits, by: <ul style="list-style-type: none"> ○ THN recipient (person who uses drugs/professional, family/friend/member of the public) ○ THN supplies as (first supply/repeat supply/spare supply) ○ Referral source (Social media or internet/TV, radio or newspaper/third sector or campaign website/Public place or public transport/previously requested/friend or colleague/health or public services/other)

THN=Take-home naloxone; NHS=National Health Service

^aPre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21; main campaign: w/b 30th Aug 21 – w/b 18th Oct 21; post-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21

^bWe have assessed community distribution within the Naloxone Monitoring Database including and excluding the online postal supplies

Table 2. Total number of take-home naloxone (THN) kits and the mean number distributed per week by campaign period and distribution source, August 2020 - December 2021

Campaign period	Total number of THN kits ^a			Community distributed (including online postal) THN kits ^a			Community distributed (excluding online postal) THN kits			Prison distributed THN kits		
	Total number of THN kits (col%) ^c	Mean number of THN supplied per week	% difference ^b	Total number of THN kits (col%)	Mean number of THN supplied per week	% difference ^b	Total number of THN kits (col%)	Mean number of THN supplied per week	% difference ^b	Total number of THN kits (col%)	Mean number of THN supplied per week	% difference ^b
Pre-campaign	17,170 (63.4%)	307	-	15,222 (63.4%)	272	-	14,632 (72.4%)	261		1,468 (70.0%)	26	-
Main campaign	5,556 (20.5%)	694	126%	5,081 (21.1%)	635	133%	2,748 (13.6%)	353	26%	231 (11.0%)	29	12%
Post-campaign	4,338 (16%)	482	57%	3,721 (15.5%)	413	52%	2,821 (14.0%)	305	14%	397 (18.9%)	44	69%
Total number of THN kits	27,064	-	-	24,024			20,201	-	-	2,096	-	

Data source: Naloxone Monitoring Database; THN=take-home naloxone

Pre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21; main campaign: w/b 30th Aug 21 – w/b 18th Oct 21; post-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21

^aDuplicate THN kits supplied to people on the waitlist removed from week beginning (w/b) 11th of October (n=66) and 18th of October (n=538) have been removed

^bRelative to the pre-campaign period

^cAny discrepancy in totals relates to kits supplied the Scottish Ambulance Service (SAS)

Table 3. Impact of the mass media campaign on take-home naloxone (THN) supplies in Scotland: segmented regression analyses modelling the changes in THN supplies when the campaign was introduced and when the campaign finished, August 2020 - December 2021

	Segmented negative binomial regression									
	Pre-campaign trend ^a		Change in level when campaign started ^b		Trend during campaign period ^c		Change in level when campaign ended ^d		Post-campaign trend ^e	
	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value
Total number of THN kits supplied	1.01 (1.01 to 1.01)	<0.001	1.75 (1.29 to 2.40)	<0.001	0.99 (0.94 to 1.06)	0.959	0.68 (0.46 to 0.98)	0.042	1.01 (0.96 to 1.06)	0.812
Distribution source										
Community (including online postal)	1.01 (1.01 to 1.01)	<0.001	1.85 (1.34 to 2.59)	<0.001	0.99 (0.94 to 1.06)	0.959	0.64 (0.44 to 0.95)	0.029	1.00 (0.95 to 1.05)	0.906
Community (excluding online postal)	1.01 (1.00 to 1.01)	<0.001	1.33 (0.97 to 1.85)	0.101	0.96 (0.89 to 1.02)	0.177	0.82 (0.55 to 1.22)	0.333	1.04 (0.98 to 1.10)	0.126
Prison	1.01 (1.00 to 1.01)	<0.001	0.85 (0.60 to 1.22)	0.393	1.01 (0.94 to 1.08)	0.753	1.37 (0.92 to 2.03)	0.121	1.01 (0.96 to 1.07)	0.560

THN=take-home naloxone

^aPre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21

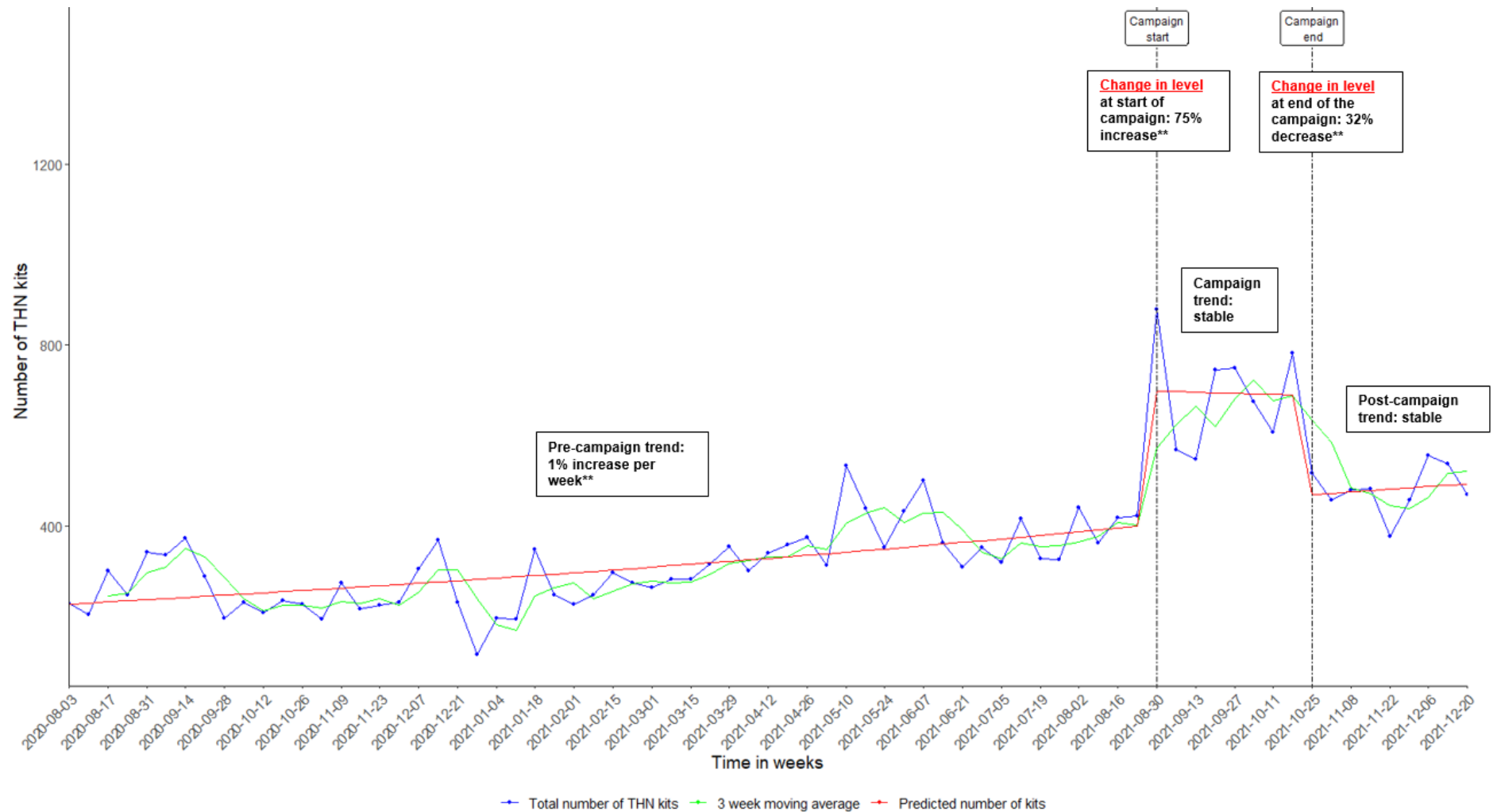
^bCampaign started: w/b 30th Aug 21

^cMain campaign period: w/b 30th Aug 21 – w/b 18th Oct 21;

^dCampaign ended: w/b 25th Oct 21

^ePost-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21

Figure 1. Impact of the mass media campaign on take-home naloxone (THN) supplies in Scotland: segmented regression analyses modelling the changes in THN supplies when the campaign started and when the campaign ended, August 2020 - December 2021



Campaign started: w/b 30th Aug 21; campaign ended: w/b 25th Oct 21: * <0.05 ; ** <0.001

Reference

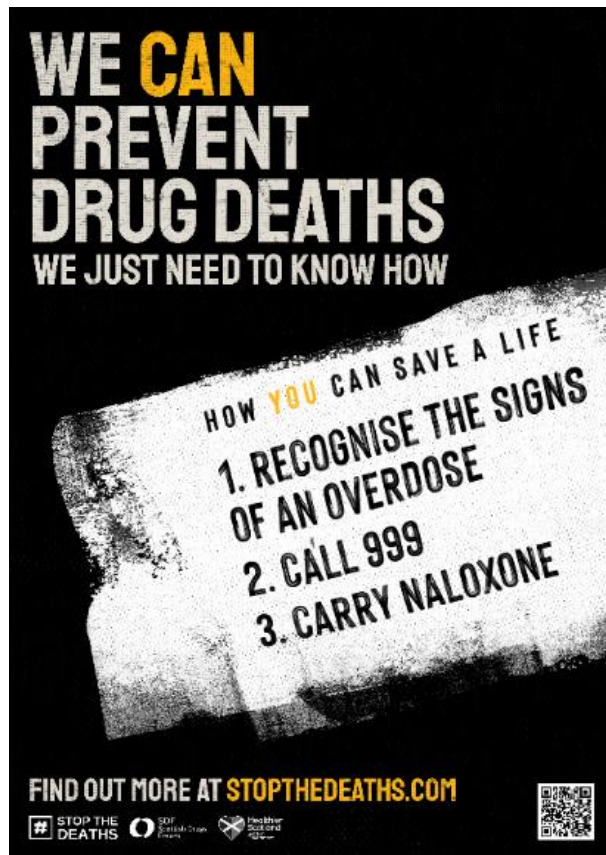
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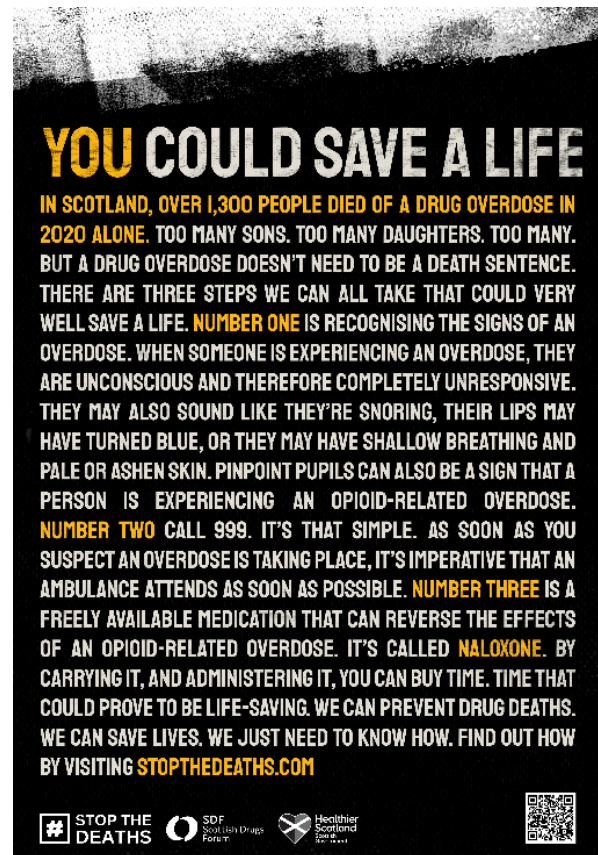
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Supplementary material S1. 'How to save a life' campaign materials

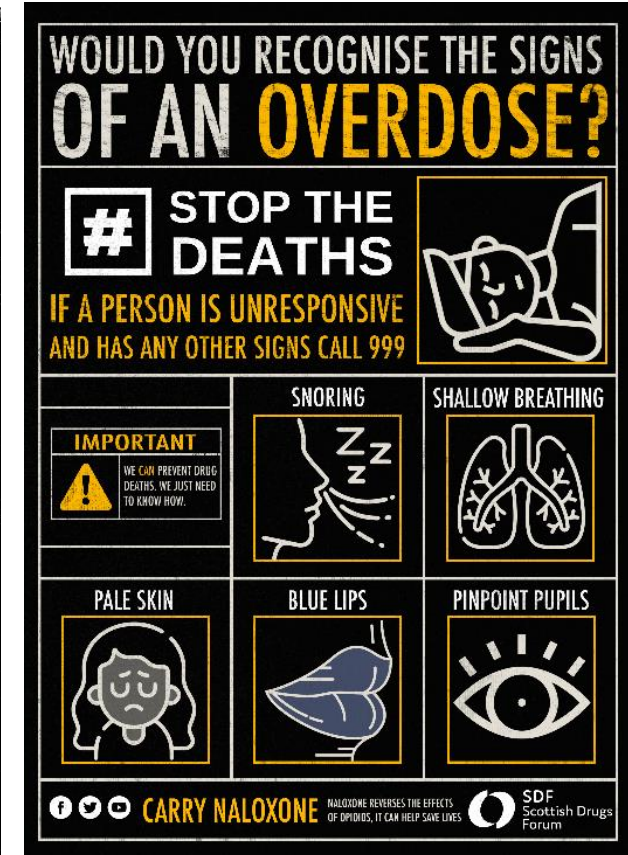
Poster 1:



Poster 2:



Poster 3:



Social media:



Campaign video: <https://www.youtube.com/watch?v=aTWZ-kpxL-g>



Supplementary material S2. Summary of take-home naloxone (THN) kits distributed in Scotland by mass media campaign period, August 2020 - December 2021

	Total number of take-home naloxone (THN) kits supplied in Scotland (col%)	Mean number of THN kits distributed per week by mass media campaign period ^a				
		Pre-campaign	Main campaign	% difference (relative to pre-campaign)	Post-main campaign	% difference (relative to pre-campaign)
Total number of THN kits^a	27,064	307	694	56%	482	36%
Gender^b						
Female	4,166 (15.1%)	55	63	13%	63	13%
Male	10,445 (37.8%)	139	160	13%	156	11%
Unknown	13,057 (47.2%)	113	546	79%	263	57%
Age group^b						
25 and under	870 (3.1%)	11	17	35%	13	15%
25 - 34	3,922 (14.2%)	53	59	10%	54	2%
35 - 44	6,258 (22.6%)	84	84	0%	95	12%
45 - 54	2,989 (10.8%)	38	48	21%	47	19%
55 and above	539 (1.9%)	6	14	57%	8	25%
Unknown age	13,090 (47.3%)	113	547	79%	263	57%
Health board^b						
Ayrshire and Arran	2,419 (8.7%)	28	39	28%	39	28%
Borders	421 (1.5%)	4	10	60%	10	60%
Dumfries and Galloway	473 (1.7%)	6	6	0%	6	0%
Fife	990 (3.6%)	9	21	57%	21	57%
Forth Valley	1,732 (6.3%)	19	34	44%	34	44%
Grampian	2,496 (9%)	29	47	38%	47	38%
Greater Glasgow and Clyde	8,776 (31.7%)	102	136	25%	136	25%
Highland	678 (2.5%)	7	13	46%	13	46%
Lanarkshire	1,958 (7.1%)	18	32	44%	32	44%
Lothian	4,116 (14.9%)	44	78	44%	78	44%
Orkney	21 (0.1%)	1	2	50%	2	50%

	Total number of take-home naloxone (THN) kits supplied in Scotland (col%)	Mean number of THN kits distributed per week by mass media campaign period ^a				
		Pre-campaign	Main campaign	% difference (relative to pre-campaign)	Post-main campaign	% difference (relative to pre-campaign)
Shetland	123 (0.4%)	1	2	50%	2	50%
Tayside	3,389 (12.3%)	37	61	39%	60	38%
Western Isles	70 (0.3%)	1	2	50%	2	50%

Data source: Naloxone Monitoring Database

Pre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21; main campaign: w/b 30th Aug 21 – w/b 18th Oct 21; post-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21

^aDuplicate waitlisted THN kits from week beginning (w/b) 11th of October (n=66) and 18th of October (n=538) have been removed

^bTotals do not add up to n=27,064 as waitlisted THN kits from week beginning (w/b) 11th of October (n=66) and 18th of October (n=538) cannot be removed

Supplementary material S3. Total number of online postal take-home naloxone (THN) kits distributed, August 2020 – December 2021.

	Total number of THN kits supplied (col%)	Mean number of online postal THN kits distributed per week by mass media campaign period ^a				
		Pre-campaign	Main campaign	% difference (relative to pre-campaign)	Post-main campaign	% difference (relative to pre-campaign)
Total^b	3,823	11	282	96%	108	90%
THN kits supplied to:						
Person who uses drugs	145 (3.8%)	1	4	75%	6	83%
Professional	1,074 (28.1%)	4	38	89%	65	94%
Family or friend	664 (17.4%)	3	16	81%	42	93%
Member of the public	1,940 (50.7%)	3	50	94%	169	98%
THN supplied as						
First supply	3,168 (82.9%)	7	251	97%	82	91%
Repeat supply	291 (7.6%)	2	12	83%	8	75%
Spare supply	364 (9.5%)	1	20	95%	17	94%
Source^c						
Social media/internet	348 (10.8%)	-	34	-	8	-325%
TV, radio, newspaper	786 (24.3%)	-	83	-	14	-493%
Third sector or campaign website	912 (28.2%)	-	71	-	38	-87%
Public place/public transport	123 (3.8%)	-	11	-	4	-175%
Previous requester	258 (8%)	-	16	-	14	-14%
Friend/Colleague	252 (7.8%)	-	23	-	8	-188%
Health/public services	482 (14.9%)	-	40	-	18	-122%
Other	72 (2.2%)	-	4	-	4	0%

Data source: Scottish Families affected by Alcohol and Drugs (SFAD)

THN=Take-home naloxone

^aPre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21; main campaign: w/b 30th Aug 21 – w/b 18th Oct 21; post-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21

^bWaitlisted THN kits from week beginning (w/b) 11th of October (n=66) and 18th of October (n=538) have been removed

^cPercentage differences relates to main campaign period

Supplementary material S4. Segmented regression model equation (Wagner et al, 2002).

$$\begin{aligned}\log(Y_t) = & \beta_0 + \beta_1 \times \text{time}_t + \beta_2 \times \text{intervention1}_t \\ & + \beta_3 \times \text{time after intervention1}_t \\ & + \beta_4 \times \text{intervention2}_t \\ & + \beta_5 \times \text{time after intervention2}_t + e_t\end{aligned}$$

Y_t = number of take-home naloxone (THN) kits distributed per week

Time_t = continuous variable of the number of weeks t since the observation period

Intervention1_t = Indicator variable that takes the value 0 before the campaign **started** and 1 after the campaign began (date: 30th of August 2021)

$\text{Time after intervention1}_t$ = Continuous variable of the number of weeks after the campaign **began** (date: 30th of August 2021)

Intervention2_t = Indicator variable that takes the value 0 before the campaign **ended** and 1 after the campaign **ended** (date: 25th of October 2021)

$\text{Time after intervention2}_t$ = Continuous variable counting the number of weeks after the campaign **ended** (date: 25th of October 2021)

β_0 = baseline number of THN kits at time zero

β_1 = describes the baseline trend in the number of THN kits before the campaign began

β_2 = level change in THN kits when the campaign is launched

β_3 = estimates the change in trend in campaign period

$\beta_1 * \beta_3$ = slope or trend during the campaign period

β_4 = level change once the campaign finished

β_5 = estimates the change in trend in the post campaign period

$\beta_1 * \beta_3 * \beta_5$ = slope or trend in the post-campaign period

e_t = error term

Supplementary material S5. Impact of the mass media campaign on take-home naloxone (THN) supplies in Scotland: segmented regression analyses modelling the changes in THN supplies when the campaign was introduced and when the campaign finished by demographic variables, August 2020 - December 2021

	Segmented negative binomial regression									
	Pre-campaign trend ^a		Change in level when campaign started ^b		Trend during campaign period ^c		Change in level when campaign ended ^d		Post-campaign trend ^e	
	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value
Gender^a										
Female	1.01 (1.00 to 1.01)	<0.001	1.44 (1.01 to 2.08)	0.052	0.91 (0.85 to 0.98)	0.014	0.86 (0.54 to 1.36)	0.522	1.09 (1.03 to 1.15)	0.003
Male	1.01 (1.00 to 1.01)	<0.001	1.00 (0.77 to 1.32)	0.999	0.99 (0.94 to 1.05)	0.812	0.83 (0.59 to 1.15)	0.266	1.04 (0.99 to 1.08)	0.108
Age group^{a,b}										
25 and under	1.01 (1.00 to 1.01)	0.021	1.07 (0.58 to 1.98)	0.839	1.02 (0.91 to 1.15)	0.625	0.72 (0.34 to 1.51)	0.382	0.99 (0.90 to 1.10)	0.959
25 - 34	1.01 (1.00 to 1.01)	0.002	1.09 (0.79 to 1.49)	0.602	0.98 (0.92 to 1.03)	0.406	0.89 (0.61 to 1.30)	0.552	1.02 (0.97 to 1.07)	0.363
35 - 44	1.00 (1.00 to 1.01)	<0.001	0.97 (0.74 to 1.28)	0.815	0.98 (0.92 to 1.03)	0.405	0.87 (0.62 to 1.21)	0.397	1.06 (1.02 to 1.12)	0.002
45-54	1.01 (1.01 to 1.01)	<0.001	1.19 (0.84 to 1.70)	0.335	0.95 (0.89 to 1.02)	0.182	0.85 (0.55 to 1.33)	0.484	1.06 (1.00 to 1.13)	0.042
55 and above	1.01 (1.00 to 1.02)	0.004	2.52 (1.39 to 4.59)	0.003	0.91 (0.81 to 1.02)	0.124	0.65 (0.29 to 1.47)	0.316	1.04 (0.93 to 1.17)	0.437
Health board^a										
Ayrshire and Arran	1.00 (0.99 to 1.01)	0.139	1.43 (0.84 to 2.52)	0.233	1.06 (0.95 to 1.19)	0.268	0.55 (0.28 to 1.09)	0.088	0.99 (0.90 to 1.08)	0.864
Borders	1.01 (0.99 to 1.02)	0.081	2.09 (0.93 to 4.85)	0.090	1.03 (0.88 to 1.20)	0.701	0.57 (0.22 to 1.49)	0.277	1.04 (0.91 to 1.19)	0.515
Dumfries and Galloway	1.02 (1.01 to 1.03)	<0.001	0.85 (0.34 to 2.26)	0.749	1.06 (0.88 to 1.26)	0.534	0.58 (0.18 to 1.86)	0.352	0.93 (0.79 to 1.10)	0.433
Fife	1.02 (1.02 to 1.03)	<0.001	1.53 (0.99 to 2.35)	0.058	1.09 (1.01 to 1.18)	0.017	0.51 (0.31 to 0.84)	0.008	0.96 (0.89 to 1.03)	0.322
Forth Valley	1.01 (1.00 to 1.01)	<0.001	1.21 (0.83 to 1.75)	0.334	1.08 (1.01 to 1.16)	0.021	0.41 (0.27 to 0.63)	<0.001	1.08 (1.02 to 1.14)	0.010
Grampian	1.00 (0.99 to 1.01)	0.508	1.15 (0.61 to 2.28)	0.664	1.11 (0.98 to 1.25)	0.092	0.52 (0.24 to 1.10)	0.088	1.02 (0.92 to 1.13)	0.665
Greater Glasgow and Clyde	1.01 (1.00 to 1.01)	0.047	1.70 (1.05 to 2.85)	0.056	1.02 (0.93 to 1.14)	0.577	0.55 (0.29 to 1.04)	0.069	0.99 (0.91 to 1.08)	0.668
Highland	0.99 (0.99 to 1.01)	0.751	1.37 (0.71 to 2.63)	0.348	1.21 (1.08 to 1.35)	<0.001	0.54 (0.27 to 1.09)	0.091	0.89 (0.80 to 0.99)	0.038
Lanarkshire	1.01 (1.00 to 1.02)	0.001	2.28 (1.36 to 3.92)	0.003	1.09 (0.98 to 1.21)	0.081	0.28 (0.15 to 0.53)	<0.001	1.00 (0.91 to 1.10)	0.907
Lothian	1.03 (1.02 to 1.04)	<0.001	0.88 (0.53 to 1.50)	0.645	1.07 (0.97 to 1.18)	0.164	0.56 (0.31 to 1.03)	0.068	0.99 (0.91 to 1.07)	0.827

	Segmented negative binomial regression									
	Pre-campaign trend ^a		Change in level when campaign started ^b		Trend during campaign period ^c		Change in level when campaign ended ^d		Post-campaign trend ^e	
	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value	RR (95% CI)	P-value
Orkney	0.99 (0.93 to 1.06)	0.904	8.82 (0.25 to 272.0)	0.904	0.91 (0.51 to 1.59)	0.734	5.29 (0.31 to 182.0)	0.278	1.02 (0.76 to 1.36)	0.872
Shetland	1.02 (1.01 to 1.04)	0.007	4.08 (1.46 to 12.20)	0.021	0.77 (0.60 to 0.98)	0.039	0.79 (0.12 to 4.82)	0.807	1.10 (0.86 to 1.41)	0.415
Tayside	1.01 (1.00 to 1.02)	<0.001	1.74 (1.04 to 3.00)	0.045	1.02 (0.92 to 1.12)	0.753	0.48 (0.25 to 0.92)	0.027	1.05 (0.97 to 1.14)	0.237
Western Isles	1.02 (0.99 to 1.06)	0.120	5.05 (0.52 to 85.9)	0.182	0.77 (0.48 to 1.23)	0.284	18.3 (0.57 to 1053.0)	0.053	0.64 (0.41 to 0.98)	0.044

THN=take-home naloxone; THN kits from unknown categories have not been modelled

^aPre-campaign: w/b 3rd Aug 20 – w/b 23rd Aug 21

^bCampaign started: w/b 30th Aug 21

^cMain campaign period: w/b 30th Aug 21 – w/b 18th Oct 21;

^dCampaign ended: w/b 25th Oct 21

^ePost-main campaign: w/b 25th Oct 21 – w/b 20th Dec 21