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Unequal Access to Services Project: Working Paper 1.
Analysis of North Lanarkshire Council's CRM system: Austerity and citizen service requests in neighbourhoods – a socio- economic and gender analysis

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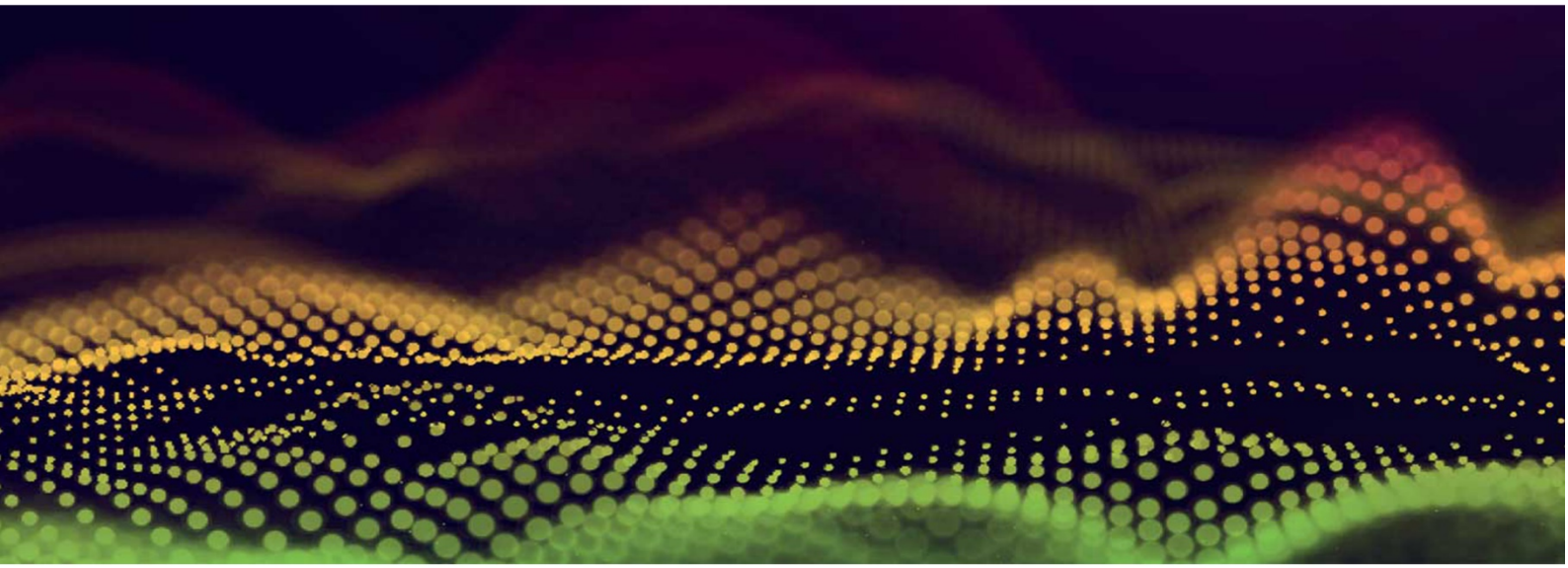

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Introduction

This working paper provides analyses of data on place-keeping services - or those that concern street cleaning, maintenance and other neighbourhood environmental issues - captured in North Lanarkshire Council's (NLC) Customer Relationship Management system (CRM) over the period 2010-2018. A data sharing agreement between NLC and the University of Glasgow enabled the full data set in the CRM system to be securely transferred to the secure server in the Urban Big Data Centre (UBDC).

In 2010-2018 period, the environmental services budget of NLC was cut in real terms by 35%, resulting in significant staffing reductions, changes to frequencies of programmed services and the introduction of new technologies to manage demand for street cleaning.

The CRM system captures when a citizen, council officer, or officer from another agency such as the police or a housing association, report an issue that requires street cleaning and other services. It also captures how long it takes the council to respond to the request, as well as when citizens re-contact the council to report dissatisfaction with the response to their initial report. Thus it captures patterns of reactive maintenance of the public realm, rather than planned and programmed service provision (such as regular street sweeps).

The project team hypothesised that reductions in the council's budget for environmental services would have an impact on the volume of service requests captured in the CRM system and on the time taken by the council to respond to these.

The CRM data set provides full details of which citizens request a service (title, name, full address), what kinds of street cleaning services they request, how they make their requests (via telephone, social media platform etc), and whether they re-contact the council to express dissatisfaction. By matching the address of those requesting services to SIMD data zones, patterns of citizen reporting in relation to the socio-economic status of their home neighbourhood can be discerned. Information on the CRM system has also been used to identify the gender of citizen reporters, revealing whether there are gendered patterns of reporting these service needs. We also use this matched data to explore socio-economic and gendered patterns in NLC's response to citizen requests. Appendix I provides details of the matching processes as well as more information about the size and scope of the data, as well as processes of data cleaning.

In this paper, we use these matched data to explore change in the austerity period (2010-2018) in service requests made by citizens and in dissatisfaction rates, as well as changes in North Lanarkshire's capacity to meet these requests as budgets have declined. The paper first sets out overall patterns with respect to service requests and responses, and then presents more detailed socio-economic and gendered analysis of these. A key aim of the analysis is to assess whether any groups distinguishable by socio-economic residence or gender fare better or worse on these assessment measures

Further work will explore the impact of austerity cuts from a more holistic neighbourhood perspective, bringing a range of data sets together in order to consider how different neighbourhood

characteristics and the configuration of services create service needs, challenges and influence cleanliness outcomes.

Findings and discussion

The overall picture.

As indicated, North Lanarkshire's environmental services department has been subject to a 35% real terms reduction in budget between 2010 and 2018. (Figure 1).

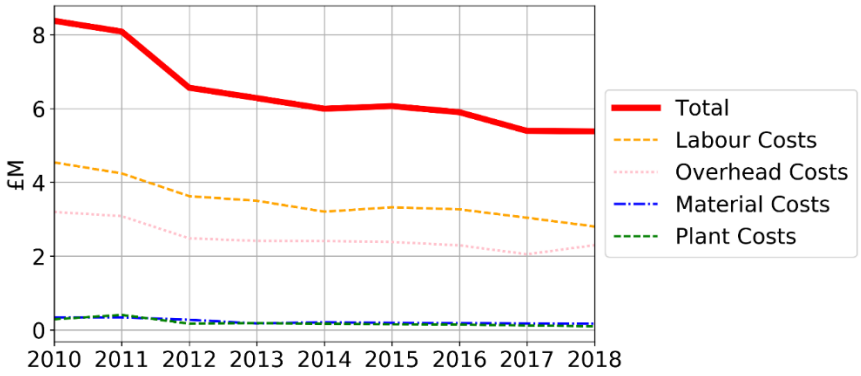


Fig. 1: Environmental services annual budget (2010-2018). (Real terms calculated using CPI).

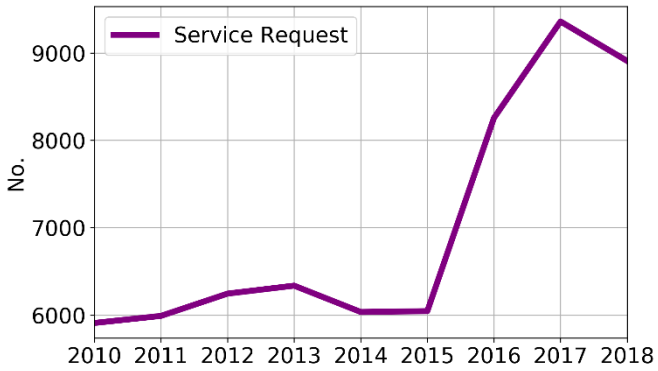


Fig.2: Volumes of Street Cleansing Service Requests (2010-2018).

Figure 2 shows that the volume of requests for additional reactive services, not resolved by programmed services, increased by about 50% between 2010 and 2018 (from around 6,000 annually to 9,300 annually). Such requests are made to report a range of problems in neighbourhoods, such as a street needing cleaned, dumped refuse and dog fouling. They are made by citizens living in North Lanarkshire and by council officers and officers from other agencies, via telephone calls, email, office visits and social media platforms. Since 2016, some requests have been logged by council operational staff via the hand-held device Confirm Mobile. This device allows staff to report further service needs that they observe when they are in the field actioning other requests. The staff are empowered to resolve these newly observed needs as soon as practicable, and record both the need for service and its resolution on the device and therefore in the Confirm data base.

Figure 3 focuses on the service requests from North Lanarkshire's citizens only. It shows that the annual volume of service requests doubled between 2010 and a peak in 2017 (3,500 to over 7000).

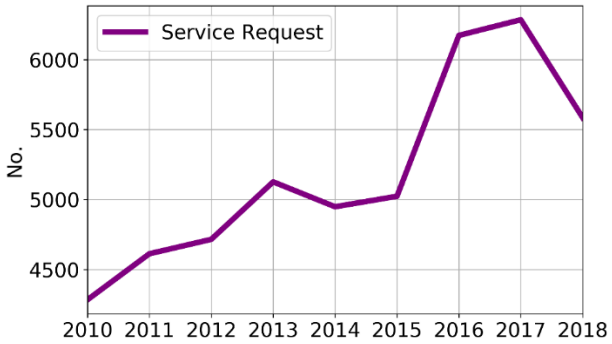


Fig. 3: Volumes of Street Cleansing Service Requests by Citizens (2010-2018).

Figure 3 shows that the rate of increase in citizen reports decelerated between 2016 and 2017 and that report volumes then fell quite substantially between 2017-2018. These changes may relate in part to the introduction of the Confirm Mobile initiative in some parts of North Lanarkshire from 2016 on as it may have reduced the need for some citizens to report problems.

Figures 1 -3 clearly show that as the overall budget for the service has reduced over time, leading to cuts in routine programmes of street cleaning, that requests for additional reactive services to address problems not resolved via regular planned services have increased substantially, from citizens and officers.

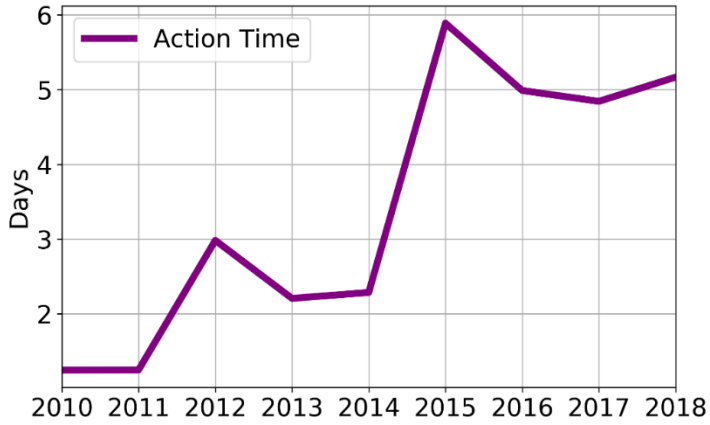


Fig. 4: **Median time taken to action a Street Cleansing Service Requests from Citizens (2010-2018).**

Figure 4 shows that there has also been a substantial increase in the time taken by the council to action service requests from citizens – from less than a day in 2010 to between 5 and 6 days in the four years 2015-2018. This increase in median action times will likely reflect the increase in citizen reports, but may also indicate more general stress or capacity issues within the service.

That the service has come under increasing stress as austerity has intensified is also indicated in Figures 5a and 5b. Figure 5a shows that, between 2010 and 2018, that there has been a doubling in the volume of citizens re-reporting an initial request to indicate dissatisfaction with the outcome of their report. The kinds of dissatisfaction captured are reports that a request has not been done or has been done to an unsatisfactory standard.

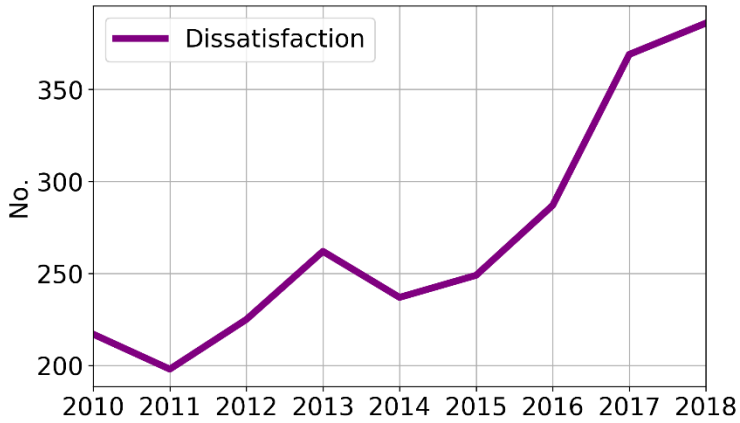


Fig. 5a: Volumes of Reports of Citizen Dissatisfaction with Service Request Outcomes (2010-2018).

In Figure 5b, we show change in the rates of reporting dissatisfaction relative to the volume of service requests made in a particular year. This figure shows that dissatisfaction rates were fairly static until 2016, but increased markedly thereafter.

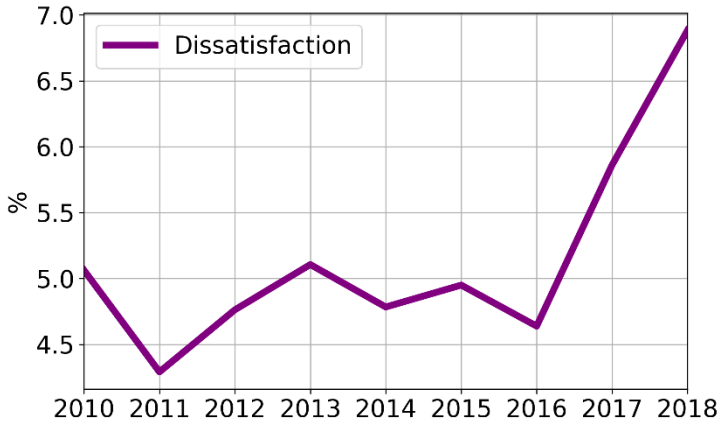


Fig. 5b: Rates of Reports of Citizen Dissatisfaction with Service Request Outcomes (2010-2018).

Together, these data indicate that the level of budget cut experienced by North Lanarkshire's street cleaning services has impacted on the quality of front line services, suggesting that the council's ability to maintain street cleanliness via a pared down programme of regular maintenance has been reduced. The impacts manifest in higher levels of need for reactive, 'catch up' services reported by agencies and residents.

The overall picture: summary points

- The overall environmental services budget in North Lanarkshire reduced by 35% in real terms between 2010 and 2018.
- Between 2010 and 2018, the volume of reports of need for reactive street cleaning services captured on NLC's CRM system increased by 50%.
- Between 2010 and 2017, there was a doubling of the number of reports from NLC's citizens.
- The rate of increase in citizen reports decelerated between 2016 and 2017 and volumes fell quite substantially between 2017-2018. These changes may relate in part to the introduction of the Confirm Mobile initiative in some parts of North Lanarkshire from 2016 on.
- There has been a substantial increase in the time taken by the council to action service requests from citizens – from less than a day in 2010 to between 5 and 6 days in 2018.

- Over the period, there has been a doubling in the volume of citizens reporting dissatisfaction with the outcome of a report of service need. After 2016, dissatisfaction rates increased.

Socio-spatial patterns

North Lanarkshire Council has a clear strategic commitment to tackling socio-economic inequality, including inequalities that manifest spatially. Nationally however, there are strong concerns that the impacts of austerity fall more substantially and even disproportionately on poorer households and people.

There is also strong international research evidence that suggests that socially and economically disadvantaged citizens tend to contact public agencies to report service needs less often than their more advantaged counterparts, certainly when differentials in actual levels of need are factored in. If citizen reporting rates are inversely related to levels of need, then modes of service provision that rely on citizens reporting problems can act as a mechanism by which poorer people and places are disproportionately impacted by austerity. In the case of North Lanarkshire and local authority environmental services nationally, austerity cuts have tended to reduce regular planned street cleaning provision and to have increased reliance on citizens reporting problems before reactive, catch up services can be deployed. It is by such means that outcomes which damage poorer groups and more deprived neighbourhoods, can occur despite the best intentions of a local authority.

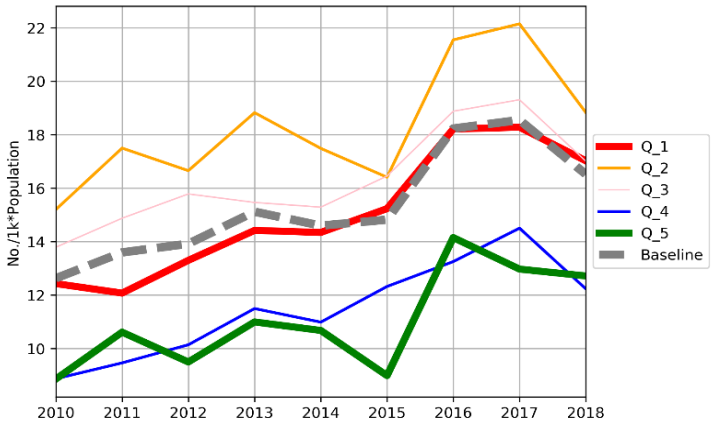


Fig. 6: Volumes of Street Cleansing Service Requests from Citizens: by SIMD deprivation quintile (2010-2018). (By Head of population)

However, what we see in Figure 6 is that in North Lanarkshire volumes of service requests are greater in more disadvantaged quintiles (Q1-3). (We have adjusted the volumes by head of population to even out differences). Rates of request are highest in the second most deprived quintile (dark orange) throughout the austerity period, but the most deprived quintile (red) has the second highest rates of reporting.

Looking at differences in reporting rates between the most (red) and least (green) deprived quintiles: in 2010, there were 12.5 reports for every 1000 adults living in the most deprived quintile, compared around nine per 1000 in the least deprived. By 2018, the rate of reporting had increased from 12.5 per thousand to 17.5 per 1000 in the most deprived quintile, a 40% increase, and by a similar 45% in the least deprived, from nine to 13 per 1000. Notably, it took nine years of austerity before reporting rates in the least deprived quintile reached the same level as was the case in the most deprived areas before austerity began.

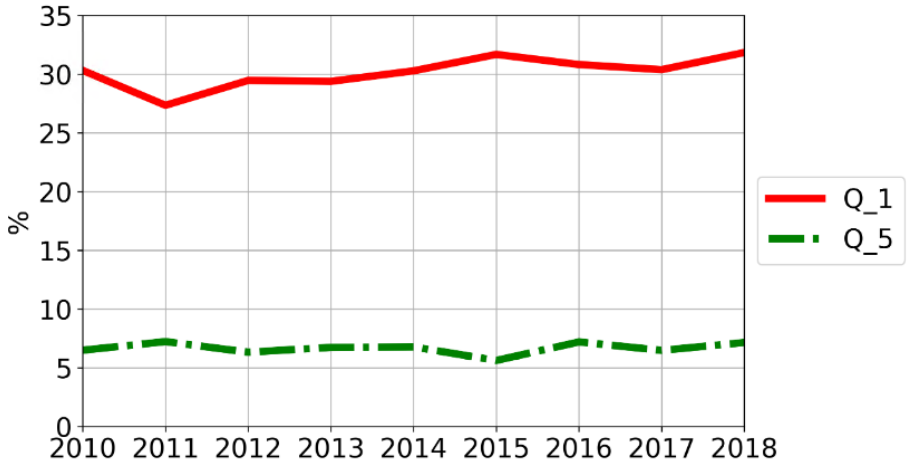


Fig. 7 Share of volumes of Street Cleansing Service Requests from Citizens: by SIMD deprivation quintile (2010/11-2018/19). (By Head of population)

As the focus of the paper is on which groups lose (more) as austerity bites, change over time in reporting rates between the deprivation groups is a good indicator of this. Such a measure also helps to control for any under-reporting of need in more deprived places. While changes in reporting rates at the beginning and end of austerity give an indication of this change, differentials in the gradients of each of the quintile lines in Figure 6 provide a more accurate assessment. Figure 7 suggests that differences in the rate of reporting between the most and least deprived groups appear to have been broadly maintained by 2018 when compared to 2010. This suggests that by this measure, the impacts of budget cuts have been largely shared between more and less deprived parts of the council area.

As indicated the wider research evidence suggests that reporting rates in disadvantaged areas may underestimate need, then it may be that the actual socio-economic needs gap in North Lanarkshire may be greater than the apparent one shown in Figure 6.

In the previous section, the analysis of the overall picture suggested that the introduction of Confirm Mobile may have impacted on the rate at which citizens reported service needs. We have begun to try and determine whether specific socio-economic effects of its introduction can be also detected. This is a complex question, which it may not be possible to resolve fully. However, our analysis of instances of when and where Confirm Mobile was introduced (not shown) shows that it was used most often in the two most deprived quintiles. However, when we normalise its use relative to differences in population size across quintiles, it is evident that quintiles 1-4 have received a fairly equal share of the intervention and that its use has been negligible in the least deprived quintile, in both absolute and relative terms. This pattern of implementation suggests that the intervention has been targeted away from those areas with least need, and that it may have dampened the impact of austerity on more disadvantaged small areas in North Lanarkshire.

It is also relevant to examine whether there is any socio-spatial patterning in the propensity for citizens reporting service needs to then make contact with the council to report dissatisfaction with how the need was resolved.

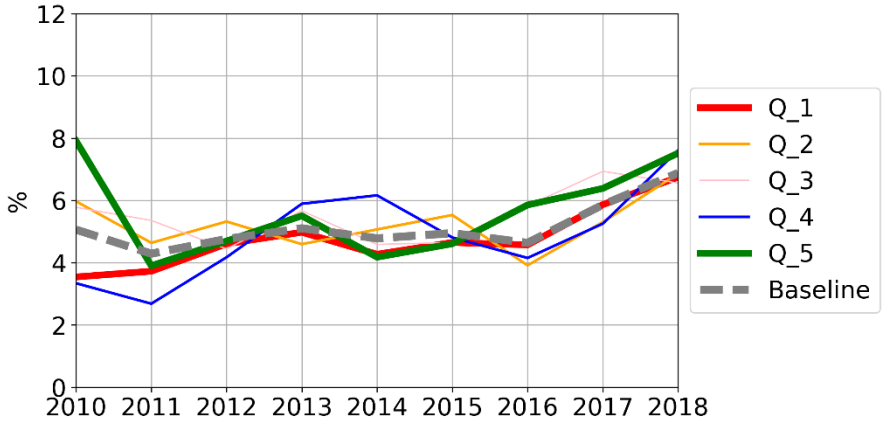


Fig. 8: Rates of Reports of Citizen Dissatisfaction with Service Request Outcomes: by SIMD deprivation quintile (2010-2018).

The dashed line in Figure 8 replicates the pattern shown in Figure 5b (the scale is different) and shows that overall rates of dissatisfaction with the response to street cleansing requests were largely static at around 5% between 2010 and 2016. It shows that since 2016, there has been a small upward trend in the rate at which citizens report dissatisfaction, so that by 2018 this was 7%.

Looking at differences between deprivation quintiles, we can see that dissatisfaction rates were lower than average in the most deprived quintile (red) until 2012, after which time they largely track the average, rising as it does in 2016. It was after 2012 that the most significant cuts to environmental services began to take effect. It is interesting to note that despite the higher volumes of service requests in the second most deprived quintile noted above (Figure 6), rates of dissatisfaction in this quintile were largely in line with or below averages.

In relation to the least deprived quintile (green), Figure 8 shows that at the outset of austerity in 2010, citizens in the least deprived quintile were more than twice as likely to be dissatisfied as citizens in the most deprived quintile. However, over the rest of the austerity period, the dissatisfaction rate in this quintile dropped and largely matched or slightly exceeded average propensities.

The evidence on dissatisfaction rates suggests that, by this indicator, austerity has not impacted on some deprivation groups more than others. It suggests that, as austerity progressed, citizens in all quintiles became more motivated to report dissatisfaction about street cleansing services. The rise in the most deprived quintile is nonetheless notable. Moreover, as shown in Figure 9., an increasing share of the council's dissatisfaction reports came from its most deprived quintile as austerity progressed – the share rose from 21% in 2010 to 31% in 2018.

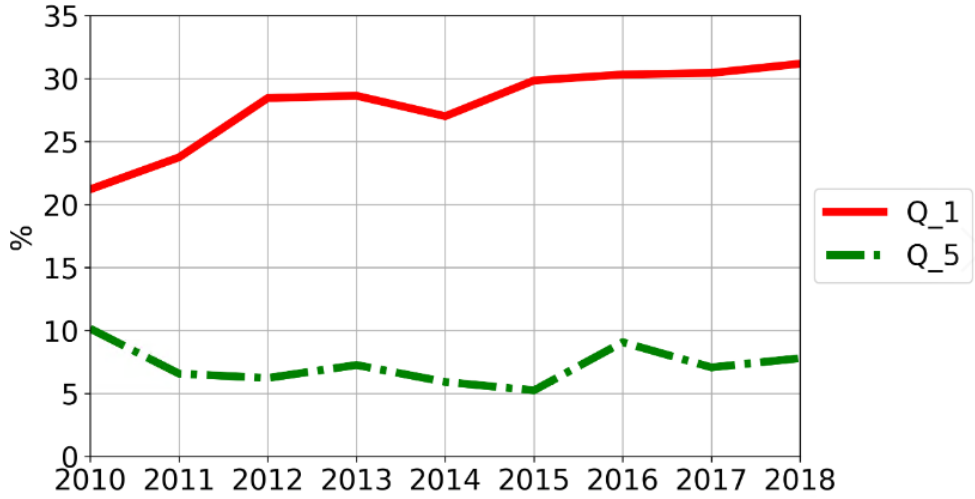


Fig. 9: Share of Citizen Dissatisfaction with Service Request Outcomes: by SIMD deprivation quintile and rate of service request (2010-2018).
(Formula: %=No.dissatisfaction_Qi/No.dissatisfaction)

As well as considering whether citizen requests are patterned with respect to deprivation, we also assess whether there is a deprivation effect on how quickly the council responds to service requests. In the overall picture section, it was established that the average time taken by the council to resolve a service request had increased substantially over the austerity period. In Figure 10, we assess whether average response times vary between deprivation quintiles.

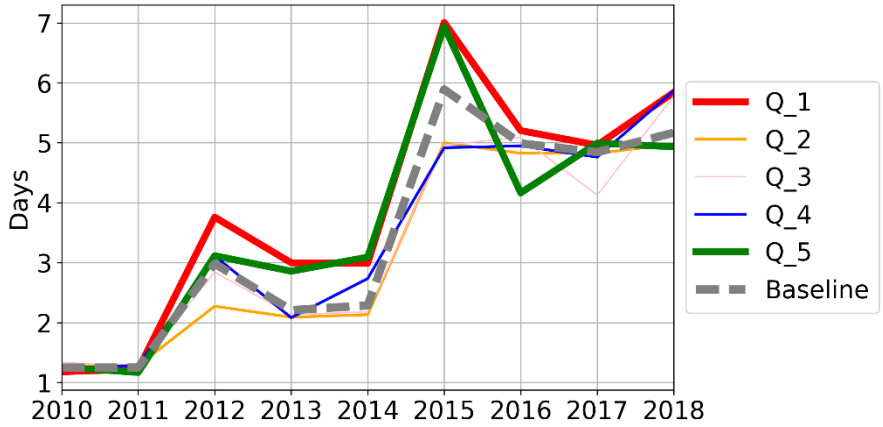


Fig. 10: Median time taken to action a Street Cleansing Service Requests from Citizens: by SIMD deprivation quintile (2010-2018).

It is notable that there was no difference in median action times between deprivation quintiles at the outset of austerity. However, as austerity progressed, and median action times increased for all quintiles, a clear deprivation effect is shown to have opened up. Thus from 2011 on, average response times in the most deprived quintile are consistently higher than the overall average times – the only quintile with such a consistent pattern. For four of the nine years, average response times in the least deprived quintile are also longer than average. Indeed, it is notable that, for two years, median action times in both the most and least deprived quintiles are equally high and that both share the peak median action time of 7 days in 2015.

As noted earlier, the Confirm Mobile intervention was introduced in 2016 by the Council to deal with the growing need for reactive street cleaning services. We have suggested that its introduction may have dampened expressed need for reactive services in all but the most advantaged quintile. Figure 10 may show an indirect impact of Confirm Mobile on the time taken to action citizen requests, as it also shows that the time taken to respond to citizen requests reduced/stabilised around the same time as Confirm Mobile was introduced. This may indicate that, as volumes of citizen reports have reduced, the capacity to respond to these reports may have increased, leading to reduced or stable action times in all areas. This further underlines the importance of decisions concerning what areas to prioritise as a new initiative, such as Confirm Mobile, is introduced.

Figure 11 takes a further look at how median action times vary with deprivation, focusing on the percentage of service requests made by citizens in each quintile that are above and below the overall median. This analysis helps to clarify differences between quintiles in the probability that the time taken to action a citizen's report will deviate from the median. If there was no deprivation effect, all five quintiles would have the same propensity to follow the median action time.

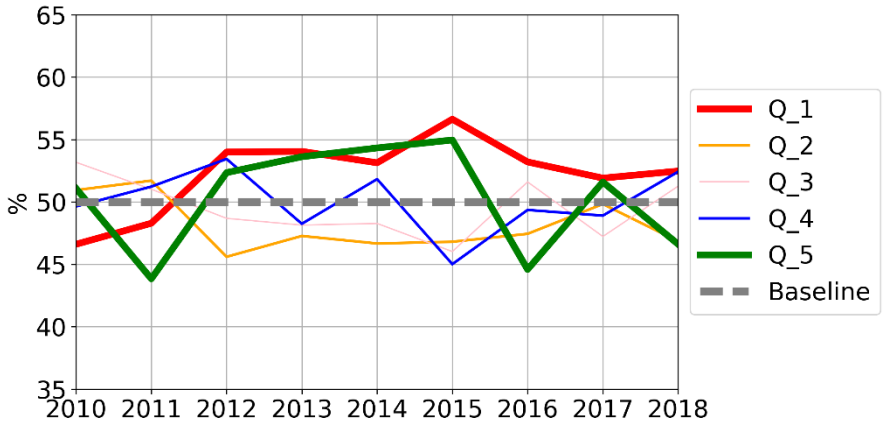


Fig. 11: Per cent of Street Cleansing Service Requests from Citizens that take longer than median action times: by SIMD deprivation quintile (2010-2018).

Figure 11 shows that since 2011, reports made by citizens living in the most deprived quintile have been consistently more likely to take longer to action than the median. Figure 11 also shows that between 2012 and 2015, delayed action times were more likely in the least deprived quintile.

These patterns contrast markedly with the pattern for the second most deprived quintile (orange) where, since 2011, reports have been dealt with in time frames consistently quicker than the median. Given that these areas are also those with the higher rates of citizen reporting (Figure 6) and around average rates of dissatisfaction (Figure 8), we can speculate that a positive feedback loop may be in play here. Thus, citizens report problems in the expectation that they will be resolved timeously and to their satisfaction. It may also suggest some prioritisation of these areas by the council.

In relation to the key question: which groups lose more as a result of austerity, it apparent that, at the outset of austerity, reports from the most deprived areas were less likely than average to be delayed than any others but then were consistently more likely to be delayed throughout the austerity period. This suggests that poorer areas have suffered more than other parts of the council area on this important measure.

Finally, we can also analyse whether there are deprivation patterns in the types of street cleaning services requested by reporters and how long it takes to NLC to action these. In Figure 12, we show how rates of reporting need for the two most common service types vary by deprivation quintile. We also show how action times vary for these types of requests by deprivation.

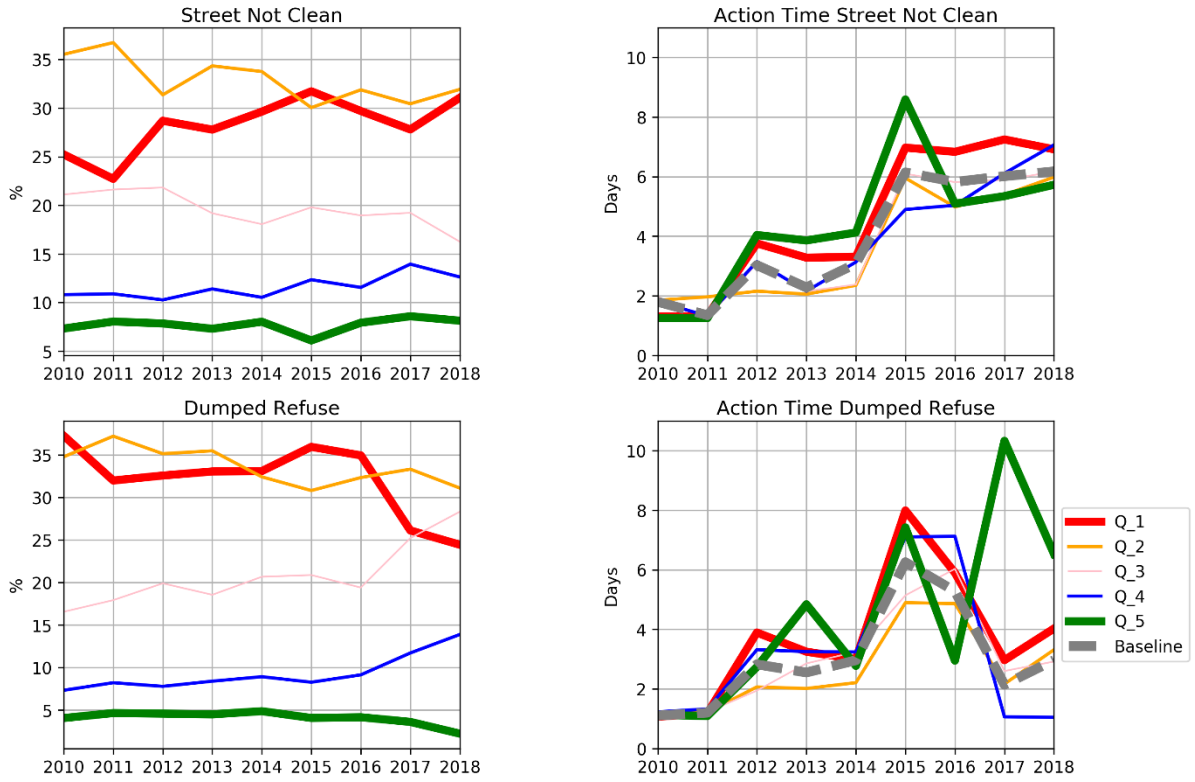


Fig. 12: Request volumes and Median Action times for 'Street not clean' and 'Dumped Refuse' (Dumped Refuse = Hi-Ab and Dump Clearance) by SIMD deprivation 2010-2018.

Figure 12 shows that citizens in deprived areas report much greater proportions of the need for both street cleaning and dumped refuse than citizens in the more advantaged areas. We can also see that there has been a growth of reports that a street is not clean in the most deprived areas, while this has declined in the second most deprived areas over the years. In contrast, there has been a reduction in reports of dumped refuse in the two most deprived quintiles, while it is a growing concern in the mid quintiles.

In relation to time taken to action reports, the overall action time for dumped refuse is shorter than for street not clean (dashed lines) although both peak similarly at around six days in 2016. This may reflect the relative difficulty of responding to these different types of requests.

Socio-economic patterns: summary points

- Since 2010, reporting rates from the most deprived neighbourhoods have been higher than from the least deprived neighbourhoods. Neighbourhoods in quintile 2 have the highest rates of reporting
- Citizens in the most deprived neighbourhoods are more likely to report issues with street cleaning and dumped refuse

- There has been a slightly larger increase in reporting in the least deprived neighbourhoods since 2010, but differences in reporting rates have largely been maintained, suggesting the impact of budget cuts has been shared fairly equally
- The use of Confirm Mobile may have helped to reduce citizen reporting rates in more deprived areas.
- There has been a small increase across the deprivation quintiles in reporting dissatisfaction with service requests since 2010
- Since 2011, response times to requests have been consistently higher in the most deprived neighbourhoods
- The introduction of Confirm Mobile corresponds with a stabilisation of the increase in reaction times in the most deprived neighbourhoods
- Neighbourhoods in quintile 2 appear to be experiencing a positive feedback loop – they report the most, then experience the shortest reaction time, which encourages further reporting

Gendered patterns

In this final section, we explore whether there are any gendered patterns in relation to how citizens express need for reactive street cleaning services as well as whether there are any patterns in how the council responds to citizen reports. We also examine gender patterns within and between socio-economic contexts.

It is not obvious that we would expect variations in how the council responds to citizen requests according to gender. Indeed, for gendered differences in such responses to occur, a number of conditions would need to be met including all of staff from the call centre to front line being aware of the gender of the citizen reporter, allowing conscious or unconscious bias to come into play. We do not think that these conditions would be met in North Lanarkshire. However, increasing awareness of the 'gender data gap' suggests that it is important to explore such questions. The possibility that socio-spatial bias would occur is more obvious – staff, particularly operational staff in the field – will have an awareness of the socio-economic status of the neighbourhoods that they work in, presenting the possibility that work can be prioritised accordingly. Drawing on previous research about the everyday work women do in deprived neighbourhoods to support the community and maintain the neighbourhood, we may expect a gendered pattern to be present, aligned with levels of neighbourhood deprivation.

Before we consider this in detail, we need to consider whether any pattern may be due to differences in the gendered population profile of neighbourhoods. If the most deprived neighbourhoods in NLC had a disproportionate female population then that, in itself, may explain any variations in gendered reporting rates. Figure 13 shows this is not the case: as we would expect from population-level statistics, there are slightly more women in all deprivation quintiles.

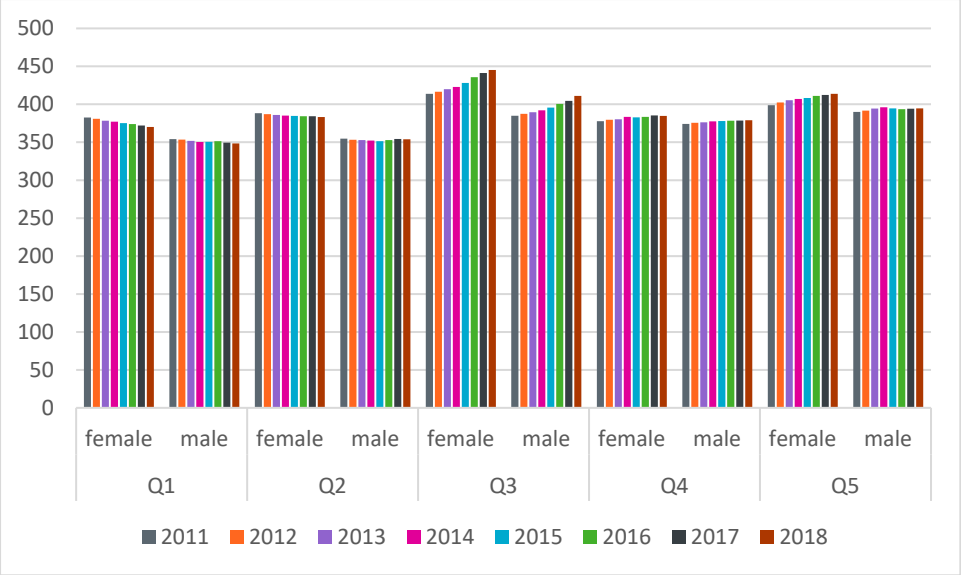
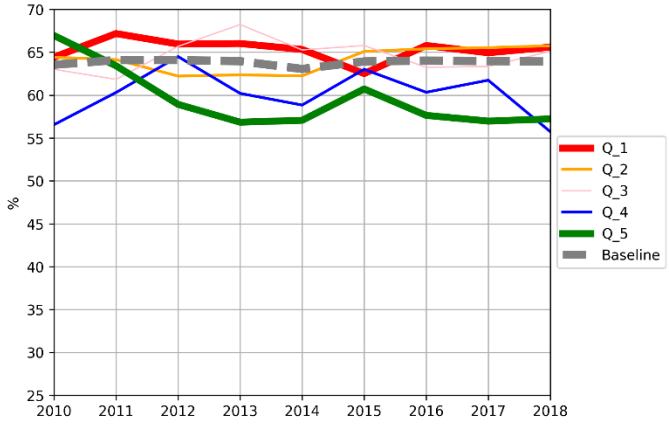


Fig. 13: Population Distribution by Gender and by SIMD deprivation 2010-2018.

In Figure 14, the dashed lines in each of the charts show the share of the gender matched citizen reports made by women and by men (see Appendix I for details of annotating genders). It is clear that women tend to make more of the reports than men – around 64% are made by women and 36% by men. This ratio stays constant over the austerity period, suggesting that changes in services as a result of budget cuts have not impacted on gender-based differences in the propensity to report problems.

Women



Men

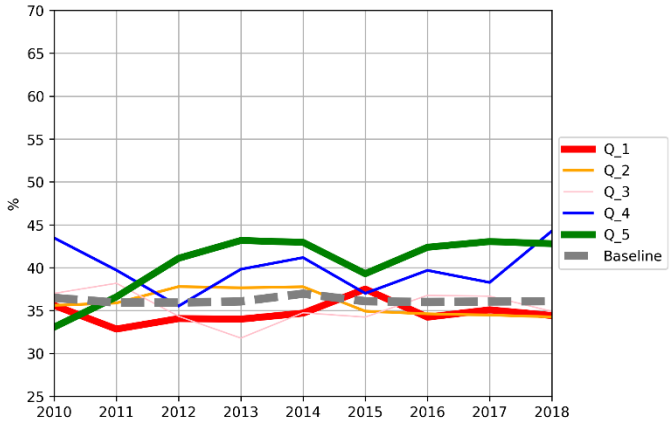


Fig. 14: Per cent by Gender of Citizen Street Cleansing Service Requests: by SIMD deprivation quintile (2010-2018).

Figure 14 also reveals gender differences in reporting rates between and within deprivation quintiles. Looking first at the most deprived quintile (red): the proportion of reports made by women in deprived areas is consistently higher than the proportion of reports made by women on average and in each of the other quintiles (with the exception of quintile 3 where women's reporting rates slightly exceed quintile 1 for three of the nine years [2012 to 2015]). As we would expect, rates of reporting by men mirror women's rates – men in deprived areas are less likely to report street cleaning problems than men on average (except for quintile 3 in the 3 year period).

These patterns suggest not only that women in deprived areas bear more of the burden of reporting street cleaning issues than their deprived male counterparts, but also that women in the most deprived areas bear more of this burden relative to men than do their female counterparts in less deprived areas.

In the least deprived quintile (green) it is striking that, while women still make a greater share of requests than men, the burden of reporting service needs is shared more equally here than in other quintiles. This could perhaps be indicative of differences in gender relations and burdens between more and less deprived areas.

To further explore this, we developed a regression model to test two hypotheses:

1. Female reporters significantly influence the total report volumes.
2. Female reporters contribute more reports than male counterparts, especially in deprived areas.

This measured variation in total number of reports controlling for: number of reports by females; year; deprivation quintiles; and the proportion of datazone population female/male as fixed effects. The results of the analysis can be seen in Appendix 2 of this working paper. This regression analysis shows, firstly, that an increase of 1 female report is associated with a 1.25 increase in total reports, supporting our first hypothesis. Secondly, the deprivation quintile dummy variable for Q2 is also statistically significant. The positive coefficient indicates that the total reports are higher in Q2 than in Q1. The regression model indicates that female reports within lower quintiles Q1 and Q2 have a combined impact on explaining the total reports. This supports our second hypothesis.

We can also analyse gendered, socio-economic patterns in the tendency of an individual citizen reporter to make multiple service requests. What this analysis shows - in Figure 15 - is that the two

most deprived quintiles have higher numbers of citizens who make multiple requests for service over the years. These 'active users' are not only more likely to live in deprived areas, but to be women. Indeed, in the most deprived quintile, there are a number of women who have made between 40-60 reports over the 9 years, and one who made 144. This volume of reporting by single citizens does not occur in other quintiles, except in quintile 2 where, in this case, there is also a man who made circa 100 reports. Overall, the distribution of the probability of making multiple requests shows that it becomes increasingly less likely that an individual will make multiple requests as the socio-economic affluence of the area increases. And within quintiles, it is more likely that more women than men will make higher numbers of requests.

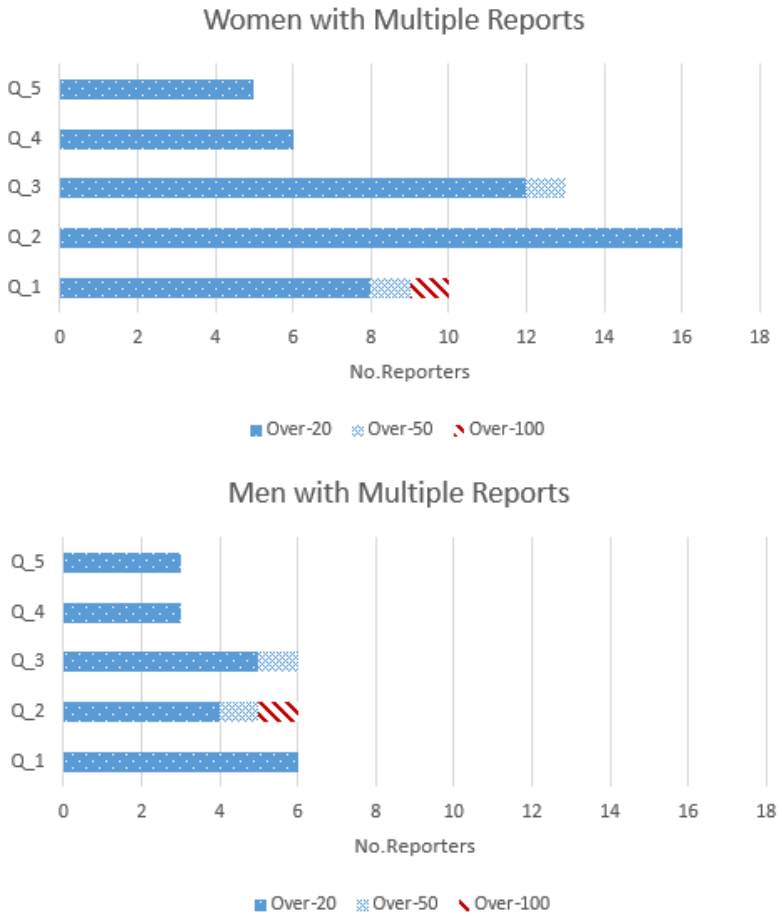


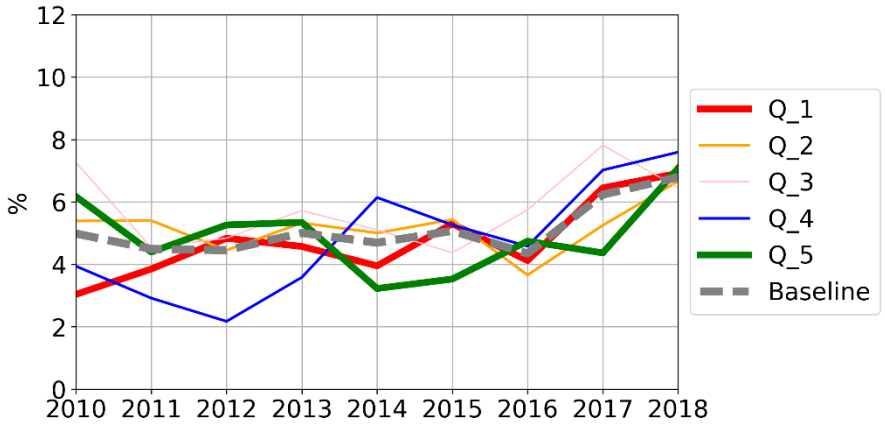
Fig 15: Women and Men making multiple reports: by SIMD deprivation quintile. (2010-2018)

These findings are relevant to debates about the gendered patterns of background 'community-building' work within neighbourhoods highlighted in broader research evidence. They also suggest that, in relation to the aspect of community-building under scrutiny here, gendered workload inequalities may apply more in deprived than non-deprived neighbourhoods.

We have also examined whether there are gender differences in what issues women and men report. However, in contrast to the stark differences in what people in more or less deprived places report noted earlier, no discernible gender differences are apparent. This would suggest that women and men experience neighbourhood street cleanliness issues in similar ways, and that when they are motivated to report a problem, they tend to prioritise reporting the same problems. However, women are clearly more motivated (or perhaps burdened by the need to) to report these problems than men.

We can explore this idea further by examining gender differences in tendencies to report dissatisfaction. In Figure 16, the dashed lines are the average propensity of women and men to be dissatisfied, regardless of deprivation. These suggest similar orders of magnitude in dissatisfaction rates between men and women, but that there has been tendency for men to express their dissatisfaction more prior to 2016. However, while men's dissatisfaction rate increased by almost 2 percentage points in 2017, women's dissatisfaction increased by a similar margin a year earlier in 2016.

Women



Men

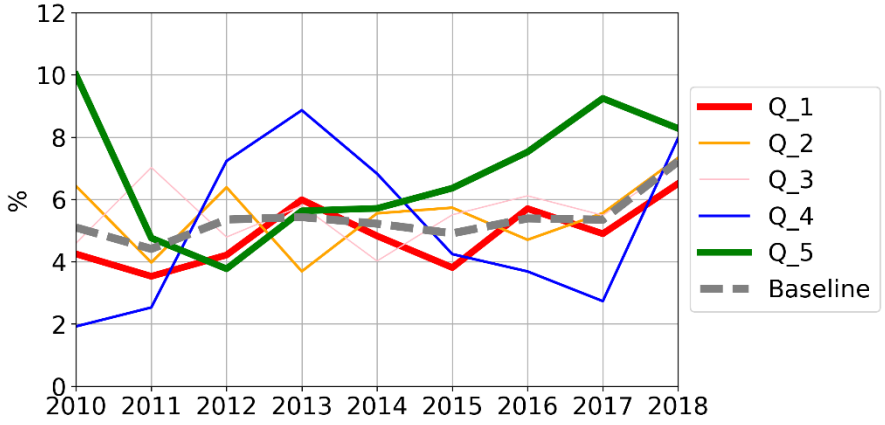


Fig. 16: Gendered Rates of Reports of Citizen Dissatisfaction with Service Request Outcomes: by SIMD deprivation quintile (2010-2018).

Bringing deprivation differences into focus, it is apparent that the rate at which women in the most deprived areas report their dissatisfaction has more than doubled as austerity has rolled out (from 3% to 7%). A similar overall increase is apparent for the second least deprived quartile (blue). In the least deprived quintile, women tend to report dissatisfaction less readily - the rate is largely below or similar to the average rate.

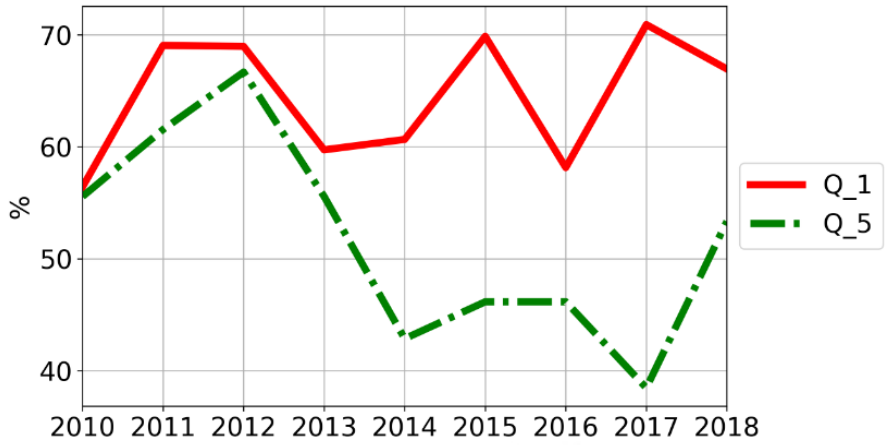
When we look at men's rates of dissatisfaction by deprivation, it is apparent that while the reporting rate of men in deprived areas tends to track or dip below the average for all men, nonetheless their dissatisfaction has increased over the austerity period, but at a slower rate than that of deprived women. We can also see that at times, men living in better off areas (green and blue) are more likely to complain than are other groups of men. The small numbers of men reporting street cleansing

issues explains the volatility in these patterns and suggests the need for caution in drawing strong conclusions from this part of the data.

Looking at gender differentials in dissatisfaction rates within quintiles, it appears that in the most deprived quintile, women and men have a similar propensity to report dissatisfaction. The two most affluent quintiles suggest a different pattern. Here men's rate of dissatisfaction is consistently higher than their female counterparts' – again perhaps suggesting potential differences in gender relations in this affluent quintile. Interestingly rates of dissatisfaction are greater for this group (better off men) than for all groups regardless of gender and deprivation. This may reflect how the higher status of this group within society more broadly, translates into higher expectations from services and therefore into a greater propensity to complain.

As we noted above that the case study council's total dissatisfaction reports had grown by 47% over the austerity period (Figure 9): a gendered analysis suggests that the increase was largely driven by the increased reporting of dissatisfaction by women (Figure 17). Thus, while deprived men's share of the council's dissatisfaction reports decreased by 24% between 2010 and 2018, deprived women's share increased by 19%.

Women:



Men:

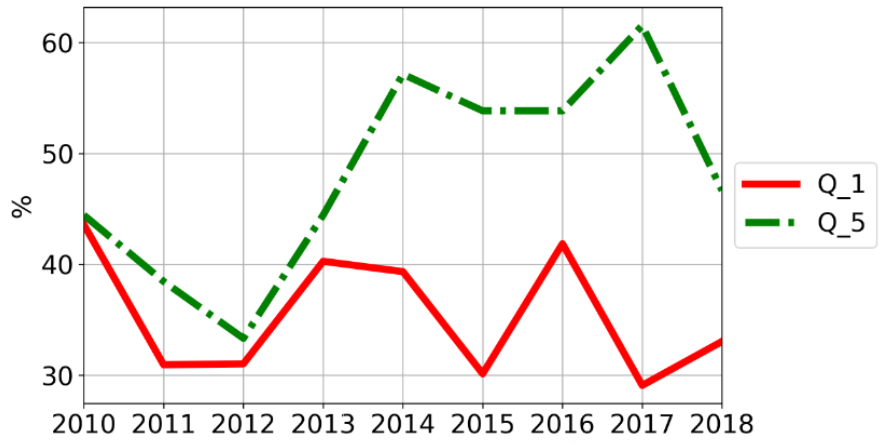


Fig. 17: Share of Citizen Dissatisfaction with Service Request Outcomes: by SIMD deprivation quintile, Gender and rate of service request (2010-2018).

Finally, we can look at whether the council responds differently to women and men when they report a service need.

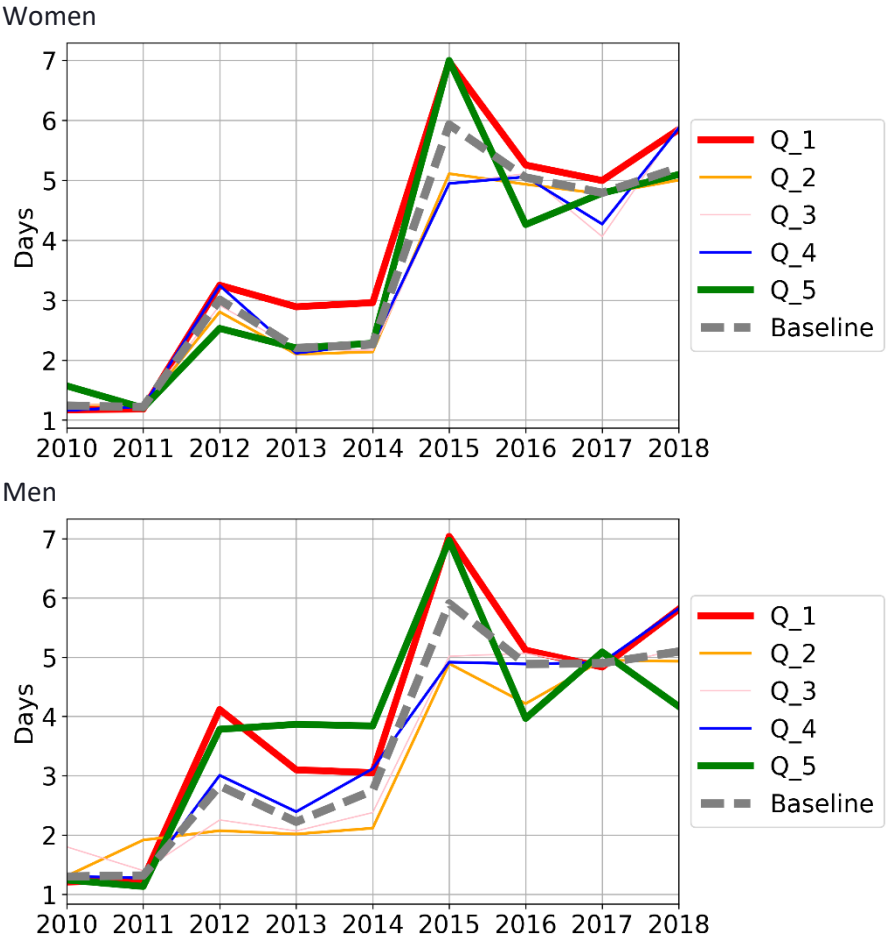
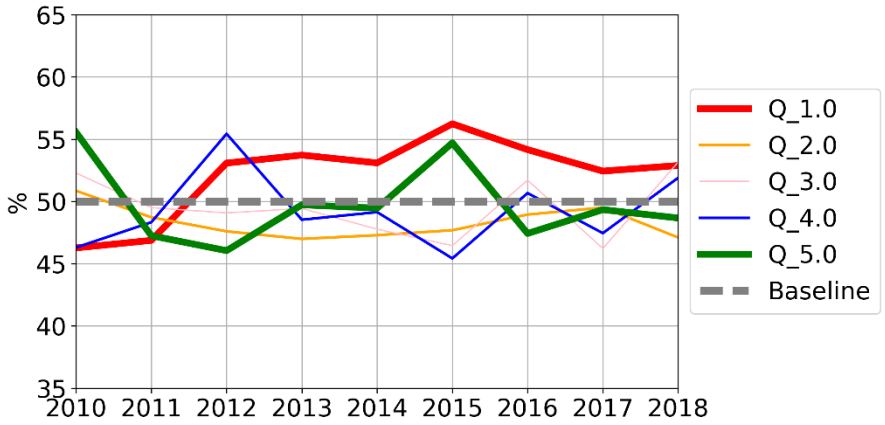


Fig. 18: Median time taken to action a Street Cleansing Service Requests from Citizens: by Gender and SIMD deprivation quintile (2010-2018).

In Figure 18, we show median action times for men and women's service reports. Comparing the dashed (average) lines there is no gender difference in median action times. As noted earlier, the socio-economic impact on median action times is however apparent - response times in deprived areas are consistently higher than average. Figure 18 suggests that this effect may, if anything, be slightly accentuated by gender. What is clear is that women living in the most deprived areas are more likely to experience delayed action times than any other group distinguishable by gender or deprivation.

However, drilling down a little to look at which gender/social groups have a tendency to have their service requests actioned in timescales beyond the median, Figure 19, suggests that both deprived women and men have this propensity over the period.

Women



Men

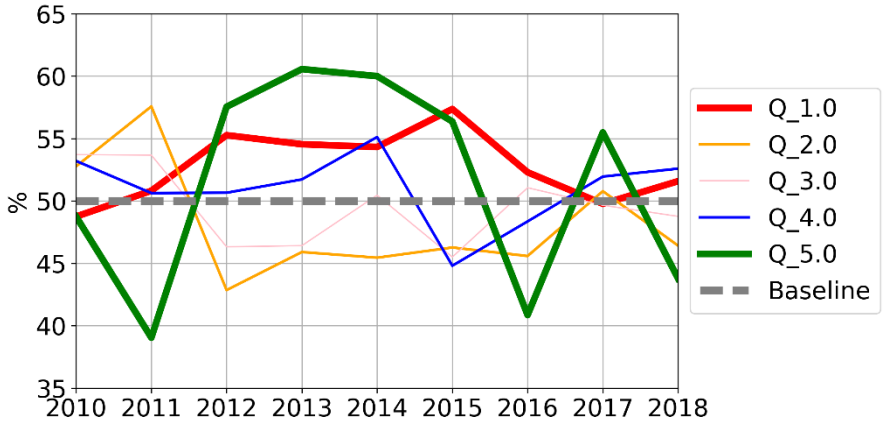


Fig. 19: Per cent by Gender of Citizen Street Cleansing Service Requests that take longer than median action times: by SIMD deprivation quintile, over time.

Gender patterns: summary points

- Around 64% of service requests are made by women
- In 2018, in the most deprived neighbourhoods, 65% of requests are made by women, compared to 56% in the least deprived neighbourhoods; in the least deprived neighbourhoods 44% of requests are made by men
- Women who live in the most deprived neighbourhoods are more likely to make multiple service requests. Some women in the most deprived neighbourhoods have made 40-60 reports. Within all neighbourhoods, women are more likely to make multiple requests
- Women in deprived neighbourhoods have had a faster growing rate of dissatisfaction with services, and experienced this dissatisfaction a year earlier, than men in such areas
- Men in the least deprived neighbourhoods have been more likely to report their dissatisfaction with services than women, and compared to any gender or deprivation group.
- Women in deprived neighbourhoods have been slightly more affected by the increase in response times since budgets have been cut.

Appendix I. Processing the Data

This document records the data cleansing steps and results for NLC full data received in Dec 2019. The initial dataset is received with all the customer details. Later in Jan 2020, it is combined with additional 'confirm mobile' part without customer fields. The merged dataset is used as the initial input to the cleaning process which aims for

(a) Cleaning the records with invalid/unreasonable action time;
(b) Geocoding the records to datazones depending their different ways of geo-references;
(c) Annotating the 'citizens' ('the public') using customer name fields;
(d) Inferring the 'gender' of the customers using title and first name;
(e) Annotating datazones from customers' home location.

The document describes the issues found and reports the valid size of the dataset after the outliers that were filtered out in each step.

1. Cleaning the initial dataset by calculating invalid/unreasonable action time

This step is designed based on a conversation with NLC CRM administrator who pointed out that the possible invalid records are those with (a) less than/equals to 0 time difference between logged/action date; (b) extreme large time gap between log and action (many of them are manually set an action date after months or years); (c) recording the traditional paper based services in CRM (many of them are closed at midnight of the day).

We first calculate the 'actionDiff' field as the days (floating) between the enquiries logging date and their recorded action date for filtering purposes. For the cases where the action date is set as 00:00:00 midnight, we change them to 18:00:00, i.e., the end of the working day. Some of the response time is set to 0 when the council staff reports the same logging/action time if an action time cannot be recalled. We impute the action time as the average service time on the same road segment as a correction. Finally, based on the new actionDiff field, we filter out the invalid records with action difference larger than 365 days (extreme large closed by the administrator) or those being actioned within no more than 0 days. [Note that the largest action time is 365 days is an arbitrary threshold. We assume the administrator buke closing the cases if they are not actioned within a year. There could be more frequent manual closing exercises.]

The initial input dataset has 151353 records. Duplications are filtered first. This gives 151272 records entering the cleaning process. After this step, we have 145809 valid records. The imputation in three steps gives estimations removing around 5000 records from the next step.

2. Geocoding Reports to datazones

The dataset is geo recorded in three different ways (a) with easting/northing locations if they are recorded using the council's handset, (b) with street name and street reference code input through the customer portal, (c) with service depot named specified by a council officer. We first split the three types and geocoding them separately. We match the records to 2011 datazones in the council area with the aim to link with 2016 SIMD indices.

For records with easting/northing locations, we generate point geometries then intersect them with the datazone shapes. There are records lay outside the council area. We allocate them to the nearest datazones.

There are 23778 records with eastings/northings. After the exercise, 23772 are assigned with datazones. Those failed are missing the geolocations.

For the cases where the street name and street reference code are given, we adopt another approach, geocoding to streets then assigning to datazones. An LSGN shapefile containing the street segments is obtained from NLC for geocoding. The matching between the enquiries' street names and the street segments happens in three steps. We firstly join the unique combined street name and street reference code to the LSGN file. This gives us the set with the most accurate match. For the rest of the enquiries, we join the street name then street reference respectively to boost the size of matching.

To assign datazones, there is an issue where some street segments layover multiple datazones. We resolve this by assuming that busier places are more likely of public interests. As a result, we assign enquires to the datazone with a higher 2016 population density along the reported streets.

There are 94812 enquiries in the original streets' names category. The most accurate matching gives us 8741 unmatched results. The street name and reference code separate matching exercise bring in an extra 8623 enquires with datazones.

For the enquiries recorded with service depot names, we match their depot reference code with a council provided service site shapefile. Exact matches are partial. There are mismatches, e.g. there could be some site code with extra character at the end dividing a larger site into smaller units. So we further strip one character off from either enquires and site code to boost the matching size. Note that the more character being stripped off, the less accurate the matching. Our process satisfies with 'one' character striping.

We assign enquires with the datazone in which the centroid of their matched depot is located.

We have 32675 initial enquires with depot names. The exact matching produces 25173. The stripping and matching exercises bring extra 3090 enquiries with assigned datazones.

In total, we have 146853 out of 151272 being matched with datazones (97% matching rate). These are including the invalid action time records (valid records, known as action time >0, outstanding=No, datazone is not none, are 138342 around 91%). We decide to keep them all in the further processes for future outlier analysis.

3. Annotating the 'citizens' ('the public')

By going through the full dataset with customer contact details, we found some of the records in the CRM system are recorded/reported by the council officers (either through confirm mobile or the portal), the organizations, or under anonymity. With the specific interests of the citizens' reports, we annotate an extra 'citizens' ('public) field. The exercise is a 3-round process. We firstly rule out the records with specific symbols, '), (, -, @' as they are likely to specify the job title of the council officers. There are special cases where issues are reported (a) on behalf of someone else as a daughter, son, (b) by someone with names containing '-' such as 'Ann-Marie'. We keep them in by dropping their names from the removing list, e.g. for (b) we loop through all the baby names in the NRS database for the names with '-' and manually going through the last names with '-' too.

To filter out council officers, we manually collect a list of occupation keywords, such as EPO, warden, manager, etc, to remove. Other keywords for organizations, such as shop, fire & rescue, police, etc are also on the removing list. Finally, we remove those records with indications as under anonymity, such as ' Anon', etc although some of them have extra information on the genders, they are treated as an unreliable stream of information. Please note that the steps are manual especially when generating keywords from the records. This may affect the accuracy of the annotating to a certain

degree but won't be a huge issue by checking for many iterations. Appendix I includes the keywords to show our efforts.

For the records inherited from the geocoding process (146853 in total), we annotated 104599 (71%) of them as reported by citizens.

4. Inferring customer 'gender'

There are two sources of the records that can be used to indicate the genders. The first, being used as the primary gender source, is the specified customer title (list of titles in the system is in the Appendix). We manually go through the unique list of these titles then picked 'mis, miss, mrs, mrs', ms' as female sources while 'mr, mr+, mr., mrmr, mrr' as male sources. Although there are other titles such as 'pc, cll, cllr' etc, we don't use them for gender inferences. This step gives us 65499 out of 146839 records with annotated gender value.

The secondary source is the customer's first name. We search the customer first name in the aforementioned baby name database then assign the highest possible 'B' (male) or 'G' (female) to the customer. Not every customer has a first name value. We assign the gender firstly using the title value if not, sorting the customer's first name to boost the record size. As a result, we successively inferred 93446 out of 146839 records in this step.

5. Datazones for customer home locations

In addition to the locations of the reports (where are the issues), the data contains detailed addresses of the reporters. This brings us the opportunity to aggregate where the reports come from. The process is described as follows.

Based upon those records that are identified to be reported by the citizens, we extract the reporters' postcode then use the Postcode Lookup file to link the reports with datazones. After this first step, 104223 reports were successively annotated.

For the rest of the reports, we use Google Geocoding API to geocode (retrieving lat/long) the home address strings (fields include property_address,sub_address,street_description). 3291 records were successively geolocated. Among them, we focus on Googles location types are under 'premise, route, street_address and subpremise' (exclude those of 'regions') because they are more likely to indicate locations of addresses. They were then aggregated to the datazone level. 2123 records were finally added to the result dataset.

This aggregation procedure gives us 105353 reports with customer home datazones.

Summary

In summary, the data cleaning and annotation process output a selection of citizen enquiries with annotated gender values in datazones. To focus on the valid action time (more than 0, less than 365 action time), within a datazone, and outstanding, we have 91766 records. Among them, 87486 (95%) has assigned gender values. Around 98% citizens reports were further annotated with customer home datazones.

Appendix I– Distinguishing non-citizen reports and gender of citizen reporters

The keywords that we use to remove non-citizen records are:

```
['housing','officer','epo','janitor','police','unknown','occupier','portal','office
','warden','chp','occupant','noname','enviro','report','caretaker','shop','co-
op','councillor','fss','tennent','msp','public','estate','chp','scotland','health',

'stevenbroadfoot','association','fire','rescue','owner','neighbour','pharmacy','boo
ts','shopkeeper','caller','tesco','morrison','protection','email','letter',

'cllr','huosing','tenant','resident','tennant','homer','sanctuary','street','cleans
ing','waste','management','bus','manager',
'letting','trainer','road','jaintor','janitor',
          'true','false',

'supervisor','contract','dump','graffiti','inspector','concierge','orthodontists','
wmo','gallagher','centre','center','teacher','operative','cctv','sse','sepa','site'
,'practice'

'cleansing','site','complex','community','council','watch','neighbourhood','awo','l
ibrary','nursery','factor','ranger','social','club','enviormental','b&q','lollipop'
,'solutions','animal','chargehand','wmo','golf','course',
          'clyde valley',
'opticain','support','assistant','transport','health','safty','army','light','litte
r picker','butcher','tattoo'
]
In order to identify the gender of citizen reporters, customer titles and baby name
database were used (details available on request).

]
```

Appendix II – Regression model on gender, neighbourhood deprivation and reporting rates

The following formula represents the regression model:

$$Y_i = \alpha + \beta_1 female - report + \beta_2 year_{2012} + \cdots + \beta_8 year_{2018} + \beta_{10} Q_2 + \cdots + \beta_{13} Q_5 + \tau_{population} + \varepsilon$$

Where Y_i is the total reports; $female - report$ is the total female reports; $year_i$ is the year dummies; Q_i is the SIMD quintile dummies; $\tau_{population}$ represents the female/male population fixed effects.

OLS Regression Results

Dep. Variable:	total_report	R-squared:	0.857
Model:	OLS	Adj. R-squared:	0.857
Method:	Least Squares	F-statistic:	1530.
Date:	Mon, 15 Feb 2021	Prob (F-statistic):	0.00
Time:	23:39:01	Log-Likelihood:	-9775.7
No. Observations:	3576	AIC:	1.958e+04
Df Residuals:	3561	BIC:	1.967e+04
Df Model:	14		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	-0.7199	0.329	-2.191	0.028	-1.364	-0.076
female_report	1.2554	0.009	133.968	0.000	1.237	1.274
female	-0.0042	0.001	-2.849	0.004	-0.007	-0.001
male	0.0107	0.002	6.816	0.000	0.008	0.014
year_2012	0.0689	0.250	0.276	0.783	-0.421	0.558
year_2013	0.3406	0.250	1.363	0.173	-0.149	0.830
year_2014	0.4269	0.250	1.709	0.087	-0.063	0.916
year_2015	0.3669	0.250	1.469	0.142	-0.123	0.857
year_2016	0.8341	0.251	3.324	0.001	0.342	1.326
year_2017	0.8873	0.251	3.534	0.000	0.395	1.380
year_2018	0.5845	0.250	2.336	0.020	0.094	1.075
SIMD16_Quintile_2	0.6523	0.161	4.040	0.000	0.336	0.969
SIMD16_Quintile_3	0.3237	0.191	1.693	0.091	-0.051	0.699
SIMD16_Quintile_4	-0.0964	0.204	-0.472	0.637	-0.497	0.304
SIMD16_Quintile_5	0.1016	0.242	0.420	0.674	-0.372	0.576

Omnibus:	2267.460	Durbin-Watson:	1.984
Prob(Omnibus):	0.000	Jarque-Bera (JB):	54264.353
Skew:	2.611	Prob(JB):	0.00
Kurtosis:	21.356	Cond. No.	4.74e+03