



Are the potential environmental gains from stain resistant finishes negated by consumer behaviour?

Fidra

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Summary

PFASs (Per- or poly- fluorinated alkyl substances) are a group of synthetic chemicals many of which are linked to major environmental and human health concerns. This report focusses on their use in children's school uniforms where they are used to produce 'stain resistant' finishes. The UK clothing industry is behind only housing, transport and food in its environmental impact therefore any reduction in the volume of clothing bought will have major environmental benefits. A key argument for the use of stain resistant finishes is that by reducing the need for frequent washing and lengthening a garment's lifespan, the environmental benefits outweigh the negatives associated with chemical pollution.

We carried out a nationwide survey including over 600 parents or guardians of primary school age children to establish whether consumers adjusted their behaviour in response to stain resistant finishes, i.e. are the potential benefits from these finishes realised in a real-world context? We also asked respondents to rate the importance of the environment, amongst other priorities, when making purchasing decisions and considered whether the marketing terms they sought out (e.g. stain resistant, TeflonTM) correlated with conscious priorities.

We found that the respondents who valued stain resistant finishes washed school uniform items more frequently, and replaced them more often, than those who considered the finishes unimportant. Respondents who valued stain resistant finishes replaced trousers and skirts (the most likely garments to be labelled stain resistant) on average 7 weeks earlier than those who considered them unimportant.

We found that the environment was generally of low priority when making purchasing decisions. We also found no change in whether consumers valued stain resistant finishes linked to how they viewed the environment, i.e. placing the environment as a high priority in making purchasing decisions did not lead them to avoid stain resistance or opt for stain resistance. This suggests that consumers are not currently linking chemical coatings with environmental concern or benefit.

Our four key recommendations following this report are:

1. Include behaviour in full life-cycle analyses to fully assess the environmental impact of stain resistant finishes.
2. Give consumers the opportunity to find out about stain resistant finishes and their environmental impacts to enable people to make purchasing decisions that match their priorities.
3. Develop ways for consumers to explore and engage with the issue, e.g. highlight links between environmentally friendly options and other benefits, such as reduced cost and convenience.
4. Encourage consumers to assess the need for washing and replacement on an individual item by item basis rather than falling into habitual behaviour patterns. Where finishes are applied this will encourage the potential environmental trade-offs to be realised.

Background and objectives

PFASs (Per- or poly-fluorinated alkyl substances) are a group of synthetic chemicals many of which are linked to major environmental and human health concerns. They are used in a wide range of consumer products from food packaging, to stain-resistant textiles, non-stick cookware and cleaning products and are now found in drinking water, wildlife and human blood serum¹¹.

These chemicals do not breakdown easily, once they enter the environment they persist and bioaccumulate. This means that even years after production and release ceases, they remain in our environment, accumulating in wildlife and humans². PFASs have been detected in marine animals, seabirds and predators across the world^{3,4}, with levels in remote Greenland Polar Bears high enough to cause potential neurological damage⁵. They have been detected in water sources including rivers, lakes, groundwater, oceans and treated waste water⁶; some forms are also airborne and have been detected in indoor and outdoor air and in household dust^{7,8}.

Laboratory experiments show that chemicals within the PFAS group can be harmful to animals upon exposure. These chemicals have been shown to disrupt the hormone system in some animals and are therefore classed as endocrine disruptors⁹. In laboratory animals, they are shown to reduce immunity to disease¹⁰, damage the liver¹¹ and pancreas¹² and affect the growth and development of young even at low levels^{13,14}.

The effects on human health are less well known and are in fact very poorly understood. Some studies have suggested that PFASs may affect fetal development and young children, leading to possible growth, learning, or behavioural problems^{15,16}. Other studies have pointed towards possible links to immune system disorders, weight gain and fertility problems^{9,17,18}. However, the findings are inconsistent as it can be difficult to confidently attribute effects to PFAS exposure alone given the wide range of chemicals and influences we are exposed to in everyday life. The most commonly studied chemicals within the group, and the focus of regulatory actions across the EU and elsewhere, are PFOS and PFOA. Official classifications include 'carcinogenic' (Cat2, suspected human carcinogens), 'reprotoxic' (Cat 1B, presumed human reproductive toxicants), 'Lact' (may cause harm to breast-fed children), and 'toxic to specific organs' (liver)¹⁹. The toxicity of lesser studied forms of PFAS, increasingly used as alternatives to the restricted substances, are still uncertain.

PFOS has been restricted under the Stockholm convention on Persistent Organic Pollutants since 2009 (note this does not constitute a total ban in the EU) and is severely restricted for use in the USA. However, there has been a marked increase in the production of PFOS in China since restrictions were applied meaning the chemicals are still entering our environment²⁰. PFOA and its related substances were added to an EU restricted substances list on 14 June 2017; actual restrictions on manufacture and sale will not come into force until 2020, with some uses remaining until 2032.

For some uses it is difficult to find replacement chemicals that have equivalent properties. Where there is a genuine health and safety concern we have little choice but to accept them until technology and innovation can provide a solution. Furthermore, where consumers see benefit from the use of PFAS chemistries, and regulations do not prevent their inclusion in products, consumer choice will influence their use and ensure their continued prevalence in our environment.

Here we look specifically at the use of PFAS chemistries to make stain resistant finishes for children's school uniforms. Whilst there is no evidence to suggest these finishes cause harm to the wearer, PFASs of concern may be lost to the environment during production and end-of-life disposal. Clothing is estimated to be the eighth largest sector in terms of household spending across the UK

yet represents the fourth largest in terms of environment impact (under only housing, transport and food)²¹. A major priority in reducing the impact of clothing on the environment is extending the wearable lifespan of garments and reducing the purchase frequency. Another key area for potential environmental gain is in reduction of wash frequency, which could subsequently reduce lifetime water, energy and chemical usage. The primary arguments cited *for* the use of stain resistant and easy-care finishes is that they are claimed to increase product lifespan and decrease the need for frequent washing²¹. To ensure that a decrease in the chemical pollution caused by finishes isn't outweighed by the environmental gains mentioned above a full life-cycle analysis is necessary.

Consumer behaviour is fundamental in establishing whether *potential* benefits are translated to *actual* benefits in a real-world situation. This survey aims to understand whether a preference for stain resistant or 'easy-care' finishes genuinely leads to a decrease in purchase and wash frequency. Furthermore, we explore the connection between consumers' conscious priorities in making purchasing decisions and whether these accurately reflect their purchasing behaviour.

We have chosen to specifically focus on school uniforms, specifically those worn by primary aged children. The assumption that increased garment durability leads to an increase in wearable lifespan is likely to fall short in this case due to the speed children of this age outgrow clothing, and an established habit of purchasing new uniforms before each school year. We hypothesise this will sway the full environmental lifecycle analysis in favour of reduced chemical usage and provide a solid basis to recommend removal of stain resistant finishes from children's school uniforms.

Aims of the Research

Fidra carried out this study to address the following research questions:

1. Does a preference for 'stain resistant' or 'easy care' finishes on children's school uniforms correlate with a decrease in purchase frequency?
2. Does a preference for 'stain resistant' or 'easy care' finishes on children's school uniforms correlate with a decrease in wash frequency?
3. Do consumers choose marketing terms and keywords that match with their conscious purchasing priorities regarding the environment?

Methodology

A key consideration in the survey design was to prevent the introduction of bias by presenting the key goals and putting the environment at the forefront of respondent's conscious. With this in mind we have tried to keep the focus of the survey vague with an option for respondents to access results or further information after survey completion. The survey is aimed at parents or guardians of primary school age children and whilst our approach to contacting respondents was targeted, this information is also given clearly in the introductory text to discourage unsuitable respondents.

The survey (see appendix 1) contained a total of 10 questions answered anonymously. Household income bracket was the only respondent background information asked directly, however age and sex were made available through the survey response platform. Information was collected on the primary means of acquiring school uniforms (e.g. second-hand or purchased new) and the main uniform retailers. The number of children the survey respondent was representative and the average number of uniform items each child owned allowed for numeric quantification within the analysis.

Questions relating to wash and purchase frequency and estimated garment lifespan were separated into three distinct garment categories, which were 'Shirts/T-shirts', 'Trousers/Skirts' and 'Jumpers/Cardigans', and formatted as multiple choice questions based on described time intervals. Descriptive time intervals were converted to numeric values for statistical analysis (Table 1).

The questionnaire was designed using SurveyMonkey (SurveyMonkey Inc.; San Mateo, California, USA; www.surveymonkey.com). Data from a total of 500 respondents was collected using SurveyMonkey Audience. Information on how respondents are recruited to SurveyMonkey is available here: www.surveymonkey.com/mp/audience. A further 137 responses were collected via link circulation utilising social media and Fidra's own contacts. Survey analysis was compared between SurveyMonkey Audience only respondents and the full dataset. Whilst there was a statistically significant difference in the average household income bracket between collector methods, the remaining results were unchanged. The presented analysis therefore includes all collected data.

SurveyMonkey Audience data was collected between 22/02/2018 and 05/03/2018. All other responses were collected between 08/02/2018 and 31/03/2018.

Statistical analysis was carried out using R statistical software (version 3.4.2). Statistical significance is ascribed with P-value of less than 0.05 corresponding to a 95% confidence interval. Correlation analysis utilises the Spearman's rank nonparametric test to account for skewed data distributions. Where \pm values are displayed these refer to standard errors of the mean unless otherwise stated. Error bars on graphs represent standard area of the mean unless otherwise stated. Where boxplots are presented these are plotted using the 'geom_box' function in 'ggplot2', R statistical software. The box represents median and interquartile range, whiskers extend to the largest value no further than 1.5 times the interquartile range. Dots represent outliers which fall beyond the whiskers.

Table 1. Time intervals for questions 5-7 including both description and ascribed quantitative value (note there is estimated to be 190 school days per calendar year).

| | Interval description | Numeric value | Unit |
|---|---------------------------------|---------------|-------------------------|
| Question 5 <i>(wash frequency)</i> | Daily | 1 | Days between washes |
| | 2-3 times per week | 3 | Days between washes |
| | Weekly | 7 | Days between washes |
| | Fortnightly | 14 | Days between washes |
| | Less frequently | 21 | Days between washes |
| Question 6 <i>(purchase frequency)</i> | Multiple times in a school year | 0.5 | Years between purchases |
| | Each school year | 1 | Years between purchases |
| | Between 1-2 school years | 1.5 | Years between purchases |
| | Less than every 2 years | 2.5 | Years between purchases |
| | | | |
| Question 7 <i>(estimated achievable lifespan)</i> | Less than 1 school year | 0.5 | Years between purchases |
| | 1 school year | 1 | Years between purchases |
| | Between 1-2 school years | 1.5 | Years between purchases |
| | More than 2 years | 2.5 | Years between purchases |
| | | | |

Survey Results

The following results are based on 637 responses, giving a 4% margin of error at the 95% confidence limits.

Respondents were primarily within the £20K-£40K income bracket, primarily aged 30-44 and primarily female (Figure 1). The mean number of children of primary school age in each response was 1.5 and was not statistically different between collectors ($F = 2.18$, $P = 0.11$).

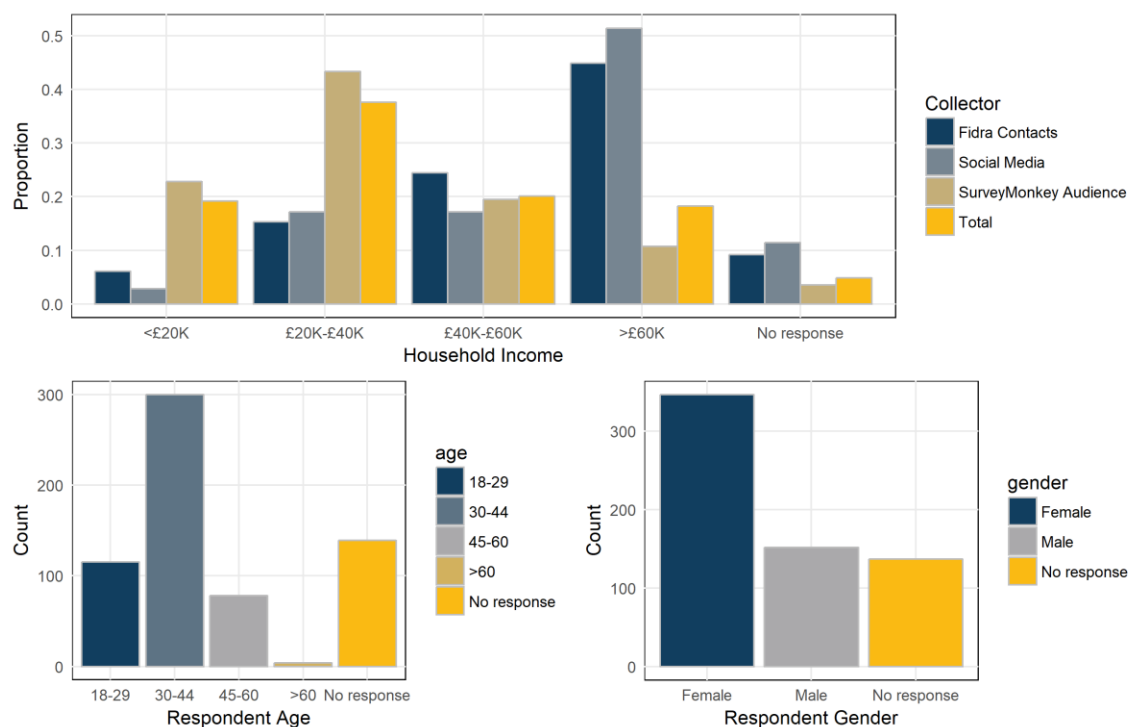


Figure 1 Respondent data including average household income, age and gender.

Uniform source and disposal

95% of respondents purchased uniforms new (Table 2) (the proportion that only bought new was 71%, the remainder combined new and second hand), 16% purchased uniforms through second hand retailers and 19% received items handed down from friends or family. 4% of respondents ticked the 'other' box in the multiple-choice options and referred primarily to uniforms provided by school or parents association, this is likely to be through 'free-for-all' used clothes bins. Household income had no significant effect on the use of new versus second-hand uniforms. This likely reflects the high availability of low-cost uniforms in the current market.

Table 2. Full list of retailers listed in survey responses

| | | |
|-------------------|--------------------------|---------------------------|
| M&S | Keywear | Screens schoolwear |
| Tesco | Truro | Littlewoods |
| Asda | Gap | Pinders |
| John Lewis | Select Kidz | Smiths |
| Sainsbury's | School Days, Enniskillen | Whitehall Clothing |
| Matalan | Fashion Stop | Laser |
| Next | Kas | Grays |
| Border Textiles | Braggs | Bambinos |
| Clan House | Hucknell Sports | Forresters |
| School Blazer | Primark | Jaymax |
| Aitken and Niven | Aldi | Shopbowl |
| Border Embroidery | School trends | Superstitch |
| H&M | Clark | Lidl |
| Debenhams | Uniform Shop | Perry |
| Ffigar sports | Matalan | Image Scotland |
| Morrisons | H&M | "Supplied by school shop" |

Respondents were also asked how they disposed of uniforms. Only 12% of respondents listed landfill as a disposal route. The most prominent means of disposal was either charity (48%) or handed down (47%). 38% of respondents listed textile recycling as a means of disposal and 10% ticked the 'other' box. 'Other' related primarily to 'free for all bins' supplied through schools or parent's associations but other uses such as 't-shirts used as dusters if no-longer suitable for wear' were also listed. Note most respondents ticked more than one of the suggested disposal routes.

How many of each item does each child have?

Most children have 4 or more shirts or t-shirts, 4 or more pairs of trousers or skirts and 2 jumpers or cardigans (Figure 2).

Based on a numeric value of 5 for '4 or more' the mean item number per garment category was 3.4 ± 0.03 , 2.9 ± 0.04 and 2.6 ± 0.04 for shirts and t-shirts, trousers or skirts and jumpers or cardigans, respectively. Note the calculated mean was relatively insensitive to the chosen value when 4 or 6 was used in place of 5.

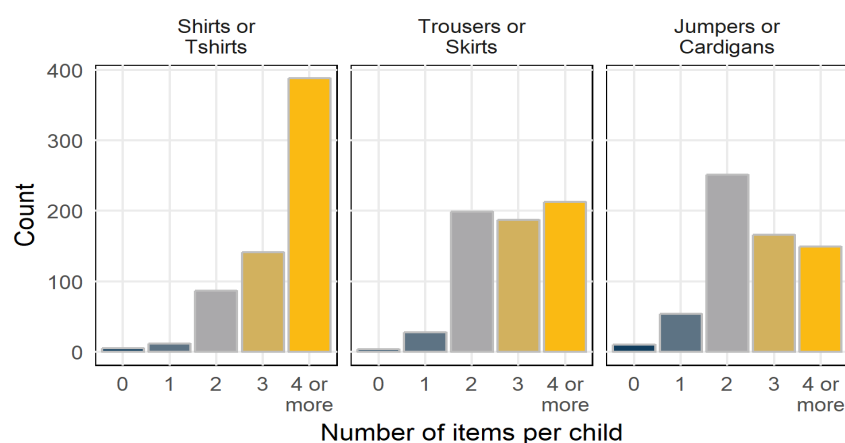


Figure 2. Number of items of each garment type per child

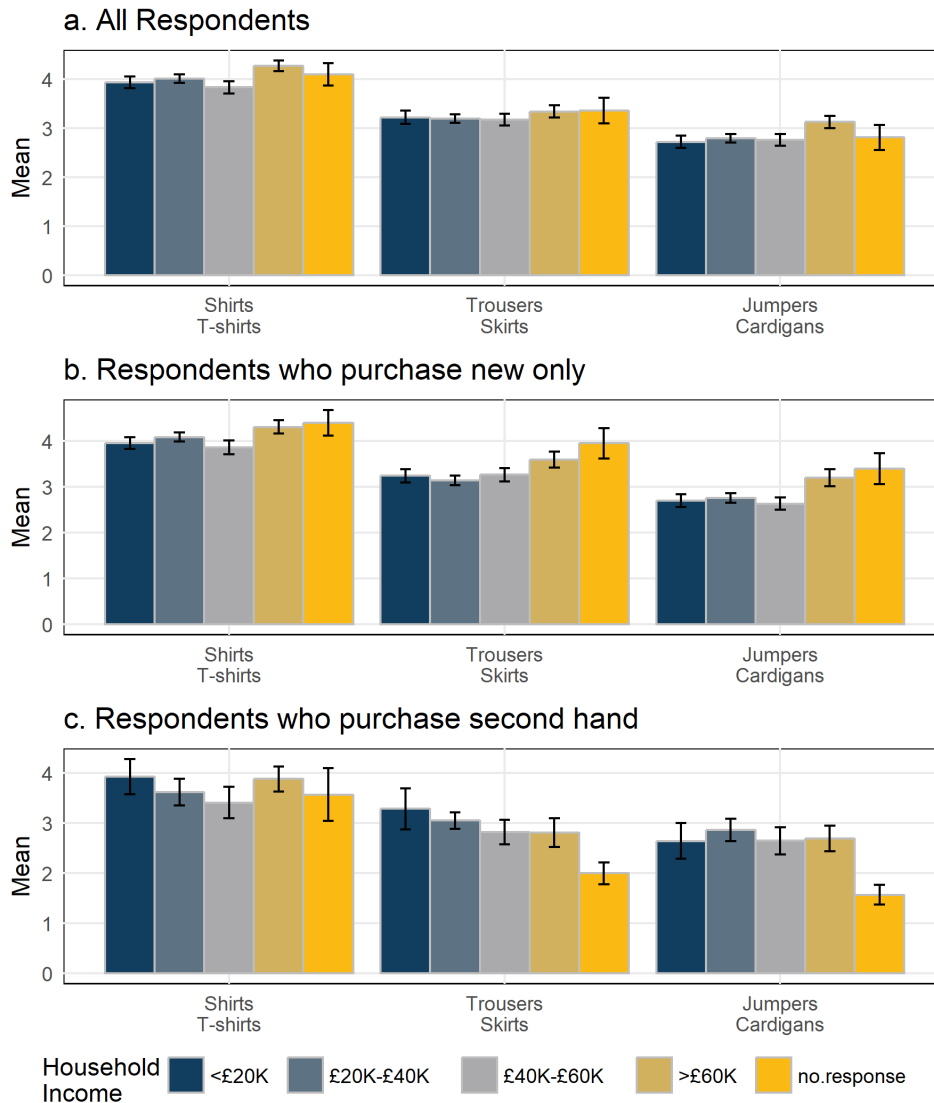


Figure 3. Illustration of the number of each uniform items (mean \pm se) per child a) across full dataset and split into respondents who b) only purchase items new from retailers or c) respondents who source some of their uniform items second hand. Note the '4 or more' bracket has been estimated as 5 for numerical calculations.

The data was subsequently split to consider differences in the number of garment items based on income bracket or purchasing source. Considering income, we saw significantly higher numbers of 'shirts or t-shirts' and 'jumpers or cardigans' in the highest income bracket compared to the remaining data. When we look at the subset that only buys new from the retailer, there is a small but significant increasing trend towards more trousers, skirts, jumpers and cardigans with increasing income. This trend was eliminated when respondents utilised second-hand uniform sources (Figure 3).

How often are uniforms washed?

Of the garment items listed, shirts and t-shirts were washed most often with the modal category being 2-3 times per week compared to weekly for trousers and skirts, and jumpers and cardigans (Figure 4). Very few respondents reported washing items fortnightly or less frequently but if they did it was primarily for the jumper and cardigans category. 25% of respondents washed shirts and t-shirts daily compared to 15% for trousers and skirts and 13% for jumpers and cardigans. These

values translate to mean wash frequencies of 3.98 ± 0.11 , 4.65 ± 0.11 and 5.08 ± 0.13 days between washes, for 'Shirts/T-shirts', 'Trousers/Skirts' and 'Jumpers/Cardigans', respectively.

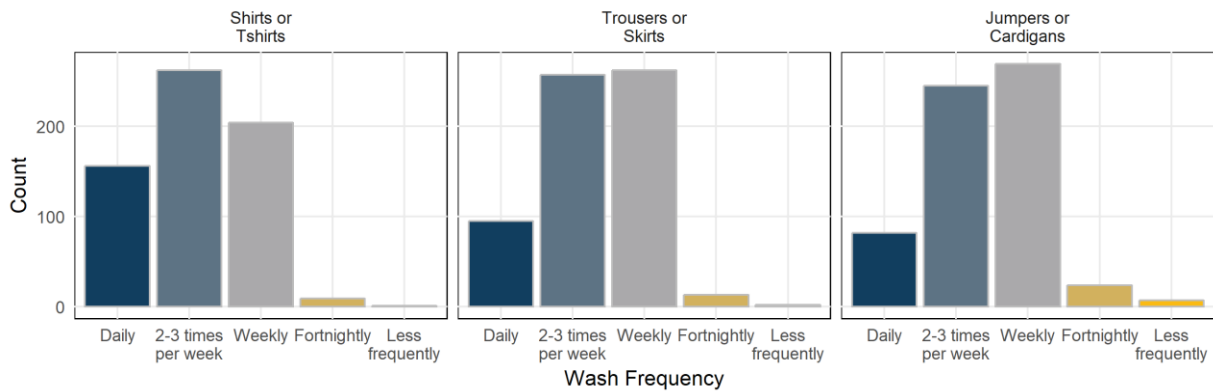


Figure 4. Wash frequency separated by garment type.

The wash frequency decreased with income bracket across all respondents, with the exception of shirts and t-shirts which had a high wash frequency across all groups.

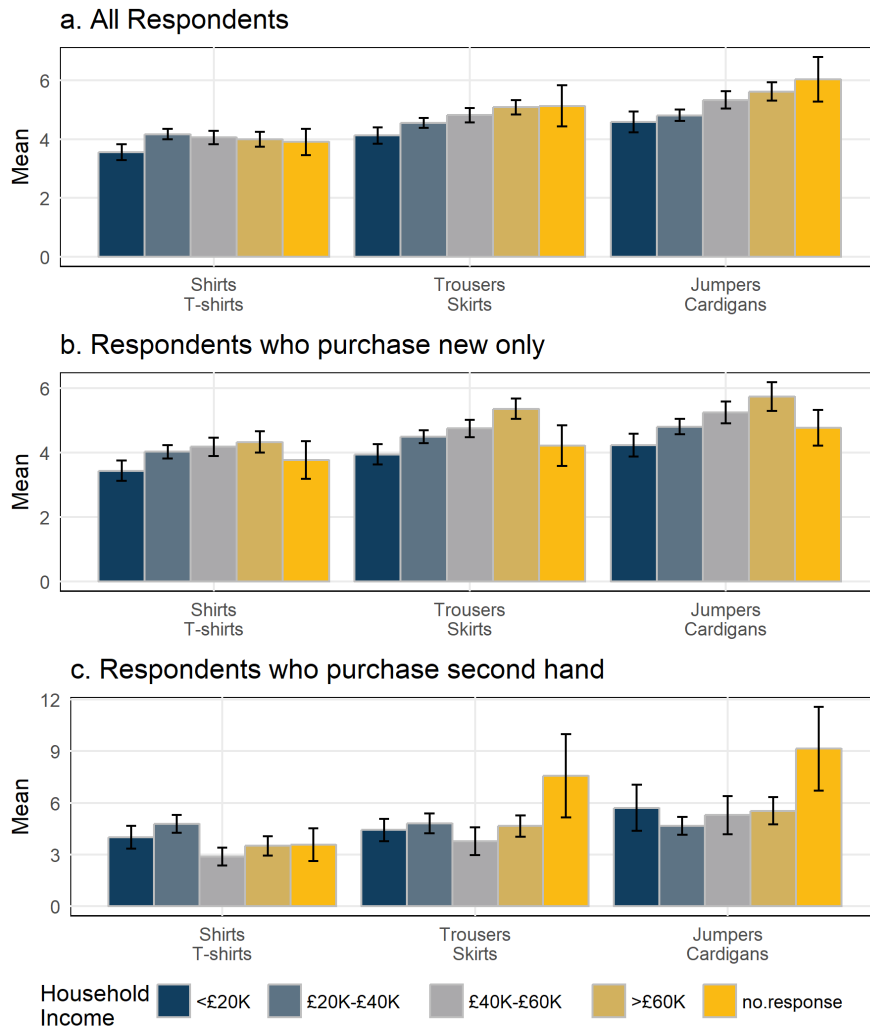


Figure 5. Average number of days between washes in a) all respondents, b) respondents who only buy new from retailers and c) respondents who purchase garments from second hand sources.

When split by those respondents who do and do not utilise second hand shops for uniforms the pattern appears stronger in the 'new only' group but falls apart in those who utilise second hand shops (Figure 5).

Respondents were asked to rate the importance of particular keywords when making purchasing decisions. Whilst our main priority is to understand behaviours related to stain resistant finishes we have included a broad range of marketing terms and brand names to avoid introducing bias by clearly stating our intentions. Figure 6 shows the relationships between the perceived value of these keywords and reported wash frequency.

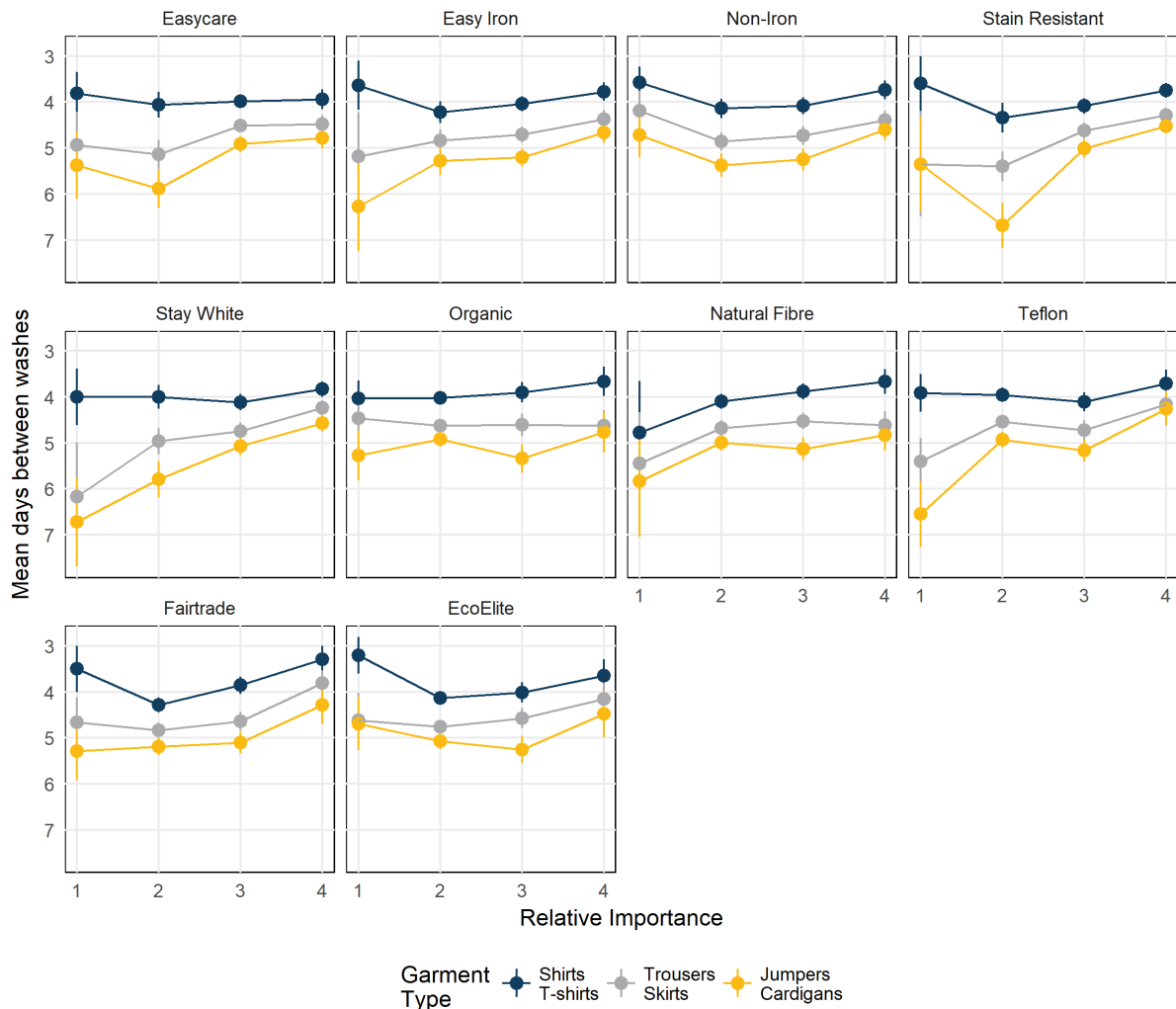


Figure 6. Wash frequency, displayed as mean number of days between washes, by numerical relative importance of faceted keywords, with 1, 2, 3 and 4 representing actively avoid, not at all important, somewhat important and very important, respectively. Note the y-scale is reversed to better illustrate wash frequency.

For shirts and t-shirts the wash frequency remained high irrespective of keyword preference; only a 'Fairtrade' preference resulted in a weak but significant correlation, with those having a preference for Fairtrade items washing more frequently ($r = 0.10$, $P < 0.05$). The greatest number of significant keyword associations were in the 'Jumpers/Cardigans' category, with significant positive relationships between wash frequency and easy iron ($r = 0.09$, $P < 0.05$), stain-resistance ($r = 0.12$, $P < 0.01$), stay-white ($r = 0.11$, $P < 0.01$), Teflon™ ($r = 0.10$, $P < 0.05$) and Fairtrade ($r = 0.12$, $P < 0.01$). The greater level of significance in this group is likely only a result of the greater range in wash frequency compared to other garment types.

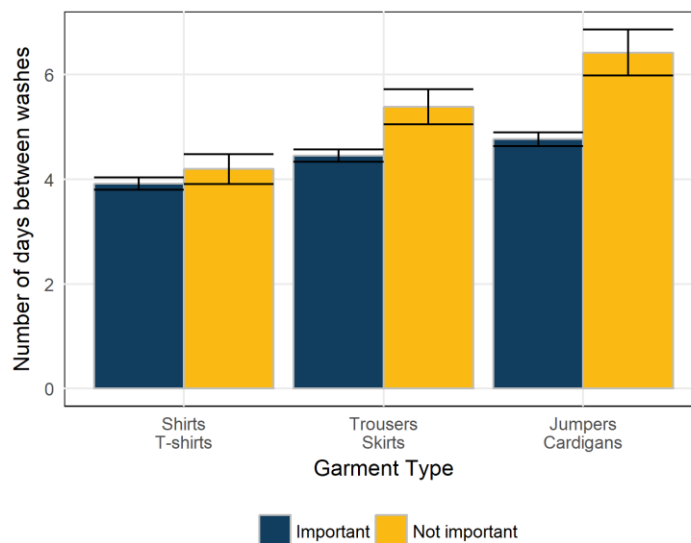


Figure 4. Comparison in wash frequency dependent on perceived importance of stain resistant finishes

Within the 'Trousers/Skirts' category, which is the most likely category to have a stain-resistant finish applied, a preference for "stain-resistant" ($r = 0.10$, $P < 0.05$) and "stay white" ($r = 0.10$, $P < 0.05$) finishes and "fairtrade" clothing ($r = 0.10$, $P < 0.01$) correlated with an increase in mean wash frequency. This suggests that individuals who purchase trousers and skirts with a stain resistant finish are actually washing the items more frequently than those who do not. This is converse to the common claim that an environmental benefit is gained through the use of these finishes as clothing requires less washing. Here we see that wash need is likely to be outweighed by behavioural traits. The potential environmental benefit is not being realised in a real-world scenario. The relationship between a preference for stain resistant finishes and wash frequency is further highlighted in Figure 7, clearly showing those respondents who value stain resistance are washing clothing more often. Respondents who *do not* value stain resistant finishes report a wash frequency of 5.4 ± 0.33 days between washes for trousers and skirts compared to respondents who *do* value stain resistant finishes and report a wash frequency of 4.5 ± 0.12 days between washes. Whilst a similar pattern was seen between wash frequency and the importance/non-importance of leading stain resistant brand name Teflon™, the difference was much smaller and not statistically significant.

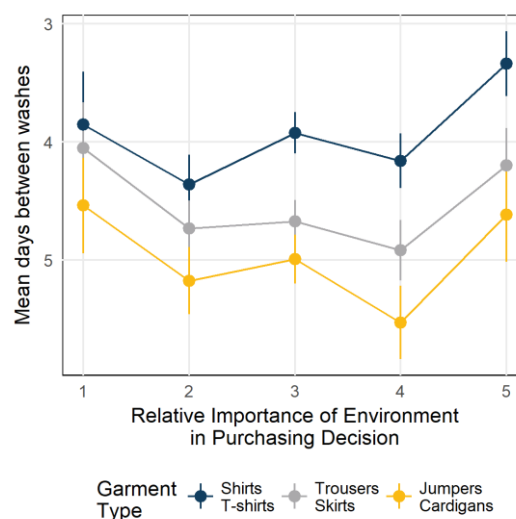


Figure 5. Relationship between wash frequency and importance of the environment when making purchasing decisions

We found no significant correlation between how often respondents washed garments and the value they placed on the environment. This suggests that the environmental gain from washing

clothes less often is not something the public are currently aware of or currently putting into practise.

How often are uniforms replaced?

Shirts and t-shirts are replaced most often out of the listed garment categories, on average after 173.2 ± 2.9 days of wear, which relates to approximately 90% of the school year (based on 190 school days per year) (Figure 9). However, differences between garment categories were minor with most items being replaced approximately once per school year ('Trousers/Skirts': 177.0 ± 2.9 days of wear; 'Jumpers/Cardigans': 193.3 ± 3.0 days of wear). The strong link to school year would suggest that purchasing frequency is based on habitual behaviour rather than an assessed need.

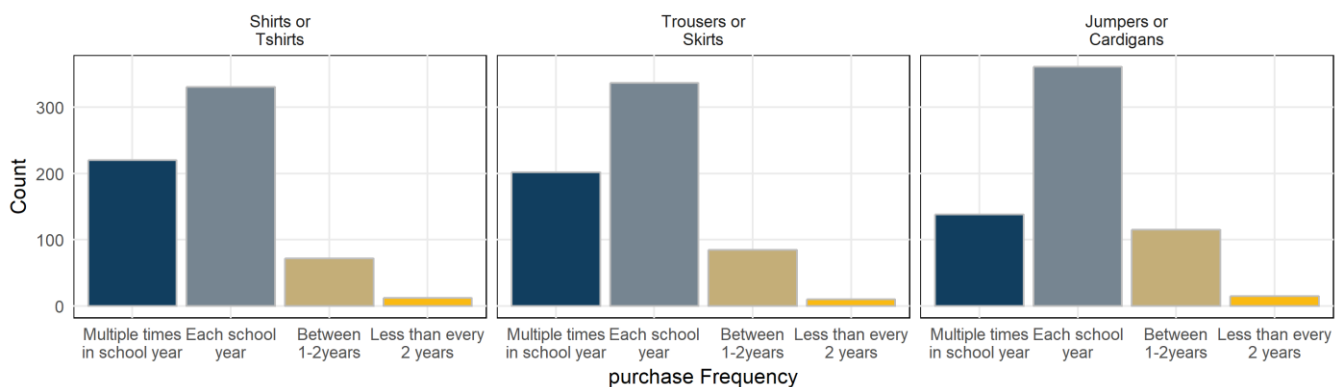


Figure 6. Estimated purchase frequency separated by garment type

We observed a weak positive trend, most apparent in the jumpers and cardigans category, showing a decrease in replacement frequency related to household income (Figure 10). This may be a reflection of garment

quality with higher income households buying more expensive items in the first instance. Within a full lifecycle analysis, the environmental benefits from decreased purchase frequency are likely to be highly relevant. However, as stain resistance is primarily used for trousers and skirts

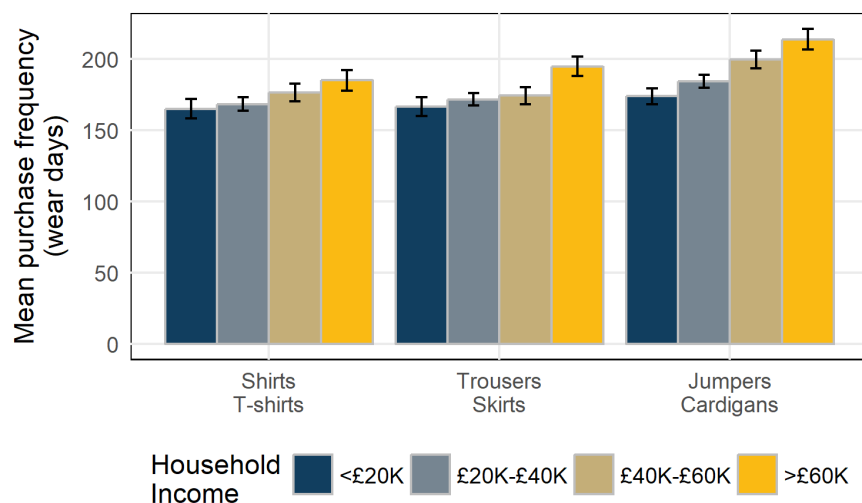
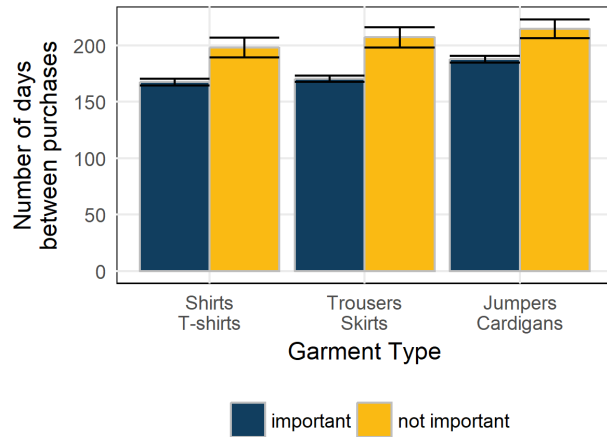


Figure 7. Purchase frequency separated by household income bracket

where the trend is not significant, we ascertain that the increased life span of the garment in this case is not linked to stain resistance.

We found a decrease in the number of days between purchases, i.e. an increase in replacement frequency, associated with a preference for stain resistant labels on clothing (Figure 11). This counters the environmental argument that stain resistant finishes increase the lifespan of garments. Again, this shows that when carrying out a full life cycle analysis to assess environmental benefit, it is critical that user behaviour is included rather than technical measures of durability.



Looking at a broader scope of keywords, we see strong and significant correlations between purchase frequency and respondents preference for 'easycare', 'easy iron', 'stain resistant', 'stay white' and 'Teflon™'. Respondents who see these keywords as important replace uniform items most often (Figure 12). A weak correlation was also seen linking a preference for EcoElite to a high replacement frequency in the 'jumpers and cardigans' category.

Figure 8. Comparison in purchase frequency dependent on perceived importance of stain resistant finishes

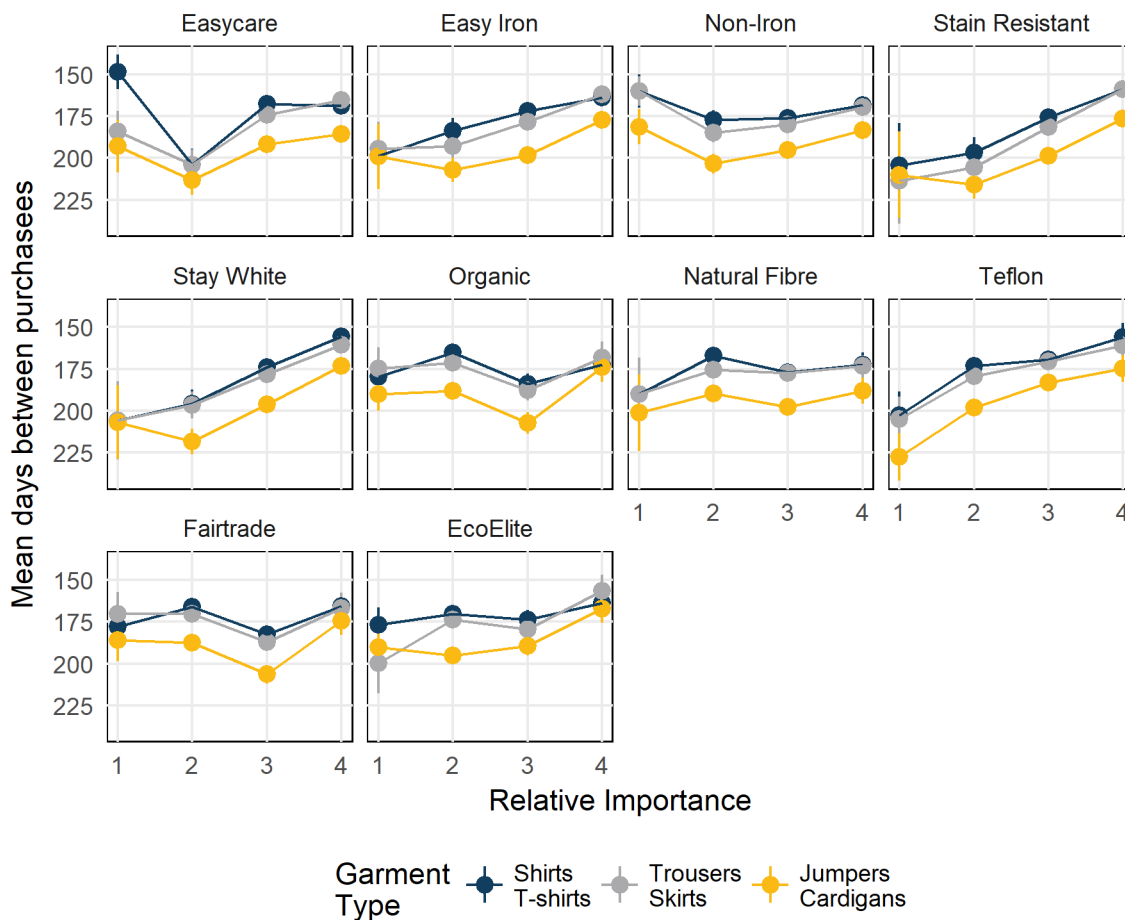


Figure 12. Purchase frequency, displayed as mean number of days wear before replacement, by relative importance of keywords, with 1, 2, 3 and 4 representing actively avoid, not at all important, somewhat important and very important, respectively. Note the y-scale is reversed to better illustrate purchase frequency.

When we consider respondents purchasing priorities, ease-of-care and cost are the only two factors which correlated significantly at $P < 0.01$ with purchase frequency across all garment categories. For both cost and ease-of-care, the higher these were valued, the more frequently garments were replaced (Figure 13).

Similar to our analysis of wash frequency, we found no significant correlation between how often respondents replaced garments and the value they placed on the environment. There is a considerable environmental impact associated with production in the textile industry, and there are subsequent benefits that can be gained from reduced purchasing behaviour²¹. However even for those that place a high value on the environment, it seems that at the point of purchase of uniforms the environmental impacts of textiles is either not considered, or a lesser priority, than other factors such as price, or convenience. This does not take into account the possible purchase of second hand items or whether items are worn by multiple children. These results are consistent with others that find consumer behaviour and values do not necessarily correlate²³.

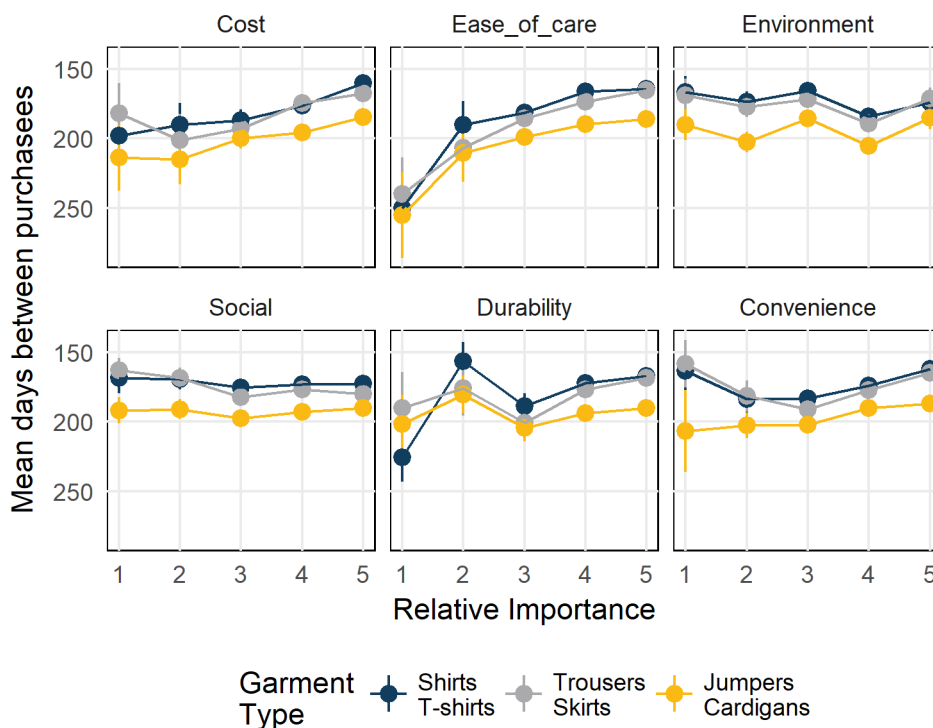


Figure 13. Purchase frequency, displayed as mean number of days wear before replacement, by relative importance of personal priorities. Note the y-scale is reversed to better illustrate purchase frequency.

Are uniforms used by multiple children?

Thus far our analysis of purchase frequency does not take account of items being passed on to siblings or friends, or made available for second-hand use via charity shop or other means. We asked parents to estimate the 'achievable lifespan' of garments, i.e. if their child had not outgrown the item or subsequent users were available, how long did they think it could be worn.

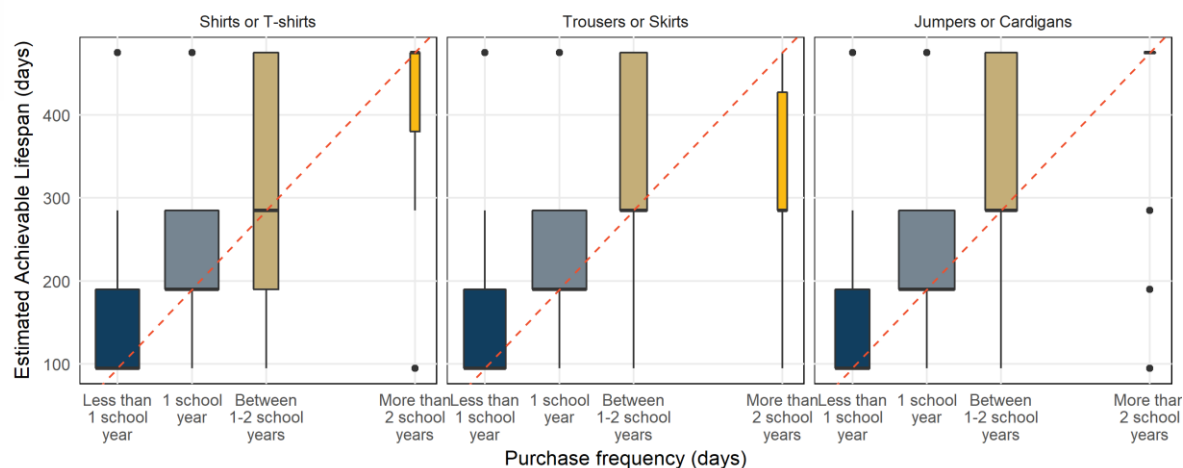


Figure 14. Boxplots showing the achievable lifespan (i.e. assuming the garment could be worn by multiple children) grouped by purchase frequency. The box width represents the number of respondents within the category (i.e. narrow bar indicates a small sample size) and the dashed line represents the 1:1 line.

The median estimate of achievable lifespan closely followed a 1:1 line with purchase frequency (Figure 14). However, the data was heavily skewed so the mean achievable lifespans within the 'Shirts/T-shirts', 'Trousers/Shirts', and 'Jumpers/Cardigans' categories were 29 wear-days, 43 wear-days and 44 wear-days longer than the reported purchase frequencies, respectively. This represents an additional ~6 weeks for shirts and t-shirts and an additional ~9 weeks for trousers, skirts, jumpers and cardigans (NB the average term length is 10-14 weeks).

The data we collected does not allow an accurate estimate of the percentage of uniform items that are worn by multiple children. However, based on the number of respondents who either exclusively used second hand means to acquire uniforms, or exclusively disposed of items via a reuse pathway, we can estimate that *at least* 57% of school uniforms are passed through multiple children. This is likely to vary according to garment type for example t-shirts and shirts may be less likely to be reused than trousers or skirts, therefore our estimate is likely an underestimation of the true multiple use frequency.

Are respondents choosing keywords and marketing terms that reflect their conscious priorities?

Looking specifically at those keywords or marketing terms that are often associated with stain resistance, we found clear trends linking the marketing terms 'stain resistant' and 'stay white' and similarly the brand names 'Teflon™' and 'EcoElite' (Figure 15). This suggests that respondents either see little difference in the terms 'stain resistant' and 'stay white' or value them equally. We can also conclude that the promise of a function i.e. a marketing term, is more important to respondents than any specific brand of treatment. The term 'Teflon™' was generally more important than 'Eco-Elite' (a PFAS-free formulation produced under the Teflon™ brand), likely as a result of brand recognition. The only time EcoElite becomes more important than Teflon™ is where Environment or Social priorities are seen as very important by the respondent and in these the difference is non-significant.

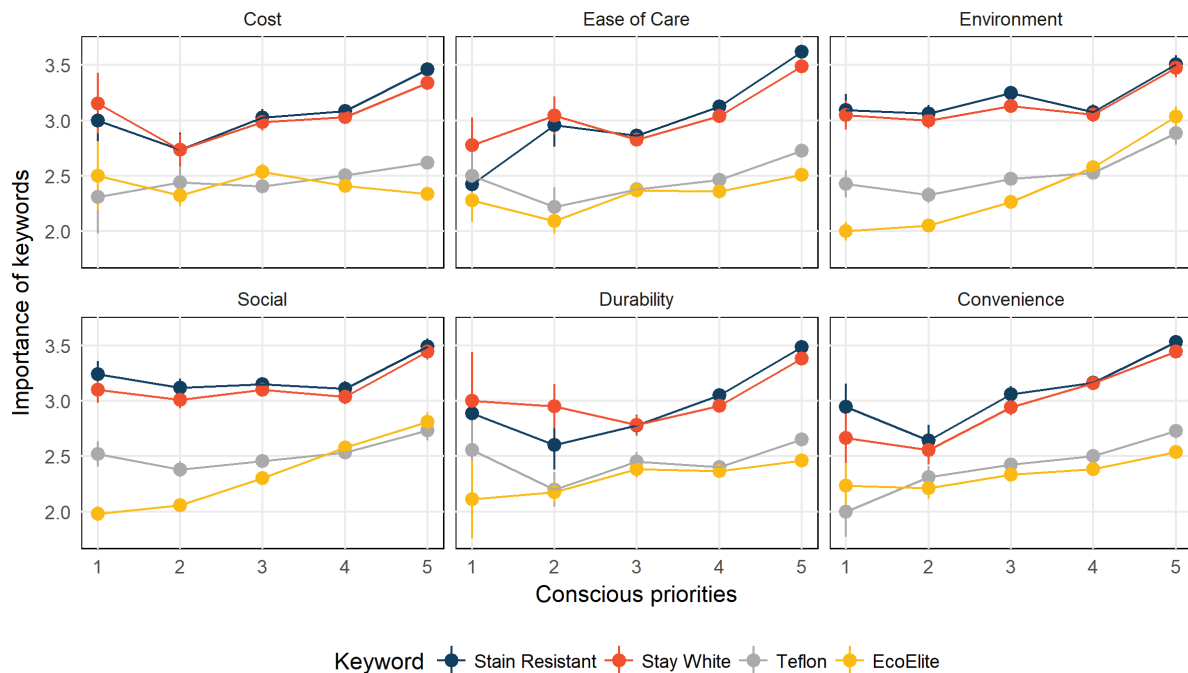


Figure 15. Graphs showing how people with different conscious priorities value keywords associated with stain resistance.

Significant trends towards increasing importance of the keywords 'stain resistant', 'stay white' and 'Teflon™' were seen across all the purchasing priorities we asked respondents to rate. Similarly, 'EcoElite' showed a significant increasing trend in all except 'Cost'.

Environment, closely followed by social responsibility, was the lowest ranked priority when purchasing school uniforms (Figure 16). When we look specifically at how people value keywords related to how important they see the environment we find increasing trends across all keywords. This is likely a bias in how particular respondents rate variables rather than an indication of specific trends,

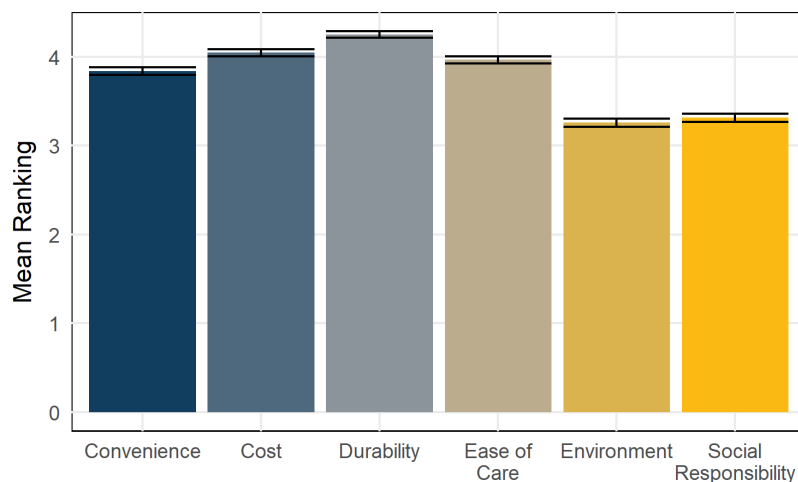


Figure 9. Ranked importance of priorities when purchasing school uniforms.

i.e. some people are more likely to answer all rated questions lower, whilst others may have a preference to scale everything amongst the higher values. What we can usefully interpret is the strength in the correlations. Stain resistance is seen to be of high value to all respondents and therefore shows little pattern related to environmental attitude. The strongest correlations are seen between the keywords 'organic', 'natural fibre', 'fairtrade' and 'EcoElite'. This indicates that these are the terms associated with environmental sustainability whereas the other keywords are seen to have little significance to the environment. This suggests the presence of chemical treatments on textiles is not clearly linked to environmental issues for consumers compared to other issues.

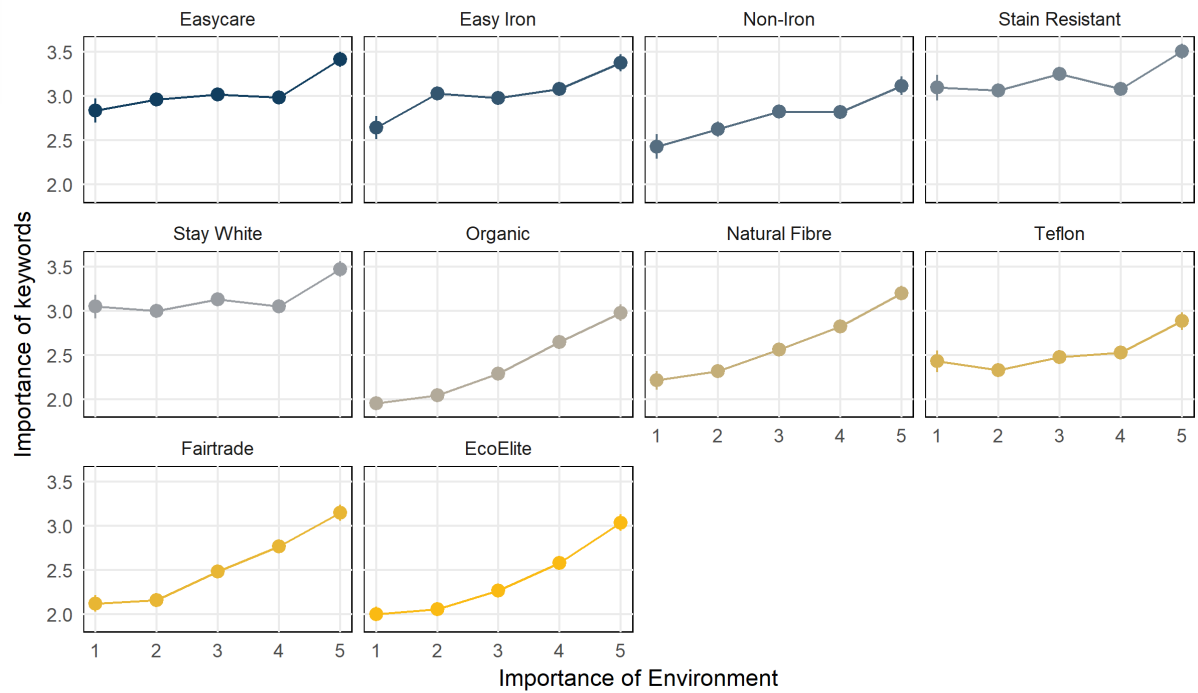


Figure 17. Graphs showing how perceived importance of environmental principles relates to preferences towards keywords

Conclusions

This report was carried out to assess the environmental benefit gained from easy-care textiles finishes, with a particular interest in stain resistance often achieved using per- or poly-fluorinated substances (PFASs).

We found that 95% of respondents purchased at least some uniform items new with 71% buying exclusively new. At least 57% of uniform items are worn by more than one child with respondents estimating that shirts and t-shirts could be worn for an additional 6 weeks beyond their current purchase frequency, and trousers, skirts, jumpers and cardigans approximately 9 weeks beyond purchase frequency. This highlights that turnover rate in the school uniform category is linked to either children outgrowing clothes or habitual behaviour rather than substandard garment quality.

The majority of respondents reported washing shirts and t-shirts 2-3 times per week with trousers, skirts, jumpers and cardigans washed weekly. We found that a preference for 'stain resistant' and 'stay white' finishes correlated with an increase in wash frequency ($P < 0.05$) throwing doubt on the claim that stain resistant finishes lead to environmental gains through decreased washing.

Additionally, we saw no correlation between how respondents valued the environment and the frequency with which they washed their clothes.

On average, shirts and t-shirts were replaced after approximately 173 days of wear (90% of a school year), trousers and skirts 177 days and jumpers and cardigans 193 days. With an average 190 days per school year, this suggests that habitual behaviour, i.e. replacing yearly, is more important than assessed need. We found positive correlations between replacement frequency and keywords 'easycare', 'easy iron', 'stain resistant', 'stay white' and 'Teflon™'. This goes against the assertion that stain resistant finishes provide environmental benefits through decreased consumption. Whilst garments may have the potential to last longer when finishes are applied, this is not reflected in consumer behaviour and therefore they cannot be shown to provide real-world benefits. As with wash frequency, we saw no link between how a respondent valued the environment and how often they replaced school uniform items, suggesting the impact of textile manufacturing on the environment is not widely known or considered.

We found that 'Environment', closely followed by 'Social Responsibility', was the lowest priority to consumers when purchasing school uniforms. Stain resistance was seen as an important keyword across all respondents regardless of their attitude towards the environment. Whilst it is unsurprising that cost and durability are seen to be of higher importance, the stark difference does suggest a lack of engagement among the public in relation to textiles impacts on the environment, here in the case of schoolwear. This might be due to a lack of awareness among the public of the magnitude of the impact the textile industry has on the environment, or due to a lack of ability to engage, relating to competing priorities or lack of knowledge of suitable alternatives. Future work could be to examine ways to inform and engage with consumers on these issues and find ways to correlate existing priorities with environmental decisions (for example, washing clothes less often is both economical and environmentally friendly).

Key Findings and Recommendations

The key findings relating to our research aims are listed below.

1. We found no reduction in wash frequency associated with stain resistant finishes. We found that a preference for stain resistance correlated with an increase in wash frequency highlighting the importance of behavioural traits above assessed wash need.

2. We found no reduction in purchase frequency associated with stain resistant finishes. Again, our analysis indicates that those respondents with a preference for stain resistant finishes replaced garments more frequently.
3. We found no correlation between how consumers valued the environment and they valued stain resistance. Those who highly value the environment were equally likely to purchase stain-resistant uniforms.

Recommendations linked to the above findings are as follows:

5. Include behaviour in full life-cycle analyses to fully assess the environmental impact of stain resistant finishes.
6. Give consumers the opportunity to find out about stain resistant finishes and their environmental impacts to enable people to make purchasing decisions that match their priorities.
7. Develop ways for consumers to explore and engage with the issue, e.g. highlight links between environmentally friendly options and other benefits, such as reduced cost and convenience.
8. Encourage consumers to assess the need for washing and replacement on an individual item by item basis rather than falling into habitual behaviour patterns. Where finishes are applied this will encourage the potential environmental trade-offs to be realised.

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Appendices

Appendix 1: Full survey questionnaire



Survey.pdf

¹ Agency USEP. 2018 26/04/2018. Per- and Polyfluoroalkyl Substances (PFAS). <<https://www.epa.gov/pfas>>. Accessed 2018 26/04/2018.