The Influence Of Behaviour Centred Design Approaches On The Flame-Based Cookstove-Related Health And Wellbeing Of Indigent South African Households

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ABSTRACT

The adoption of energy-efficient, clean and safe cookstoves can significantly enhance the health and quality of life of poverty-stricken sub-Saharan households, reducing mortality and poverty and positively impacting the protection of biodiversity and the climate identified in the United Nations Sustainable Development Goals (SDGs). The harmful emissions from inefficient flame-based cookstoves are the leading global cause of disease and death, after only inadequate water, poor sanitation and malnutrition. Multiple stakeholders are implementing programmes to promote access to improved stoves and clean fuels, with the Global Alliance for Clean Cookstoves (GACC) being prominent in dissemination efforts. However, few interventions have borne fruit on a significant scale over time, despite ample support in finding workable solutions. A sustainable transformation in household cookstove-related practices across diverse conditions requires innovative transdisciplinary approaches. The behavioural sciences suggest possible approaches for addressing the complex, interrelated, social, economic and environmental challenges facing communities in sub-Saharan Africa (SSA). Behaviour-focussed design interventions exhibit the possibility of transcending disciplinary boundaries. This paper explores the ability of a Behaviour Centred Design (BCD) approach to change cookstove-related behavioural motivations in a South African context. A series of motivational touchpoints are developed and tested in two representative South African sample areas on a pilot scale. The preliminary results suggest that a BCD approach targeting a set of mapped touchpoints can significantly change the pertinent behavioural motivations related to flame-based cookstoves, responding to a vital evidence gap in efforts to shift inefficient cookstove-related behaviour in a South African low-income context.

Keywords: Behavioural Sciences, Behaviour Centred Design, Improved Cookstoves, UN Sustainable Development Goals

INTRODUCTION (2 PAGES)

Household air pollution (HAP), in large part due to the use of inefficient cookstoves, is the third most significant global cause of morbidity and mortality, primarily affecting women and children (Who, 2014). In addition each year, over 300 000 people succumb to severe burn injuries in large part attributed to inefficient flame-based household appliances (Mock et al., 2008). The majority of interventions focus on disseminating improved cookstoves and fuels, improved ventilation in the household environment and changes in cookstove-related behaviour (Puzzolo et al., 2013; Golden et al., 2015). Despite broad support, only a limited

number of interventions have shown success, at scale, over the long term (Hanna et al., 2012). South Africa has followed the same trajectory (Kimemia & Van Niekerk, 2017). Cooking with traditional solid biomass and liquid paraffin persists among impoverished South African households (Kimemia & Van Niekerk, 2017). In addition to an estimated 2 500 deaths in South Africa in 2008 attributed to HAP (Barnes et al., 2009); burns, scalds and poisonings have since become a public health priority (Kimemia & Van Niekerk, 2017). South Africa records 1.6 million burn victims per year, of which 3200 require medical attention (Allorto et al., 2018). A significant proportion are directly linked to the explosions of poorly designed and manufactured paraffin devices (Kimemia et al., 2014). In South Africa, the large-scale electrification rollout, introduction of regulatory standards and provision of fuel subsidies has had a limited influence on the use of unimproved cookstoves (Makonese & Bradnum, 2018; Kimemia & Annegarn, 2012).

Over the past five years, the UNDP, UNICEF, UN Women and UNITAR, in partnership with related agencies, have embarked on probing the efficacy of designing behavioural approaches to achieve increased adoption of new cooking appliances (Lambe & Senyagwa, 2015; Dieye, 2018; Goodwin et al., 2014; Rhodes et al., 2014; Niedderer et al., 2016; Lambe et al., 2018). The hybrid Behaviour Centered Design (BCD) approach (Aunger & Curtis, 2016) under consideration, is attributed to notable successes in campaigns ranging from handwashing to oral rehydration, food hygiene, child and maternal nutrition achieved in low-income contexts spanning India, Zambia, Nepal and Indonesia (Greenland et al., 2016; Rajaraman et al., 2014; Biran et al., 2014). Key to the iterative phase-based BCD approach is the careful development, implementation and assessment of surprising touchpoints to spark revaluation of the pertinent behavioural motivations leading to the repeated performance of a behavioural goal by the targeted segment of the population (White et al., 2016; Gautam et al., 2017; Greenland et al., 2016; Rajaraman et al., 2014; Burns et al., 2018; Tidwell et al., 2019; Wood & Neal, 2007; Aunger & Curtis, 2015a).

MAIN RESEARCH OBJECTIVES

This paper investigates the role motivational touchpoints could play in facilitating a shift in the South African flame-based cookstove-related behaviour as part of a behaviour centred design (BCD) intervention campaign. The main objectives in this paper are to describe the targeted population base affected by unimproved flame-based cookstoves in South Africa; provide a brief overview of the South African cookstove-related behavioural context, propose possible behavioural motivations related to flame-based cookstove use, and conduct a case-study-based mapping and assessment of a set of selected touchpoints in revaluing motivations linked to selected flame-based cooking appliances among a representative sample of South African households.

LIMITATIONS OF RESEARCH

The scope of the research is limited to the field of BCD, specifically the aspects related to motivational touchpoints required for a successful improved cookstove dissemination campaign, applicable to South African households living in poverty. The development of a full BCD intervention strategy and its implementation is outside the scope of the paper. Detailed technical aspects of the relevant cooking appliances and the investigation of the larger socio-cultural, socio-technical and socio-economic environment are excluded. While present in South Africa, coal-fired combustion stoves are excluded because of their localised use – the study is targeted at results that can be generalised to other low- and middle-income regions in

sub-Saharan Africa. While this study was limited to a relatively small sample size in two geographic regions, the regions were chosen to gain a generalisable result for other contexts.

BACKGROUND AND LITERATURE

The integration of behavioural motivations in a BCD intervention campaign relies heavily on the concept of touchpoints drawn from the field of service design (Lockwood, 2009; Zomerdijk & Voss, 2009; Aunger & Curtis, 2016). The mapping of touchpoints to the relevant behavioural motivations serves to guide the exposure the identification of the representative segment of the target population in an intervention campaign (Lockwood, 2009; Aunger & Curtis, 2015a), and generate a marked surprising response at the point of interaction during an intervention campaign (Clatworthy, 2011). The exposure to the touchpoints facilitates the revaluation of the pertinent underlying behavioural motivations, leading to the performance of a specific behavioural goal (Stein & Ramaseshan, 2015; Ziliani & Ieva, 2018; Moggridge & Atkinson, 2007). The behavioural motivations for the cooks to shift from using unimproved flame-based stoves to clean and efficient advanced stoves are influenced by the demographic factors of the targeted population base; and the availability and affordability of appropriate improved cooking stove and fuel combinations (Holdren et al., 2000; Maré & Annegarn, 2017) and the behavioural motivations for cooking with flame-based cookstoves (Maré & Annegarn, 2014).

SOUTH AFRICAN TARGETED POPULATION BASE

The use of inefficient flame-based cookstoves is prevalent among black South African households living in the bottom four SEM bands representative of South Africans living in poverty (World Bank, 2014; Kimemia & Annegarn, 2016). The lower SEM groups are still racially skewed in representation, with ninety-eight percent of people in *SEM1* black African (Stats SA, 2012).

The targeted population base can be further categorised in the lower threshold living in poverty (*SEM1* - *SEM2*) and households beginning to emerge from poverty (*SEM3* and *SEM4*) (BRC, 2017). Households living in *SEM1* and *SEM2* are predominantly dependent on fuelwood as a fuel source (Stats SA, 2012); living in informal shacks, small state-provided cement-brick houses and traditional dwellings (SAARF, 2014; BRC, 2017). A significant number of households own electric hob stoves. Paraffin as a fuel source is reported in both segments (Stats, 2015; BRC, 2017). *SEM3* and *SEM4* households have some high school background and are prevalent in both urban and rural areas (BRC, 2017). Urban households reside in small state-provided cement-brick dwellings and small houses; rural residents live in traditional dwellings (BRC, 2017). *SEM4* households tend to own a title deed to the house they live in and can take out credit for purchases such as larger stoves and furniture. Ownership of electric hob stoves is high, with the emergence of four hob electric stoves (BRC, 2017).

COOKSTOVE-RELATED CONTEXT IN SOUTH AFRICA

The cookstove-related behaviour of low-income electrified and unelectrified households do not differ significantly, with hoarding of cookstoves and fuels prevalent (van der Kroon et al., 2013). Impoverished South Africans still cook and heat with flame-based appliances. The failure of a shift to electric cooking is attributed to the low power output, unreliability of the supply, growing number of illegal makeshift electrical connections, fear of electrocution, dramatic increases in the relative cost of electricity, and precarious levels of household income. Increases in flame-based cookstove use have been reported in several areas (Tait, 2015; Tait,

2017; Lusinga & de Groot, 2019). The flame-based appliances include stoves using paraffin, LPG and biomass. Although coal-fired stoves are typical on a localised basis near South African coalfields, they were excluded from this study.

Paraffin Cookstoves

Flame-based cooking is still characterised by the prominent use of paraffin-based cooking stoves (Lloyd, 2014). The escalating cost of electricity in recent years has also led to an increase in the use of paraffin for cooking (Tait et al., 2012; Buthelezi et al., 2019). The introduction of unpressurised methanol stoves have recently been introduced as an improved alternative.

Biomass Cookstoves

The use of biomass cookstove appliances in South Africa is still common in rural and urban settings (Matsika et al., 2013; Makonese & Bradnum, 2018). The most common urban low-cost cooking appliance is the inefficient 'imbaula' stove, a basic self-constructed stove linked to severe respiratory problems. A wide variety of improved biomass stoves have been introduced over the years without success (De Chastonay et al., 2012).

Liquefied petroleum gas (LPG) Cookstoves

The use of LPG among South Africa's low-income households remains low, standing out globally among similar emerging countries (Kojima et al., 2011). Price controls and subsidies have been introduced in response (Buthelezi et al., 2019). A variety of LPG stoves are available in many stores with negligible focus on low-income households in either urban or rural low-income areas. An exception is KayaGAS which distributes LPG gas, stoves and cylinders in low-income settlements on a localised basis (Tatham, 2013).

COOKSTOVE-RELATED MOTIVATIONS

The mapping of touchpoints requires an understanding of the local cookstove-related motivations in South Africa. Cooking over a wood-fuelled fire remains prevalent in both urban and rural environments, and substantial meals prepared for the extended family with large pots on weekends and special events (i.e., funerals and weddings). Households regard the role of wood in their culinary routines very differently – and it does not appear to carry the same connotations of poverty – with open fires being used alongside electric stoves (Balmer, 2007; Madubansi & Shackleton, 2007; Matsika et al., 2013). Cooking over an open fire in rural areas is usually done outside or in a separate traditional kitchen area (Madubansi & Shackleton, 2007; Maré, 2013; Matsika et al., 2013).

Unique to the mapping of touchpoints in a BCD approach is the incorporation of the distinct biophysical and psychological mechanisms motivating nearly all facets of human behaviour (Aunger & Curtis, 2008; Aunger & Curtis, 2013; Aunger & Curtis, 2015b; Kenrick et al., 2010). Aunger and Curtis (2008) categorises motivations in the following manner. The biophysical motivations are satisfied by absorbing physical resources in our immediate environment into our bodies (e.g., food for hunger and heat for comfort) or avoiding resources that may be harmful to our bodies (e.g., the disgust associated with rotting food or fear of fire) (Aunger & Curtis, 2008). The emotional motivations are influenced by the local physical and social context we live in (i.e. affiliation, nurture, attraction, status and justice). The touchpoints linked to motivations for learning refer to the motivations linked to the brain satisfied by curiosity and play. Drawing on reviewed literature the behavioural motivation under

consideration for linking with prospective touchpoints in a cookstove-related dissemination campaign are tabulated Table 1 below:

Table 1: Possible behavioural motivations linked to flame-based cookstove-related behaviour

Motive	Description of Behavioural Motivation
Lust	An image of a woman or man, with the women stating: "I will find a better husband/partner."
Hunger	*Food is primarily cooked as a source of biophysical sustenance and consumed for energy and strength rather than as a luxury (Maré & Annegarn, 2017). The precarious income levels are directly linked to the levels of hunger (Maré & Annegarn, 2017). Intentional exposure to aromas is frequently targeted in triggering hunger for food items sold among impoverished segments of the population (Ramaekers et al., 2014).*
Comfort	*The comfort derived from a warm and dry space provided by an improved flame-based appliance appears a critical motivation linked to the use of paraffin-fuelled appliances or self-constructed imbaula stoves (Makonese et al., 2016).*
Fear	*The fear motivations could be linked to the fear of injury to the body from gas and paraffin stove explosions or fires; the threats of death associated with carbon monoxide poisoning or the threats of death of children from paraffin ingestion (Barnes et al., 2009).*
Disgust	*Disgust motivations could be linked to the taste of food cooked over paraffin. Disgust is reported attributed to the pungent smell of paraffin or smoke associated with dirty home and clothes permeated with the odours of smoke and paraffin is South African households (Lloyd, 2014).*
Nurture	*The maternal nurture motive is linked to the hazards of unimproved flame-based stoves (Harold et al., 2013). The motives of caring and protecting children could be targeted as the women cook nurture and care for their children predominantly in close proximity to where the meals were being prepared, due to the cramped living conditions (Lusinga & de Groot, 2019).*
Hoard	*The precarious levels of poverty lead to a hoarding of options between the many competing household decisions (Masera et al., 2015); as observed is the activity of stacking of multiple cookstove types and fuels as a hedging measure (Maré & Annegarn, 2017; van der Kroon et al., 2014). The effects of resource scarcity are strongly linked to hoarding motivations.*
Create	*Motivations to create are observed in the wide variety of pathways and recipes observed in preparing meals under severe constraints. Motivations to create are often sparked by the material, social and economic constraints. The creativity of cooks through a multitude of iterations in the preparation of meals is confirmed in the literature (Modi, 2009; Bikombo, 2014). An example are the adaptations in preparing steam bread in an urban environment diverging from its traditional origins in South Africa (Paxie W. Chirwa et al., 2010).*

Affiliation	*Motivations for affiliation to build trust and strengthen social cohesion are frequently observed through the cooperation with others by sharing food or cooking together in social settings (Viljoen & Others, 2010; Maré & Annegarn, 2014; Rhodes et al., 2014). The positive motivations gained from cooking together with family and friends can provide motivations to maintain social relationships, form new alliances or conform to the established norm (Kar & Zerriffi, 2018; Minkow, 2016; Rebitski et al., 2019).*
Status	*Th motivations of status with an improved stove could be linked to the perception of a higher standard of living (Lloyd, 2014; Ravindra et al., 2021; Khadilkar et al., 2015). A durable, well-constructed appliance with a brand reputation for quality will take pride in the home, with the user taking great care to maintain it (Jayawickramarathna et al., 2018; Oodith & Parumasur, 2017). The importance of the status motive is furthermore observed and confirmed by the perceptions of low status associated with the odours emanating from poorly constructed wood and paraffin stoves (Maré & Annegarn, 2017; Lloyd, 2014).*
Justice	*The justice motivation is frequently ill-advisedly targeted by regulatory means. The preponderance of illegal electric connections and unsafe paraffin stoves continue despite regulations and standards in place (Kimemia & Van Niekerk, 2017).*
Curiosity	*Motivations for learning through curiosity could be linked to cooking luxurious foods with a novel improved stove accentuating dramatic savings in time and money compared to an unimproved stove as cookstove marketing practice in India indicates (Beltramo et al., 2015; Perry et al., 2000).*
Play	*The role of motivations of play in cooking are well established (Altarriba Bertran et al., 2019; Larsen & Österlund-Pötzsch, 2012). The play motive can be linked to the learning of embodied skills and knowledge in using an improved flame-based appliance in simulated activities demonstrating the dangers of stoves without the risks of injury (Nuwarinda, 2010).*

RESEARCH METHODOLOGY

The case study based mapping of motivational touchpoints for an intervention campaign is facilitated by a co-creative workshop method facilitating a series of collaborative activities as suggested by Mor, Warburton and Winters (, 2012); and Kwon (, 2010), conducted by a representative group of participants in partnership with BREADrev a local behaviour change agency. To assess the fidelity of exposure to the selected motivational touchpoints in achieving a revaluation of motivations, a stated preference study incorporating a card-based Choice Experiment (CE) is administered before and after a pilot implementation of selected aspects of the campaign concept in two sample areas representative of households in the four lower *SEM* bands of South Africa.

INTERVENTION MAPPING METHOD

An intervention mapping method is employed by the researcher to synthesise the collected qualitative data emerging from workshop-based observations confirmed by semi-structured interviews elicited from workshop participants. The workshop sessions encouraged an informal, comfortable atmosphere between the community residents, baking staff and the workshop facilitators.

Figure 1: Workshop participants baking scones with an improved rocket stove

For the first workshop session the facilitator guided the participants through the process of baking a high-hydration dough bread with an improved flame-based oven following the amended BREADrev activities (Figure 1). The procedures of lighting and using an LPG stove and heater are added. The data collected from each workshop session were collated and mapped around a sequential series of touchpoints and corresponding behavioural motivations. The qualitative data analysis consisted of a combination of phenomenological and narrative methods applied to the data collected during the workshop activities.

Figure 2: Low fidelity intervention mapping by workshop participants of key aspects during the baking sequences.

The selected touchpoints are adjusted after each workshop session in consultation with the workshop participants between each workshop session (Figure 2). The causal linkages between the campaign design elements, campaign activities and touchpoints linked to the behavioural motivations guide the mapping process. The touchpoints are formulated by the expected proportional intensity and frequency of interactions during an intervention campaign, balanced against the cost and effectiveness of each interaction. The intervention mapping culminates in a proposed campaign concept and touchpoints linked to corresponding behavioural motivations that could lead to the sustained adoption of improved flame-based cookstoves by the targeted population base.

STATED PREFERENCE METHOD

A card-based stated preference (SP) survey is conducted to assess the changes in behavioural motivations linked to available flame-based stove types targeted by the selected touchpoints included in the intervention campaign strategy piloted in Dunoon and Mamelodi. The first pilot implementation is conducted by the researcher from the 24th of August to the 12th of September 2017 in the representative sample area of Mamelodi, Gauteng Figure 3. The second intervention campaign implementation is conducted by the behaviour change agency BREADrev from the 12 of August to the 27 of September 2017 in the representative sample area of Dunoon, Western Cape as depicted in Figure 4 and Figure 5.

Figure 3: Demonstration of LPG stove with auto-switch mechanism during the Mamelodi pilot implementation

Figure 4: Demonstration of the improved biomass oven during the Dunoon pilot implementation

Figure 5: Sharing of freshly baked scones with the improved rocket oven during the Dunoon pilot implementation

A visual card-based CE is used to assess the proposed set of motivational touchpoints. The CE consists of choice sets depicting photos of the stove-related attributes under investigation linked to visualisations of each behavioural motivation drawn from the pre-coded list in Table 2.

Table 2: Pre-coded list of questions for each behavioural motivation

Motive	Description	Motive	Description	Motive	Description
Lust	An image of a woman or man, with the women stating: "I will find a better husband/partner."	Attract	A picture of a well-dressed woman saying: "I like looking beautiful after cooking in the home."	Affiliation	An illustration of a woman caregiver typical of the neighbourhood saying: "You showed you are one of us, well done!"
Hunger	An illustration of a woman saying: "I never want to go hungry again."	Love	An illustration of a young child saying: "I love you for doing that!"	Status	A respected elder says: "Everyone in the community will admire you for doing that!"
Comfort	A woman appearing comfortable at home, stating: "I like being warm and comfortable when cooking at home."	Nurture	A confident mother says to him/herself: "Now my child will be safe!"	Justice	An illustration of a male or female elder saying: "That was the right thing to do, well done!"
Fear	An image of a woman stating: "I am safe from accidents and dangers."	Hoard	A depiction of a woman in a well-stocked home saying: "I will never need anything for cooking a meal."	Curiosity	An illustration of a woman saying: "I like being well informed about what is going on in my community."
Disgust	An illustration of a woman elder pulling her face and thinking to herself: "The smell is disgusting; you did well!"	Create	An illustration of a woman saying herself: "I've made the household better now; I did well!"	Play	A woman saying to herself: "I really learned a new way of doing things, I did well!"

The main flame-based cookstove features available in a South African setting were used in the design of the CE sets, presented to respondents as card-based question sets. The use of multiple questions, with different combinations of attributes, is used, due to the variety and number of questions can be asked, thereby generating more than one sample from each respondent. The

image-based cards are selected to allow the visualisation of the various choices and avoid potential confusion and fatigue from an overload of similar questions. The stove types referenced in each of the card-based choice sets include the biomass, LPG and paraffin powered cooking devices as depicted in Figure 6.

Figure 6: Sample card representing a pre-coded list of behavioural motivations targeted by the selected motivational touchpoints

Data Collection

The data collection commenced with the administration of the baseline survey in each study area, followed by the pilot intervention campaign, first in Mamelodi followed by Dunoon. The endline survey is administered six months after the pilot the intervention campaigns again in each study area. Both baseline and endline surveys are administered on a door-to-door basis among the four sample groups of respondents administered first in Mamelodi, followed by Dunoon. Given the low literacy rates, the field workers administered the survey verbally to respondents following the same format in all sample groups at baseline and endline. Each motivation is presented as a short narrated informed by the statements listed in Table 2; and asked which stove option best matches the narrated motivation Respondents chose between options each with stated attributes, using question card sets to determine the preference between various combinations of cookstove features linked to behavioural motivations targeted by the selected touchpoints integrated in the intervention campaign. After presenting each card to the respondents, each individual illustrated motivation depicted in the card sets is verbally described to the respondents. The responses were recorded, with the chosen cards marked and filed with each consent form. The survey in each sample area concludes with questions to assess the respondents' survey experience.

Data Analysis

The stated preference results of the two groups of endline respondents (i.e. those respondents in the study areas exposed to the intervention campaign and those who were not) are separated and compared. The resulting data are visually displayed with spider chart method as suggested by (Atanassova & Angelova, 2021). The data is separated by stove type, with the stove type being the dependent variable and the behavioural motivation levels plotted against it. The range of motivations provides a measure of sensitivity for each given stove attribute. The data were entered and analysed in a statistical model running in Excel software.

RESULTS

The results of the development and assessment of selected aspects of a BCD approach is presented below.

TOUCHPOINT MAPPING RESULTS

The mapping facilitated by the workshop-based activities suggests the following set of touchpoints, matching relevant behavioural motivations incorporated in an amended campaign concept tabulated in Figure 7.

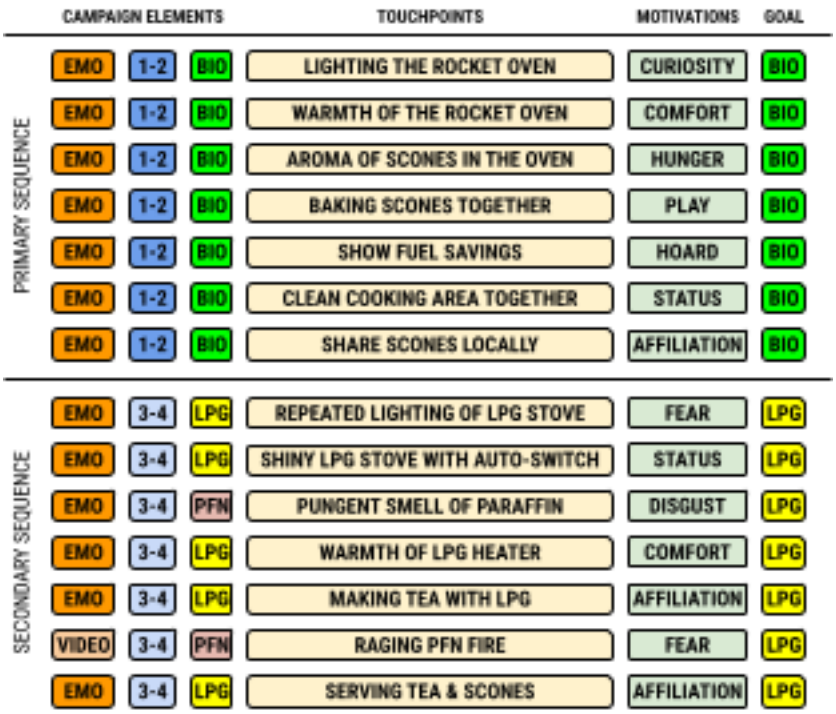

Figure 7: Mapping of Proposed Touchpoints linked to corresponding behavioural motivations for the primary and secondary campaign sequence

The campaign concept consists of two sequences demonstrating selected improved flame-based appliances with the two bands representative of the target population in a local physical setting, facilitated by trained local change agents drawn from the local community. The primary campaign sequence aimed at triggering increased adoption of improved biomass stove (similar to the Stovetec Ecozoom) among South Africans living in the SEM1 and SEM2 category consists of demonstrations of baking scones with an improved biomass oven. The secondary campaign sequence of aimed at triggering increased adoption of LPG double hob stoves (similar to the KayaGAS offering) among South Africans living in the SEM3 and SEM4 category is facilitated by the serving snacks and tea boiled with an LPG stove.

Primary Sequence: Baking Scones with an Improved Biomass Oven

The first touchpoint focussed on demonstrating the ignition of a novel improved flame-based oven with a chimney linked to motivations of curiosity. A touchpoint of the warmth emanating from the flame-based oven linked to the motivations of comfort is included. The aroma of freshly baked goods emerging from the oven is selected as the third touchpoint, targeting the motivation of hunger. The touchpoint to facilitate motivations for playfulness. A key touchpoint is proposed to be the baking luxurious items with the participants in a controlled

sequence with the improved biomass oven without the risks of injury targeting motivations for play. A touchpoint showing physically how much wood is saved to address motivations to hoard. A touchpoint linking the use of a clean stove and cooking area to status motivations of being seen as a good housekeeper among their peers is suggested. A touchpoint of sharing the baked or cooked items emanating from the demonstration in the local setting is suggested targeting motivations for social affiliation.

Secondary Sequence: Luxuries & Tea with an LPG Stove

For the second campaign sequence, a touchpoint of a physical repeated lighting of a LPG appliance by participants to dispel motivations of fear associated with LPG stoves is included. The mapping furthermore proposes a touchpoint of using a high-quality LPG device with an auto-switch mechanism linked to the motivations of status. The pungent odour emanating from the brief lighting of a paraffin stove is suggested as touchpoint linked to motivations of disgust. A touchpoint targeting warmth of the LPG powered heater is suggested as motivation for comfort if the weather is cold enough at the time of demonstration. The key touchpoint of boiling water for tea with an LPG stove by participants together to facilitate motivations of affiliation by demonstrating the speed and ease in using an LPG stove. The touchpoint of experiencing the uncontrolled destructive force of a fire caused by a paraffin stove linked to motivations of fear and disgust is suggested, facilitated by a video of a shack burning down viewed on a mobile phone during the sequence. Finally a touchpoint serving snacks with tea is suggested to conclude the sequence with to facilitate the exchange personal pleasantries, establish an open atmosphere conducive for building trust and linked to motivations for social affiliation and dissemination of changes in behavioural routines related to LPG stoves in the community.

STATED PREFERENCE RESULTS

The stated preference results of the exposed and unexposed samples for the Mamelodi and Dunoon intervention indicated clear changes in touchpoint-linked behavioural motivations after exposure in the intervention campaign as indicated in the tabulated results (Figure 8).

Figure 8: Changes in Cookstove-Related Motivations for the Two Sample Areas

Stove Type	Area	Sample	Hunger	Comfort	Fear	Disgust	Nurture	Hoarding	Create	Affiliation	Status	Justice	Curiosity	Play
LPG	Mamelodi	baseline	34% (15)	31% (16)	45% (14)	5% (23)	34% (19)	48% (17)	32% (17)	38% (15)	35% (12)	42% (15)	34% (16)	30% (17)
		endline	35% (19)	36% (10)	24% (11)	3% (15)	30% (19)	47% (16)	34% (19)	38% (19)	45% (15)	40% (19)	35% (18)	32% (14)
	Dunoon	baseline	23% (15)	12% (11)	45% (14)	22% (18)	33% (20)	23% (19)	34% (13)	16% (17)	36% (15)	41% (18)	36% (17)	23% (17)
		endline	22% (13)	11% (15)	34% (13)	12% (18)	32% (17)	38% (15)	30% (16)	18% (21)	39% (13)	40% (18)	38% (23)	28.% (12)
Paraffin	Mamelodi	baseline	32% (22)	38% (15)	32% (22)	78% (8)	23% (10)	30% (17)	12% (14)	36% (20)	13% (18)	23% (21)	36% (13)	32% (18)
		endline	31% (22)	34% (15)	45% (16)	83% (16)	16% (19)	31% (19)	16% (13)	38% (17)	11% (16)	22% (19)	32% (15)	33% (11)

	Dunoon	baseline	31% (24)	21% (15)	34% (16)	34% (13)	23% (12)	31% (19)	21% (18)	11% (19)	12% (15)	34% (19)	26% (21)	26% (16)
		endline	8% (23)	12% (19)	51% (18)	76% (14)	31% (16)	12% (17)	12% (23)	3% (16)	8% (22)	31% (17)	12% (14)	16% (20)
Biomass	Mamelodi	baseline	34.% (13)	31.% (19)	23.% (14)	17.% (19)	43.% (21)	22.% (16)	56.% (19)	26% (15)	52% (20)	35.% (14)	30.% (21)	38.% (15)
		endline	34% (9)	30% (25)	31% (23)	14.% (19)	54.% (12)	23% (15)	50.% (18)	24% (14)	44.% (19)	38% (12)	33% (17)	35.% (25)
	Dunoon	baseline	46% (11)	67% (24)	21.% (20)	44% (19)	44.% (18)	46% (12)	45.% (19)	73% (14)	52% (20)	25.% (13)	38% (12)	51% (17)
		endline	70% (14)	77% (16)	15.% (19)	12% (18)	37.% (17)	50% (18)	58.% (11)	79% (13)	53% (15)	29.% (15)	50% (13)	56.% (18)

The results of the stated preference survey administered after both interventions indicate an increase in motivations of fear associated with paraffin stoves in both study areas as targeted by the selected touchpoints (Figure 9).

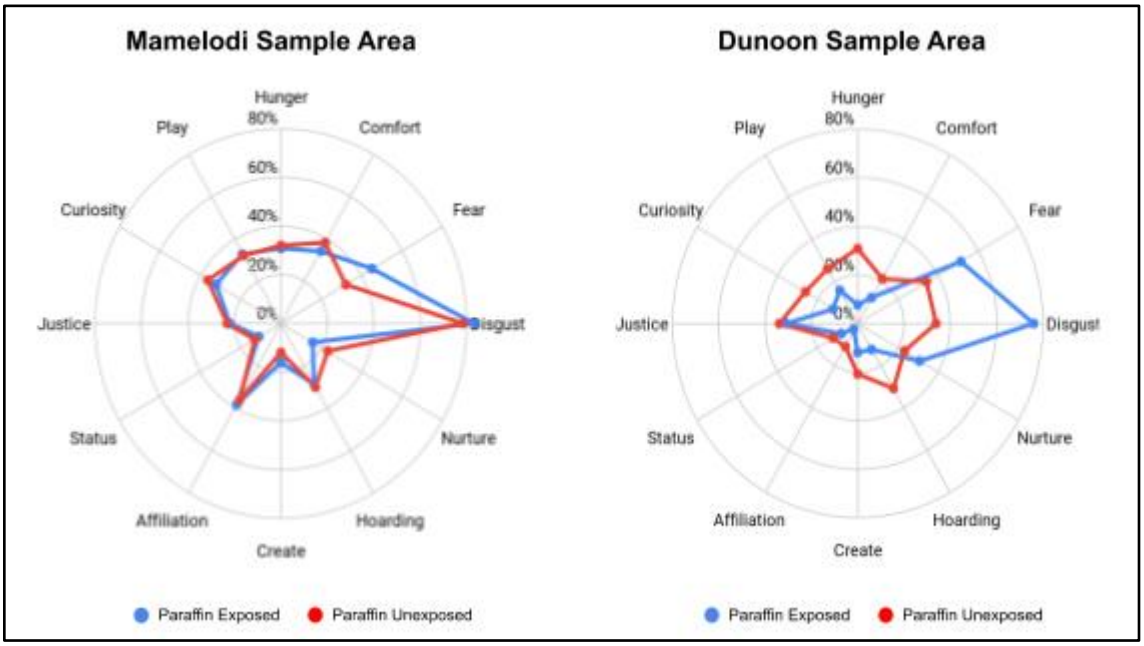

Figure 9: Behavioural Motivations related to Paraffin Stoves

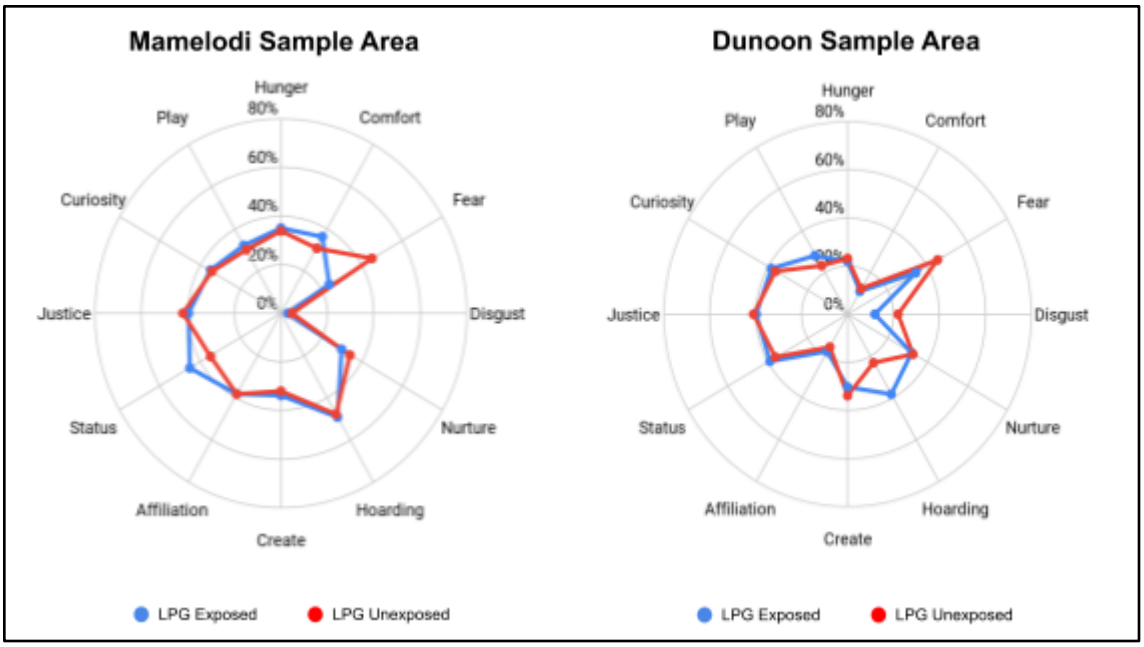

Figure 10: Behavioural Motivations related to LPG Stoves

A significant decrease in motivations of fear was associated with LPG stoves in the Mamelodi sample area, while a modest decrease was reported after the Dunoon intervention. Motivations associated with status showed a small increase associated with biomass stoves (Figure 10).

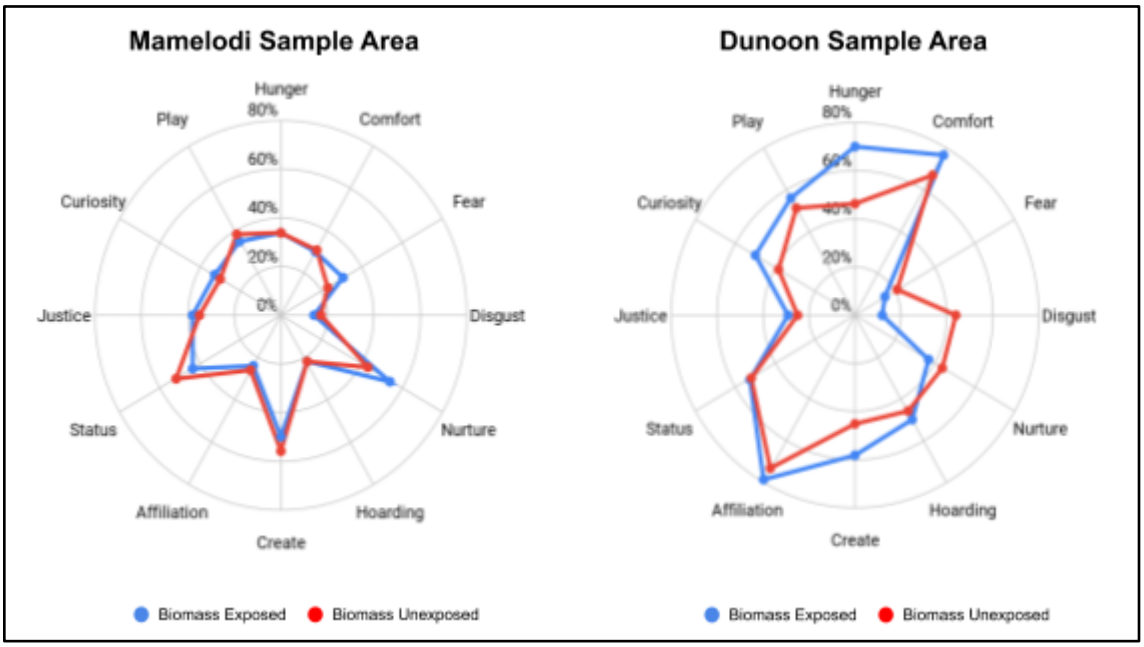

Figure 11: Behavioural Motivations related to Biomass Stoves

No significant change in motivations associated with biomass stoves is reported in the Mamelodi sample area, while the motivations linked to comfort, curiosity and play increased

after the Dunoon intervention. A significant decrease in motivations linked to disgust and a moderate decrease in motivations of fear is furthermore observed for Dunoon (Figure 11).

DISCUSSION & CONCLUSIONS

The results indicate that aspects of a BCD approach, specifically including motivational touchpoints in cookstove-related dissemination campaigns could significantly decrease the use of inefficient and dangerous flame-based paraffin powered appliances. An additional finding indicates that the application of a stated preference methodology could assist in assessing the level of change in the key cookstove-related motivations of South African households in response to behaviour-focussed intervention campaigns. Respondents in both sample areas changed their motivations linked to more efficient options after exposure to the selected motivational touchpoints. The pilot campaign increased the motivations of fear associated with paraffin stoves in both sample areas and decreased motivations of fear associated with LPG stoves.

The findings in this study indicate that the mapping of motivational touchpoints could significantly accelerate the adoption of more efficient cookstove alternatives as verified by the results of stated preference methodology of the changes in cookstove-related motivations of South African households in response to the dissemination campaigns.

Despite the study being limited to two South African sample areas, the sampled households shared the main criteria for using inefficient cookstoves, implying a wider relevance beyond South Africa.

This study may have important implications beyond change in motivations for using clean and efficient cookstoves. BCD based approaches could significantly assist the implementation of cookstove dissemination campaigns, addressing barriers to a change in of cookstove-related behaviour that have impeded the success of previous dissemination efforts in developing countries. The inclusion of touchpoints linked to cookstove-relation motivations in the development of tailored campaigns attuned to local cultural settings faced by low and middle-income households globally. The application of BCD methods and instruments can assist in understanding the motivations of households across sub-Saharan Africa, and can demonstrably ease the success of initiatives aimed at achieving the SDGs.

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