

Insight inTo Stress and POOping on work TIME (ITS POO TIME): an online and cross-sectional study protocol

Phillip Tully, Suzanne Cosh, Gary Wittert, Sean Martin, Andrew Vincent, Antonina Mikocka-Walus, Deborah Turnbull

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Abstract

Background: Long occupational working hours and shift work are common in high, middle, and lower-income economies. Bowel movement frequency and stool form in occupational settings may be important markers of stressful working conditions as well as diurnal gut microbiota action, gastrointestinal discomfort, and disorders of gut-brain interaction (DGBI). Characterizing DGBI in shift and non-shift workers could help identify the impact of diurnal work patterns on worker's physical and mental health, including anxiety related to bowel movements.

Objective: The paper outlines the Insight inTo Stress and POOping on work TIME (ITS POO TIME) protocol describing a web-based multi-methods research project on DGBI, stool form and frequency, psychological factors, sleep, diet and anxiety related to bowel movements in occupational settings by comparison to residential settings.

Methods: Study 1 comprises a web-based convenience sampling survey to acquire quantitative data from adults who are engaged in paid employment. We seek to assess occupational characteristics, organizational factors, as well as standardized questionnaires for stool form, DGBI assessed by Rome-IV criteria, sleep, diet, bowel movement anxiety (i.e. parcopresis), and distress. Study 2 is a qualitative study which asks open-ended questions about respondents' attitudes to defecation at work. Analyses for Study 1 will explore rates of DGBI in shift vs. non-shift workers and explore how occupational characteristics are associated with occupational bowel movement stool form and frequency. With regards to distress, and parcopresis, Study 1 will analyse how parcopresis, distress, and contamination fears are associated with stool form and frequency in occupational settings compared with residential settings. Study 1 is designed to have 90% power to detect a 5% difference in DGBI prevalence between groups at $\alpha = 0.05$ based on the conservative estimate of 15% DGBI prevalence in shift workers and 10% DGBI prevalence in non-shift workers, with a final sample of N=1967 required. Study 2 qualitative data will be analysed using inductive thematic analysis to identify themes concerning feelings and attitudes about bowel movements in occupational settings.

Results: The findings of ITS POO TIME will elicit important information on what factors are associated with bowel movements and stool form and frequency in occupational settings and identify associations pertinent to occupational health. Data collection commenced in January 2019 and finished enrolment in December 2023. Study 1 obtained 1872 responses and fell short of the desired sample size. Study 2 received 337 responses, and the primary results are expected to be published in 2025 and qualitative results published in 2026.

Conclusions: The results of the research described in this research protocol will have direct implications for industry, employers, and policy makers concerning DGBI, stress, and worker health.

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Original Manuscript

Insight inTo Stress and POOPing on work TIME (ITS POO TIME): an online and cross-sectional study protocol

Journal for consideration: *JMIR Protocols*

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Conclusions: The results of the research described in this research protocol will have direct implications for industry, employers, and policy makers concerning DGBI, stress, and worker health.

Keywords: disorders of gut-brain interaction; gastrointestinal disease; irritable bowel syndrome; shift work; anxiety; occupational health; occupational stress; parcopresis; social anxiety disorder; mixed-methods;



Introduction

Extended occupational hours including paid and unpaid overtime as well as shift work during the biological night are an increasingly vital and common component of the labour force in global economies. The number of shift workers alone is estimated at 22 million in the USA [1]. Long work hours and shift work may lead to disrupted circadian rhythms [2], change in hormonal metabolism [3], change in diet [4, 5], and irregular timing of eating [6] as a direct consequence of being exposed to artificial light at night [7, 8]. The influence of diurnal rhythms on gut microbiota [9, 10], patterns of food intake and satiety [11], is being increasingly recognized as important to worker health. Direct health consequences include upregulated inflammatory response and metabolic disease [10, 12], obesity [13], gastrointestinal diseases, and disorders of gut-brain interaction (DGBI) [14]. This research predominantly relates to the latter aspect of gastrointestinal health, specifically, DGBI such as irritable bowel syndrome and related symptoms as they are among the most common health complaints of shift workers [15]. Other DGBI can be categorised as oesophageal (e.g. functional heartburn), gastroduodenal (e.g. functional dyspepsia), bowel (e.g. functional diarrhoea), centrally mediated disorders of GI pain, gallbladder and sphincter of oddi disorders (e.g. functional gallbladder disorder), anorectal disorders (e.g. faecal incontinence), as well as childhood functional GI disorders.

A higher prevalence of GI diseases, DGBI's and related symptoms documented among shift workers than their non-shift worker peers include *Helicobacter pylori* infection [16, 17], duodenal ulcer [18], irritable bowel syndrome [19-21], constipation [22, 23], diarrhea, abdominal bloating, gastro-esophageal reflux, and regurgitation [23]. A high prevalence of GI disease and DGBI is reported in diverse shift work samples such as Iranian petrochemical workers [24], US air traffic controllers [25], German resident physicians [26], Indian restaurant workers [27], Danish fisherman [28], and merchant sailors [29]. High GI disease and DGBI rates among nurse shift workers alone was reported in Brazil [30], South Korea [31], Iran [23], Iceland [32], Poland [33], and Turkey [34]. Collective findings raise the likelihood that shift work, regardless of occupation or location, is associated with DGBI. However, most research to date is merely descriptive of GI symptom correlates in different occupational settings, and despite this, our understanding of putative associations are incompletely understood.

One aspect of GI disease and DGBI risk in shift workers that has not been examined comprehensively is the association between GI symptoms and defecation routines in occupational

settings. Changes in defecation patterns during shift work could be an important marker of diurnal gut microbiota action, GI discomfort, or an early indicator for DGBI [35]. Indeed, shift workers may face high job demands as well as limited access to toilets and toilet breaks in addition to the abovementioned diurnal changes [36]. A parallel body of research in school settings offers insights into the impact of restricting access to toilets and voiding behaviours [37-39]. A survey of 791 school teachers suggested that teachers restricted their fluid intake to limit the number of toilet breaks and this was associated with a higher likelihood of experiencing urinary tract infections [39]. Similarly, school students reported behavioural strategies including limiting food and water intake to mitigate the need to use school toilets [40]. Students have also reported avoiding bowel movements at school due to lack of privacy and perceptions of uncleanness [40-42]. The ratio of toilets to users has also been identified as a factor in toilet use among students and workers, with privacy and uncleanness again cited as reasons for toilet avoidance behaviors [37, 41]. Despite these findings, there is a very limited understanding of whether such avoidances persist into adulthood and whether toilet access impacts worker attitudes and defecation behaviours in occupational settings. To the best of our knowledge, no study has investigated symptoms of DGBI, occupational toilet characteristics, and attitudes to defecation in occupational settings in shift and non-shift workers.

A second aspect of the association between shift work and GI health that remains unclear is the role of psychosocial factors such as stress. Occupational health policies typically focus on biological, chemical, physical and ergonomic factors, paying less attention to psychosocial well-being of their workers [12, 43, 44]. To date, research on the interplay between shift work and GI symptoms has largely neglected psychosocial factors. This approach belies prior reports linking shift work with depression [45-47], suicidal ideation [47], burnout [48], work-place conflict [30], poorer decision making [49, 50], work-place accidents [12], and disruption to life outside work [51]. Similarly, psychosocial factors like stress are implicated in DGBI such as irritable bowel syndrome [52-58]. The collective findings raise the possibility that stress is a contributing factor in the association between shift work and adverse GI symptoms such as those characterising DGBI.

Indeed, the term stress is rather nebulous and therefore it is imperative to further explore different stressors which may include general distress, anxiety, and even voiding-specific stressors. Specifically, diagnostic descriptors of social anxiety disorder refer to “bladder shyness” and difficulties using public bathrooms [59]. More specifically, parcopresis is a term used to describe

anxiety surrounding one's own bowel movements in public restrooms because of overwhelming fear of perceived scrutiny [60]. Given that prior research indicates approximately 85% of students avoid defecating at high school [61], it remains unknown whether such avoidance behaviours and social concerns persist into adulthood and occupational settings. Elucidating defecation avoidance behaviours in adult workers is imperative because such avoidances may have harmful secondary consequences to GI health. Unfortunately, less empirical data exists concerning parcopresis by comparison to social anxiety disorder in general as well as paruresis, i.e. the difficulty or inability to initiate or sustain micturition [62]. Conceptual models of social anxiety applied to parcopresis and paruresis [63] supports the direct contribution to symptom severity from the components of the extended bivalent fear of evaluation model [64]; fear of negative and positive evaluation, concerns of social reprisal (CSR), and dysfunctional attitudes [65]. Parcopresis was also associated with toilet avoidance more commonly than contamination fears (17% vs. 3%) underscoring that social anxiety processes were responsible for toilet avoidance behaviours [66]. Further empirical data on parcopresis could help improve understandings of this condition contextualised against socio-occupational toileting norms. Specifically, it is unclear if parcopresis symptoms are heightened in restrooms utilised by work colleagues where perceived social scrutiny could foreseeably be higher. Most research to date investigates toilet behaviours in public restrooms which are largely utilised by strangers and not work colleagues. To the best of our knowledge, neither social anxiety nor parcopresis have been examined in relation to bowel habits in occupational settings.

The Insight inTo Stress and POOping on work TIME (ITS POO TIME) study's main aim is to comprehensively describe the prevalence of probable DGBI in shift- and non-shift workers, estimate the prevalence of parcopresis in adult workers, and examine the impact and characteristics of residential and occupational bowel movements. A secondary aim is to explore the role of pertinent covariates including sleep, diet, and psychosocial stress while also collecting data on relevant occupational characteristics. A qualitative study aims to identify attitudes to bowel movements in occupational settings.

Methods

Study 1

Recruitment

The quantitative study utilises a cross-sectional survey and convenience sampling design, hosted on the surveymonkey® electronic platform. Participants are recruited via advertising at The University

of Adelaide Medical School, The University of New England (UNE) Faculty of Health, as well as investigator promotional interviews with national radio and free to air television stations, and organisations representing occupations with shift work (Nursing Times) or known toileting restrictions (NSW Teachers Federation). The study adheres to the principles of the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [67] and is reported in Supplement 1.

Ethical Considerations

This study was approved by the Human Research Ethics Committees of the University of Adelaide (H-2018-235) and UNE (HE18-300). Study participants reporting any concerns to the questions pertaining to GI health are provided with referral information for national healthcare services and recommendations to consult their primary care provider in the first instance. Participants reporting any concerns relating to mental health are provided with 24-hour emergency and general mental health support services.

Statistical Analysis

Power

Study 1 is designed to have 90% power to detect a 5% difference in DGBI prevalence between groups at $\alpha = 0.05$ (one-sided) based on the conservative estimate of 15% DGBI prevalence in shift workers and 10% DGBI prevalence in non-shift workers [15]. The study aimed to recruit 2,500 persons based on the anticipated sampling of 25% shift-workers and 75% non-shift workers, allowing for 25% incomplete responses in the study, with a final sample of $N=1967$ required.

Hypothesis 1: There will be higher levels in occupational stool form indicating looser stools when compared with residential stools.

Hypothesis 2: Shift workers will have an increased odds for DGBI compared to persons not engaged in shift work.

Hypothesis 3: Higher anxiety and distress scores will be observed in persons with DGBI.

Hypothesis 4: Higher parcopresis anxiety symptoms will be more strongly associated with bowel movement form in occupational settings than occupational characteristics.

To answer Hypothesis 1, a paired samples test will be used to evaluate change between residential and occupational stool types rated on the Bristol Stool Chart. To answer Hypothesis 2, analyses will utilise logistic regression showing the odds and 95% confidence interval for any probable DGBI (binary outcome) in shift-workers by comparison to their non-shift working counterparts using non-adjusted, minimally adjusted (socio-demographic factors), and adjusted for occupational factors

such as perceived toilet break adequacy and other self-reported measures including distress. To answer Hypothesis 3, a one-way analysis of variance will examine if higher anxiety and distress scores are observed in persons with DGBI compared with their non-DGBI counterparts, using non-adjusted, minimally adjusted models (socio-demographic factors), and models fully adjusted for occupational factors. To answer Hypothesis 4, multivariable regression will assess the association between occupational bowel movement type (outcome) and parcopresis (predictor) and occupational factors (predictors), adjusted for other self-reported measures including contamination fears. Occupational factors include toilet break adequacy, number of toilets, and toilet sub-type, perceived adequacy of toilet breaks.

Eligibility

Inclusion criteria; age ≥ 18 years who self-identify as having paid employment on a part-time or full-time capacity in any work role in any organization, or self-employed, or undertaking paid training (e.g. apprentice, internist).

Exclusion criteria; retired, volunteer role, unpaid work placement, working from home office (e.g. during COVID-19 lockdowns), working in a sheltered workshop due to intellectual disability or developmental disorder, no access to the internet to complete the survey, unable to visually rate one's own stool.

Measures

Demographic and occupational data collected

General descriptive information included age, gender, occupation and industry, years of employment in current job, household income, shift work type, the number of employees at each workplace, number of toilets at the place of employment, type of toilet (gender specific, gender neutral/shared), cubicle within larger toilet room or enclosed blocks, and perceived adequacy of toilet breaks. We will also quantify how often respondents report defecating in the occupational and residential setting.

Medical history

Self-report questions (dichotomised, yes/no) ask about past history of gastrointestinal surgery, gastrointestinal cancer, urological surgery, urological cancer, spine surgery, use of laxatives, and use of anti-diarrhoea drugs. This serves as the pre-screener before administering comprehensive questions pertaining to GI health and DGBI.

Shift-work

We will utilise reference values for melatonin and the biological night (2100–0700) as proposed by Arendt and the UK Labour Force Survey [68] to classify workers utilising their self-reported typical start and end work times as shift work or non-shift work.

GI Disorders

The primary outcome of interest is the prevalence of probable DGBI measured by the Rome IV Diagnostic Questionnaire (R4DQ) [69]. The R4DQ was designed to measure oesophageal disorders, gastroduodenal disorders, bowel disorders, centrally mediated disorders of gastrointestinal pain, gall bladder and sphincter oddi disorders, and anorectal disorders, as well as two domains not relevant to the proposed project (*excluded: childhood functional disorders in neonate/toddler, or children/adolescent*). The questionnaire asks respondents a series of questions about GI symptoms over the past 6 months, and between 26 to 86 questions are asked in total depending on R4DQ skip pattern logic which we implemented for ITS POO TIME. It takes respondents approximately 15 to minutes to complete the R4DQ. Validation studies with the R4DQ [69] indicate high receiver operating characteristic specificity for detection of any irritable bowel syndrome, functional dyspepsia, and functional constipation (specificity 97.1%, 93.3%, and 93.6% respectively). However, the sensitivity for detection of DGBI's was low irrespective of whether disorders were mutually exclusive (<63%) or when disorders were permitted to overlap (73%) [69]. In Australia, the R4DQ was successfully administered via the web to 2,036 Australians as part of a study on the global prevalence of DGBI [70].

Stool form and frequency

Using the Bristol Stool Chart [71] participants were asked to identify the form and frequency of their most recent stool. There are 7 options on the Bristol Stool Chart, with two categories indicative of constipation, two categories indicative of normal bowel movements, and three categories indicative of diarrhea or urgency. The Bristol Stool Chart was adapted here to ask respondents to rate their most recent stool in the occupational setting, where we obtained information about toilet design. A modified Bristol Stool Chart was also asked for respondents to rate their most recent residential stool. Other bowel habit questions were adapted from the Taiwan Teacher Bladder Survey which asked participants about the adequacy of toilet breaks and frequency of toilet behaviours [38].

Sleep

The eight-item Sleep Condition Indicator (SCI) asks respondents about their concerns about getting

to sleep, remaining asleep, sleep quality, daytime personal functioning, daytime performance, duration of sleep problem, nights per week having a sleep problem and extent troubled by poor sleep. The SCI has high internal consistency ($\alpha \geq 0.86$) and convergent validity with other sleep measures [72].

Diet

General food frequency was quantified by an abbreviated Food Frequency Questionnaire (FFQ). Abbreviated FFQ are common in epidemiological surveys when diet is not the key variable of interest. We selected 10 items from the 2008/2009 New Zealand nutrition survey that asks about the frequency of eating fruit (servings per day), vegetables (servings per day), wholemeal or whole grain foods, soft drink, alcohol (standard units), cake sweet or chocolate biscuits, processed meats, red meat, low or reduced fat foods, take away foods [73].

Parcopresis

Several scales exist for anxiety related to urinary voiding, however, only one exists for anxiety related to bowel movements. Toilet anxiety in relation to bowel movements was quantified by the 8 item parcopresis sub-scale of the Shy Bladder and Bowel Scale [74]. The questionnaire was explicitly designed to assess toilet anxiety in adults, and consists of two sub-scales, one for urinary voiding and one for bowel voiding. A validation study of the Shy Bladder and Bowel Scale was performed in psychology student ($n = 387$) and general population groups ($n = 334$) which supported the proposed eight-item two-factor structure as well as favourable content-, concurrent-, and test retest- validity [74]. The scale asks respondents a series of questions about their toilet behaviours on a Likert type scale from; “none of the time”, “a little of the time”, “some of the time”, “most of the time”, “all of the time”. Higher scores are indicative of higher parcopresis.

Social anxiety

Social anxiety was quantified with 3-items from the abbreviated Social Phobia Inventory (Mini-SPIN) [75]. The Mini-SPIN items are; “Fear of embarrassment causes me to avoid doing things or speaking to people,” “I avoid activities in which I am the centre of attention,” and “Being embarrassed or looking stupid are among my worst fears.” Respondents rate each item on a Likert type scale from; “not at all”, “a little bit”, “somewhat”, “very much”, “extremely”. The Mini-SPIN was evaluated in 344 persons in a two-stage psychiatric assessment which showed that a cutoff score of ≥ 6 demonstrated high sensitivity (88.7%), specificity (90.0%), and negative predictive value (98.5%), supporting its utility as a screening tool for social anxiety disorder.

Contamination fears

Fear of contamination was quantified with 3-items comprising the contamination subscale of the Obsessive-Compulsive Inventory-Revised as validated by Huppert et al [76]. The sub-scale items are; "I find it difficult to touch an object when I know it has been touched by strangers or certain people," "I sometimes have to wash or clean myself simply because I feel contaminated," and "I wash my hands more often and longer than necessary." Respondents rate each item on a Likert type scale from; "not at all", "a little", "moderately", "a lot", "extremely".

Distress

General distress is measured with the Kessler Psychological Distress Scale (K10) [77]. The 10 item questionnaire asks about general psychological distress in the previous month. Respondents rate each of 10 symptoms on a Likert scale from 1 "none of the time" to 5 "all of the time." The K10 is commonly used in epidemiological surveys and normative data exist for the Australian general population [78]. Scores range from 10 to 50, with cut-off scores of 10 to 15, 16 to 29, and ≥ 30 indicative of low, medium and high risk for a probable mood or anxiety disorder.

Study 2

Recruitment

Study 2 is a distinct study hosted on Qualtrics^{XM} and was advertised concurrently with Study 1, and it was possible to participate in Study 1 and/or Study 2. Advertising was performed through the UNE Faculty of Health research participant pool. UNE typically attracts students characterized as older adult learners retraining for a new career who are engaged in part- or full-time work in addition to their University studies.

Ethical Considerations

Study 2 was approved by the Human Research Ethics Committee of UNE (HE19-198). The study is anonymous, and participants can withdraw at any time. Any potentially identifying information (e.g. name of workplace) will be removed in any publication of results or data sharing.

Methods and Analysis

The study will be conducted in line with the well-recognized quality principles for qualitative research outlined by Tracy et al. [79], including rigor and sincerity. For example, we will aim to provide sufficient, abundant, appropriate and complex data to ensure rigor. To achieve this, data analysis will be iterative and conducted by multiple authors. Doing so enables peer discussion and reflection in order to engage with reflexive considerations and manage researcher subjectivity and

theoretical assumptions [80]. Ongoing engagement with the data through the analysis further enables reflexivity to be explored and considered. To achieve sincerity, we will provide a reflexivity statement about the relevant background details of our team so that the reader can judge how these may have impacted on our approach to the work, including the way that we have interpreted the data. Ongoing review of analysis and the coded data by multiple authors will also take place to support analytic rigor and trustworthiness by ensuring that analysis provides a clear and coherent representation of the data, with trustworthiness and openness also supported by the presentation of detailed extracts in publications from the study.

Qualitative data will be analyzed using an inductive thematic analysis at the latent level from a realist epistemology perspective [81]. Thematic analysis can be viable on open ended survey questions, and data will be coded across the dataset, rather than by individual question, to ensure breadth and depth of patterns across the entirety of the data [78]. Study analysis will expand on Study 1 results regarding workplace parcopresis by further outlining attitudes and experiences of defecation in the workplace. Data will be read and reread to gain familiarity. Initial coding of data will be undertaken, with similar codes grouped together. Coding will be conducted across the entire dataset rather than individual items, as recommended for qualitative online survey research [82]. In the next stage of analysis, data for each code will be collated and reviewed in depth, with a view to exploring patterns and themes in the data. Preliminary themes and the generated codes will be reviewed by other authors. In an iterative process, overarching themes and subthemes will be reviewed and refined to ensure coherence, distinctiveness, that they provide a comprehensive representation of the data.

The quantitative (Study 1) and qualitative data (Study 2) will be analyzed separately. Due to the de-identified nature of the study, it is not possible to determine if a respondent participated in both studies or not. Thus, an integrated analysis of the two datasets (e.g. outliers and typical instances from the quantitative findings) cannot be performed. Study 2 will build on results of study 1 by providing in depth insight into experiences around defecation at work to complement quantitative findings.

Power

While it is not possible to ascertain power for qualitative research, and some coherently argue against such a quantitative approach to inductive thematic analysis [83], nonetheless, a number of factors can guide what constitutes a sufficient sample. Data saturation (i.e., the point at which no new themes or ideas are identified) is a common method of determining a sufficient sample [84]. In research designs that utilise free-response qualitative surveys, a median sample size of 75 has previously been identified as required for reaching saturation [84]. Therefore, a minimum sample of 75 is sought.

Eligibility

The eligibility was the same as specified for Study 1 above.

Measures

Study 2 collates descriptive information pertaining to age and employment status. Respondents are asked a series of twelve questions, some with probes, each with a separate free-text box without response character limit. Specific questions used in the survey are displayed in **Figure 1**.

[Figure 1 about here]

Results

Description of Sample 1

Study 1 commenced enrolment in January 2019 and finished enrolment in December 2023. The analyses to answer the study's hypotheses will commence after publication of the protocol, expected in the first quarter of 2025. Thematic analyses are expected to occur in the second half of 2025. From 2113 persons who read the study information sheet, 241 were ineligible for the following reasons; withdrawing consent ($n = 5$), not answering any questions ($n = 131$) and not completing assessment of bowel and/or psychosocial factors ($n = 105$) leaving an analytical sample of 1872 persons and estimated 88.6% completion rate (**Table 1**). It should be noted that a further 95 persons did not rate their work and/or home stool type on the Bristol Stool Form and Frequency chart but had sufficient data for occupational and residential bowel movement frequency.

The sample was comprised predominantly by persons of female gender (75.5%) and the average age was 34.5 years $\pm$ 11.3. Approximately 29.5% of respondents had a household income above the Australian median income. However, 3.5% of respondents' work was outside of Australia

and, in total, workers in 27 countries completed the study, most commonly from Australia and New Zealand (95.5% of sample).

The occupational characteristics of Study 1 indicate that most respondents were engaged in full time employment (51.4%), with work hours mostly between 31 to 45 hours per week (47.9%) (**Table 2**). Employees had been in their current employment for on average 7.7 years. The majority of respondents were not engaged in shift work (67.5%) with the remaining 32.5% engaged in some form of shift work. 19.7% of respondents were classified as working during the biological night.

Table 1. Descriptive information of the ITS POO TIME Study 1

Descriptive Information	Completed Study N = 1872 ^a
Age in years ^b	34.5 ± 11.3 (IQR 26.0 – 42.0)
Gender	
Female	1413 (75.5)
Male	449 (24.0)
Non-binary and other gender identities	10 (0.5)
Household income \$AUD ^c	
0 – 50,000	428 (22.9)
50,000 – 100,000	631 (33.7)
100,000 to 150,000	413 (22.1)
> 150,000	400 (21.4)
Region where working	
Australia and New Zealand	1787 (95.5)
Europe	40 (2.1)
North America	17 (0.9)
South America	12 (0.6)
Africa and Middle East	6(0.3)

^a Data presented as N(%) unless otherwise specified

^b Data presented as Mean ± Standard Deviation followed by interquartile range (IQR)

^c AUD, Australian Dollar; IQR, interquartile range; NR, not reported

Table 2. Employment characteristics of the ITS POO TIME Study 1

Employment characteristics	Completed Study N = 1754 ^a
Employment status	
Full-time	962 (51.4)
Part-time	491 (26.2)
Self-employed	114 (6.1)
Casual	305 (16.3)
Work hours p/week	
0-15	243 (13.0)
16-30	488 (26.1)
31-45	897 (47.9)
46-60	207 (11.1)
>60	37 (2.0)
Years in current employment	7.7 ± 8.1 (IQR 2.0 – 11.0)
Number of employees at workplace	
Sole (self-employed)	117 (6.3)
Small ≤10	363 (19.4)
Medium 11 to 50	555 (29.6)
Moderate 51 to 100	274 (14.6)
Large 101 to 1000	347 (18.5)
Very large ≥ 10,001	216 (11.5)
Work during the biological night	
9 pm to 4 am	199 (10.6)
4 am to 7 am	146 (7.8)
Commute time to employment, mins	
≤ 15	833 (44.5)
16 to 30	553 (29.5)
31 to 60	374 (20.0)
> 61	112 (6.0)

^a Data presented as N(%)

A graphical display of respondents at home and occupational bowel movement (**Figure 1**) indicates that type 3 (Like a sausage but with cracks in its surface) and type 4 (Like a sausage or snake, smooth and soft) bowel movements were the most common, irrespective of location.

[Figure 2 about here]

Description of Sample 2

Study 2 commenced enrolment in December 2019 and finished enrolment in September 2020. A total of N=346 persons commenced the study. Of those who responded to Study 2, 3 did not provide consent and are excluded, 8 persons provided no response to any of the open-ended

questions, and 1 person provided part responses to some of the open-ended questions. Due to the qualitative nature of the analysis, any completed data will be retained for thematic analysis, resulting in a final analytical sample of $N = 337$ for Study 2. The average age was 34 years $\pm$ 10.49. Of the analytical sample 49.6% worked full time, 34.7% were engaged in part time work, and 10.1% undertook shift work, whilst 0.9% worked both full-time and a part-time job, and 4.7% did not specify their employment type.

Discussion

Principal Results

This will be the first research project known to the authors with the specific aim of assessing bowel movement anxieties and DGBI in shift and non-shift workers. The qualitative study aims to identify attitudes to bowel movements in occupational settings as well as patterns, behaviors, and strategies utilized to mitigate embarrassment, fear, or parcopresis. The research study is pivotal in providing further information regarding the prevalence of parcopresis and its relationship to occupational toileting avoidances as well as GI health in a range of employees, including shift and non shift workers.

Limitations

ITS POO TIME is limited in scope to persons with employment, meaning that the findings may not generalize readily to persons engaged in non-paid internships, persons studying, or those with carer responsibilities. A related limitation is that we have restricted the research focus to bowel movements in occupational settings when parcopresis applies more generally to use of any public restroom. It remains unknown and a limitation of ITS POO TIME whether parcopresistic fears of embarrassment are amplified around known persons such as work colleagues compared with strangers.

In the interests of brevity, the assessment battery is limited to subsets of more exhaustive questionnaires. Indeed, we have adopted brief measures and subscales for key constructs in our study pertaining to social anxiety, contamination fears, and parcopresis. With regards to the latter, though this construct is commonly comorbid with paruresis, our study has not assessed paruresis. More than 50% of persons with this condition report limiting their occupation because of paruresis [85]. This may have significant impacts on the research findings and though there are known gender differences in paruresis [62], it remains unclear whether gender differences hold in parcopresis. The Study 1 sample is overly representative of female gender respondents which may

lead to biases in planned comparisons across genders, whilst Study 2 did not collate information on gender. A possible explanation for the over-representation of female gender respondents could relate to over-sampling from specific occupations characterized by shift-work (e.g. nurses) and toileting restrictions (e.g. school teachers). Another limitation is that there are potential selection biases and response biases and we were unable to reach the pre-specified power calculation. This study did not reach the target sample as stipulated in the power calculation due to larger survey response attrition than anticipated combined with an institutional change in ethics and recruitment procedures, resulting in a need to close the study after 4 years. Consequently, the results will have will result in less than 90% power to detect a difference DGBI between shift work groups.

Conclusions

There is a known paucity of empirical data concerning parcopresis [62]. This project will offer novel insights into occupational, behavioural and psychosocial factors associated with GI health and identify if there are differences between residential and occupational toileting frequency and voiding behaviours. The results of the studies projected in this research protocol will have direct implications for industry, employers, and policy makers concerning functional gastrointestinal diseases, stress, and worker health.

Acknowledgments

Nil.

Conflicts of Interest

Dr Tully reports receiving consulting fees from the Asia-Pacific Institute of Psycho-Cardiology Research and Oxford University Press.

Funding

Nil.

Data Availability

Data generated or analyzed during this study are subject to an embargo of 12 months from the publication date of the article. Once the embargo expires the data will be available upon reasonable request from the corresponding author on reasonable request, for non-commercial purposes, and without breaching participant confidentiality.

Author's Contributions

PT and SC were responsible for conceptualization, project administration, and supervision. PT was responsible for data curation, formal analysis, visualization and writing the original draft. PT, SC, GW, SM, AV, AM-W, and DT were responsible for the methodology and review and editing the protocol.

Declarations

No generative AI was used in the production of this research.

Abbreviations

AUD, Australian Dollar

DGBI, Disorders of Gut Brain Interactions

FFQ, Food Frequency Questionnaire

GI, gastrointestinal

ITS POO TIME, Insight inTo Stress and POOping on work TIME

IQR, interquartile range

K10, Kessler Psychological Distress Scale

Mini-SPIN, Mini-Social Phobia Inventory

NR, not reported

R4DQ, Rome IV Diagnostic Questionnaire

SCI, Sleep Condition Indicator

UNE, University of New England

Figure Captions

Fig 1.

A figure displaying the questions regarding attitudes, patterns, behaviours, and strategies utilized at a respondent's place of employment.

Fig 2.

A histogram depicts the frequency of different types of stool selected by participants for the most recent home (panel A) and work (panel B) bowel movement. Participants selected the most appropriate response using a visual representation and description of the Bristol Stool Form Chart.

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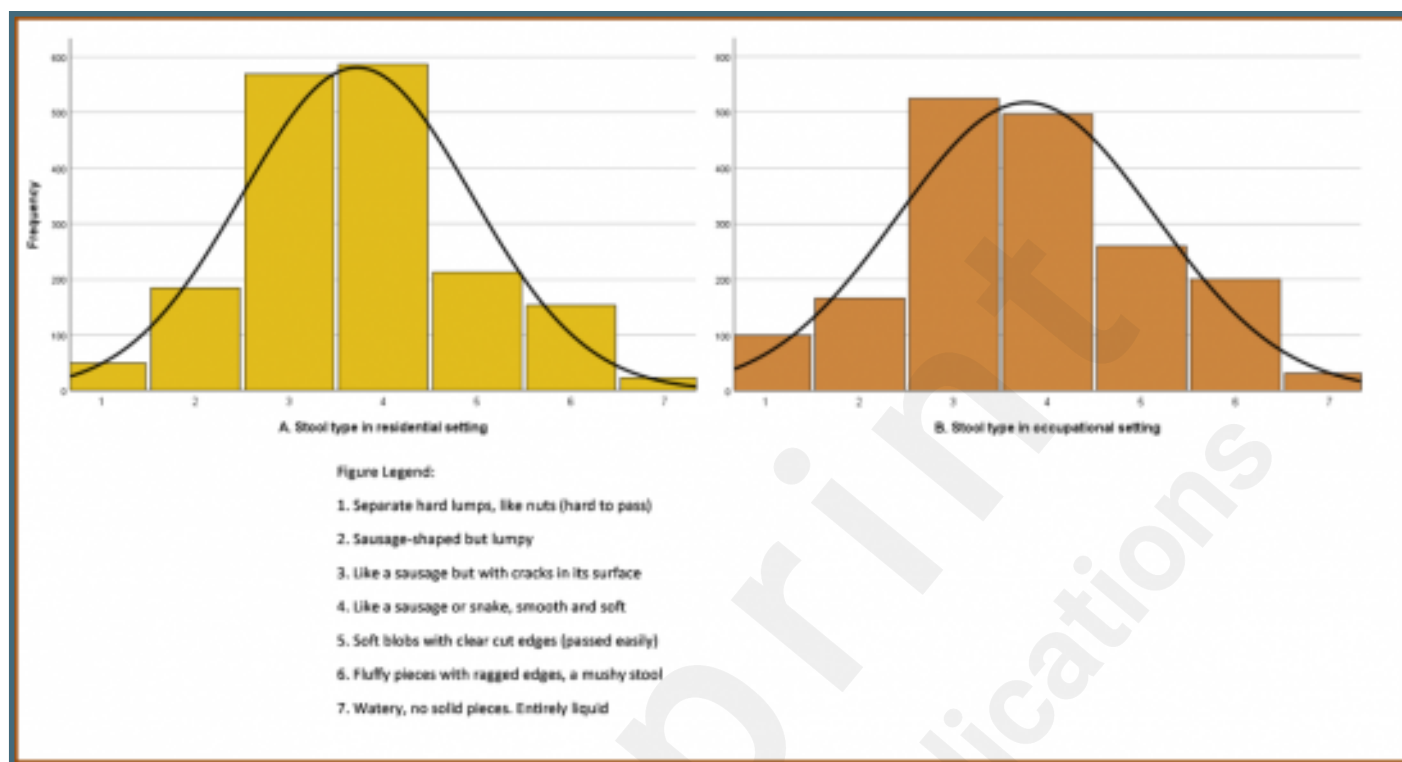
Supplementary Files

Figures

A figure displaying the questions regarding attitudes, patterns, behaviours, and strategies utilized at a respondent's place of employment.



A histogram depicts the frequency of different types of stool selected by participants for the most recent home (panel A) and work (panel B) bowel movement. Participants selected the most appropriate response using a visual representation and description of the Bristol Stool Form Chart.



Multimedia Appendixes

Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

URL: <http://asset.jmir.pub/assets/94f909414ee45cf3d4a56a525698c658.docx>

