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Preconception health knowledge, attitudes and behavioural intentions among adults: a multi-country study

A. Craig[1*], K. Mabetha[2], J. Stephenson[3], D. Schoenaker[4,5,6] and S. A. Norris[1,4]

Abstract

Background Preconception health—the health status of individuals prior to conception—is vital for positive pregnancy outcomes and long-term health. Despite its importance for maternal and infant well-being, it remains underresearched and often overlooked in global maternal and child healthcare.

Methods We conducted a cross-sectional online survey with adults (18–55 years old) from Kenya, South Africa, Malaysia, the United States, and the United Kingdom (n = 5000), gathering data on preconception health knowledge, attitudes, behavioural intent, and respondents' preferences regarding factors important before pregnancy and preferred sources of health information. A generalised structural equation model (gSEM) was constructed a priori to assess the relationship between socioeconomic position and preconception health knowledge, and whether this relationship was mediated by preconception attitudes and behavioural intent.

Results Preconception health knowledge, attitudes, and behavioural intent showed significant variation across the countries. Over half of the respondents reported having adequate preconception knowledge (50.3%), with the USA having the highest proportion of respondents with good knowledge (13.8%) and Malaysia having the highest proportion with poor knowledge (42.5%). In the pooled sample, physical health was considered the most important factor before pregnancy, followed by relationships and family. Clinic doctors were the most preferred source of information, followed by nurses and obstetricians/gynaecologists. The relationship between preconception knowledge and behavioural intent was fully mediated by a combination of preconception attitudes (71.7%).

Conclusion Preconception health knowledge, attitudes, and behavioural intent differed across the five economically diverse countries. Pregnancy factors were prioritised differently across settings, likely reflecting disparities in culture, socioeconomic status, and healthcare access, with varying preferences for sources of preconception health information. These findings underscore the importance of designing tailored interventions that consider socioeconomic and cultural differences to enhance overall health outcomes.

Keywords Preconception health knowledge, Attitudes, Behavioural intent, Multicountry, Preferred sources of health information, Factors important prior to pregnancy

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Introduction

Preconception health, which is defined as the health behaviours and status of individuals prior to conception [1, 2], is essential for achieving positive pregnancy outcomes and promoting long-term health for both parents and their children. The preconception period serves as a critical window of opportunity when pregnancy and parenthood aspirations may motivate women and men to improve their health and make lifestyle changes [3]. Growing evidence highlights the significance of preconception health as a key factor in maternal and infant well-being. However, it remains a relatively under-researched area in public health, also often not overtly evident in the continuum of maternal and child healthcare [4, 5] especially across diverse global settings.

Various interventions have been implemented to improve both parental and infant outcomes, including those focused on diet and nutrition [6, 7], lifestyle counselling and modification [8, 9], education [10, 11], medical treatments or medications [12], and more complex, multifaceted intervention strategies [13, 14]. Preconception health knowledge can therefore minimise the risk of negative pregnancy outcomes. Although preconception health knowledge can serve as a promising strategy for improving reproductive outcomes, it varies significantly according to socioeconomic status (SES), education, and access to healthcare [15–17]. Individuals from lower resourced backgrounds often face limited access to essential health information and services, which restricts their understanding of key aspects of preconception care, such as nutrition, exercise, and managing chronic conditions [16]. Most often in resource-deficient settings, financial barriers prevent individuals from accessing regular health screening, leaving them unaware of important health risks. On the other hand, it has been noted that even when women and men have adequate preconception knowledge, they may not always pursue formal healthcare screenings or make the respective behavioural changes [15, 18].

Preconception health knowledge plays a role in shaping attitudes and behaviours towards pregnancy planning, influencing how individuals manage their health and lifestyle prior to conception [19]. Those who are well-informed about topics like diet, exercise, chronic condition management, and avoiding harmful substances, and are able to make healthier choices, are more likely to engage in behaviours that support a healthy pregnancy [20], such as taking folic acid supplements and reducing smoking and alcohol intake. However, a lack of knowledge and support to make changes can lead to complacency and behaviours associated with poorer health. Individuals who are unaware of the effects of stress, poor diet, or underlying health conditions may overlook important health measures, raising the risk of complications [20]. Preconception knowledge also influences attitudes and intentions by increasing awareness, encouraging healthier behaviours, promoting proactive care, and facilitating informed decision-making [21]. A solid understanding of preconception health and an environment conducive to healthy living therefore encourages a pre-emptive approach to reproductive health, fostering positive changes that contribute to healthier pregnancies and better outcomes for both maternal and child health.

This study therefore seeks to illuminate commonalities and disparities in preconception knowledge and practices, offering insights into how attitudes and behaviours are shaped by different national contexts. This multi-country study describes preconception health knowledge, attitudes and behavioural intent and examines the relationships between these among adult men and women across five distinct countries, namely, South Africa, the United Kingdom (UK), the United States of America (USA), Kenya and Malaysia. Participants' views on the relative importance of factors prior to conception are also described, along with their preferred sources of health education and information across the distinct settings. Each of these countries presents unique sociocultural, economic, and healthcare contexts that can significantly influence ones' preconception health practices. The findings from this study will also aid in the contribution to the global discourse on preconception health by understanding variations which is essential for developing targeted interventions and policies that address specific needs and challenges in different settings.

Methodology

Survey data containing information around preconception health knowledge, attitudes, behavioural intent and preferences prior to conception were collected in April 2024 from respondents residing in five countries—USA, Malaysia, Kenya, South Africa, and the UK (Fig. 1). This selection was made to ensure representation from diverse continents: North America, Africa, Europe, and Asia. The countries were chosen to reflect a range of economic developments and healthcare systems. Specifically, the USA and UK are high-income countries (HICs), South Africa and Kenya are middle-income countries, and Malaysia is considered a low-income country. By including these nations, we aim to capture a broad spectrum of healthcare contexts, access, and socioeconomic conditions, which is essential for understanding the global landscape. The survey was concluded when 1000 respondents from each country completed the survey and



Fig. 1 Geographic location outlining sample distribution. United Kingdom (UK), Kenya (KE) United States of America (USA), Malaysia (MYS) and South Africa (RSA)

were deemed valid through the backend checks described below. The study sample (total $n = 5000$) was a targeted sample from the general population of the recruited country panel according to the following demographics, which were identical for each country: (i) equal proportion of women and men; (ii) 65% of the sample from the 18 to 30 years age group; (ii) 25% from the 31 to 45 years age group; and (iii) 10% of the 46–55 years age group. The questionnaire was administered in English across all five countries to ensure consistency and uniformity, allowing for standardised responses and facilitating more accurate comparisons and analysis across these diverse regions.

Survey integrity and processes

The survey questionnaire was distributed electronically through Ipsos' proprietary i-Say panel, as outlined in Supplementary Figure S1, using two main processes: (A) panel registration and (B) in-survey completion. In summary the Ipsos protocol is comprised of verified data audits of those respondents who participated in each country, in combination with multiple checks and linked to remuneration, only one response is possible from each respondent. Furthermore, the recruitment was based on the individual level with an exclusion criterion that no two respondents could participate from the same household. Respondents were recruited to be representative of men and women aged 18–55 years specific to each country that had internet access. Consequently, this may not necessarily be representative of the entire youth or general population of the five countries.

To assess preconception health knowledge, attitudes, behavioural intent and respondents' preferences prior to conception (relative importance of factors before pregnancy and preferred sources of health education/information), respondents participated in a structured survey (Supplementary Table S1) comprising a series of targeted questions designed to evaluate their understanding, beliefs, and practices related to preconception health. The preconception health knowledge section adapted questions from a previously developed preconception health knowledge questionnaire [25] covering reproductive life plans and history, sexual health, infectious diseases, medications, chronic diseases, mental health, tobacco use, alcohol and other substance use, nutrition, weight and physical activity, psychosocial stressors and environmental stressors. The preconception health knowledge questionnaire was designed to include questions relevant to both male and female factors, and it is scored as a single, comprehensive survey regardless of the respondent's sex. Multiple-choice format was used with one or several correct answers. Correct responses were given a score of 1, and incorrect or "don't know" answers a score of 0. An accumulative score of all correct answers were tallied (total 22). Total knowledge score was then categorised into 3 groups: poor (≤ 10), adequate (> 10 and ≤ 16) and good (> 16).

Statistical analyses

For the statistical analyses, IBM® SPSS® version 29 (IBM Corporation, Armonk, New York) and STATA version 18.1 (StataCorp LLC, College Station, TX, USA) were used to analyse the data. GraphPad Prism version 5.03 for Microsoft® Windows (GraphPad Software, San Diego, California, USA) was used to plot the data.

Proportions across both continuous and categorical variables were determined with crosstabs with significant differences indicated by Chi-square tests and presented

as percentages. A generalised structural equation model (gSEM) constructed a priori was used to assess the relationship between socioeconomic position (SEP) and preconception health knowledge and whether this relationship was mediated by preconception attitudes and behavioural intent. To reduce measurement error, allow for a more precise model, and capture a multidimensional nature for testing complex relationships, a latent variable was constructed for preconception attitudes that consisted of the following variables: taking folate; avoiding alcohol; exercise daily; avoid smoking; maintain good mental health; eat healthily; check blood pressure regularly. Direct (unmediated), indirect (mediated) and total effects were computed and recorded, and the proportion of the total effect mediated was calculated. Modifications to pathways and adding/removing variables were made iteratively and the Akaike and Bayesian Information Criteria (IC) of each model were compared. The final model was selected for having a low IC and high theoretical relevance. Direct, indirect, and total effects were calculated using non-linear combination estimates. The outcome variable was adjusted for age.

Results

General descriptives

Due to the nature of the survey which targeted 1000 respondents per country, a total of 5000 respondents (51.9% female) participated in the survey with a similar age distribution across the countries (18–35 yrs: 65%; 36–45 yrs: 25%; 46–55 yrs: 10%) (Table 1). In South Africa, USA and Malaysia, the majority of the respondents reported a marital status of single or never married (≥ 49.2%), while the majority of those residing in UK and Kenya reported being married or cohabiting (≥ 52.6). Additionally, the majority of respondents across all 5 countries were employed (ranging from 69.9% in the USA to 82.0% in Kenya).

Preconception knowledge, attitudes and behavioural intention

Table 1 and Fig. 2 shows preconception knowledge, attitudes and behavioural intent in the overall study population and across the 5 countries. More than half of the respondents had self-reported adequate preconception knowledge (50.3%). The USA sample had the most respondents with good knowledge (13.8%), while Malaysia had the highest number of respondents with poor knowledge (42.5%). In terms of attitudes towards preconception health behaviours to change before pregnancy, the majority of participants indicated they found avoiding alcohol (83.5%), avoiding smoking (88.9%), maintaining good mental health (89.6%) and eating healthily (91.0%) important. While taking folate was important to 63.2% in the overall study population, this was notably higher among respondents in Kenya (77.4%). Generally, more than three quarters of respondents in each country reported that if they were planning a pregnancy, they would access preconception health care services if they were available at their clinic (≥ 79.1%). Furthermore, in the pooled sample, a higher percentage of women (by +7.1%) demonstrated good preconception health knowledge compared to men (Table 2). Overall, more women denoted the importance of all preconception attitudes (by ≥10.5%) and behavioural intentions (by +12.9%) than men. Interestingly, compared to women, a higher percentage of men from the UK, USA, Kenya and Maylasia indicated the importance of exercising daily (by ≥1.9%).

Relative importance of factors before pregnancy

When asked how important the following factors are before pregnancy, in the pooled sample of respondents (Table 3 and Supplementary Figure S2), physical health emerged as the most critical consideration, following closely, relationships and family was ranked second. Mental health was identified as the third most important factor, financial stability ranked fourth, while living conditions, work or education, and climate followed in importance.

Across different countries and sexes, clear patterns emerged with some regional differences (Table 3 and Supplementary Figure S4). Physical health consistently ranked first for both men and women across all countries, except women in the UK. Relationships and family ranked second for most men and women, although UK women ranked it most important. Mental health ranked third for most respondents, but Kenyan men and women and Malaysian women ranked it second. For both men and women across the countries, money ranked fourth, while Kenyan women ranked it fifth. Living conditions (ranked fifth or fourth), work or education, and climate were universally ranked fifth, sixth and seventh, respectively.

Preferred sources of health education/information

Respondents were asked to identify their preferred sources of health education or information before pregnancy (Table 4 and Supplementary Figure S3). In the overall study population, clinic doctors were the most preferred source, followed by nurses in second, and obstetricians/gynaecologists in third. Pharmacists ranked fourth, while family and friends were the fifth choice. Internet and social media were ranked sixth, and magazines/newspapers were considered the least preferred source.

Table 1 General descriptives of survey respondents from five countries

		Pooled sample ($n=5000$)	South Africa ($n=1000$)	UK ($n=1000$)	USA ($n=1000$)	Kenya ($n=1000$)	Malaysia ($n=1000$)	*p* value
Sociodemographics								
Sex	Male	2398 (48.1)	490 (49.0)	468 (46.8)	480 (48.0)	480 (48.0)	480 (48.0)	0.969
	Female	2590 (51.9)	510 (51.0)	520 (52.0)	520 (52.0)	520 (52.0)	520 (52.0)	
Age	18–30 yrs	3249 (65.0)	649 (64.9)	650 (65.0)	650 (65.0)	650 (65.0)	650 (65.0)	**0.004**
	31–45 yrs	1251 (25.0)	251 (25.1)	250 (25.0)	250 (25.0)	250 (25.0)	250 (25.0)	
	46–55 yrs	500 (10.0)	100 (10.0)	100 (10.0)	100 (10.0)	100 (10.0)	100 (10.0)	
Parity	Score	1.92 ± 1.11	2.41 ± 1.21	1.77 ± 0.965	1.70 ± 0.980	2.42 ± 1.16	1.33 ± 0.721	**< 0.001**
Marital status	Single	2494 (49.9)	639 (63.9)	447 (44.7)	492 (49.2)	397 (39.7)	519 (51.9)	**< 0.001**
	Married/Cohabit	2302 (46.0)	309 (30.9)	526 (52.6)	457 (45.7)	561 (56.1)	449 (44.9)	
	Divorced/ widowed/ separated	204 (4.1)	52 (5.2)	27 (2.7)	51 (5.1)	42 (4.2)	32 (3.2)	
Employment	Employed	3900 (78.2)	764 (76.4)	800 (80.0)	699 (69.9)	820 (82.0)	817 (81.7)	**< 0.001**
	Unemployed	694 (13.9)	146 (14.6)	113 (11.3)	231 (23.1)	107 (10.7)	97 (9.7)	
	Student	379 (7.6)	88 (8.8)	86 (8.6)	49 (4.9)	73 (7.3)	83 (8.3)	
	Retired	16 (0.3)	2 (0.2)	1 (0.1)	10 (1.0)	0 (0)	3 (0.3)	
Preconception health knowledge, attitude and behaviour								
Preconception health knowledge	Low knowledge score	1957 (39.1)	397 (39.7)	411 (41.1)	351 (35.1)	373 (37.3)	425 (42.5)	**< 0.001**
	Adequate knowledge score	2515 (50.3)	532 (53.2)	477 (47.7)	511 (51.1)	497 (49.7)	498 (49.8)	
	Good knowledge score	528 (10.6)	71 (7.1)	112 (11.2)	138 (13.8)	130 (13.0)	77 (7.7)	
Attitude (% rates as important)	Take folate	3161 (63.2)	696 (69.6)	528 (52.8)	531 (53.1)	774 (77.4)	632 (63.2)	**< 0.001**
	Avoid alcohol	4174 (83.5)	907 (90.7)	778 (77.8)	823 (82.3)	843 (84.3)	823 (82.3)	**< 0.001**
	Exercise daily	4153 (83.1)	883 (88.3)	752 (75.2)	789 (78.9)	937 (93.7)	792 (79.2)	**< 0.001**
	Avoid smoking	4443 (88.9)	927 (92.7)	840 (84.0)	844 (84.4)	960 (96.0)	872 (87.2)	**< 0.001**
	Maintain good mental health	4479 (89.6)	941 (94.1)	822 (82.2)	845 (84.5)	978 (97.8)	893 (89.3)	**< 0.001**
	Eat healthily	4548 (91.0)	953 (95.3)	875 (87.5)	849 (84.9)	984 (98.4)	887 (88.7)	**< 0.001**
	Check blood pressure regularly	4423 (88.5)	941 (94.1)	808 (80.8)	812 (81.2)	973 (97.3)	889 (88.9)	**< 0.001**
Behaviour (% rates as likely)	Access preconception care if available and planning a pregnancy	4266 (85.3)	856 (85.6)	797 (79.7)	802 (80.2)	922 (92.2)	889 (88.9)	**< 0.001**

n Number of participants; UK United Kingdom; USA United States of America; PHK preconception health knowledge. Bold values denote statistical significance ($p < 0.05$)

Table 4 and Supplementary Figure S5 shows clinic doctors ranked first across all countries for both men and women, except for USA and Kenyan women who ranked them second. Nurses were consistently ranked second by men, with some variation among women, as women from the UK ranked nurses second, women from Kenya, South Africa and Malaysia placed nurses third. Family and friends were ranked between third and fifth, with US men and women placing them higher (third) than in other countries, where they were generally fifth. Pharmacists ranked fourth to fifth, while internet/social media were consistently ranked sixth across all regions. Magazines/newspapers were universally ranked seventh. The ranking of obstetricians/gynaecologists varied: women from USA and Kenya ranked them most preferred, while women from South Africa, UK and Malaysia ranked them second or third preferred. In contrast, among men, obstetricians/gynaecologists were ranked between third and fifth.

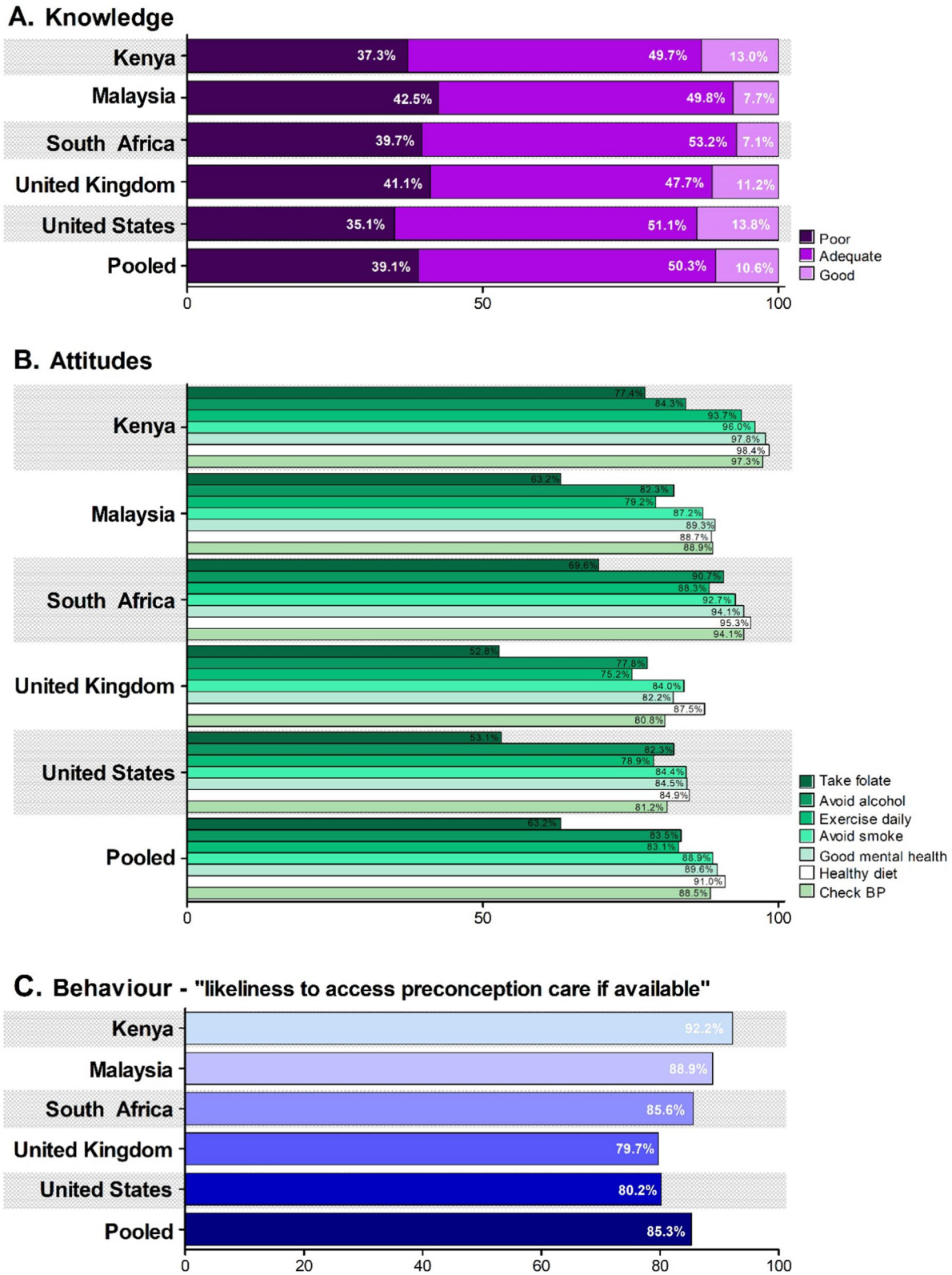


Fig. 2 Preconception health **a** knowledge about preconception health, **b** attitudes towards changing behaviours before pregnancy and **c** behaviour of accessing preconception services if available and if planning a pregnancy in the overall study population and in each country

Table 2 Preconception health knowledge, attitudes and behavioural intent of survey respondents from five countries stratified by sex

		Pooled		South Africa		UK		USA		Kenya		Malaysia	
		Men (*n* = 2590)	Women (*n* = 2410)	Men (*n* = 490)	Women (*n* = 510)	Men (*n* = 468)	Women (*n* = 527)	Men (*n* = 480)	Women (*n* = 520)	Men (*n* = 480)	Women (*n* = 520)	Men (*n* = 480)	Women (*n* = 520)
Preconception health knowledge, attitude and behavioural intent													
Preconception health knowledge	Poor knowledge score	1109 (42.8)	848 (35.2)	211 (43.1)	186 (36.5)	252 (58.9)	159 (30.2)	222 (42.3)	129 (24.8)	204 (42.5)	169 (32.5)	220 (45.8)	205 (39.4)
	Adequate knowledge score	1116 (43.1)	1399 (58.1)	238 (48.6)	294 (57.7)	187 (40.0)	290 (55.0)	213 (44.4)	298 (57.3)	238 (49.6)	259 (49.8)	240 (50.0)	258 (49.6)
	Good knowledge score	185 (7.1)	343 (14.2)	41 (8.4)	30 (5.9)	41 (8.8)	71 (13.5)	45 (9.4)	93 (17.9)	38 (7.9)	92 (17.7)	20 (4.2)	57 (11.0)
Attitude (% rates as important)	Take folate	1408 (54.4)	1753 (72.7)	297 (60.6)	399 (78.2)	226 (48.3)	302 (57.3)	238 (49.6)	293 (56.4)	353 (73.5)	421 (81.0)	294 (61.3)	338 (65.0)
	Avoid alcohol	2041 (78.8)	2248 (93.3)	437 (89.2)	470 (92.2)	369 (78.9)	409 (77.6)	391 (81.5)	432 (83.1)	446 (92.9)	492 (94.6)	398 (82.9)	445 (85.6)
	Exercise daily	2021 (78.0)	2132 (88.5)	430 (87.8)	453 (88.8)	365 (78.0)	387 (73.4)	384 (80.0)	405 (77.9)	457 (95.2)	480 (92.3)	385 (80.2)	407 (78.3)
	Avoid smoking	2078 (80.2)	2365 (98.1)	445 (90.8)	482 (94.5)	383 (81.8)	457 (86.7)	389 (81.0)	455 (87.5)	455 (94.8)	505 (97.1)	406 (84.6)	466 (89.6)
	Maintain good mental health	2093 (80.8)	2386 (99.0)	458 (93.5)	483 (94.7)	371 (79.3)	451 (85.6)	381 (79.4)	464 (83.2)	467 (97.3)	511 (98.3)	416 (86.7)	477 (91.7)
	Eat healthily	2146 (82.9)	2402 (99.7)	463 (94.5)	490 (96.1)	400 (85.5)	468 (88.8)	399 (83.1)	450 (86.5)	470 (97.9)	514 (98.9)	414 (86.3)	473 (91.0)
	Check blood pressure regularly	2077 (80.2)	2346 (97.3)	454 (92.7)	487 (95.5)	378 (80.8)	430 (81.6)	373 (77.7)	439 (84.4)	459 (95.6)	514 (98.9)	413 (86.0)	476 (91.5)
Behaviour (% rates as likely)	Access preconception care if available and planning a pregnancy	2048 (79.1)	2218 (92.0)	420 (85.7)	436 (85.5)	376 (80.3)	421 (79.9)	397 (82.7)	405 (77.9)	435 (90.6)	487 (93.7)	420 (87.5)	469 (90.2)

n Number of participants; *UK* United Kingdom; *USA* United States of America

Table 3 Relative importance of factors before pregnancy

Overall		Kenya		Malaysia		South Africa		UK		USA	
		Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Seven groups of factors	n = 5000	n = 520	n = 480	n = 520	n = 480	n = 510	n = 490	n = 527	n = 468	n = 520	n = 480
Relationships and family	25,026	2396	2369	2444	2457	2503	2523	2887	2451	2568	2411
Physical health	27,653	3066	2701	2998	2653	2787	2610	2850	2544	2807	2595
Money	21,259	2021	1906	2416	2042	2165	2093	2201	2039	2200	2154
Mental health	24,460	2805	2429	2590	2290	2448	2232	2486	2222	2626	2309
Climate change	8588	930	810	815	1074	762	754	811	919	776	931
Work and education	14,140	1319	1398	1372	1397	1641	1606	2113	1237	1460	1353
Living conditions	18,874	2023	1827	1925	1527	1974	1902	2178	1692	2123	1676

Values are borda count, with higher scores indicating higher priority (score range: 1–7)

Table 4 Relative importance of sources of health education/information in the preconception period

Overall		Kenya		Malaysia		South Africa		UK		USA	
		Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Seven groups of factors	n = 5000	n = 520	n = 480	n = 520	n = 480	n = 510	n = 490	n = 527	n = 468	n = 520	n = 480
Nurse	25,412	2596	2471	2398	2355	2597	2582	2831	2482	1564	2425
Family + friends	19,413	1611	1638	2075	2091	1877	1935	2031	1896	2145	2075
Pharmacist	19,456	1930	1896	2034	2067	1954	2034	1914	1967	1790	1825
Internet/social media	13,516	1255	1238	1582	1564	1136	1215	1346	1377	1319	1460
Clinic doctor	28,395	3123	2871	3059	2541	2925	2867	2885	2576	2889	2582
Magazines/newspaper	9389	921	878	990	1005	884	827	973	939	906	1047
Obstetrician/gynaecologist	24,419	3124	2448	2422	1817	2907	2260	2580	1867	2897	2026

Values are borda count, with higher scores indicating higher priority (score range: 1–7)

Relationship between preconception knowledge, attitudes and behaviour

In the gSEM model (Fig. 3 and Table 5), we identified significant direct effects such as SEP on preconception behavioural intent ($p = 0.014$) and parity on preconception attitudes ($p < 0.001$). The results further indicated inconsistent mediation when examining the role of preconception knowledge in the relationship between SEP and preconception attitudes. Notably, the relationship between preconception knowledge and behavioural intent was fully mediated by a combined model of attitudes towards lifestyle behaviours, maintaining good mental health, and checking blood pressure regularly (71.7%).

Discussion

This comprehensive study observed geographic variations in preconception health knowledge, attitudes, and behavioural intent among respondents from the five distinct settings. The finding that the USA had the highest proportion of respondents with good preconception knowledge (13.8%) while Malaysia had the highest percentage of respondents with poorer knowledge (42.5%) points to significant differences in preconception health awareness between the differing economically developed countries. This is in line with a previous finding which showed that women of reproductive age from a HIC, such as USA, showed greater knowledge [26, 27]. The disparity in preconception knowledge between the settings could be attributed to several factors. Firstly, access to adequate healthcare plays a pivotal role in shaping ones' preconception awareness [26–29]. In HICs such as USA, access to a well-established healthcare system with extensive public health campaigns, health education resources, and widespread healthcare services [30], likely contributes to the higher knowledge levels we report. In contrast, Malaysia, despite its increasing progress in health educational programmes [31], faces many challenges such as limited educational outreach particularly evident in rural or underserved regions, which could possibly hinder knowledge dissemination considering nearly a quarter of the country is rural [32]. It has been reported that populations in more urban or better resourced areas typically have better access to health information

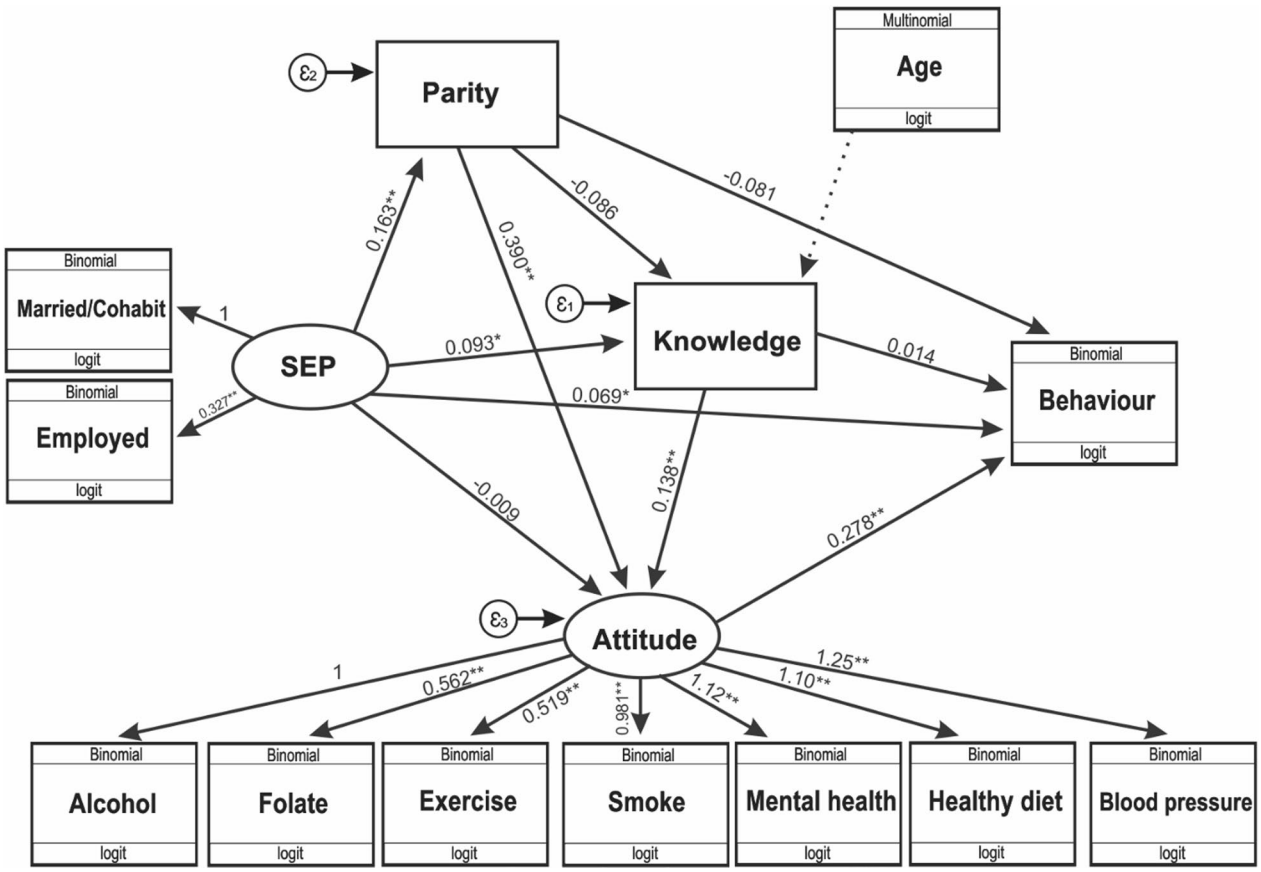


Fig. 3 Generalised structural equation model for preconception health knowledge, attitudes and behaviours. *SEP* socioeconomic position. *$p <$ 0.05; **$p \leq 0.001$

Table 5 Generalised structural equation model in a pooled sample of respondents for preconception health knowledge, attitudes and behaviours

Exposure	Outcome	Direct effect		Indirect effect		Total effect		Proportion of total effect mediated
		Estimate (95% CI)	*p* value	Estimate (95% CI)	*p* value	Estimate (95% CI)	*p* value	
Effect of SEP on attitudes via knowledge								
SEP	Attitudes	− 0.009 (− 0.047; 0.029)	0.64	0.013 (0.001; 0.024)	**0.030**	0.003 (− 0.036; 0.043)	0.86	‡
Effect of SEP on behaviour via knowledge								
SEP	Behaviour	0.069 (0.014; 0.123)	**0.014**	0.001 (− 0.001; 0.003)	0.20	0.070 (0.015; 0.125)	**0.012**	–
Effect of knowledge on behaviour via attitudes								
Knowledge	Behaviour	0.014 (− 0.004; 0.033)	0.13	0.038 (0.030; 0.047)	**< 0.001**	0.053 (0.036; 0.070)	**< 0.001**	71.7%*
Effect of parity on attitudes via knowledge								
Parity	Attitudes	0.390 (0.316; 0.464)	**< 0.001**	− 0.012 (− 0.031; 0.007)	0.23	0.378 (0.302; 0.454)	**< 0.001**	–
Effect of parity on behaviour via knowledge								
Parity	Behaviour	− 0.081 (− 0.174; 0.011)	0.086	− 0.001 (− 0.004; 0.001)	0.33	− 0.082 (− 0.175; 0.010)	0.081	–

Outcome variable adjusted for age

n number of participants; *PHK* preconception health knowledge. *Full mediation, p < 0.05; †partial mediation, p < 0.05; ‡inconsistent mediation, p < 0.05. Bold values denote statistical significance ($p < 0.05$)

[33]. Additionally, health knowledge prior to conception may not be prioritised as much in countries such as Malaysia, possibly due to cultural/societal norms or a lack of emphasis on preventive healthcare [34]. It has also recently been reported that there are still knowledge gaps concerning the facility-level and contextual factors that influence variations in primary care quality in low-resourced settings [35]. Lastly, regional disparities across all five countries, such as differences in SES, urbanisation, and education attainment [33, 36, 37], could contribute to variations in preconception knowledge noted in this study. These factors collectively suggest that improving preconception health knowledge by addressing access to adequate healthcare and considering cultural/societal norms or practices could be the key factors in enhancing awareness. Though in HICs, continuing to build on existing educational initiatives, and using meaningful language and health messages on preconception health, could further improve awareness [38].

A clear finding was that women generally demonstrate better preconception health knowledge compared to men [15, 39, 40]. This trend was consistent across most preconception attitudes and behavioural intention, with women consistently recognising the importance of adopting healthy behaviours, such as avoiding alcohol and smoking, maintaining good mental health, and eating healthily [41]. Additionally, women were also more likely to express a strong intent to seek preconception healthcare services if available. This aligns with previous research suggesting that women tend to be more engaged in health-related behaviours, particularly in areas linked to reproductive health and pregnancy planning [18, 42]. An unexpected finding was that more men, than women, in the UK, USA, Kenya, and Malaysia believed that exercising daily was important for preconception health. This contrasts with the general trend observed in the pooled sample, where women consistently showed higher awareness and intent regarding other preconception health attitudes. The higher emphasis on daily exercise among men in these countries may reflect growing awareness of the importance of physical activity for overall health and well-being, potentially influenced by changing health trends or societal shifts in attitudes toward men's health and fitness [43]. This finding therefore suggests that the development of targeted interventions could further emphasise the importance of exercise for both men and women when planning for a healthy pregnancy.

The findings reveal clear patterns in preconception priorities, with physical health identified as the most critical factor, followed by relationships and family, mental health, and financial stability in the pooled sample. These results suggest that physical well-being plays a significant role in preconception planning, with emotional and social factors also widely recognised as crucial. Mental health emerged as the third priority, reflecting growing awareness of its importance in reproductive health, while financial stability underscored the practical considerations of family planning. Regional and gender-based differences were also evident. For example, UK women prioritised relationships and family over physical health, while mental health ranked second for Kenyan and Malaysian women. Financial stability ranked fourth overall, but Kenyan women placed it fifth, possibly due to economic challenges [44, 45]. Living conditions, work or education, and climate were consistently ranked lower, suggesting that while important, they are secondary to health and emotional readiness. These findings highlight the need for context-specific preconception health education and interventions tailored to regional and cultural priorities.

The results regarding preferred sources of health education or information before pregnancy reveal clear preferences across the study population. Clinic doctors were the most preferred source, followed by nurses, obstetricians/gynaecologists, pharmacists, and family and friends. The internet and social media ranked sixth, while magazines/newspapers were the least preferred. These preferences were largely consistent across countries, with clinic doctors ranked first by both men and women in all countries, except for USA and Kenyan women, who ranked them second. These findings further highlight the importance of healthcare professionals, especially clinic doctors and nurses, as trusted sources of preconception health information, with some regional and gender-based variations in preferences. Even though the internet and social media were generally ranked sixth, a study in the UK found this to be an acceptable and trusted source of preconception health information when it was supported by the national/local health service [38]. To reduce pressure on healthcare professionals, and support widespread awareness raising on preconception health, further context-specific education opportunities should be co-developed.

When examining the role of preconception knowledge in mediating the relationship between SEP and preconception attitudes and behavioural intent, interestingly, we observed a significant direct effect between parity and attitudes, which may suggest that multipara, may directly influence preconception attitudes, particularly a combination of those related to lifestyle, maintaining good mental health, and regularly checking blood pressure. This direct positive relationship is in line with previous findings that showed that multiparous mothers may have more awareness due to past pregnancy experiences and experience less anxiety

compared to primiparous women [46]. The study also found that the relationship between preconception knowledge and behavioural intent was fully mediated by a combination of preconception attitudes with a high mediation effect of 71.7%. This could therefore be suggestive that the interplay between one's preconception health knowledge and the intent to adopt healthy behaviours (i.e., improve their health prior to pregnancy) was largely influenced by one's preconception attitudes. The results also suggest that preconception knowledge alone may not always be sufficient in explaining how SEP influences attitudes towards preconception health, and other factors, such as cultural or contextual elements, might be at play. Therefore, preconception knowledge alone not always leads to behavioural change; rather, it is the attitudes shaped by knowledge that strongly influence preconception health behaviours. Therefore, although it is evidently critical for individuals to attain adequate preconception health knowledge, it is, however, more important how individuals interpret and internalise knowledge—through their attitudes—is what drives actual behavioural change in the preconception period throughout gestation. This finding underscores the importance of fostering positive attitudes towards preconception health to translate knowledge into concrete behavioural changes.

This study must be interpreted by its strengths and limitations. The study is strengthened by the inclusion of a diverse geographic scope covering five countries with varied socioeconomic, cultural and healthcare context, which provides valuable cross-cultural insights into preconception health. This study was, however, cross-sectionally designed and therefore cannot infer causality. This study was, in part, limited to a sample of adults with internet access, which is not representative of the general population. Our results should, therefore, rather be interpreted in relation to the targeted respondents and not generalised for all adults in this age range. There was a potential risk of sample independence being violated, however, quality control of the online platform ensured that only a single response was acquired from a single respondent. The study made use of self-reported data which may be subject to respondent recall bias [47]. The virtual panel includes a general population where respondents self-identified as either female or male for survey enrolment, limiting our ability to explore gender variability, which we acknowledge as a potential study limitation. Another potential limitation of this study is that existing reproductive diseases and infertility diagnoses and educational attainment were not considered part of the study survey. To address these gaps, future research is recommended to incorporate these factors to provide a more comprehensive understanding of reproductive health.

To conclude, this multi-country study highlighted significant differences in respondents' preconception health knowledge, attitudes, and behavioural intent across five economically varied countries. Variations were observed in how respondents prioritised factors before pregnancy, likely reflecting cultural, socioeconomic, and healthcare access differences. Additionally, the study revealed diverse preferences for sources of preconception health information showing varying levels of awareness regarding preconception care. Overall, the findings emphasise the need for tailored preconception health interventions that consider both socioeconomic factors and regional cultural differences to improve health outcomes.

Abbreviations

gSEM	Generalised structural equation model
IC	Information criteria
KE	Kenya
MYS	Malaysia
n	Number of respondents
SEP	Socioeconomic position
SES	Socioeconomic status
RSA	South Africa
UK	United Kingdom
USA	United States of America

Supplementary Information

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Additional file 1.

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Author contributions

AC, KM and SAN were involved in the conception and planning of the study. SAN was responsible for oversight of data collection. AC carried out the data analyses and generated tables, interpreted the data, did the literature search, and the writing of the paper. AC, KM, JS, DS and SAN interpreted the data and made a significant contribution to the interpretation of the results.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Ipsos panels are part of research institutions that adhere to industry standards and regulations, such as those set by the South African Market Research Association, the European Society for Opinion and Market Research, the Protection of Personal Information Act in South Africa, the Market Research Society, and the General Data Protection Regulation. Additionally, since Ipsos operates as a market research firm and panel surveys are opt-in (respondents voluntarily choose to participate after reviewing the data privacy policy and confidentiality procedures), Ipsos and its entities are not required to obtain ethical approval. However, for any study involving human participants, ethical approval is necessary. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki, and ethics approval was granted by the Human Research Ethics Committee (Non-Medical) at the University of the Witwatersrand, South Africa (H21/06/36). All participants were thoroughly informed about the study's objectives, and informed consent was obtained from each respondent.

Consent for publication

All authors were responsible for revising the manuscript and approved the submitted version.

Competing interests

The authors declare no competing interests.

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References

1. Shawe J, Steegers EAP, Verbiest S, Springerlink. Preconception health and care: a life course approach. cham: springer international publishing; 2020.
2. Stephenson J, Heslehurst N, Hall J, Schoenaker DAJM, Hutchinson J, Cade JE, Poston L, Barrett G, Crozier SR, Barker M, Kumaran K, Yajnik CS, Baird J, Mishra GD. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. Lancet. 2018;391(10132):1830–41. https://doi.org/10.1016/S0140-6736(18)30311-8.
3. Barker M, Dombrowski SU, Colbourn T, Fall CHD, Kriznik NM, Lawrence WT, Norris SA, Ngaiza G, Patel D, Skordis-Worrall J, Sniehotta FF, Steegers-Theunissen R, Vogel C, Woods-Townsend K, Stephenson J. Intervention strategies to improve nutrition and health behaviours before conception. Lancet. 2018;391(10132):1853–64. https://doi.org/10.1016/S0140-6736(18)30313-1.
4. Caut C, Schoenaker D, McIntyre E, Vilcins D, Gavine A, Steel A. Relationships between women's and men's modifiable preconception risks and health behaviors and maternal and offspring health outcomes: an umbrella review. Semin Reprod Med. 2022;40(3–04):170–83. https://doi.org/10.1055/s-0042-1744257.
5. Carter T, Schoenaker D, Adams J, Steel A. Paternal preconception modifiable risk factors for adverse pregnancy and offspring outcomes: a review of contemporary evidence from observational studies. BMC Public Health. 2023;23(1):509. https://doi.org/10.1186/s12889-023-15335-1.
6. Brabin B, Gies S, Roberts SA, Diallo S, Lompo OM, Kazienga A, Brabin L, Ouedraogo S, Tinto H. Excess risk of preterm birth with periconceptional iron supplementation in a malaria endemic area: analysis of secondary data on birth outcomes in a double blind randomized controlled safety trial in Burkina Faso. Malar J. 2019;18(1):161. https://doi.org/10.1186/s12936-019-2797-8.
7. Chan SY, Barton SJ, Loy SL, Chang HF, Titcombe P, Wong JT, Ebreo M, Ong J, Tan KM, Nield H, El-Heis S, Kenealy T, Chong YS, Baker PN, Cutfield WS, Godfrey KM; NiPPeR Study Group. Time-to-conception and clinical pregnancy rate with a myo-inositol, probiotics, and micronutrient supplement: secondary outcomes of the NiPPeR randomized trial. Fertil Steril. 2023;119(6):1031–42. https://doi.org/10.1016/j.fertnstert.2023.01.047.
8. LeBlanc ES, Smith NX, Vesco KK, Paul IM, Stevens VJ. Weight loss prior to pregnancy and subsequent gestational weight gain: prepare, a randomized clinical trial. Am J Obstet Gynecol. 2021;224(1):99.e1-99.e14. https://doi.org/10.1016/j.ajog.2020.07.027.
9. Skogsdal Y, Fadl H, Cao Y, Karlsson J, Tydén T. An intervention in contraceptive counseling increased the knowledge about fertility and awareness of preconception health-a randomized controlled trial. Ups J Med Sci. 2019;124(3):203–12. https://doi.org/10.1080/03009734.2019.1653407.
10. Gardiner P, Bickmore T, Yinusa-Nyahkoon L, Reichert M, Julce C, Sidduri N, Martin-Howard J, Woodhams E, Aryan J, Zhang Z, Fernandez J, Loafman M, Srinivasan J, Cabral H, Jack BW. Using health information technology to engage african american women on nutrition and supplement use during the preconception period. Front Endocrinol (Lausanne). 2021;11:571705. https://doi.org/10.3389/fendo.2020.571705.
11. Maeda E, Miyata A, Boivin J, Nomura K, Kumazawa Y, Shirasawa H, Saito H, Terada Y. Promoting fertility awareness and preconception health using a chatbot: a randomized controlled trial. Reprod Biomed Online. 2020;41(6):1133–43. https://doi.org/10.1016/j.rbmo.2020.09.006.
12. Cérbulo-Vázquez A, Arriaga-Pizano L, Cruz-Cureño G, Boscó-Gárate I, Ferat-Osorio E, Pastelin-Palacios R, Figueroa-Damian R, Castro-Eguiluz D, Mancilla-Ramirez J, Isibasi A, López-Macías C. Medical outcomes in women who became pregnant after vaccination with a virus-like particle experimental vaccine against influenza a (H1N1) 2009 virus tested during 2009 pandemic outbreak. Viruses. 2019;11(9):868. https://doi.org/10.3390/v11090868.
13. Jiskoot G, Timman R, Beerthuizen A, Dietz de Loos A, Busschbach J, Laven J. Weight reduction through a cognitive behavioral therapy lifestyle intervention in PCOS: the primary outcome of a randomized controlled trial. Obesity (Silver Spring). 2020;28(11):2134–2141. https://doi.org/10.1002/oby.22980.
14. Hanafiah AN, Aagaard-Hansen J, Ch Cheah J, Norris SA, Karim ZB, Skau JK, Ali ZM, Biesma R, Matzen P, Sulaiman LH, Hanson M. Effectiveness of a complex, pre-conception intervention to reduce the risk of diabetes by reducing adiposity in young adults in Malaysia: the Jom mama project—a randomised controlled trial. J Glob Health. 2022;12:04053. https://doi.org/10.7189/jogh.12.04053.
15. Rabiei Z, Shariati M, Mogharabian N, Tahmasebi R, Ghiasi A, Motaghi Z. Men's knowledge of preconception health: a systematic review. J Family Med Prim Care. 2023;12(2):201–7. https://doi.org/10.4103/jfmpc.jfmpc_1090_22.
16. Daly MP, White J, Sanders J, Kipping RR. Women's knowledge, attitudes and views of preconception health and intervention delivery methods: a cross-sectional survey. BMC Pregnancy Childbirth. 2022;22(1):729. https://doi.org/10.1186/s12884-022-05058-3.
17. Fikadu K, Wasihun B, Yimer O. Knowledge of pre-conception health and planned pregnancy among married women in Jinka town, southern Ethiopia and factors influencing knowledge. PLoS ONE. 2022;17(5):e0268012. https://doi.org/10.1371/journal.pone.0268012.
18. Musgrave L, Homer C, Gordon A. Knowledge, attitudes and behaviours surrounding preconception and pregnancy health: an Australian cross-sectional survey. BMJ Open. 2023;13(1): e065055. https://doi.org/10.1136/bmjopen-2022-065055.
19. Phelan S. Pregnancy: a "teachable moment" for weight control and obesity prevention. Am J Obstet Gynecol. 2010;202(2):135.e1-8. https://doi.org/10.1016/j.ajog.2009.06.008.
20. LeBlanc ES, Boisvert C, Catlin C, Lee MH, Smith N, Vesco KK, Savage J, Mitchell DC, Gruß I, Stevens VJ. Prepare randomized clinical trial: acceptability, engagement, and lifestyle effects of a weight loss intervention

beginning in pre-pregnancy. Obes Sci Pract. 2022;8(5):603–16. https://doi.org/10.1002/osp4.596.
21. Demeke M, Yetwale F, Mulaw Z, Yehualashet D, Gashaw A, Agegn MB. Knowledge and attitude towards preconception care and associated factors among women of reproductive age with chronic disease in Amhara region referral hospitals, Ethiopia, 2022. BMC Womens Health. 2024;24(1):184. https://doi.org/10.1186/s12905-024-02994-4.
22. Craig A, Mtintsilana A, Mapanga W, Dlamini SN, Norris SA. Socioeconomic position, perceived weight, lifestyle risk, and multimorbidity in young adults aged 18 to 35 years: a Multi-country Study. BMC Public Health. 2023;23(1):1360. https://doi.org/10.1186/s12889-023-16234-1.
23. Mtintsilana A, Craig A, Mapanga W, Dlamini SN, Norris SA. Association between socio-economic status and non-communicable disease risk in young adults from Kenya, South Africa, and the United Kingdom. Sci Rep. 2023;13(1):728. https://doi.org/10.1038/s41598-023-28013-4.
24. Dlamini SN, Mtintsilana A, Mapanga W, Craig A, Norris SA. Associations between nutrition knowledge and obesity-related attitudes and physical activity among young adults from Kenya, South Africa, and the United Kingdom. South Afr J Clin Nutr. 2024;37(1):9–22. https://doi.org/10.1080/16070658.2023.2198844.
25. Cairncross ZF, Ravindran S, Yoganathan S, Dennis CL, Enders J, Graves L, Mill C, Telner D, Brown HK. Measurement of preconception health knowledge: a systematic review. Am J Health Promot. 2019;33(6):941–54. https://doi.org/10.1177/0890117119835518.
26. Ekbal AERE, Amany HAER, Naglaa MAG, Hanan EH. Knowledge and attitude of women and nurses regarding pre-conception care: a comparative study. Am J Nurs. 2019;5(1):1–15.
27. Kassa A, Hadra N. A systematic review and meta-analysis on women's knowledge of preconception care. EJRH. 2021;13(2):1–8.
28. Dennis CL, Brennenstuhl S, Brown HK, Bell RC, Marini F, Birken CS. High-risk health behaviours of pregnancy-planning women and men: Is there a need for preconception care? Midwifery. 2022;106: 103244. https://doi.org/10.1016/j.midw.2021.103244.
29. Demisse TL, Aliyu SA, Kitila SB, Tafesse TT, Gelaw KA, Zerihun MS. Utilization of preconception care and associated factors among reproductive age group women in Debre Birhan town, North Shewa, Ethiopia. Reprod Health. 2019;16(1):96. https://doi.org/10.1186/s12978-019-0758-x.
30. Stephenson J, Schoenaker DA, Hinton W, Poston L, Barker M, Alwan NA, Godfrey K, Hanson M, de Lusignan S. UK preconception partnership. A wake-up call for preconception health: a clinical review. Br J Gen Pract. 2021;71(706):233–6. https://doi.org/10.3399/bjgp21X715733.
31. Pre-School Young Doctor (Tunas Doktor Muda) Programme and the Development of God Health Behaviour among Pre-School Children in Pahang. International Journal for Studies on Children, Women, Elderly and Disabled. 2019:6.
32. Tradingeconomics.com. (n.d.). Malaysia-Rural Population-1960–2018 Data | 2020 Forecast. [online] Available at: https://tradingeconomics.com/malaysia/rural-population-percent-of-total-population-wb-data.html. [Accessed 5 Jan. 2025].
33. Chen X, Orom H, Hay JL, Waters EA, Schofield E, Li Y, Kiviniemi MT. Differences in rural and Urban health information access and use. J Rural Health. 2019;35(3):405–17. https://doi.org/10.1111/jrh.12335.
34. Fazaniza E. Support lacking for preventive healthcare measures. The Sun. Available at: https://thesun.my/home-news/support-lacking-for-preventive-healthcare-measures-GH9382239. [Accessed 5 Jan. 2025].
35. Macarayan EK, Gage AD, Doubova SV, Guanais F, Lemango ET, Ndiaye Y, Waiswa P, Kruk ME. Assessment of quality of primary care with facility surveys: a descriptive analysis in ten low-income and middle-income countries. Lancet Glob Health. 2018;6(11):e1176–85. https://doi.org/10.1016/S2214-109X(18)30440-6.
36. Moeti T, Mokhele T, Weir-Smith G, Dlamini S, Tesfamicheal S. Factors affecting access to public healthcare facilities in the City of Tshwane, South Africa. Int J Environ Res Public Health. 2023;20(4):3651. https://doi.org/10.3390/ijerph20043651.
37. Zurich.com. (2025). Available at: https://www.zurich.com/knowledge/topics/global-risks/the-risks-of-rapid-urbanization-in-developing-countries. [Accessed 5 Jan. 2025].
38. Schoenaker D, Gafari O, Taylor E, Hall J, Barker C, Jones B, Alwan NA, Watson D, Jacob CM, Barker M, Godfrey KM, Reason E, Forder F, Stephenson J. UK preconception partnership. What does 'preconception health' mean to people? A public consultation on awareness and use of language. Health Expect. 2024;27(4): e14181. https://doi.org/10.1111/hex.14181.
39. Cassinelli EH, McClure A, Cairns B, Griffin S, Walton J, McKinley MC, Woodside JV, McGowan L. Exploring health behaviours, attitudes and beliefs of women and men during the preconception and interconception periods: a cross-sectional study of adults on the Island of Ireland. Nutrients. 2023;15(17):3832. https://doi.org/10.3390/nu15173832.
40. Mello S, Stifano S, Tan AS, Sanders-Jackson A, Bigman CA. Gendered conceptions of preconception health: a thematic analysis of men's and women's beliefs about responsibility for preconception health behavior. J Health Commun. 2020;25(5):374–84. https://doi.org/10.1080/10810730.2020.1775728.
41. General (OSG), O. of the S. (2020). Strategies and actions: improving maternal health and reducing maternal mortality and Morbidity. [online] www.ncbi.nlm.nih.gov. Available at: https://www.ncbi.nlm.nih.gov/books/NBK568218.
42. Khan NN, Boyle JA, Lang AY, Harrison CL. Preconception health attitudes and behaviours of women: a qualitative investigation. Nutrients. 2019;11(7):1490. https://doi.org/10.3390/nu11071490.
43. Vaara JP, Vasankari T, Koski HJ, Kyröläinen H. Awareness and knowledge of physical activity recommendations in Young Adult Men. Front Public Health. 2019;7:310. https://doi.org/10.3389/fpubh.2019.00310.
44. Centralbank.go.ke. (2023). Kenya Financial Sector Stability Report 2023 | CBK. [online] Available at: https://www.centralbank.go.ke/2024/10/17/kenya-financial-sector-stability-report-2023 [Accessed 3 Jan. 2025].
45. Njagi P, Groot W, Arsenijevic J. Impact of household shocks on access to healthcare services in Kenya: a propensity score matching analysis. BMJ Open. 2021;11(9): e048189. https://doi.org/10.1136/bmjopen-2020-048189.
46. Lindblad V, Melgaard D, Jensen KL, Eidhammer A, Westmark S, Kragholm KH, et al. Primiparous women differ from multiparous women after early discharge regarding breastfeeding, anxiety, and insecurity: a prospective cohort study. Eur J Midwifery. 2022;6:1–11. https://doi.org/10.18332/ejm/146897.
47. Devaux M, Sassi F. Social disparities in hazardous alcohol use: self-report bias may lead to incorrect estimates. Eur J Public Health. 2016;26(1):129–34. https://doi.org/10.1093/eurpub/ckv190.

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