Hey Siri, track my period symptoms in Flo!

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Differences in women's perception of sexual and reproductive health advice provided by menstrual cycle tracking apps and doctors

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ABSTRACT

Title: “Hey Siri, track my period symptoms in Flo!” - Differences in women’s perception in sexual and reproductive health advice provided by menstrual cycle tracking apps and doctors

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Over the course of the last decade, several topics have gained emerging interest – digital healthcare, discrimination and female-health related topics. As academic research inherently provides more knowledge on well-funded and well-researched topics such as diabetes, emerging topics such as endometriosis do not receive the same attention of scientific research yet. On the other side, business investments have increased in the area of sexual and reproductive health, yet they focus to a majority on infertility which only impacts 15% of all couples. While 25% of women encounter menstrual irregularities which is a under-researched topic. Combined with a gender-biased healthcare system where powerless groups fear bias and stigma during the patient-physician interaction, there seems to be potential for innovation. Increasingly more private companies start exploring the market potential of physical, hybrid and digital products targeting the problems women face with menstrual irregularities. Based on data collection, digital products such as menstrual tracking apps can provide personalized insights and treatment suggestions without having to consult a healthcare provider.

This study aims to investigate the trust, intention to treatment adherence and psychological safety to share information with either the menstrual tracking app or doctors. Participants found themselves in one of the 4 experimental designed, manipulating the advice setting (app/doctor) and making previous (good/bad) experience more salient. Managers and healthcare providers are tasked to find solutions to bridge the gap between digital solutions and healthcare institutions.

Keywords: FemTech; construal level of psychological distance; menstrual tracking apps; digital healthcare; psychological safety in healthcare

Abstract – Versão Portuguesa

Título: "Ei Siri, rastreia os sintomas da minha menstruação em Flo!" - Diferenças na percepção das mulheres nos conselhos de saúde sexual e reprodutiva fornecidos por aplicações de rastreio do ciclo menstrual e por medicos

Autora: Daniela Redding

Na última década têm havido um aumento de interesse em vários tópicos - cuidados de saúde digitais, discriminação e a saúde feminina. Como a investigação académica origina inerentemente mais conhecimentos sobre temas bem documentados (diabetes) temas emergentes (endometrioses) ainda não foram alvos de estudo da mesma quantidade de investigação científica. Em contrapartida, os investimentos empresariais têm aumentado na área da saúde sexual, mas concentram-se maioritariamente no tema da infertilidade, que apenas impacta 15% de todos os casais, enquanto que 25% das mulheres se deparam com irregularidades menstruais. Sendo isto acompanhado por um sistema de saúde tendencioso em termos de género, onde grupos impotentes receiam preconceitos durante a interacção paciente-médico, parece haver aqui potencial para inovação. Cada vez mais empresas privadas começam a explorar o potencial de mercado de produtos que visam lidar com os problemas que as mulheres enfrentam no que toca a irregularidades menstruais. Recolhendo dados, produtos como aplicações de monitorização menstrual, podem fornecer perspectivas personalizadas e sugestões de tratamento sem haver a necessidade de consultar um prestador de cuidados de saúde.

Este estudo visa investigar a confiança, intenção de adesão ao tratamento, e segurança psicológica para partilhar informação com uma aplicação de monitorização menstrual ou com médicos. Os participantes encontraram-se numa das experimentais concebidas, manipulando o ambiente de aconselhamento (aplicação/médico) e salientado a qualidade da sua experiência prévia (boa/má). Os gestores e prestadores de cuidados de saúde são encarregados de encontrar soluções para colmatar a lacuna entre as soluções digitais e as instituições de cuidados de saúde.

Keywords: FemTech; nível de constrição da distância psicológica; aplicações de monitorização menstrual; cuidados de saúde digitais; segurança psicológica nos cuidados de saúde

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This dissertation does not only mark the end of my master studies but also the end of 2 years of personal development, sunshine and getting out of my comfort zone. Writing a dissertation about a taboo topic in society was inspiring and opened my horizon to many perspectives, new scientific insights and created hope that a for-profit, for-purpose business model can be a long-term successful one.

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1.0 Introduction

The World Health Organization (WHO) has defined sexual health as important and is working on enabling the safe and secure access to comprehensive, good-quality information as well as access to sexual health care. Over the last decades, the amount of research and investment in digital health has increased significantly. The women's health tech startup has increased similarly from $250 USD in 2018 (Lovett, 2021) and is projected to reach a market share size of $50 billion USD by 2025 (Frist & Sullivan, 2018). In 2020, the investment into healthcare products made up four percent of R&D funding and the largest proportion of the investment (65%) focusses on infertility products and services (Accenture, 2021). While infertility is a relevant topic, only 15% of couples in reproductive age are faced with difficulties in child planning (UCLA Health, 2020). In one third of the cases, the infertility causes can be solely attributed to the women in the relationship. In comparison, the amount of women experiencing menstrual irregularities far outnumbers the infertility impact with up to 25% of all women (Whitaker & Critchley, 2016). Therefore, this research focusses on the problems and symptoms that women are experiencing during their menstrual cycle.

Additionally, research is showing that the healthcare system is disadvantaging powerless groups (Ghods, et al., 2008, Sheridan, et al., 2015, WHO, 2011). This can be members of minority groups (sexual identity, sexual preference, disability, etc.) but it also includes women as powerless group. The awareness of potential stigma of healthcare providers inhibits the patients' trust in their physicians, limits their willingness to share full and accurate insights on symptoms and decreases their intention to treatment adherence. Due to the emergence of digital health, partly also due to the Covid-19 pandemic, healthcare providers and patients alike increasingly trust healthcare provided and relationships formed with the help of mobile health offerings. Menstrual cycle tracking apps allow women to track not only the dates of their menstruation but also problems and symptoms occurring. Based on this data, the menstrual cycle tracking apps are able to provide personalized information, forecasts and advice to change behaviors to prevent symptoms.

This research focusses on the differences in women's perception in sexual and reproductive health advice given by either menstrual cycle tracking apps or doctors. In order to investigate the research question, the following section provides an overview of the literature available, which helps form the hypotheses. In the third section, the participants, structure, material and design of the 2x2 between group experiments are described. The fourth section shows the results of the experiment for the four different hypotheses and a significant result is found for the psychological safety women feel when providing information to their doctor or the app. Finally, the limitations of this research are discussed mainly being the construction of the sample, suggestions for future research are given based on the limitations and additional comments that participants provided after completing the survey and the managerial implications followed by this research are provided.

2.0 Theoretical Background

2.1 Underserving women and women's health

Women make up 50.6% of the world-wide population in 2020 (World Bank, 2020) and various studies have found that despite the equal gender ratio, women have been underserved in many industries such as medicine, car safety and artificial intelligence based product development (Wenger, 2014, Mordaka, 2003, Kim, et al. 2019) as there was either no segregation of gender data or women were explicitly excluded. In recent years, many studies highlight the issue of gender biases in studies and call for gender parity in trials to prevent for example adverse drug reactions which women are twice as likely to be subject to than men (Tharpe, 2011). Including women in early stage trials is also attractive for pharmaceutical companies to avoid withdrawal of prescription drugs which were eight out of ten in the US market in 2005 (Simon, 2015). Hence the need to focus on research on women's health.

One example of the lack of adequate healthcare for women is symptoms and diseases related with women's menstrual cycle and reproductive care. Endometriosis, which can be extremely severe in its symptoms, is often not diagnosed due to doctors' tendency to underestimate the severity of reported symptoms which leads to missing out to perform the required tests to diagnose this disease (Green, et al., 2009). Therefore, the average time to diagnose endometriosis ranges from 4-11 years and reportedly, 65% of the women received an initial misdiagnosis (Green, et al., 2009). Besides reflecting the women's poor access to adequate healthcare, this also suggests the need to integrate women's perspective in healthcare to increase gender equality.

2.2 Emergence of technology and FemTech for women's health

Over the past decade the usage of wearable technology increased immensely (Ameen, et al. 2021), and simultaneously users of (wearable) technology are getting used to receiving an increasing amount of data. According to Lee and Lee (2018), wearables aim to achieve a state of consumer's self-connection by using sensors and software that facilitate data exchange, communication, and access to information in real-time. People are using technology to track health data such as tracking food intake and sports achievements (Murnane, et al., 2015, Karahanoğlu, et al., 2021). The availability of data has increased consequently over the last two decades and the personalization based on the data available as well (Berkovsky & Freyne, 2015). Mobile Health (mHealth) is an emerging topic based on the factors mentioned above, by combining the data tracked with behavior change theories (BCT), mobile apps can intervene in the routine behavior of individuals (Direito, et al., 2014).

With the emergence of technology, an increasing number of technological solutions are targeting female focused issues to overcome the gender gap in health equality. The term "FemTech" was coined by Ida Tin, who founded the period-tracking app Clue (Tin, 2016). There is an increasing

amount of technology aiming to empower women, providing access to information and healthcare providing personalized advice for women. The industry entails sexual and reproductive health, fertility, pregnancy and nursing care, general female wellness (Frost & Sullivan, 2018). The market potential is large given that half of the population is a potential user. In 2018, women's health tech startups secured more than $250 million USD (Lovett, 2021) in investment and the market share size is projected to be $50 billion USD by 2025 (Frist & Sullivan, 2018).

There are different kinds of innovation targeted towards women; physical products, hybrid products and technological products. Physical products such as periods panties, soft tampons, etc. innovate on how products which women use during their menstruation (e.g. Ooia, Einhorn). Hybrid products combine hardware and software - such as a case that houses the birth control pill and which connects to an app which warns the user when the case was not opened which implies that the pill was not taken (e.g. Emme). Lastly, fully technological products, such as apps, track user's menstrual cycles, periods, fertile days, menstural irregularities and period symptoms (e.g. Flo, Clue). The underlying mission of all the above mentioned companies is to empower women and provide devices and/or access to information regarding their sexual and reproductive health to make informed decisions in their every-day life.

Simultaneously to the emergence of FemTech, the Covid-19 pandemic has supported the growth of telemedicine which leads to more digital offerings of health consulting and trust in advice given by doctors online both in emergency and primary care, in order to decrease the risk of infection (Fagherazzi, et al., 2020). The exogenous shock of the pandemic to society increased the willingness to change and adapt to new innovation, this includes digital health but also the rapid digitalization of education (Alam, 2020).

2.3 The role of stigma and perceived trust in gender gap in healthcare

According to research conducted by Goffman (1963),

> *The word stigma refers to any stain or mark that sets some people apart from others; it conveys the information that those people have a defect of body or of character that spoils their appearance or identity. The word derives from a practice of the ancient Greeks, who branded criminals and slaves to mark their status. People reacted with disgust when they saw the brands associated with thieves or traitors, and citizens avoided interacting socially with criminals and slaves*.

In the context of this research, due to women's great effort to conceal visible cues that they might be menstruating (e.g. carrying tampons, preventing or hiding leakage), menstruation can be seen as invisible stigma (Oxley, 1998). On the one hand, stigma is related to people's socialization which influences how they perceive their surroundings and influences their judgments of

situations, information and people around them. On the other hand, biases refer to negative attitudes towards stigmatized groups of people and influence the decision-making process. There can be implicit bias present, which influences the decision-makers without them being aware of the bias, or explicit bias, which they are aware of. Biases are more likely to occur during heuristic decision- making when the human brain jumps to conclusions to save efforts (Gigerenzer & Gaissmaier, 2011).

One form of socialization which biases decision making are stigmatized topics such as menstrual cycles and openly talking about one's sexual activity or health which are viewed as private topics and therefore either avoided to be shared by the patient or avoided to ask for by the healthcare provider (Gill & Hough, 2007). By removing those topics from the open dialogue, information gathering is harder, misinformation can be spread easier and people are discouraged to talk about it openly which creates feelings of shame (Heath &White, 2008). There are different types of biases and stigma, especially relevant for health care, which influence the formation of a holistic picture of a person to make the best-informed diagnosis possible. Stigma often occurs around topics that have a normative form and a minority form, such as physical disabilities or sexual orientation.

The world in the current moment is a heteronormative place with ableist tendencies which requires people not identifying with the "norm" to explain the deviation. Due to this, a large burden is created on minority groups and the awareness of healthcare providers lacks sensitivity around this burden (Gill & Hough, 2007). Research found that physicians' communication changed over the last decades from paternalism to partnership (Emanuel & Emanuel, 1992, Leopold, Cooper, & Clancy, 1996; Perry, 1993). The concept of patient participation has become more focal when identifying drivers and barriers of a successful physician-patient relationship (Cegala et al., 2007). It refers to patients that participate actively in primary care medical interviews by asking questions, verifying information, raising concerns and volunteering additional information. Consequently, physicians are able to make a better diagnosis and can potentially adjust treatment based on the concerns and additional information provided (Street, et al., 2003).

Increasingly, research is focusing on the reasons for lower patient participation. Acker (1990) emphasizes in their research that healthcare facilities are not gender-neutral, healthcare facilities are highly patriarchal - describing a system that is mainly controlled by men and for decades has been created by the powerful group; men. The powerless group, women, experience a higher stigma awareness and experience institutionalized misogyny on a daily basis. This leads to lower participation and even avoidance to consult a healthcare provider for either regular check-up or with acute symptoms (Grogan, et al., 2018). Trust issues can be caused by bad experiences, stigma or by healthcare providers assuming sexual orientations which places the burden on the members of the powerless group, which a form of stigma (Link & Phelan, 2001). The relationship between patient with healthcare providers is of higher relevance when patients experience intersectional

prejudice. For instance, according to Leonardi and colleagues (2019), members of sexual minority groups are less likely to discuss reproductive health with healthcare providers. The implications of this lack of trust can especially be seen for younger members of powerless groups which increases the risk of teen pregnancy involvement between 2 and 10 times higher for sexual minority youth compared with heterosexual youth (Leonardi, et al., 2019).

As another example, women experiencing physical disabilities have reported that they did not receive the necessary respect and were not perceived as adults during patient-physician consultations (Becker, et al., 1997). Moreover, the correlation between their individual disability with proposed treatment and, specifically, medication was not considered when diagnosing, providing advice or information regarding sexual health, contraception and sexually transmitted infections (Becker, et al., 1997). This research emphasized that women tend to avoid routine examinations and seek gynecologic services only when they are experiencing severe problems or are in need of medically prescribed contraceptives. This highlights the importance of women trusting their physician, their advice and that they are being taken seriously.

Every patient-physician relationship is set in a unique setting between two individuals. While physical disabilities, or belonging to a sexual minority or another powerless group magnify the complexity of such relationship, previous experiences contribute as well. Human interaction, accuracy of diagnosis and quality of care are factors to be considered when measuring patients' trust in their physicians (Thom, et al., 2004). In 1990, Anderson, et al., aimed to develop a scale to assess a patient's interpersonal trust in their physicians. The initial study was conducted with a solely male sample but the scale has been validated for different settings, e.g. developing countries (Kalsingh, et al., 2017) and participant groups, e.g. pediatric care (Moseley, et al. 2006) and rheumatic patients (Freburger, et al. 2003), since the original development. The higher the trust in the physician, the more likely a patient is to attend physicians regularly or early when symptoms show allowing them to make a timely diagnosis. Additionally, lower trust leads to patients sharing less information and details or manipulating the presentation of symptoms due to social acceptance bias (Cunningham, et al., 2007). Subsequently, physicians' ability to make a good diagnosis is reduced as their available data is limited or potentially not accurate.

Women suffer gender inequality in health access and care (Celik, et al., 2011). As outlined above, one component of the gender inequality is explained by the stigma associated with being a woman and their sexual and reproductive health. This stigma is extrapolated by intersectional prejudice such as being a woman of color, physical disability or sexual minority. In interactions between women and their healthcare providers this stigma influences the experience which patients have, biases and stigma can lead to bad experiences which influences the perceived quality of care, relationship with healthcare providers and leads to lower trust. Lower trust leads to reduced help seeking and lack of adherence to prescribed treatment (Verhaeghe & Bracke, 2011).

2.4 Construal level of psychological distance

As described above, the interaction between physicians and patients usually take place face-to-face or increasingly digitally and discuss symptoms occurring in the present or past. One way to address the decreased trust during biases interactions can be increasing psychological distance when reporting symptoms, providing treatment suggestions and tracking treatment adherence.

Several studies investigated the seemingly contradicting capabilities of humans to live now but remember the past and imagine the future, Trope and Liberman (1998, 2003, 2010) explained the capability with construal levels to extrapolate what humans are experiencing in the presence to the past or future. The farther the memory in the past or the imagination in the future, the more abstract the construct and the higher the psychological distance as a person's reference point is egocentric and sees itself in the present moment as a starting point (Lieberman & Trope, 2010). In the theory of construal level of psychological distance, the correspondence bias refers to people's tendency to relate others' behavior with their personal dispositions (Gilbert & Malone, 1995). By presenting a person or a situation more abstractedly, longer in the past or further in the future, the social distance and the correspondence bias increases (Lieberman & Trope, 2010). This phenomena can be described as actor-observer in attribution (Jones & Nisbett, 1972) and can be extrapolated to the physician-patient relationship in different cases. While visiting the doctor's office, symptoms can either be happening at this moment or occurred previously.

In the first case, the symptoms are occurring the moment of the patient-physician interaction and the patient will be able to provide a detailed description of the symptoms and the severity of symptoms. However, the psychological distance between doctor and patient can lead the doctor to rate the symptoms more abstractly and potentially underestimate symptoms. As the doctor's impression is based on his/her own experience, the receival of the description and severity of symptoms is impacted by biases. Misdiagnosis due to underestimation of pain levels is frequently happening in the case of endometriosis (Green, et al., 2009).

In the latter case, the symptoms occurred in the past and the patient will be able to describe the symptoms in less detail as temporal distance causes details to fade from the patient's memory more rapidly and become more abstract the longer ago they occurred (Wyer & Srull, 1986). Combining both psychological and temporal distance, the optimal registration of symptoms occurring would be by having the patient reporting it at the moment of occurrence in a way that excludes the personal bias of a doctor. The accuracy of diagnosis impacts the intention to adhere to treatment prescribed by the doctor. If members of powerless groups do not feel heard and taken seriously, the intention to treatment adherence decreases (Becker, et al., 1997).

2.5 Research gap & hypotheses development

As identified above, an increasing trend towards digitalization of healthcare and the need for unbiased and unstigmatized healthcare has developed over the last two decades and is predicted to continue. With more people tracking their health related data and digital (mHealth) businesses offering personalized suggestions, the question remains on how to bridge the gap to physicians. Research indicates that specifically members of powerless groups tend to withhold information when they do not feel psychologically safe around their healthcare provider. While collecting data at the point of occurrence will benefit the diagnosing process of healthcare providers.

In sexual and reproductive health, previous research focusses on infertility and the tracking of treatments and businesses provided kits to track and treat (e.g. ClearBlue). In 2020, four percent of R&D funding into healthcare products and services and the majority, 65%, focuses on infertility (Accenture, 2021). While there are technology tracking symptoms during the menstrual cycle (e.g. Flo, Clue, etc), research on tracking symptoms is lacking behind similar to the investments.

Furthermore, the construal level theory describes that from a patient's perspective, tracking symptoms at the point of occurrence increases the level of detail that can be recorded without the presence of the physician's bias when communicating. Removing the personal aspect of reporting symptoms decreases the correspondence bias which leaves room for doctors to make inferences from a person to judge their judgment of e.g. pain levels. This bias can lead to misdiagnosis such as in the case of an endometriosis diagnosis as the powerless group's pain level are underestimated. By recording more concrete levels of detail via an app and displaying those as facts rather than a story to the doctor, it is likely that less biases are occurring when making a diagnosis and suggestion treatment.

This research aims to investigate the research question *How does women's perception of advice regarding their sexual / reproductive health differ between doctors and menstrual cycle tracking apps?*

Firstly, the difference in trust given by either a doctor or a menstrual tracking app will be measured and compared. Given the removal of bias during diagnosis and treatment suggestion, the expected result would be that advice by menstrual tracking app lead to higher trust in medical advice than if treatment is suggested by doctors.

> *H1a: Advice provided by healthcare online services (apps) lead to higher trust in medical advice than when it is provided by doctors.*

Complementarily, it is hypothesized that this effect is influenced by whether a patient previously had good or bad experiences with their healthcare provider. In order to test this effect, patients' previous experience will be made salient and based on previous research, the expected outcome is

that the tendency to show higher trust in the advice given by menstrual tracking apps is higher when the previous experience with a doctor was bad.

> *H1b: The tendency to show higher trust in advice given by apps than by doctors is higher when previous experience with doctor is bad than when previous experience with doctor is good.*

Subsequently, the interaction between patient and healthcare provider impacts the patient's intention to treatment adherence. With previous research showing that there is a relation between patients' impression of the interaction between themselves and their healhtcare provider, the expected outcome would be that women's intention to treatment adherence is higher when given by menstrual cycle tracking apps compared to doctors.

> *H2: Women's intention to treatment adherence is higher when given by menstrual cycle tracking apps compared doctors.*

Finally, the psychological safety of sharing information will be researched, as research has shown that there is a stigma around sexual and reprotuctive health and patients are reluctant to share information. Based on this, the expected result is that women feel safer to share information with a menstrual tracking app compared to doctors.

> *H3: Women feel safer to share information (e.g. on sexual activity, diseases, practices) with a menstrual cycle tracking app compared to doctors.*

These hypotheses will help identify the result of the research question whether women's perception of advice regarding their sexual / reproductive health differ between doctors and menstrual cycle tracking apps and show implications for both further research and managerial implications.

3.0 Methodology & Data Collection

The main goal of this study is to understand women's trust in their sexual and reproductive health advice. To answer this question, an experimental study was developed that allows a direct comparison of sexual and reproductive health advice given by a doctor or a menstrual cycle tracking app.

3.1 Participants

This study was conducted with 159 participants who voluntarily answered the survey. The survey participation eligibility was restricted by the participant's sexual identification as a woman. The survey was available for 20 days. The survey was distributed online and shared primarily on social media (Instagram, Facebook, LinkedIn, SurveyCircle).

The average age was 27.9 years with a standard deviation of 7.043, 91.1% identified as heterosexual, 28.9% are students, 16.5% are students with jobs and 49.6% are employed. The study was conducted in English and was tested to confirm the language by 3 individuals who are active in diversity and inclusion topics.

3.2 Materials

To test the role of the attitudes towards women's healthcare, we manipulated the salience of positive and negative past experiences in the context of women's medical care. To induce positive attitudes towards women's healthcare, participants were asked to recall a good medical experience, an experience where participants felt comfortable, respected and felt that they received good care. To induce negative attitudes, participants were asked to recall a bad experience, experience where they felt uncomfortable, disrespected and felt that they did not receive good care. To facilitate a vivid recalling and, therefore, ensure stronger attitudes, this manipulation asked participants how long ago this experience took place Subsequently, participants were asked to complete a scale asking how they felt about they felt about their experience and their doctor. This scale was intended to facilitate the analysis of the experience and reinforce the attitudes induced by the recalling exercise.

To test the role of women's healthcare context, we manipulated the outlet in which the service would occur, face-to-face consultation or online application. For both context conditions, participants were asked to imagine they were experiencing certain menstrual symptoms and they received specific feedback about on how to reduce those symptoms (*see appendix 1*).

In the online condition, participants received the advice from an app which can be used to track menstrual cycles, symptoms and problems. In the face-to-face condition, the same advice was given by a women's health doctor.

The dependent variables were measured as follows. To measure the intention to adhere to treatment, participants were asked to rate how likely they would follow four treatment prescriptions: "I intend to start drinking water" and "I intend to start walking 10.000 steps" both for short-term (today) and long-term (over the course of the next cycle). Participants gave their answers on a 7-point rating scale from 1- not likely at all to 7 – extremely likely.

To measure the trust in the service care given, participants were asked to complete four items: "I trust all symptoms were taken into consideration", "I trust this service care will help the me", "I trust the service care has helped others before", and "I trust the service care is in my best interest". Participants gave their answers on a 7-point rating scale from 1- not likely at all to 7 – extremely likely.

To measure perceived safety when sharing information, participants were asked to complete 7 items that they might be asked to share: the participant's likelihood to share information on her menstrual cycle, problems/symptoms during the cycle, sexual preference, identity and activity, the

participant's partner(s) and child planning. Participants gave their answers on a 7-point rating scale from 1- not likely at all to 7 – extremely likely.

To assess the participant's general trust in physician, the participant was asked to complete 11items based on Anderson, et al., (1990); "I doubt that my doctor really cares about me as person", "My doctor is usually considerate of my needs and puts them first.", "I trust my doctor so much I always try to follow his/her advice.", "If my doctor tells me something is so, then it must be true.", "I sometimes distrust my doctor's opinion and would like a second one.", "I trust my doctor's judgment about my medical care.", "I feel my doctor does not do everything he/she should for my medical care", "I trust my doctor to put my medical needs above other considerations when treating my medical problems", "My doctor is a real expert in taking care of medical problems like mine.", "I trust my doctor to tell me if a mistake was made about my treatment.", "I sometimes worry that my doctor may not keep the information we discuss totally private.". Participants gave their answers on a 7-point rating scale from 1- not fitting at all to 7 – extremely fitting.

Following, all groups were presented with the same set of questions evaluating the participant's experience with women's health doctors. Participants were asked to identify whether they have ever consulted a healthcare provider regarding their sexual/reproductive health, whether the healthcare provider was specialized in women's health or a general practitioner. Participants were asked to share the frequency with which they attend the healthcare provider from weekly to less than 1x per year. Lastly, participants were asked to complete 5 items regarding their perceived psychological safety to share information on: Sexual experiences, Sexual health symptoms (e.g. vaginal dryness), Global health symptoms (e.g. headaches), Sexual health concerns (e.g. sexually transmitted diseases), Global health conditions (e.g. having cancer). Participants gave their answers on a 7-point rating scale from 1- not likely at all to 7 – extremely likely.

Subsequently, the participants answered questions regarding the frequency and severity of problems and symptoms during their menstrual cycle. First, participants were asked to share how frequently symptoms and problems occur ranging from weekly to 1x per year. The participants were presented with a list of symptoms to select those that they encounter during their cycle; headaches, migraines, cravings, bloating, nausea, mood swings, depression, skin issues/ acne, changes in sex drive, tender breasts, cramps, back pain, insomnia. Next, participants were asked to complete 2 items; "How severe are your symptoms?" and "How symptoms negatively impact your day-today life?". Participants gave their answers on a 7-point rating scale from 1- not at all to 7 – extremely.

Following, the participant's familiarity and experience with menstrual cycle tracking apps were investigated; Asking the participant whether they have used a menstrual cycle tracking app in the past. If the participant selected "no", the participant was asked the likelihood of using the app in

the future. If the participant selected “yes”, the participant was asked how frequently the app was used from daily to less than quarterly. Then, participant was presented with a list of potential use cases and was asked to select those applicable; “Tracking period dates”, “Tracking fertile days”, “Tracking symptoms”, “Adjusting eating habits to time of the cycle”, “Adjusting sports habits to time of the cycle”. Lastly, participants were asked to complete 5 items regarding their perceived psychological safety to share information on: Sexual experiences, Sexual health symptoms (e.g. vaginal dryness), Global health symptoms (e.g. headaches), Sexual health concerns (e.g. sexually transmitted diseases), Global health conditions (e.g. having cancer). Participants gave their answers on a 7-point rating scale from 1- not likely at all to 7 – extremely likely.

Next, the participant was presented with a manipulation check aimed at identifying the validity of the response recorded. The participant was asked to recall the valence of the medical experience recalled in the beginning of the survey and the setting of the healthcare service described.

The final part collected demographic information such as the age and gender as input field, sexual orientation with selected options and the option to add another option if needed. Then the participants were asked whether they have children and their likelihood to have children within the next 12 months, 2 years and 10 years. Two questions identified in which country the participant spent most time growing up and where they are currently residing with a dropdown of all countries. The final information asked for was the participant’s current employment status.

3.3 Procedure

In the introduction of the survey, participants were told they would be participating in a study about women’s trust in reproductive health advice and that the participation is anonymous and voluntary. Participants were then randomly assigned and re-directed to one of the four conditions. As this study is specific to individuals identifying as women, a control question asked for this information. When a person did not identify as a woman, the survey was concluded and informed the participant thanked them for the participation.

Subsequently, the participant was prompted to think about an either good or bad experience with her women’s health doctor and in order to reinforce the experience, participants were asked how long ago this experience took place. By using the general trust in physician scale (Anderson, et al., 1990), participant’s trust was measured after the stimuli. Following, the advice regarding the participants sexual and reproductive health was presented either by an app or by a doctor. The intention of the participant to apply the advice and follow through over the next cycle was asked to test how the advice was perceived given the different stimuli of experiences. Additionally, the participants indicated how psychologically safe they feel sharing information with either the app or the doctor regarding different sexual and reproductive health related topics.

Following, all groups were presented with the same set of questions evaluating the participant’s experience with women’s health doctors, frequency and severity of problems and symptoms during

their menstrual cycle. Next, the participant's familiarity and experience with menstrual cycle tracking apps were investigated, different use cases and the likelihood to start or continue using it in the future.

Next, the participant was presented with a manipulation check aimed at identifying the validity of the response recorded. The participant was asked to recall the two different conditions of the experience and the setting of the advice received.

The final part collected demographic information such as the age and gender as input field, sexual orientation with selected options and the option to add another option if needed. Then the participants were asked whether they have children and their likelihood to have children within the next 12 months, 2 years and 10 years. Two questions identified in which country the participant spent most time growing up and where they are currently residing with a dropdown of all countries. The final information asked for was the participant's current employment status.

Finally, the participant was thanked for the participation and given the opportunity to provide questions or comments in an open text field.

3.4 Design

The study followed a 2x2 experimental design manipulating two independent variables with a between subject design. The independent variables being previous experience in the medical context (good, bad) and setting of medical advice (app, doctor). Per experiment, a group of 30 participants were collected according to Cohen (1975).

4.0 Analyses and Results

From the 159 participants, 121 responses were included in the analysis with 38 responses being excluded for either not passing the initial check whether the respondent identified as women or due to incomplete responses. The participants' average age is 27.9 years with a standard deviation of 7.1.

At the moment of data collection, 10.7% of the participants have children, and over the next 12months the average participant is unlikely to plan to become pregnant (M = 1.25, SD = 0.87), over the next two years the average participant is unlikely to plan to become pregnant (M = 2.07, SD = 1.65) and over the next 10 years the average participant is more likely to plan to become pregnant (M = 4.99, SD = 2.23). The current country of residence is for 68.6% of the participants also the country where they spent the majority of time growing up.

Furthermore, in terms of occupation; students made up 28.93% of participants, 16.53% are working-students, employed participants accounted for 49.59% of participants, 3.31% are self-employed and finally, 1.65% are retired.

4.1 Trust in advice

4.1.1 Trust in advice

H1a: Advice provided by healthcare online services (apps) lead to higher trust in medical advice than when it is provided by doctors.

In order to measure the dependent variable "trust", 4 items measured in 7-point scales were merged; "I believe the doctors takes all symptoms into consideration.", "I believe the advice will help me.", "I believe the advice has helped others before.", "I believe the advice is in my best interest".

A 2 advice setting (app/doctor) × 2 experience (good/bad) ANOVA was performed on participants' response (*table 1*). No significant main effects were found for neither advice setting ($F<1$), $p = 0.415$) nor the valence of previous experience $F(<1)$, $p = 0.991$) (*see appendix 2*).

In order to explore the potential impact of other variables, a regression was run with different control variables *(trust in physician, symptom severity, symptom impact, symptom frequency, app usage, frequency of app usage, age, current amount of children, plans to become pregnant over the next 12months, 2 years or 10 years, country of residence and childhood, doctor, frequency of doctor visits, sexual orientation, occupation)* and given the negative adjusted R square, those variables do not have an effect on trust (*see appendix 3*). Finally, mediation analysis was conducted to investigate whether independent variables are mediated by another variable (*see appendix 4*). There was no mediating variable found at a 95% confidence interval (*p(Experience)* = 0.48 & *p(Advice)* = 0.85).

The hypothesis 1a that the advice provided by healthcare online services (menstrual cycle tracking apps) leads to higher trust in medical advice than when it is provided by doctors is not supported.

Table 1. Judgments of perceived trust in the treatment recommendation, in a 7 points scale in which higher values correspond to higher trust.

	Good experience	Bad experience	Total
	M(SD)	*M(SD)*	*M(SD)*
Doctor	4.28 (1.26)	4.15 (1.46)	4.39 (1.05)
App	4.33 (0.82)	4.45 (1.25)	4.21 (1.35)
Total	4.30 (1.05)	4.30 (1.35)	4.30 (1.21)

4.1.2 Trust in advice interaction with previous experience

H1b: The tendency to show higher trust in advice given by apps than by doctors is higher when previous experience with doctor is bad than when previous experience with doctor is good.

In order to measure the interaction between trust in advice and previous experience, the merged variable "trust" as described in H1a was combined with the question that made participants' previous experience more salient by asking to recall feelings during the experience and asking how long ago the experience took place.

In order to investigate the interaction effect between advice setting and experience, a 2 advice setting (app/doctor) × 2 experience (good/bad) ANOVA was performed on participants' responses. No significant interaction effect was found for the perceived trust (*table 2*).

Table 2. Interaction effect of advice and experience on perceived trust, in a 7 points scale in which higher values correspond to higher trust.

	DF	SumSQ	MeanSQ	F value	P-value
Advice	1	0.99	0.99	0.67	0.415
Experience	1	0.99	0.00	0.00	0.991
Interaction	1	0.45	0.45	0.30	0.585

The subsequent regression including control variables provided no significant effect and a negative adjusted R square which defines that there is no significant explanation by the variables included in the regression (*(trust in physician, symptom severity, symptom impact, symptom frequency, app usage, frequency of app usage, age, current amount of children, plans to become pregnant over the next 12months, 2 years or 10 years, country of residence and childhood, doctor, frequency of doctor visits, sexual orientation, occupation) (see appendix 6)*. Finally, mediation analysis was conducted to investigate whether independent variables are mediated by another variable (*see appendix 7*). There was no mediating variable found at a 95% confidence interval (*p(Experience)* = 0.66 & *p(Advice)* = 0.76).

The hypothesis that the tendency to show higher trust in advice by apps than by doctors is higher when previous experience with doctor is bad than when previous experience with doctor is good is not supported.

4.2 Intention of treatment adherence

H2: Women's intention to treatment adherence is higher when given by menstrual cycle tracking apps compared doctors.

In order to measure the intention of treatment adherence, 4 variables measured on 7-point scales were merged to create the dependent variable; "I will start drinking 2l of water today.", "I will continue to drink 2l of water every day for the next cycle.", "I will start walking 10.000 steps today.", "I will continue to walk 10.000 steps every day for the next cycle.".

In order to measure the differences in intention of treatment adherence, a 2 advice setting (app/doctor) × 2 experience (good/bad) ANOVA was performed on participants' responses (*table 3*). We found no main effect of advice setting (F <1, p = 0.940), no main effect of previous experience (F < 1, p = 0.688) and no interaction effect (F <1, p = 0.308) (*see appendix 8*).

Table 3. Judgment of intention of treatment adherence, in a 7 points scale in which higher values correspond to higher intention to treatment adherence.

	Good experience	Bad experience	Total
	M(SD)	*M(SD)*	*M(SD)*
Doctor	4.19 (1.69)	4.37 (1.47)	4.28 (1.57)
App	4.46 (1.43)	4.06 (1.50)	4.26 (1.47)
Total	4.33 (1.56)	4.21 (1.48)	4.27 (1.52)

The subsequent regression including control variables resulted in a significant variable *"impact of symptoms*" is a significant predictor of the intention to adhere to treatment. The higher the impact of symptoms, the higher the intention to adhere to the treatment (0.315**, F= 1.252 (df = 9; 111), 95% CI). If everything held constant, an increase of the impact of symptoms increases the intention of treatment adherence from 5.569 to 5.884. While the regression resulted in a negative adjusted R square, the variable impact of symptoms explains a neglectable part of the intent of treatment adherence. The regression analysis showed that no other significant effects were found (*see appendix 9*).

The hypothesis that the intention for treatment adherence is higher when provided by a menstrual cycle tracking app compared to doctors is not supported. Moreover, this pattern of results does not change depending on the type of previous experience. Following, the investigation whether the

impact of symptoms mediates the effect of one of the independent variables showed that it there is no mediation effect at a 95% confidence interval. Neither of the other control variables shows a mediation effect (*see appendix 10*).

4.3 Psychological safety

H3: Women feel safer to share information (e.g. on sexual activity, diseases, practices) with a menstrual cycle tracking app compared to doctors

The dependent variable "psychological safety" was merged by 6 items on a 7-point scale, the question was "How likely is it that you share information about different topics with your doctor/app?" and the following topics were asked: "Menstrual cycle", "Problems / symptoms during your cycle", "Sexual preference and identity", "Sexual activity", "Partner(s)", "Child planning".

In order to measure the differences in the psychological safety, a 2 advice setting (app/doctor) × 2 experience (good/bad) ANOVA was performed on participants' responses (*table 4*). The results revealed a main effect of advice setting, $F = 5.230$, $p = 0.024$, 95% CI, such there is a difference in psychological safety between sharing information with an app ($M = 4.10$, $SD = 1.57$) than with a doctor ($M = 4.71$, $SD = 1.36$). No main effect of previous experience was found ($F < 1$, $p = 0.530$) and no interaction effect ($F < 1$, $p = 0.602$) (*see appendix 11*).

Table 4. Judgment of psychological safety, in a 7 points scale in which higher values correspond to higher psychological safety.

	Good experience	Bad experience	Total
	M(SD)	*M(SD)*	*M(SD)*
Doctor	4.56 (1.34)	4.87 (1.38)	4.71 (1.36)
App	4.08 (1.61)	4.11 (1.55)	4.10 (1.57)
Total	4.31 (1.49)	4.48 (1.51)	4.40 (1.50)

Subsequently, the regression analysis revealed the following variables predicting the psychological safety: impact of symptoms ($\beta = -0.362$ ***), severity of symptoms ($\beta = 0.345$ ***), trust in sharing information with doctor on general topics ($\beta = 0.525$ ***), trust in sharing information with app on sexual topics ($\beta = 0.180$ ***) (*see appendix 12*).

Following, the investigation whether the impact of symptoms mediates the effect of one of the independent variables showed that it there is no mediation effect at a 95% confidence interval. Neither of the other control variables shows a mediation effect (*see appendix 13*).

5.0 General Discussion

5.1 Main Discussion

Previous research on health judgments and decision making and the sudden emergence of eHealth services raised the research question of *How does women's trust in advice regarding their sexual / reproductive health differ between doctors and apps?* In an experimental study focused on understanding the impact of the advice setting and the previous experience with the medical consultations, four hypotheses were tested. Specifically, the impact of the advice setting and previous experience on three dependent variables; trust in advice, intention for treatment adherence and psychological safety when sharing information, was tested.

The hypothesis H1a that *advice provided by healthcare online services (menstrual cycle tracking apps) lead to higher trust in medical advice than when it is provided by doctors* was not supported by the analysis. Given that only 65.29 % of the participants were familiar with menstrual cycle tracking apps, the result could differ when all participants are familiar with the usage of menstrual cycle tracking apps and receiving advice digitally. Given this heterogeneity in the sample, drawing conclusions from any results might not be robust given that the usage of menstrual cycle tracking app can depend on different psycho-demographic factors, such as age, education, technical affinity, data privacy sensitivity, etc.

Additionally, literature suggested that previous experience impacts the trust relationship between healthcare providers and patients (Verhaeghe & Bracke, 2011). Therefore, the hypothesis H1b investigated the interaction effect between setting and previous experience and included that participants are expected to have the *tendency to show higher trust in advice by apps than by doctors is higher when previous experience with doctor is bad than when previous experience with doctor is good.* The results did not provide significant support for this hypothesis. The participants' previous experience was made more salient, half of the participants were asked to recall good vs bad experience for the second half. Participants were not asked whether they had any good or bad experiences and therefore, there is a possibility that participants in the "good" experience experiment had no experiences to recall or respectively, participants in the "bad" experience experiment had no bad experience to recall. It could also be that the manipulation used was not strong enough to elicit the emotions associated to the experience with the doctor.

Furthermore, previous research suggested a relationship between intention for treatment adherence and the healthcare provider who provides the diagnose and treatment plan. The hypothesis H2 is that *intention for treatment adherence is higher when provided by a menstrual cycle tracking app compared to doctors.* The analysis did not find support for this hypothesis and in a subsequent step controlling variables were analysis to find that the impact of symptoms has a significant positive effect on intention for treatment adherence. This result is according to the literature that shows that

higher severity leads to higher motivation to adhere to treatment. (Gao, et al., 2000). The proposed treatment was non-invasive, “Walk 10.000 steps daily”, “Drink 2l of water daily”. Additionally, it can be beneficial in any circumstance, even when there are no symptoms, since it can also be preventive, and still a difference was found depending on women's experience with their own menstrual cycle. The severity of women's own symptoms made them more likely to adhere to a beneficial treatment than women with low severity symptoms. Simply because they suffer less in general, they tend to adhere less to a treatment, even if that treatment is focused on mild symptoms such has headaches.

Moreover, the theory of psychological distance suggests that information in the present are available in more detail compared to having to record past events or symptoms. Due to this, the suggestion is that tracking symptoms in the presents will present more accurate information to enable the healthcare provider to make a better diagnosis and informed treatment plan. Providing information in the app removes the interpersonal level of bias and stigma awareness where patients fear judgment by the healthcare provider when providing information on their symptoms, general health status or life conditions. Therefore, the hypothesis H3 analysis whether *the psychological safety to share information is higher with a menstrual cycle tracking app compared to doctors.* This hypothesis was supported and the resulting implication is to investigate on how to combine the provision of information via an app into the healthcare institutions.

5.2 Limitations

This research contributed with relevant knowledge for both academic researchers, healthcare providers, patients and businesses in the FemTech area. Nevertheless, certain limitations are attributed to this research.

This research’s main limitation is the non-probabilistic convenience sampling method; hence this sampling method is not representative for the population. Due to this limitation and the fairly small sample size, a generalization of results is not allowed.

Additionally, the research excluded trans-men as well as people identifying as non-binary by asking whether participants identify as women. They do make up part of the population who can track their menstruation using cycle tracking apps. An additional study is required to account for the excluded groups.

The manipulation to make good or bad experiences more salient presents a key limitation to the study as it is possible that participants did not have a good or bad experience to recall when asked to do so. Additionally, it is possible that the manipulation was not strong enough to influence participants throughout the study.

Due to a small number of participants being familiar with menstrual cycle tracking apps (65% of the participants), additional studies should focus on participants who are familiar with menstrual cycle tracking apps. By including a degree of familiarity for all participants, the potential differences regarding functionality, simplicity of usage and information provided and recorded can be excluded. Additionally, the method of symptoms recorded should be taken into account for future research, in order to support the assumption that participants record symptoms which can be the basis for treatment suggested.

Lastly, the data sensitivity was not included in the research which can have an impact on trust and intention for treatment adherence and needs to be tested in future research.

5.3 Future Research

5.3.1 Data privacy sensitivity

There is future research needed regarding the relationship between trust, intention for treatment adherence, psychological safety and the patient's data privacy sensitivity. One comment on the survey conducted was that the participant had no desire to use any health apps due to data privacy concerns and literature supports data privacy as being a barrier to digital healthcare adoption (Rosas, 2019; Shipp & Blasco, 2020; Alfawzan, et al., 2022). The sensitivity for data privacy and corresponding laws varies per country or region (e.g. European Union) and the country of residence and childhood of participants will be related.

5.3.2 Manipulation of previous experience

For future research, the manipulation of previous experience needs to be revisited and potentially redesigned. One possibility is to ask participants whether their good or bad experiences outweigh the other and include this variable in the analysis. Further, the manipulation itself can be elaborated with factors that influence psychological safety in a healthcare setting, examples include questions regarding patient participation, general trust in healthcare, input on treatment or demographic differences such as power distance in the respective countries.

5.3.3 Sexual orientation or identification

The term "sexual minority" includes a variety of gender and sexual identities and expressions that differ from cultural norms. Usually, sexual minorities are comprised of lesbian, gay, bisexual and transgender individuals. " (Cochat Costa Rodrigues, et al., 2017). Due to minority status, a majority of healthcare providers are not part of minority groups and potentially lack the awareness for topics that are more relevant for those groups. Sexual minorities present another powerless group in the healthcare system and requires future research to confirm the hypothesis for this group. The sample of this study did not entail sufficient sample size for a non-heterosexual subset and therefore future research is required.

5.3.4 Digital provision of information process

While funding of research in the health sector is also subject to gender bias (Weisz, 2004), many governments and public research funding agencies have starting taking steps to increase the numbers of research done with sex-segregated trials, Canada being one of the first which first started monitoring and then assigning grants to research which includes both women and men in trials (Johnson, et al. 2013). Due to this, historical research influences the knowledge around certain diseases previously which still prevails today. While diabetes is a well-researched topic (3,680,000 articles on google scholar), it is a disease that men are twice as likely to have than women (Diabetes UK, 2009). Simultaneously, endometriosis is a disease which affects approximately 10% of the women in reproductive age worldwide (Adamson, et al. 2010) and is an under-researched disease (390.000 articles on google scholar). This research has confirmed the need for change in the way of providing information as participants felt more psychologically safe to provide information via an app instead to their doctor directly. Future research can focus on understanding the reasons for psychological safety and how to make the process increasingly personalized and efficient for both the health care provider as well as the patient.

5.3.5 Availability and quality of information

The lack of patients' participation in healthcare is a problem that depends not only on the medical approach, but also on patient's beliefs about their health and their access to the services. Many societies consider menstruation and other reproductive processes taboo (Christler, 2011), which makes it difficult for girls and women to gain access to information. In the 70s, textbooks covered the biological basics on menstruation while nowadays, there are multiple factors influencing the contents of educational books leading to cuts of content. Depending on educational books available, the courses in schools and universities are structured and when basic information is not covered, students are missing the basics to understand following discussions (Chrisler, 2008). Apart from courses in schools and universities, information is often taken from public information such as advertisements, books, or pamphlets produced not only by objective sources (e.g. Planned Parenthood) but also by tampon manufacturers who reinforce the need to conceal menstruation and negative associations with menstruation (Hoerster et al., 2003).

Among other countries, the sexual education in the U.S. is influenced by religious beliefs, politics and changing school laws with formal education largely focusing on abstinence-only or abstinence-plus which includes information on condoms and contraceptives (Young, et al., 2006). While studies have shown that growing up in religious households delays sexual intercourse it does not create a safe space to discuss questions within the school system but refers this to parents (Aspy, et al., 2007).

Menstrual cycle tracking apps can provide another source of information and future research is required to investigate the trust in information provided. Additionally, research to investigate how to identify independent and factual accurate information on these apps.

5.4 Managerial implications

As the emergence of digital health is projected to grow over the next years, as well as the acceptance of the public and the healthcare system, there are commercial opportunities to develop products or services in this area. Firstly, by collecting stigma-related health information via an app, healthcare providers can be supported to focus on core information and on managing patient-physician conversations in a bias-aware and relationship fostering manner. Secondly, allowing patients to provide information via an app will enable them to provide information more accurately without the perceived fear of judgment by the healthcare provider. Thirdly, businesses will increase their investments in FemTech and healthcare and need to foster the connection with healthcare institutions to ensure the adoption of the tools developed.

5.5. Main conclusion

This study aimed to investigate the trust, intention to treatment adherence and psychological safety to share information with either the menstrual tracking app or doctors. During a 2x2 experimental designed, participants' the advice setting was manipulated to either be an app or a doctor and the participants' previous good or bad experience was made more salient. The data analysis showed no significant differences for trust or intention to adhere to treatment for either advice setting and showed no influence of previous experience. However, the perceived psychological safety of participants to share information with the app or doctor showed a significant difference. As research implied, the interaction between physician and patient and the concept of construal level of psychological distance impacts the psychological safety of patients. While further research is needed to be able to extrapolate results and to dive deeper into factors impacting trust and intention to adhere to treatment, managers and healthcare providers are tasked to find solutions to bridge the gap between digital solutions and healthcare institutions.

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Appendix

Appendix 1 - Experimental conditions

Condition	Option	Stimuli
Previous Experience	Good	First, we would like to ask you to recall the last time you had a good experience with your women's health doctor. How did you feel after receiving good care? What was the thing that made you feel most comfortable? What were your feelings after that good experience? Think of how you felt valued, trusted, listened to and received actionable advice which helped you with your symptoms. Please, take a moment to remember how this experience made you feel safe and confident that you were receiving good care.
	Bad	First, we would like to ask you to recall the last time you had a bad experience with your women's health doctor. How did you feel after receiving bad care? What was the thing that made you feel most uncomfortable? What were your feelings after that bad experience? Think of how you feel unvalued, disrespected, neglected, and how the doctor failed to give you the support and care you needed at that moment. Please, take a moment to remember how this experience made you feel unsafe and confident that you were receiving bad care.

Delivery of advice	App	Now, please imagine that you use an app for your sexual/reproductive related health. There are several apps in the market which allow you to track your period, symptoms or problems in a calendar. Imagine that you receive the following advice from your cycle tracking app: You have logged headaches and nausea in the week before menstruation. The drop in estrogen just before your period might contribute to headaches. 60% of women report headaches before or during menstruation. Try the following advice to reduce your headaches: - Drink 2l of water every day - Walk 10.000 steps outside every day
	Doctor	Now, please imagine that you go to a doctor for your sexual/reproductive related health. In the intake conversation, you share with your doctor that you experience headaches and nausea in the week before menstruation. Imagine that you receive the following advice from your doctor: "You have shared that you experience headaches and nausea in the week before menstruation. The drop in estrogen just before your period might contribute to headaches. Many of my patients report headaches before or during menstruation. Try the following advice to reduce your headaches: - Drink 2l of water every day - Walk 10.000 steps outside every day

Appendix 2 – H1a, Anova results

	DF	SumSQ	MeanSQ	F value	P-value
Advice	1	0.99	0.99	0.67	0.415
Experience	1	0.99	0.00	0.00	0.991

Appendix 3 – H1a, Regression analysis of Trust in Advice

	Dependent variable:
	Trust in Advice
Experience	-0.081
	(0.320)
Advice	0.187
	(0.298)
Trust in physician	0.096
	(0.131)
Symptom severity	0.143
	(0.164)
Symptom impact	-0.160
	(0.161)
Frequency of app usage	0.097
	(0.131)
Age	0.008
	(0.047)
Children	0.806
	(0.918)
Moved between countries	0.345
	(0.372)
Frequency of doctor visits	-0.022
	(0.147)
Symptom frequency	-0.171
	(0.164)
Sexual Orientation	0.282
	(0.211)
Childwish (12 months)	-0.103
	(0.252)
Childwish (2 years)	-0.104
	(0.120)
Childwish (10 years)	0.198**

	(0.084)
Occupation	-0.027
	(0.095)
Constant	2.848
	(1.762)
Observations	77
R2	0.147
Adjusted R2	-0.080
Residual Std. Error	1.224 (df = 60)
F Statistic	0.647 (df = 16; 60)

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 4 – H1a, Mediation Effects

Average causal mediation effect	P-value (95% CI)
Experience	0.48
Advice	0.85

Appendix 5 - H1b, Anova results

	DF	SumSQ	MeanSQ	F value	P-value
Advice	1	0.99	0.99	0.67	0.415
Experience	1	0.99	0.00	0.00	0.991
Interaction	1	0.45	0.45	0.30	0.585

Appendix 6 – H1b, Regression Results

	Dependent variable:
	Q8_trustAdvice
	lm1b4
Experience	0.124
	(0.357)
Advice	0.260
	(0.339)
Trust in Physician	0.129
	(0.109)
Symptom severity	0.038
	(0.141)
Symptom impact	-0.006
	(0.139)
App Usage.	-0.010
	(0.273)
Age	0.001
	(0.027)
Children.	0.617
	(0.579)
Moved between countries	0.310
	(0.292)
Frequency of doctor visits	-0.018
	(0.115)
Symptom Frequency	-0.082
	(0.115)
Sexual Orientation	0.185
	(0.189)
Childwish (12 months)	-0.164
	(0.188)
Childwish (2 years)	-0.037
	(0.102)
Childwish (10years)	0.210***
	(0.068)
Occupation	-0.062
	(0.068)
Interaction Advice*Experience	-0.225
	(0.477)

Constant	2.765**
	(1.324)
Observations	120
R2	0.156
Adjusted R2	0.016
Residual Std. Error	1.200 (df = 102)
F Statistic	1.113 (df = 17; 102)

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 7 – H1b, Mediation effects

Average causal mediation effect	P-value (95% CI)
Experience	0.66
Advice	0.76

Appendix 8 – H2, Anova results

	DF	SumSQ	MeanSQ	F value	P-value
Advice	1	0.01	0.01	0.00	0.940
Experience	1	0.38	0.38	0.16	0.688
Interaction Advice*Experience	1	2.45	2.45	1.05	0.308

Appendix 9 – H2, regression results

	Dependent variable:
	Q7_intention
	lm2b
Experience	0.329
	(0.306)
Advice	0.077
	(0.293)
Trust in Physician	-0.101
	(0.134)
Symptom severity	-0.209

	(0.159)
Symptom impact	0.315**
	(0.154)
Usage of app	-0.079
	(0.327)
Age	-0.037
	(0.030)
Children	0.142
	(0.644)
Moved between countries	-0.486
	(0.329)
Constant	5.569***
	(1.137)
Observations	121
R2	0.092
Adjusted R2	0.019
Residual Std. Error	1.501 (df = 111)
F Statistic	1.252 (df = 9; 111)

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 10 - H2, mediation results

Average causal mediation effect	P-value (95% CI)
Experience	0.08
Advice	0.45

Appendix 11 - H3, Anova results

	DF	SumSQ	MeanSQ	F value	P-value
Advice	1	11.36	11.36	5.23	0.024 (95% CI)
Experience	1	0.87	0.87	0.40	0.53

Appendix 12 – H3, Regression results

	Dependent variable:

	Q10_topics
	lm3a1
Experience	-0.275
	(0.246)
Advice	-0.758***
	(0.240)
Symptom severity	0.345***
	(0.127)
Symptom impact	-0.362***
	(0.126)
Doctor trust - General topics	0.525***
	(0.096)
App trust – Sexual topics	0.180***
	(0.061)
Constant	1.294*
	(0.683)
Observations	105
R2	0.381
Adjusted R2	0.343
Residual Std. Error	1.218 (df = 98)
F Statistic	10.037*** (df = 6; 98)

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 13 – H3, Mediation results

Average causal mediation effect	P-value (95% CI)
Experience	0.69
Advice	0.86

Appendix 14 – Questionnaire

Start of Block: Check

Q2 Thank you for starting the survey. This survey is about women's sexual / reproductive health. Before you continue, please confirm that you identify as a woman?

- Yes, I identify as a woman (1)
- No, I do not identify as a woman (2)

Skip To: End of Survey If Thank you for starting the survey. This survey is about women's sexual / reproductive health. Bef... = No, I do not identify as a woman

End of Block: Check

Start of Block: Good exp/App

Q3 - intro

Part 1/4

The World Health Organization (WHO) has defined sexual health as important and is working on enabling the safe and secure access to comprehensive, good-quality information as well as access to sexual health care.

In this study, we are interested in understanding **women's experiences and trust in the health care advice** they receive. You will be asked to think about your experiences with sexual/reproductive health services.

Page Break

Q4 - good experience

First, we would like to ask you to recall the last time you had a **good experience** with your women's health doctor.

- How did you feel after receiving good care?
- What was the thing that made you feel most comfortable?
- What were your feelings after that good experience?

Think of how you felt valued, trusted, listened to, and how the doctor promptly provided the support and care you needed at the moment.

Please, take a moment to remember how this experience made you feel safe and confident that you were receiving good care.

Page Break

Q57 How long ago did the experience take place?

- Last 6 months (1)
- Last 12 months (2)
- Longer than 12 months ago (3)

Page Break

Q5 With this experience in mind, please read the following statements and select a number from 1 (not fitting at all) to 7 (extremely fitting) to indicate how well a statement fits to you.

	Not fitting at all 1	2	3	4	5	6
I doubt that my doctor really cares about me as person. (1)	○	○	○	○	○	○
My doctor is usually considerate of my needs and puts them first. (2)	○	○	○	○	○	○
I trust my doctor so much I always try to follow his/her advice. (3)	○	○	○	○	○	○
If my doctor tells me something is so, then it must be true. (4)	○	○	○	○	○	○
I sometimes distrust my doctor's opinion and would like a second one. (5)	○	○	○	○	○	○
I trust my doctor's judgement about my medical care. (6)	○	○	○	○	○	○
I feel my doctor does not do everything he/she should for my medical care (7)	○	○	○	○	○	○
I trust my doctor to put my medical needs above other considerations when treating my medical problems. (8)	○	○	○	○	○	○
My doctor is a real expert in taking care of medical problems like mine. (9)	○	○	○	○	○	○
I trust my doctor to tell me if a mistake was made about my treatment. (10)	○	○	○	○	○	○
I sometimes worry that my doctor may not keep the information we discuss totally private. (11)	○	○	○	○	○	○

Page Break

Q6 - app

Now, please imagine that you use **an app for your sexual/reproductive related health.**

There are several apps in the market which allow you to track your period, symptoms or problems in a calendar.

Imagine that you **receive the following advice from your cycle tracking app**:

You have logged headaches and nausea in the week before menstruation. The drop in estrogen just before your period might contribute to headaches. 60% of women report headaches before or during menstruation.

Try the following advice to reduce your headaches:

- Drink 2l of water every day
- Walk 10.000 steps outside every day

Page Break

End of Block: Good exp/App

Start of Block: Trust health services

Q7 - interaction
Please read the following statements and select a number from 1 (not likely at all) to 7 (extremely likely) to indicate how well a statement fits to you.

	Not likely at all 1	2	3	4	5	6	Extremely likely 7
I will start drinking 2l of water today. (1)	○	○	○	○	○	○	○
I will continue to drink 2l of water every day for the next cycle. (2)	○	○	○	○	○	○	○
I will start walking 10.000 steps today. (3)	○	○	○	○	○	○	○
I will continue to walk 10.000 steps every day for the next cycle. (4)	○	○	○	○	○	○	○

○ Page Break

Q8 - trust advice
Please read the following statements and select a number from 1 (not accurate at all) to 7 (extremely accurate) to indicate how well a statement fits to you.

I believe...

	Not accurate at all 1	2	3	4	5	6	Extremely accurate 7
the app takes all symptoms into consideration. (1)	○	○	○	○	○	○	○
the advice will help me. (2)	○	○	○	○	○	○	○
the advice has helped others before. (3)	○	○	○	○	○	○	○
the advice is in my best interest. (4)	○	○	○	○	○	○	○

Page Break

End of Block: Trust health services

Start of Block: Personal data concerns - app

Q10 Below you can find different types of information you may be asked to share in the context of your health.

How likely is it that you share information about different topics with your app?

	Not likely at all 1	2	3	4	5	6	Extremely likely 7
Menstrual cycle (1)	○	○	○	○	○	○	○
Problems / symptoms during your cycle (2)	○	○	○	○	○	○	○
Sexual preference and identity (3)	○	○	○	○	○	○	○
Sexual activity (4)	○	○	○	○	○	○	○
Partner(s) (5)	○	○	○	○	○	○	○
Child planning (6)	○	○	○	○	○	○	○

End of Block: Personal data concerns - app

Start of Block: Same for all - general trust in doctor - control measures

Page Break

○

Q55 Part 3/5 - Half-way there!

In the second part of the survey you will be asked questions about your experience with your sexual and reproductive health.

Q11 Have you ever visited a doctor regarding your reproductive / sexual health?

- Yes (1)
- No (2)
- I prefer not to answer (3)

- *Skip To: Q12 If Have you ever visited a doctor regarding your reproductive / sexual health? = No*

Q12 Was this doctor specialized in women's health or a general practitioner?

- Doctor specialized in women's health (1)
- General practicitioner (2)
- I don't know (3)
- Other (4) _____

Q13 How frequently do you visit your women's health doctor?

- Weekly (1)
- Monthly (2)
- 4x per year (3)
- 2x per year (4)
- 1x per year (5)
- less than 1x per year (6)
- Other (7) _____

Q14 -Trust in doctor Please read the following statement and select a number from 1 (not safe at all) to 7 (extremely safe) to indicate how well a statement fits to you.

How safe do you feel sharing the following information with your women's health doctor?

	Not safe at all 1	2	3	4	5	6	Extremely safe 7
Sexual experiences (2)	○	○	○	○	○	○	○
Sexual health symptoms (e.g. vaginal dryness) (3)	○	○	○	○	○	○	○
Global health symptoms (e.g. headaches) (4)	○	○	○	○	○	○	○
Sexual health concerns (e.g. sexually transmitted diseases) (5)	○	○	○	○	○	○	○
Global health conditions (e.g. having cancer) (6)	○	○	○	○	○	○	○

Page Break

Q15 How frequently do you experience problems / symptoms during your cylce?

- Daily (1)
- Weekly (2)
- Monthly (3)
- 4x per year (4)
- 2x per year (5)
- 1x per year (6)
- Other (7) _____

Q16
Which problems/ symptoms during your cycle do you encounter? (select multiple if applicable)

- Headaches (1)
- Migraines (2)
- Cravings (3)
- Bloating (4)
- Naseau (5)
- Mood swings (6)
- Depression (7)
- Skin issues / acne (8)
- Changes in sex drive (9)
- Tender breasts (10)
- Cramps (11)
- Back pain (12)
- Insomnia (13)
- Other (14) _____

- Page Break

Q17 - symptoms Please indicate how severe are your problems or symptoms during your cycle, from 1 (not at all) to 7 (extremely).

	Not at all 1	2	3	4	5	6	Extremely 7
How severe are your symptoms? (1)	○	○	○	○	○	○	○

Page Break

Q58 Please indicate to which extent your problems/symptoms during your cycle negatively impact your day-today life, from 1 (not at all) to 7 (extremely).

	Not at all 1	2	3	4	5	6	Extremely 7
How symptoms negatively impact your day-today life? (1)	○	○	○	○	○	○	○

Page Break

Q54 Part 4/5 - Almost there!

QX2 There are several apps in the market which allow you to track your period, symptoms or problems in a calendar. This information is used to make predictions for when your next period

starts, when your ovulation happens, provide warnings when periods have been irregular or late, and provide insights on symptoms.

Q20 Have you ever used an app to track your cycle?

- Yes (1)
- No (2)

Page Break

Q60 **How long** have you used the app to track your cycle?

- Between 0-3 months (1)
- Between 3-6 months (5)
- Between 6-12 months (2)
- More than 12 months (4)

Q21 **How frequently** do you use the app to track your cycle?

- Daily (1)
- Weekly (2)
- Monthly (3)
- Quarterly (4)
- Less than quarterly (5)
- Never (6)

Q22 What do you use the app for? (select multiple of applicable)

- Tracking period dates (1)
- Tracking fertile days (2)
- Tracking symptoms (3)
- Adjusting eating habits to time of the cycle (4)
- Adjusting sports habits to time of the cycle (5)
- Other (6) _____

Q61 Please read the following statement and select a number from 1 (not safe at all) to 7 (extremely safe) to indicate how well a statement fits to you.

How safe do you feel sharing the following information with **your app**?

	Not safe at all 1	2	3	4	5	6	Extremely safe 7
Sexual experiences (2)	○	○	○	○	○	○	○
Sexual health symptoms (e.g. vaginal dryness) (3)	○	○	○	○	○	○	○
Global health symptoms (e.g. headaches) (4)	○	○	○	○	○	○	○
Sexual health concerns (e.g. sexually transmitted diseases) (5)	○	○	○	○	○	○	○
Global health conditions (e.g. having cancer) (6)	○	○	○	○	○	○	○

- *Display This Question:*
- *If Have you ever used an app to track your cycle? = No*

Q24 You have never used an app to track your cycle - how likely are you to use it in the future?

- Extremely unlikely (1)
- Somewhat unlikely (2)
- Neither likely nor unlikely (3)
- Somewhat likely (4)
- Extremely likely (5)

End of Block: Same for all - general trust in doctor - control measures

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Start of Block: Manipulations check

Q59 Now, please answer the following two questions about your participation in this survey.

Q25 Which type of service did you think of when replying to the previous questions?

- Face to face consultation with doctor (1)
- Online consultation with doctor (2)
- App, online self-help service (3)

Page Break

Q26 You were asked to recall your previous health experiences with a doctor.
How was the experience that you recalled?

- Good healthcare experience (1)
- Bad healthcare experience (2)
- Neither good or bad experience (3)

End of Block: Manipulations check

Start of Block: Same for all - demographics

Q53 Part 5/5 - Last part!
The following questions ask for your demographic data.

Q32 How old are you?

- _____

Q30
Which gender do you identify with?

- _____

Q31 Which sexual orientation do you identify with?

- Heterosexual (1)
- Homosexual (2)
- Bisexual (3)
- Asexual (4)
- Prefer not to say (5)
- Add option (6) _____

Q34 Do you have children?

- ○ Yes (1)
- ○ No (2)

Q35 How likely are you to plan having (more) children....

	Not likely at all 1	2	3	4	5	6	Extremely likely 7
within the next 12 months (1)	○	○	○	○	○	○	○
within the next 2 years (2)	○	○	○	○	○	○	○
within the next 10+ years (3)	○	○	○	○	○	○	○

Q36 In which country did you spend the most time growing up?

- ○ ▼ Afghanistan (1) ... Zimbabwe (1357)

Q37 In which country do you currently reside?

- ▼ Afghanistan (1) ... Zimbabwe (1357)

Q38 What is your current employment status?

- Student (1)
- Working-student (2)
- Not employed (3)
- Stay-at-home parent / full-time caregiver (4)
- Employed (5)
- Self-employed (6)
- Retired (7)

Page Break

Q39 You completed this survey. Thank you very much for your interest and for your answers to our questions.

If you want you can use the space below to add a comment. If you have further questions you can also send an email to s-dredding@ucp.pt.

Please continue to the next page to finish the survey.

Thank you for your participation!

End of Block: Same for all - demographics