

How Students at the University of Colorado at Boulder Dispose of User-disposed Contraceptives
Potential Implications for the Environment

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Abstract

With intersex fish becoming more prominent and causing population collapse, and improper disposal causing contraceptives to wind up on beaches and killing aquatic animals, it is imperative to mitigate improper contraceptive disposal and its implications. With the intention of determining reasons for the improper disposal of contraceptives, I wrote and published a survey collecting quantitative and qualitative measurements of contraceptive use and disposal. These included questions of contraceptives used in the past year, disposal methods, and percent of the time disposed in that method compared to other methods, and the respondent's reasoning. The survey also measured contraceptive disposal education and pertinent factors to respondents regarding contraceptive choice. A total of 138 people responded to the survey with 18% actually or claiming they would improperly dispose. Through correlation analysis, I determined that there was no statistically significant correlation between improper disposal and age, sex, or attendance at the University of Colorado, Boulder. In response to why respondents dispose in their chosen method(s), most of the people who improperly disposed cited ease or convenience as reasons, but there were others who reported they did not know what else to do. Contraceptives that were packaged with disposal instructions tended to be correctly disposed of; for example: two of the three users of the contraceptive ring properly disposed citing the instructions as their reasoning. There are typically no disposal instructions on both condom and oral contraceptive packaging. This leads me to recommend two actions to decrease improper contraceptive disposal: increased exposure to disposal education, and clearly indicating the proper disposal for contraceptives on their packaging.

Preface

In order to help more people properly dispose of contraceptives, we must determine the percentage of the population improperly disposing and understand why. With this information, we can attempt to alter behaviors and lower the anthropogenic impact on the environment, which is why this paper is necessary. To attempt this, I created a survey and wrote a thesis regarding the results of the survey. None of this would have been even remotely possible without the supervision and guidance of my committee members: Professor Dale Miller, Professor Peter Newton, and Professor Jeffrey Writer, who supervised and guided me through this project and gave me the greatest gift of all: time. I feel so incredibly grateful to my parents, who edited the longest paper I have ever written and supported me unconditionally, and to Casey and Darcy, who didn't get angry with me when this took precedence over spending time with them. Thank you all.

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Introduction

Very few studies exist on how various contraceptives and their disposal affect the environment. I instituted this project to quantify on a small scale the percentage of people who use and dispose of contraceptives in different methods and to determine possible explanations for why people dispose of contraceptives in methods that are detrimental to the environment. This paper is in response to the increasing evidence of ocean pollution and excess hormones in freshwater aquatic systems causing intersex fish and decreasing fish populations. In order to accomplish this, I surveyed CU and non-CU students, asking a range of questions about their personal contraceptive use and disposal. This study reviewed four user-disposed contraceptives: condoms, oral contraceptive, the contraceptive ring, and the contraceptive sponge. These are all contraceptives in which a single unit is disposed of by the user. In addition, this study reviewed three non-user-disposed contraceptives: diaphragms, intrauterine devices, and the contraceptive implant; all three are contraceptives where an individual unit is used for longer than a month and not disposed of by the user. Then it compared and analyzed available scientific data with six different disposal methods: garbage, flushing in toilets, recycling, composting, littering, and any further methods.

My research question is: how do people dispose of user-disposed contraceptives, leading to greater understanding of the impact of disposal; and why do people dispose of contraceptives in methods that are detrimental to the environment? This study and further research are imperative because the consequences of incorrect disposal have very detrimental impacts on the environment. In order to determine how best to mitigate incorrect disposal, we first need to learn the reasons why people dispose of contraceptives incorrectly.

Background

Recently, there has been a lot of attention towards the results of anthropogenic pollution; how it affects not only humans but other species as well. Decades of mass creation and disposal, without complete understanding of the consequences, has created a snowball effect harming different land and aquatic systems. We see one unforeseen consequences in intersex fish: caused by the endocrine disruption from chemicals found in wastewater. Fish populations all over America and developed countries exhibit exposure to endocrine disruptors, resulting in the feminization and growth of eggs in the testes, or a phenomenon called intersex (Kidd, 2007). Intersex transformations in fish cause declines in fish populations, and in experimental cases: to the point of population collapse. Additionally, improper condom disposal through either water systems or littering causes mass unsanitary and health hazards on beaches and to animals in aquatic habitats (EPA, 2010). Condoms also contribute to sewer system buildups and can increase the extent of pollution when sewer system overflows occur, which includes waste water runoff into the streets or bypass treatment plants and pollute freshwater. In the next section, after a quick overview on past and recent trends in contraceptive use, we will review the available data on seven contraceptives and the consequences for their different disposal methods.

Trends in Contraceptive Use

Since before their criminalization in 1873 through the Comstock Act, contraceptives have sparked immense controversy and popularity. The Comstock Act, with the prescription to imprison or fine anyone who publicized, distributed, or possessed information about or was in possession of devices or medication for unlawful contraception (or abortion), made it extremely difficult to possess and use contraceptives. Finally challenged at the start of the Twentieth century, Margaret Sanger used birth control as a mechanism of change. She fought valiantly against the Comstock laws, and although imprisoned multiple times by the government, she created a birth control clinic (which was short lived), and even coined the term “birth control”. Although she was not able to change the Comstock Act itself, she greatly transformed public opinion and helped many women that crossed her path. Not absolved until 1973 with Roe v. Wade, laws prohibiting contraception persisted for a hundred years with its stigmatism still remaining in some areas (Encyclopaedia Britannica, 2018). Along with the decreasing stigmatism of using contraceptives, the Center for Disease Control has found increased upward trends in societal approval of people eighteen and over having premarital sex, same sex relationships, non-marital childbearing, and other related areas that would be considered horrendous fifty years ago (Daugherty & Copen, 2016). This pattern of sexual freedom and the decreasing stigmatism of using protection coexists with the rising rates of birth control use.

Trends in contraceptive use and duration explain current popular methods of birth control and possible explanations in use seen among survey results within and outside of the CU Boulder population. Although condoms and oral contraceptives are the most prevalent nationally, non-user-disposed contraceptives have been trending upwards since the early 2000s. Although

women are 17% less likely to get pregnant while using intrauterine devices and other non-user-disposed methods (including sterilization), the costs associated with non-user-disposed contraceptives can be prohibited by and often not covered by insurance companies. This partially explains why many younger people use user-disposed methods and why older women have a greater ability to invest in non-user-disposed methods (Fischman, 2015). In a study done by the CDC examining the contraceptive trends of 10,000 women (aged 14-44), the CDC found that the most used contraceptive was the contraceptive pill with 25.9%, female sterilization closely following at 25.1%, male condoms 15.3%, and non-user-disposed reversible contraceptives, including intrauterine devices and implants at 11.6% (10.3% IUD and 1.3% implant). Among these there were significant trends that women with three or more children had a greater affinity for sterilization with 56.7% compared to only 9.8% of women with one child using sterilization (Daniels & Daugherty, 2015). Although trends indicate that condoms and oral contraceptives are the most prevalent, there are increasing trends towards longer-acting contraceptives increasing every year, which indicates a lower impact on the environment and greater contraceptive sustainability.

The Nature and Expanse of the Problem

The following sections will review seven contraceptives; four are used at an interval of a month or less: condoms, oral contraceptive, the contraceptive ring, and the contraceptive sponge. As well as three non-user-disposed contraceptives: the diaphragm, Intrauterine Device (IUD), and the contraceptive implant. The sections will review the available data surrounding the disposal of these contraceptives, including: garbage, flushing down the toilet, recycling, and littering, and their respective implications on the environment.

Condoms

Condoms producers predominantly make condoms out of latex, which comes from rubber. Rubber is manufactured in a method very similarly to syrup: plantation workers make incisions in the bark of rubber trees and put a bucket underneath to collect the runoff. The rubber then travels from factory to factory where it is molded and tested. Fair trade certified condoms cost more but the extra money allegedly sustains plantation workers, mainly in Southeast Asia, with potable water, health care, and education (Bitchell 2014). Condoms have an important adjunct to contraception because it is one of the only contraceptives that protects against sexually transmitted infections. But condoms also cause a nuisance to the environment because they are not recyclable nor biodegradable, and the least impactful method of disposal (I will refer to as the “proper method” of disposal) is to the landfill. We will see in the next couple of sections how other methods of disposal, such as disposal in the waste water stream, have been correlated with aquatic animal harm and disruptions to sewer systems.

Flushing

A combined sewer system collects sanitary/waste water and storm water through a single pipe. During heavy rainfall, engineers designed the system so that overflow discharges directly to surface water. According to the EPA, around 850 billion gallons of untreated storm/wastewater are discharged to surface water, such as streams and rivers, each year from combined system overflows (CSOs) (EPA, 2010). A more environmental protective but expensive wastewater collection device used by states and municipalities does not combine wastewater and storm water. This sanitary sewer system only collects and conveys wastewater, domestic, industrial, and commercial, and distributes wastewater through a different set of pipes. Sewer system overflows (SSOs) can occur due to wet weather (due to inflow and infiltration) when there are normal sewage blockages and mechanical or system failures. As a result of SSOs, somewhere between 3 billion and 10 billion gallons of untreated wastewater get released each year. Overflows from either system release of untreated sewage into public areas can have detrimental environmental and public health effects and can contaminate drinking water, cause beach closures and cause public health concerns. A study done by the Environmental Protection Agency and National Marine Debris Monitoring Program has categorized condoms as the 7th most commonly found marine pollutant, the most common being plastic straws and bottles (EPA, 2010). With humans improperly disposing of condoms into the wastewater system and the frequency of combined and sanitary sewer system overflows polluting storm and wastewater systems, it is likely that many of condoms found littered in beaches, marine habitats and elsewhere are the result of improper disposal of condoms.

Research done in the United Kingdom by the “Bag it and Bin it” campaign, estimates that over 60 million used condoms end up on beaches and rivers each year (Ehiri 2002). Many of these originally flushed down toilets wound up in the sewer system. Through the first step of wastewater treatment: screening for solid objects, particulate matter like condoms, wet wipes, and diapers are removed from the system and either moved to a landfill or incinerated. Research done on UK sewer systems found that, due to site constraints, the inlet works – where wastewater screenings occur – become higher and screenings often dry out before they can be removed from the screens. This results in windblown litter and the study maintains that condoms are especially liable to contribute to windblown litter. After the treatment plant eliminates condoms they join the sludge: the residual, semi-solid material that is the combination of the particulates removed, it can be disposed of in many different places. Sometimes sludge is used in agricultural lands and used condoms can be added to windblown litter, similarly, sludge disposed at sea can contribute to sea-side and ocean litter. Even with the screening and precautions in place, when sewer system overflows occur, condoms and other particulates can bypass the entire treatment plant and pass untreated into water systems.

I interviewed a waste expert at the city of Boulder’s waste water treatment facility regarding the consequences of flushing nonbiodegradable products like condoms and they stated as follows. Normally condoms and other nonbiodegradable products are removed during waste treatment screenings, but it happens that condoms catch on natural litter like twigs and roots that are stuck in the grease that often lines sewer lines. When this occurs, and more and more debris and solid waste contribute, it causes sewer system blockages. Most of the time staff remove blockages but when they build up and there is an influx in waste, waste that can’t move toward the treatment plants will block the pipes and take the path of least resistance: either out of the

nearest man hole covers or through businesses and houses. This causes untreated waste water to pollute the nearest opening was. In the past, sewage overflows have runoff into the streets and even into the Boulder Creek. Since Boulder has a sanitary sewer system, which isn't at risk for overflows from most heavy rainfall occurrences to the extent that combined sewer systems are, there haven't been many cases of sewage runoff from heavy rainfall. But one example of the extraordinary was during the Boulder flood of 2013. On a normal day, Boulder's waste management can handle an influx of 20 million gallons per day, but during that flood, there was over 50 million gallons per day for four days straight. The treatment plant didn't have the capacity for this and rainfall and sewage ran rampant through Boulder for the duration of the flooding. The extent that the Boulder treatment plants can absorb flooding is very high and comparable with the best national treatment facilities. However, sewage blockages due to natural elements and increased by anthropogenic pollution greatly decrease the plant's ability to work efficiently and process waste.

Recycling

The process of recycling in Boulder requires paid employees to manually separate the different recyclables from nonrecyclables. The more nonrecyclable products in the system, the more time required for employees to properly separate materials, the more time it takes to get through a load of incoming recycling, wasting energy and resources. I interviewed an overseer at Boulder's recycling plant and her main opposition to personal contraceptives being recycled is to the sanitary violations and health of her employees. She was not aware of major plant disruption caused by condoms. She stated that if they bypassed the sorting process it was possible, yet still unlikely.

Littering

An example of the consequences caused by litter, either directly or from sewer systems, is the detrimental effects on aquatic animals. Off the coast of Rio De Janeiro, Brazil, five of the seven sea turtle species exist. Scientist examined the bodies of sea turtles post mortem and found marine debris in 39% of 23 specimens. Marine debris causes intestinal blockages and disruption in lipid metabolism causing accumulation of gas, which makes turtles more buoyant and thus more susceptible to predators. Digesting marine debris, even in small quantities, kills sea turtles and other marine species (birds and aquatic mammals). The debris they specifically found were hard plastics, soft plastics, metals, human hair, tampons, and condoms (De Carvalho 2015). Condoms and other trash wind up on beaches and in water systems as the result of either littering or sewage system overflows. The consequences can be catastrophic for marine life and result in the harm and death of many aquatic species.

The Contraceptive Pill

With the potential to be one of the most environmentally harmful contraceptives, the contraceptive pill has drastically varying effects depending on method of disposal. Its effects also vary depending on the type of pill. There are many different contraceptive pills; these can be classified into four types with two sub-types: conventional, continuous dosage, minipill, and combination birth control: monophasic, multiphasic. Conventional pills contain 21 active pills and 7 inactive pills or 24 active pills and 4 inactive pills. Continuous dosing or extended cycling pills contain 84 active pills and 7 inactive pills: which causes menstruation approximately 4 times a year. Minipills only have progestin. Combination birth control pills have various mixtures of active and inactive ingredients, though most of these contain at least some ethinyl estradiol, a semisynthetic estrogen. Of the combination pills, monophasic pills contain the same amount of estrogen and progestin while multiphasic pills have varying amounts of hormones (Mayo Clinic Staff, 2018). Environmental effects also vary depending on brand of pill.

Even though all manufacturers make their pills differently, they all use an array of the same chemicals. There are more than eighty (80) different combination birth control pills. Most contain Ethinyl Estradiol along with one of the following: Levonorgestrel, Norethindrone, Norgestimate, Desogestrel, Drospirenone, Mestranol, etc. (“Estrogen and Progestin”, 2015). Each pill also contains inactive ingredients including: a lactose (monohydrate, anhydrous, or other), a starch (sodium starch glycolate, pregelatinized starch, or other), a stearate (usually magnesium stearate but sometimes stearic acid), dyes and more (“Microgestin Fe”, 2012) (“Emoquette”, 2011) (“Lo Loestrin Fe”, 2017). Each contraceptive pill, in order to fully calculate and comprehend the environmental effects through different disposal methods, would have to be monitored for how each chemical effects the environment. The next few sections will

mainly focus on how Ethinyl Estradiol effects the environment since it is a major component in all contraceptive pills.

Flushing

Across the United States and in developed countries, fish populations are declining. This is due in part to natural and synthetic hormones, predominantly ethinyl estradiol, leaching into aquatic systems. In what may be considered the most widescale U.S. survey on gender bending fish in U.S. waters, Jo Ellen Hinck and her team at the U.S. Geological Survey tested fish from 111 different sites across America (Joyce, 2009). They were searching for intersex fish: male fish that have immature egg cell growth in their testes. They found that a profound number of bass were intersex. Across the study, 33% of smallmouth bass were found to be intersex. They also had some surprising results: “In regions of the southeast, 70 to 90 percent of the fish were found to be intersex. Only in Alaska's Yukon River in were fish completely free of this condition,” (Joyce, 2009). It is difficult to determine the exact cause of these sex transformations.

Lab experiments have started to point toward estrogenic compounds that can be found in oral contraceptives. Another scientist, University of Colorado, Boulder's David Norris, has studied fish specimens from 50 to 100 years ago and found no evidence of intersex fish. If fish 100 years ago weren't undergoing transformations, then something has to have changed between then and now for such a predominant number of fish to be affected. Scientist have hypothesized that this could be due extra estrogen and synthetic estrogens contaminating their environment. Professor Norris also reviewed other transformations in the past 10 years (Norris, 2000). He discusses the feminization of fish from sewage effluents, disruption of sexual development in

male alligators, lower immunological function in seals, and even reduction in sperm count in human males. All possibly impacted by endocrine disruptors, including natural and synthetic hormones, which are found in items that we use daily and are continually flowing out of our waste water treatment plants.

In order to determine the exact cause of this problem, one study conducted a seven-year experiment throughout an entire lake at the Experimental Lake Area in Ontario, Canada (Kidd, 2007). The purpose of this study was to see if low-level, chronic exposure has an effect on aquatic species, specifically fathead minnow in this case. The results of the experiment concluded that low-levels of estrogen and synthetic estrogen, especially ethinyl estradiol causes male fish to produce a hormone called Vitellogenin, which is a protein produced by females during oocyte maturation. This hormone causes feminization and for males with diminished reproductive efficacy. This ultimately caused the minnow population in the lake to collapse. This study concludes that even low-levels of exposure from estrogens can harm fish populations, considering how ubiquitous oral contraceptives are in America, we have need to be concerned. Furthering this, a study done in part by the University of Colorado, Boulder's Professor Jeff H. Writer found that endocrine disrupting compounds have the ability to travel several kilometers from their source (Writer, 2009). Testing for low level concentrations of endocrine disrupting compounds, the study found elevated plasma vitellogenin in fish populations exemplifying that endocrine disruption occurred.

Endocrine disrupters, like ethinyl estradiol, can only be partially removed from current water treatment plants. Since endocrine disrupters can have adverse effects on humans and wildlife, they must be removed before water is returned to potable water supplies. Although there are multiple methods that can remove ethinyl estradiol from wastewater, a study done by

the American Chemical Supply found that these compounds were degraded most efficiently when using UV/H₂O₂ advanced oxidation (Rosenfeldt & Linden, 2004). Although there are proper methods to remove Ethinyl Estradiol and other synthetic estrogens and progestins from wastewater, including UV/H₂O₂ advanced oxidation, they are extremely costly, and many would consider treating wastewater that doesn't return for human use not worth it; but not Boulder.

In the past decade, the Boulder Waste Water Treatment Facility upgraded their facility from a trickling filter/solid contact to an activated sludge mechanism. Scientists exposed fathead minnows to upstream conditions and the effluent wastewater downstream pre and post facility upgrade conditions (Barber, 2012). Although not wholly removing the effluence of endocrine disruptors, they observed a reduction in endocrine disrupting chemicals, and its effects on the fish. Aside from spending millions of dollars upgrading treatment facilities, another solution is stopping people from improperly disposing of hormonal contraceptives into the water system. Although that does not prevent the hormones that women naturally produce escaping through urine into the waste water system.

Recycling

Medicines themselves are not recyclable. Oral contraceptives arrive packaged in “blister packs” which are primarily composed of plastic and aluminum. The two materials themselves are often recyclable but together are useless to recycling plants and disposed of in the landfill. Blister packs are commonly placed in recycling unseparated. However, to be considered recyclable they must be manually separated completely (Granger, 2018). Even then, not all recycling plants will consider it economically viable to recycle such a small amount of plastic or aluminum.

Vaginal Ring

The duration of a NuvaRing is one month. It is used for a three-week period interval, removed for a week, and then a new one is inserted. Although, one month may not be an accurate estimate of the use of a NuvaRing due to its unpredictable expulsions. NuvaRings have been known to fall out during intercourse, while removing a tampon, and even during straining bowel movements. In the cases where they are in proper condition to be reinserted, they need to be inserted within three hours or a new one is necessary. NuvaRing is made of non-biodegradable “ethylene vinylacetate copolymers and magnesium stearate, and contains 11.7 mg etonogestrel and 2.7 mg ethinyl estradiol” (“NuvaRing” 2016). Insertion also requires a one-time-use applicator which is supposed to be disposed of in the garbage.

The Environmental Protection Agency rates vinyl acetate, a component of the vaginal ring, as a possible harmful drug: while exposing rats to two hundred ppm or particles per million, they experienced congestion and increased lung weight while possibly affecting the immune system and nervous system and may cause cancer in humans (“Vinyl Acetate” 2015).

Garbage

A study done on the environmental effects of ethinyl estradiol leaching into landfills from NuvaRing found the leaching effects observed through a meter of landfill took approximately 40 years. They concluded that the effects of ethinyl estradiol are negligible in landfills and that the sandy soils at the base are good for soaking in most of the synthetic estrogen before it hits ground water (Geurts 2007). Although, the study does not look into the impacts of the NuvaRing as a whole.

NuvaRing has been shown to still contain estrogen after use. To combat the hormone getting into the water supply, the company has “do not flush” instructions. Because landfills slow drug seepage, they are a better alternative to estrogens becoming more potent in the water supply and contaminating the drinking water and harming aquatic and human populations (Neegaard 2003).

Contraceptive Sponge

The birth control sponge is a small, round sponge made of a soft plastic and contains spermicide. It can be used for a continual 24 hours without regard to the amount of intercourse in the 24 hours, and then be disposed. The sponge does not protect against sexually transmitted infections. If used perfectly, the contraceptive sponge prevents pregnancy 91% of the time. In reality, it is 88% effective in women who have never given birth and 76% effective in women who have had at least one child. Nonoxynol-9, or spermicide, has been known to cause vaginal irritation and thus, create a greater chance of sexually transmitted infections. Although made of non-biodegradable plastic, the sponge is hormone free which is a benefit for aquatic populations (Planned Parenthood n.d.).

Flushing

Besides the possibility of the sponge contributing to sewer system blockages, the main component of the contraceptive sponge that could affect the environment is Nonoxynol-9: spermicide. The National Center for Biotechnological Information suggests that Nonoxynol-9 will not evaporate into the atmosphere from water or soil or through hydrolysis. They also claim that bioconcentration and thus toxicity in aquatic species is moderate. This leads to the conclusion that it is best to avoid depositing the contraceptive sponge, or other contraceptives with spermicide, into the water systems.

Diaphragm with Spermicide

The diaphragm is a small, bendable cup/saucer made of silicone that is inserted inside the vagina and covers the cervix. It mostly stops sperm from reaching the egg but is most effective when used with spermicide. It requires an initial size fitting by a doctor (or a less effective one size fits some) and lasts up to 2 years. The diaphragm is around 94% effective when used perfectly and around 88% effective when factoring in human error. The diaphragm should be inserted with spermicide no more than two hours before intercourse and should remain in the cervix for at least eight but no more than 24 hours after intercourse. If having intercourse multiple times or after two hours since spermicide was used, another dose of spermicide should be applied. Diaphragms are meant to be reused. After use, the user should wash with soap and water.

Spermicide makes diaphragms as a contraceptive much more effective but has some risks. Also known as nonoxynol-9, the chemical in spermicide has been known to irritate the vaginal area and also increase the risk of HIV and other sexually transmitted infections. The diaphragm has environmental benefits, such as lack of hormones as well as its longevity (if cleaned properly). The diaphragm has a small impact on the environment with its nonbiodegradable silicone and moderately toxic spermicide addition: which is minimalized if it is disposed of in the landfill.

Intrauterine Device (IUD)

There are two different types of IUDs used in America: copper and hormonal. The copper, also known as ParaGard, uses copper to deflect sperm and can be used for ten years. The hormonal IUD, Mirena, is made of plastic and use the synthetic hormone progestin to block sperm and can normally be effective for five years (Planned Parenthood n.d.).

As the main ingredient in copper intrauterine devices, Ethylene-Vinyl Acetate Copolymer is neither biodegradable nor soluble and has been estimated to have negligible impact on the physical or aquatic environment (Honeywell 2015).

Mirena is a small, T-shaped intrauterine device with a polyethylene frame and covered with a thin layer of barium sulfate. The drug reservoir is composed of levonorgestrel, a Progestin, and silicon, covered wholly in a semi-opaque silicone membrane. The entire IUD contains a total of 52 milligrams levonorgestrel with an initial release rate of 20 micrograms per day lasting on average five years (“Mirena Releasing Intrauterine System” 2017).

ParaGard’s copper contraceptive is a T-shaped intrauterine device. The T-frame is made of polyethylene and barium sulfate. ParaGard contains 176 milligrams of copper coiled along the vertical stem and 68.7 milligrams each of the horizontal arms. This results in approximately 380 millimeters of exposed copper. Each IUD weighs less than a gram. ParaGard is packaged in a Tyvek polyethylene pouch and contains an insertion tube (Cooper Surgical 2018).

Medical waste is defined as healthcare waste contaminated with blood, bodily fluids, or potential harmful materials. Medical waste is strictly regulated by the EPA. Non-user-disposed devices such as the intrauterine devices and contraceptive implant, are removed by a physician and disposed of as medical waste that either gets incinerated or treated and brought to a landfill or recycled (“Medical Waste” 2017).

Contraceptive Implant

Nexplanon, previously Implanon, is a small, flexible, plastic rod that gets injected in the non-dominant arm between the triceps and bicep. It is 4 centimeters long and 2 millimeters in diameter and contains a ethylene vinyl acetate copolymer core (Adams 2009).

The implant is effective for up to three years and when inserted correctly, prevents pregnancy over 99% of the time. One notable downside is that there is no evidence if Nexplanon is effective in obese women due to a lack of survey data (“Nexplanon” 2017).

The implant contains 68 milligrams of a progestin hormone called etonogestrel as well as 15 milligrams barium sulfate, for X-ray viewing, and .1 milligram magnesium stearate surrounded by an ethylene vinyl acetate copolymer skin (“Nexplanon Package Leaflet” 2016).

Methods

To discover why people dispose of contraceptives in methods that are detrimental to the environment, this paper reviewed each contraceptive with the available data on the results of disposing in different methods, and then analyzed the results of the survey collected primary research for this thesis. In order to cater to the specific audience and the nature of the topic, I chose to distribute the survey online using Qualtrics. By using Qualtrics and not collecting emails or names or any other direct or indirect identifiers, the surveys were completely anonymous. College students were the chosen population not only because they were the most readily accessible, but also because they are in the age range of people who trend towards user-disposed contraceptives. I also tried to survey those outside this population in order to have a base of answers to compare the results to and test for possible age-improper disposal correlations. This was critical in identifying if college students actually have statistically significant differences in contraceptive use compared to everyone else.

The survey (Appendix A) opens with general questions that were used to compare different types of users. Background questions included: age, sex, and attendance at the University of Colorado Boulder. The latter was used to compare results from students at the university versus everyone else. Sex was asked because an important differential in contraceptive use is dependent on anatomy. Males will have used only condoms while females could have used any method. I chose not to ask about the respondents' partners in the past year because I wanted to protect against the possibility of duplicate answers in the unlikely but possible case that both parties responded to the survey or the possibility that partners did not know enough about the other's contraceptive use. The survey then asked which contraceptive the user has used in the past year. The timescale of the survey was a year because that was a

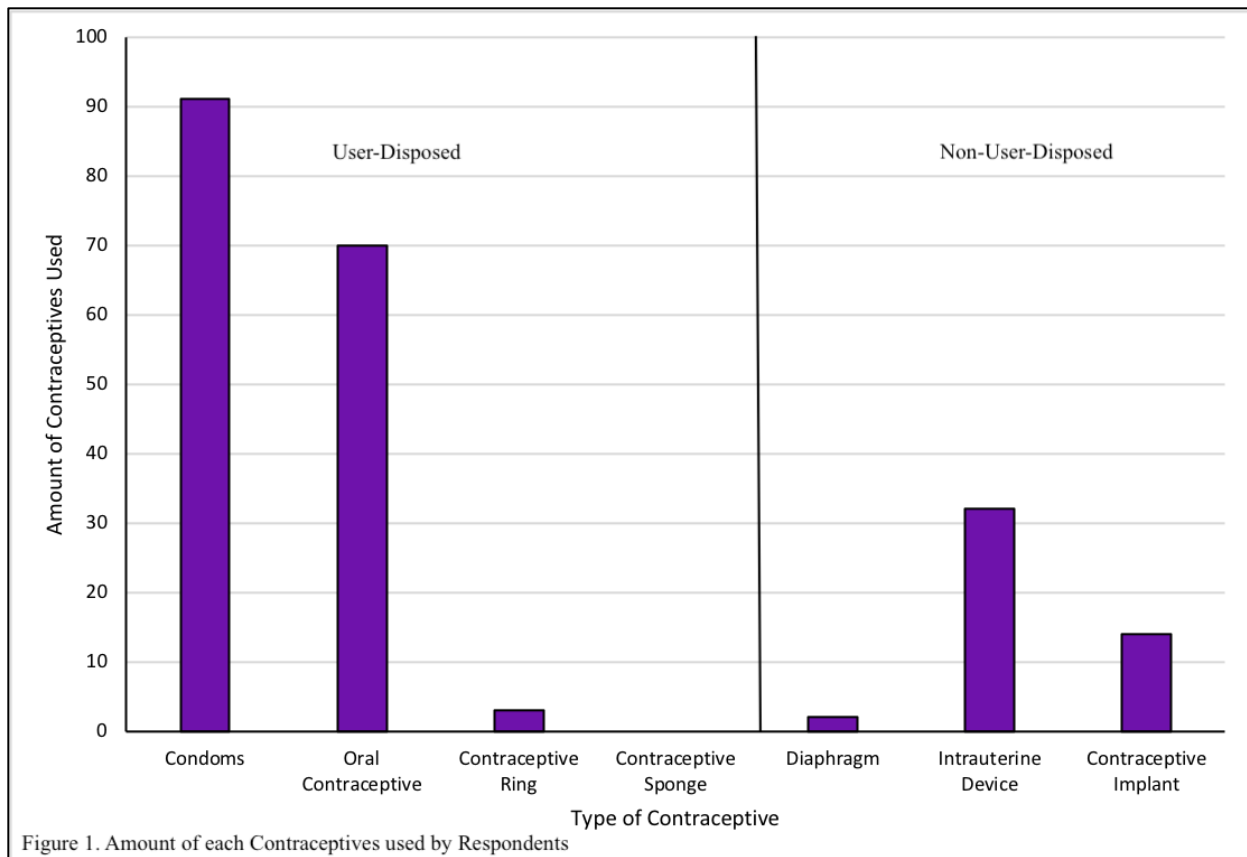
reasonable amount of time for people to remember and estimate their contraceptive use. Then, based on their responses, the survey opened up a block for each of the chosen contraceptive. For each of the user-disposed contraceptives, the survey asked how often in the past year they have used that contraceptive and which methods they have used in the past year to dispose of them. Based on their answers to how they dispose of them, the survey asked what percentage of the time they dispose that way, and an open-ended write in question: why? The non-user-disposed contraceptives opened up a slightly different block of questions, asking how long in the past year they used that contraceptive. This was just to equalize the time period between methods if they had switched to or from a different contraceptive in the last year. I did not ask questions about disposal for non-user-disposed contraceptives (IUD, implant, and diaphragm) because those are disposed of by the doctor that removes them.

The last three questions are different. The first was a hypothetical question: “Hypothetically, if you lost a pack of oral contraceptives half way through the cycle and had to start a new one, what would you do with the leftover pills?” This was opened to anyone who identified as the female sex. During the contraceptive pill questions, an initial question asked if the user had, in the past year, not finished, for whatever reason, a pack of pills and had to dispose of the remaining pills. I did this because people who have never had left over pills would not have had to dispose of extra contraceptive pills. In order to gauge the intentions of those who had yet to have leftover pills, I asked the hypothetical, to discern how everyone would dispose of leftover pills, not just those who already have. The second question asked if the respondent had ever had any disposal education, to determine if education has any correlation with disposal habits. Lastly, in order to understand what priority environmental factors may have on people when using contraceptives, I asked what factor, besides effectiveness, determined the user’s

contraceptive choice. Overall, the survey was used to determine mostly qualitative answers to why people dispose of contraceptives in the method that they choose. Especially in methods that are detrimental to the environment.

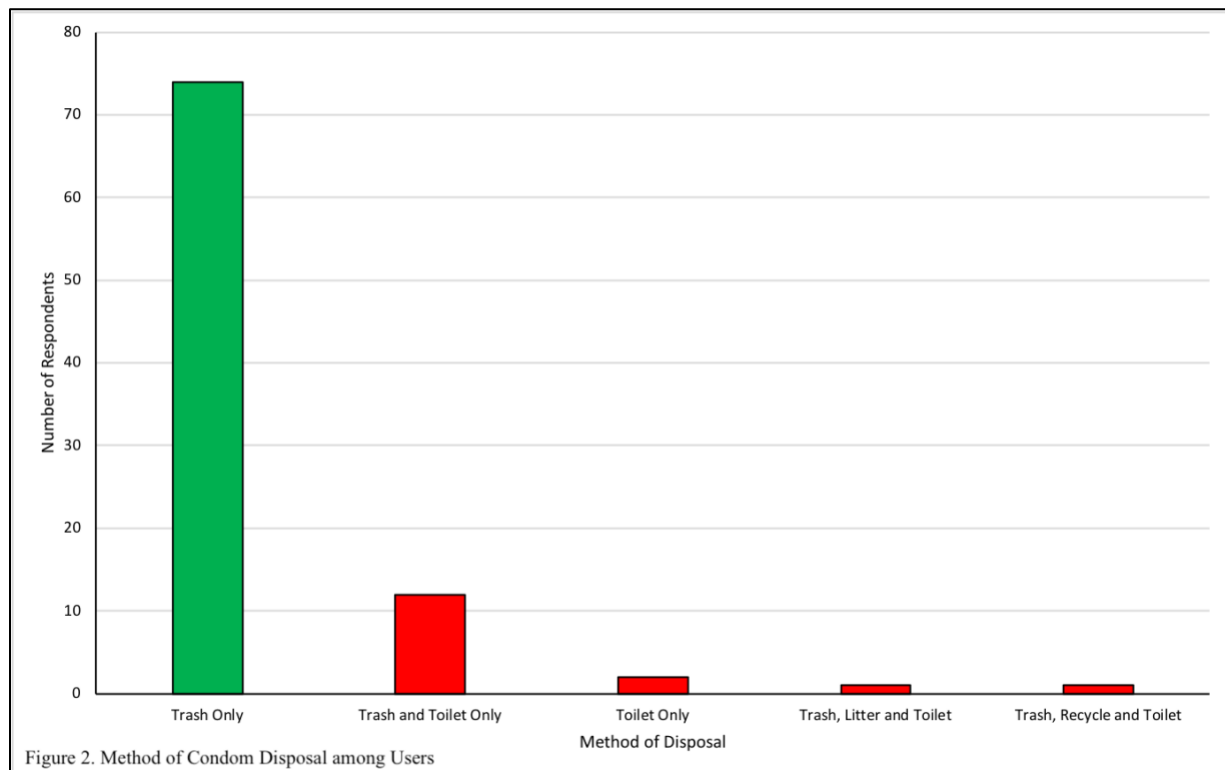
Results and Discussion

There were 138 responses. Of those, 109 identified as female, 23 as male, and 6 who did not report sex. Respondents spanned from 18 to 73 years old, with the majority 21 years of age; 112 respondents attend the University of Colorado, Boulder while 25 do not. The most prevalent trend showed that people employ user-disposed contraceptives, with the most predominantly used contraceptives being condoms and the contraceptive pill, portrayed in Figure 1. One of the reasons that condoms are so prevalent may be because they are the main form of birth control that protects from Sexually Transmitted Infections (STIs).



Nationally, there are trends that account for younger people using user-disposed contraceptives and older people using longer-acting methods. Of the 138 responses, 18 did not

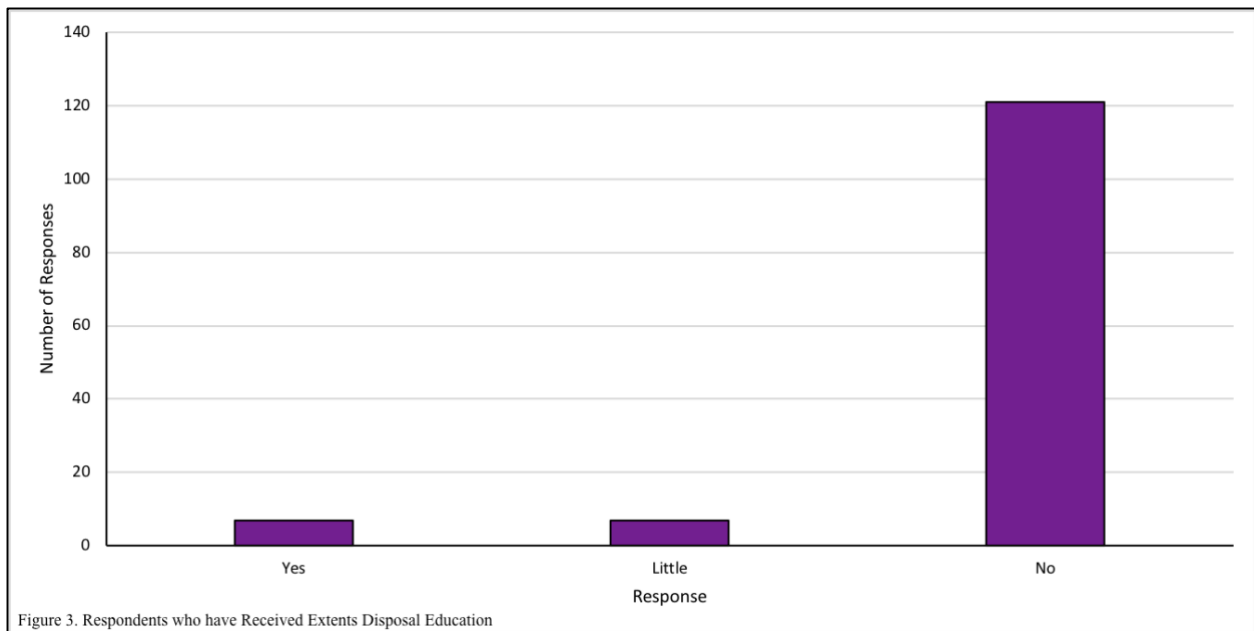
report age; thus, there was not enough data to do any statistical analysis to test for this trend with this survey data. Two people had undergone medical procedures as a form of birth control, one vasectomy and one tubal ligation. The former was 36 and the latter 73. This corresponds with the national trend. Otherwise, non-user-disposed methods like Intrauterine Devices and the implant and diaphragm were spread pretty evenly among respondents.



Being the most prevalent contraceptive (Figure 1), not recyclable or biodegradable, and the most improperly disposed of contraceptive, condoms have the potential to have the largest impact on the environment. Most people dispose of condoms in the trash, illustrated in Figure 2, due to simplicity. There were a few people who flushed condoms down the toilet, citing their

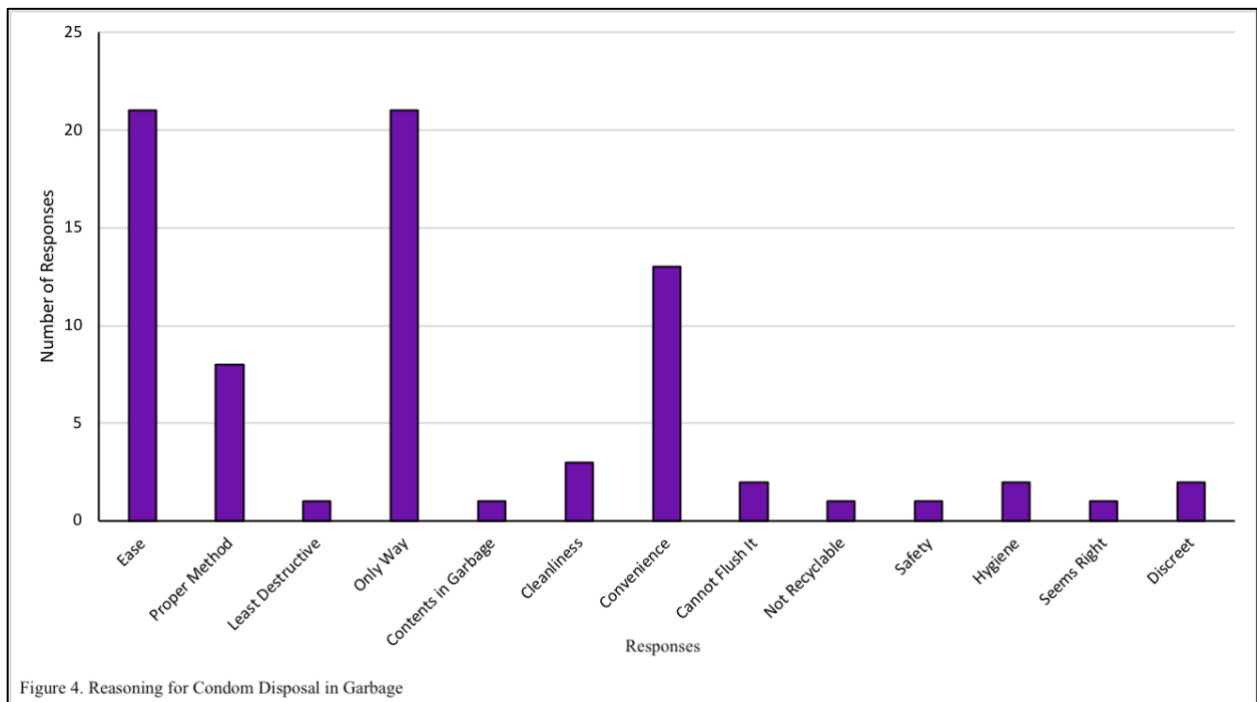
reasons as either cleanliness, ease, or lack of better options. In Figure 2, proper disposal is in green and improper in red.

Out of the 138 participants, 18, or 13% reported they have personally, in the past year, disposed of a contraceptive in a method that is detrimental to the environment and not the intended method of disposal. This does not include the responses to the hypothetical question: “Hypothetically, if you lost a pack of oral contraceptives half way through the cycle and had to start a new one, what would you do with the leftover pills?” Six more people would hypothetically dispose of oral contraceptives in improper manners, totaling over 18% of respondents claiming to have actually or in the future would dispose improperly. Two of those individuals claimed they would push the pills out of the case, flush them down the toilet, and then recycle the plastic exterior, which isn’t necessarily recyclable.



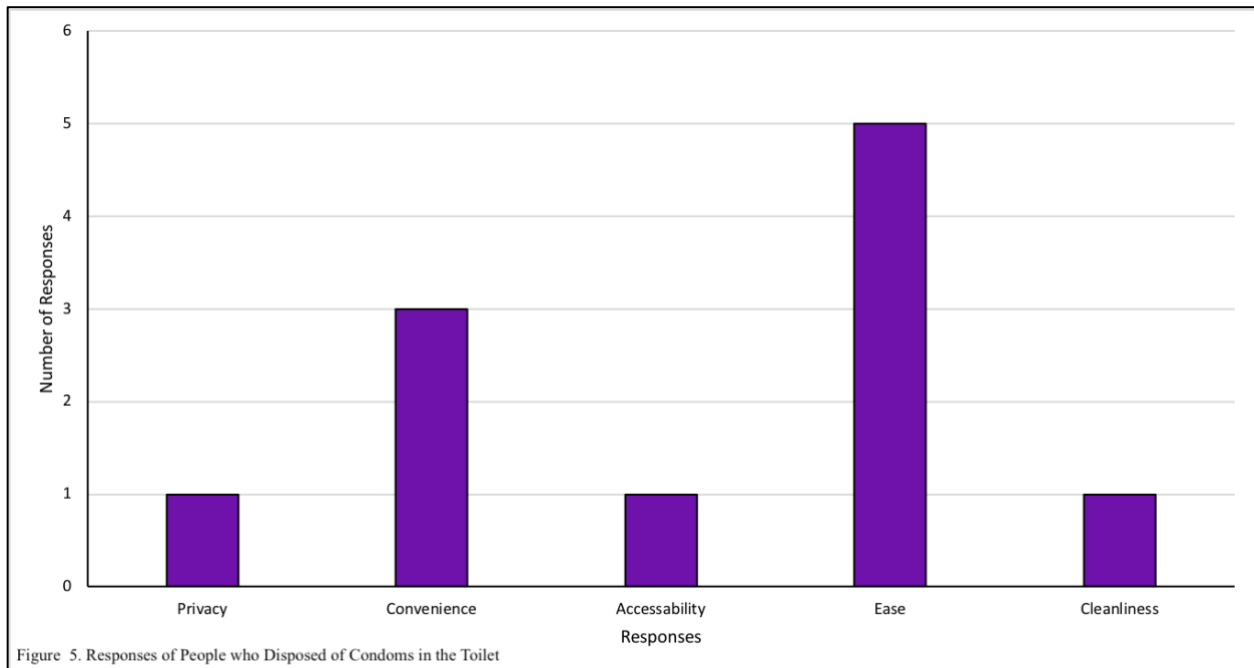
Seen in Figure 3, prevalent among recipients was lack of education. A majority of the respondents, in question to past education on contraceptives and their disposals claimed they

have had none. Through statistical analysis, I determined that there was not significant correlation between people who improperly disposed and age or sex (Appendix B). Indeed, only 11% of respondents who properly disposed claimed to have had any type of education on contraceptive disposal compared to 16% of the people who improperly disposed or hypothetically would improperly dispose. This is expected given the amount of responses. Though there were no quantitative correlations with the sample size, there were some interesting responses with the qualitative data.



Within the respondents who correctly disposed of condoms in the garbage, there were many common responses (Figure 4). The two most prominent were “Ease” and “Only Way” followed by “Convenience” and “Proper Method”. I separated “Only Way” and “Proper Method” responses because I believe they signify two very different ideals. Originally, I separated the two answers instead of grouping them together because I thought that people who

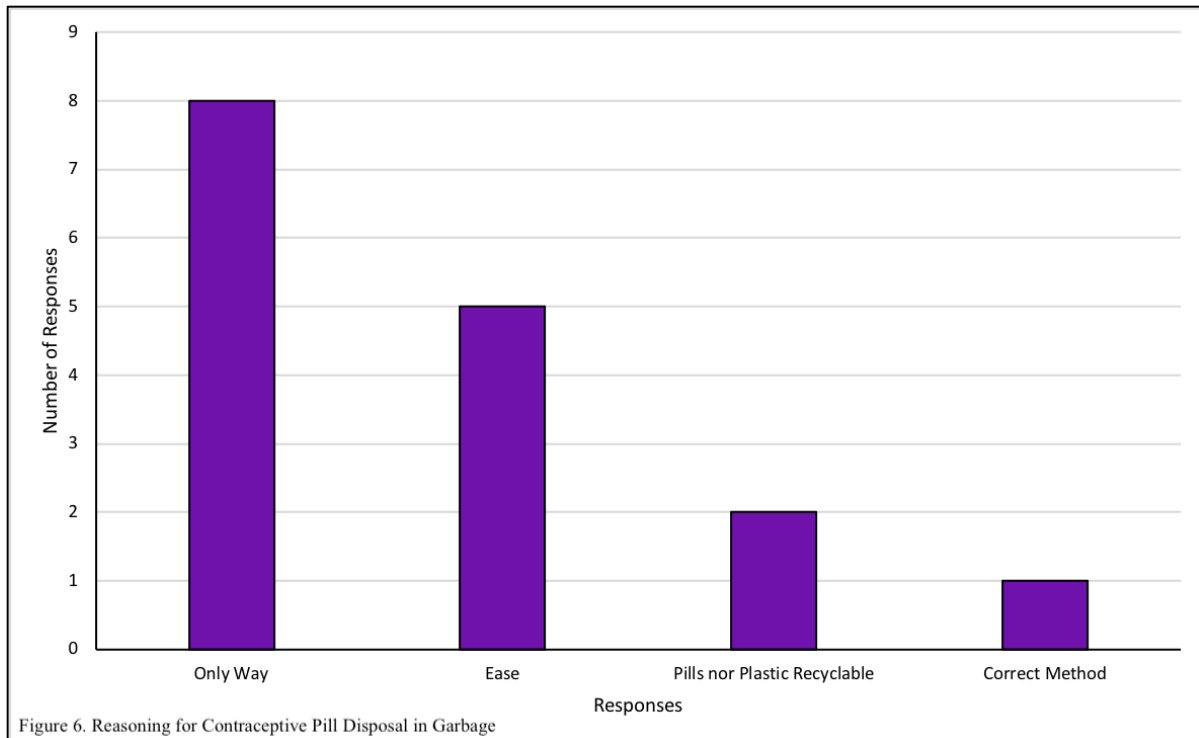
used the term “proper” were acknowledging that there was a correct method of disposal compared to incorrect methods. While I considered people who wrote “Only Way” to not give other methods consideration. But, there were 5 instances, two actual disposal and three hypothetical disposal, of people responding who wrote “Proper Disposal” for the times they disposed into the garbage and also disposed incorrectly. This includes two people who said they would hypothetically flush the pills down the toilet and recycle the pack if they had leftover pills. This is compared to only one person who wrote “Only Way” hypothetically disposing incorrectly. This leads me to presume that, at least a portion of the people who responded with “Proper Method” were acknowledging that they were aware of a more correct method of disposal and even so decided to dispose of incorrectly. To highlight why people dispose incorrectly, we will review incorrect condom disposal responses.



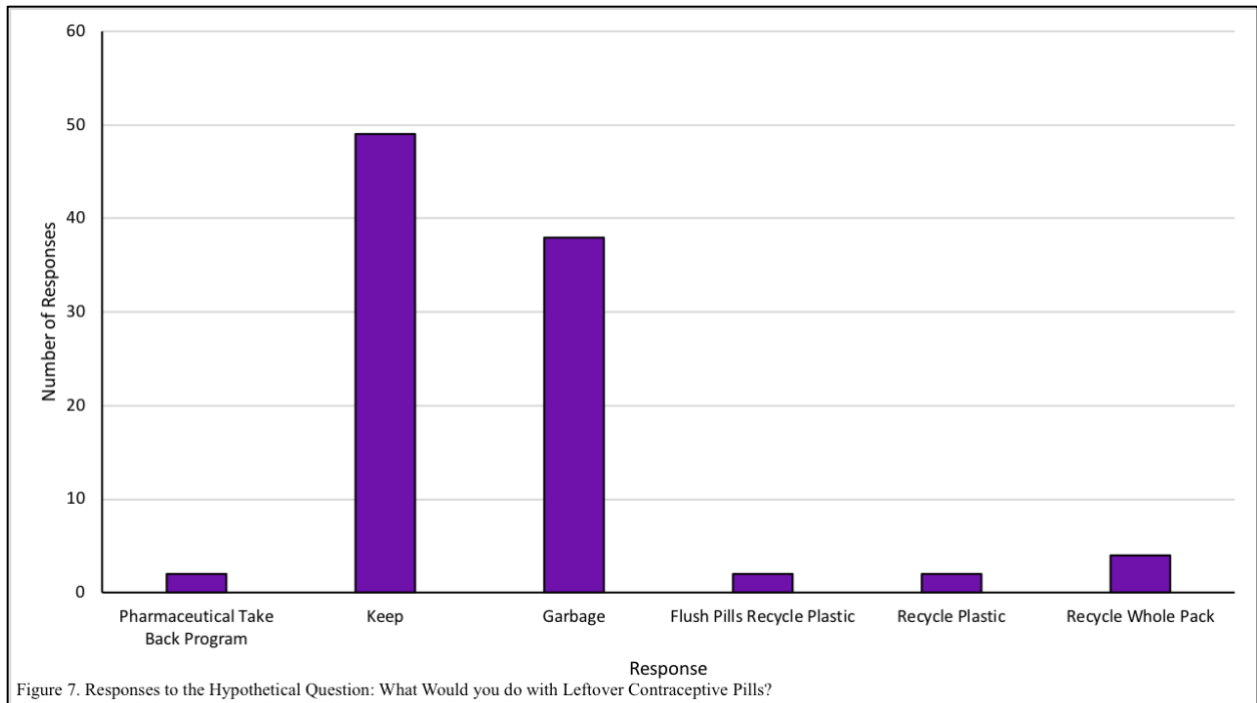
Out of the 88 respondents who stated that they have used condoms in the past year, 16 of them reported flushing them down the toilet. That equates to 18% of people, nearly 1/5, who used condoms with incorrectly disposing. Figure 5 examines the reasoning of people who

improperly disposed of condoms via toilet. This only accounts for incorrect disposal of condoms via toilet. The most common responses attribute either ease or convenience with improper disposal, which stems from either a lack of knowledge or lack of caring from the respondent. Privacy, accessibility, and cleanliness were all mentioned once, along with “didn’t know what else to do”, “trashcan was full”, and “the person I was with told me he didn’t have a trashcan”. All of the people who improperly disposed of condoms, except the person who didn’t have a trashcan” admitted to never having any disposal education. This leads to the assumption that the first step in lowering the amount of improper disposers is through education.

In addition to flushing, one respondent also claimed to “litter” condoms. That person attributes both her garbage and flushing disposal to convenience but declined to give a reason for littering. If her attitude towards improper disposal via toilet is due to convenience, that might correspond with her attitude towards all improper disposal. A separate oddity is the 21-year-old male who mostly disposes of condoms in the garbage due to “ease” but has, in the past year, disposed via toilet for “privacy”, and disposed via recycling with the reasoning: “to feel better about myself”. I didn’t specify in the survey the difference between recycling and reusing, so his response could mean either.



The majority of the people disposing the contraceptive pill in the survey throw them away. This is in regard to those people who have ever had left over pills in a pack for whatever reason. I initially wanted to determine the amount of people disposing of the actual pills and not the packaging. Hypothetically, the blister packs containing the pills may be recyclable at certain recycling plants, but only when perfectly separated from aluminum foil. There are a lot of people who don't know how to properly recycle and separating the plastic and aluminum required. Many people in the survey may be unaware of the necessity of separating the materials, and that withstanding, I attempted to separate the aluminum from the plastic of a birth control pack and it was very difficult, ripped multiple times, and in the end, unsuccessful.



With this in mind, moving forward, I have designated recycling, either the pills or the pack, as improper disposal. One person who had not finished a full pack of pills claimed to dispose of the pills in the garbage and the pack in the recycling. In response to the hypothetical question: “Hypothetically, if you lost a pack of oral contraceptives half way through the cycle and had to start a new one, what would you do with the leftover pills?”, the majority would either keep or dispose of left-over pills in the garbage (Figure 7). Four people would recycle the whole pack and two people would recycle the plastic. Two people claimed they would flush the pills and then recycle the plastic, perhaps the pinnacle of improper disposal. All of the people who dispose of contraceptives pills or packaging improperly via either toilet or recycling have not received any type of disposal education. One of the two people who stated the pharmaceutical take back program for disposal claimed they have had some sort of disposal education. While this is not a statistically significant correlation, it is worth considering that a practical first step at reducing improper disposal would be education.

Three people out of the 138 respondents have used a contraceptive ring in the past year. These are statistically less popular than condoms and rings but are still considered user-disposed in this survey. Two out of the three respondents both attested to putting used rings back in the packaging and disposing in the garbage, as per instructions. The third person reported flushing them down the toilet. The person who flushed the ring was 19 while the other two people were 21 and 26. Perhaps age has a role in some circumstances, or perhaps not, larger survey populations would be required to test this. Completely juxtaposed to past results, both of the proper disposers claimed to never have received any disposal education while the person who disposes of contraceptive rings in the toilet claimed they had more than a little disposal education.

Considered a user-disposed contraceptive, the sponge had zero users in this survey. For the non-user-disposed methods: two people used the diaphragm, 32 people had an IUD, and 14

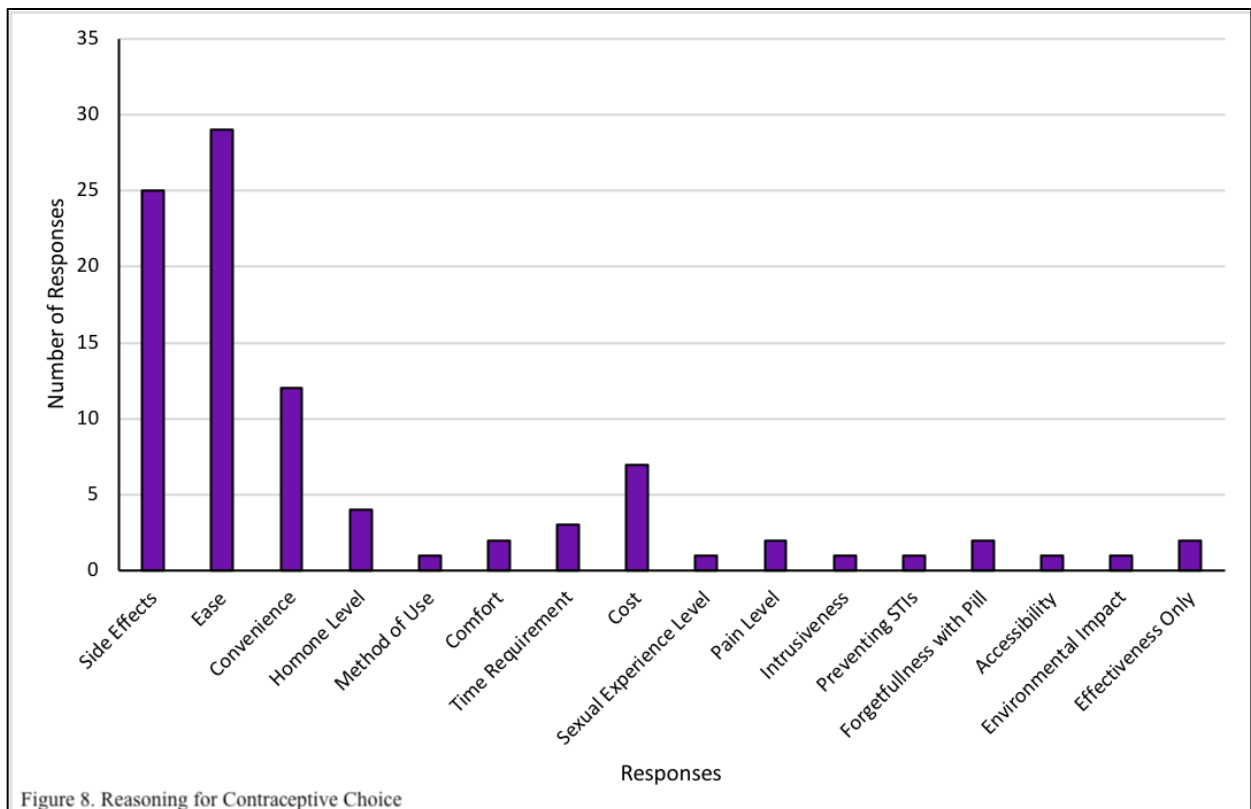


Figure 8. Reasoning for Contraceptive Choice

people had the implant (Figure 1). There were nine people who answered “other”, these include the two surgical procedures: tubal ligation and vasectomy, and the contraceptive injection. One person said they weren’t sexually active, one used the “pull-out method”, and one said they used no method at all. There was also a respondent who used no method because their partner had an IUD and one who used Vaginal Contraceptive Film, which is a clear film that is inserted into the cervix and transforms into a gel of spermicide (nonoxynol-9). There was also a respondent who used a combination of condoms and plan B.

Lastly, in order to determine where environmental factors contribute to decisions regarding contraceptives, the final survey question concerned the main factor aside from effectiveness that contribute to contraceptive choice, responses seen in Figure 8. The most important factors to respondents were: ease of use, then side effects, convenience, cost, and hormone level. Only one person claimed that a large factor contributing to contraceptive choice was environmental impact, but that person also stated that if they had leftover pills in a pack, they would recycle the entire thing. With this perspective, perhaps beside lacking knowledge, many lack caring as well.

Conclusions

There are endocrine disruptors in wastewater effluence defeminizing fish, solid waste contributing to the extent of sewer system overflows, and unsanitary products like condoms ending up on beaches and in freshwater. With improper contraceptive disposal contributing to these environmental problems, it is time to reduce improper disposal. Eighteen percent of respondents either actually or planning that they would improperly dispose of contraceptives, highlights the necessity for not only awareness, but also behavioral modifications. Through dissection and analysis of the qualitative responses, it is evident that the majority of people have not received any type of education on contraceptive disposal. If even a small portion of improper disposal stems from education, introducing a lesson on proper disposal in high school health classes, might improve proper disposal. Most improper disposals were accompanied with the reasoning of ease or convenience, followed by privacy, accessibility, cleanliness, and “didn’t know what else to do”. The last response highlights the opportunity for increased education to at least affect certain people. Never cited for condom or oral contraceptive disposal was instructions. This is because most packaging for condoms and oral contraceptive do not contain or display instructions for proper disposal. This could also help to reduce improper disposal. This is especially apparent because two out of the three contraceptive ring user’s cited the instructions as their reasoning, whereas neither condom nor contraceptive pill users did, despite having many more users. With these in mind, the next page makes recommendations for alterations that have the potential to reduce improper disposal.

Recommendations

In order to have better disposal habits, something needs to change. With the age and sex correlations between improper disposal being mostly equal, it follows that neither sex nor age have an effect on disposal (Appendix B). However, disposal directions on instructions do. This leads me to recommend two changes. First, based on 2/3 of the contraceptive ring users citing instructions as rationale for proper disposal, and no condom or oral contraceptive users citing instructions for either proper or improper disposal: disposal instructions should be included somewhere on the packaging for user-disposed contraceptives. Second, due to the various responses similar to “didn’t know what else to do” when flushing their condoms 100% of the time, a review of contraceptive disposal in high school health class, or elsewhere, would increase awareness of not only the problem but the solution to improper disposal.

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Appendix

Appendix A

Contraceptive Disposal Survey

Start of Block: Default Question Block

Q1 The purpose of this survey is to examine the number of people using different contraceptives and how they dispose of them. Your survey responses will be anonymous and are for research purposes only.

Your participation in this survey is completely voluntary. If at any time you do not wish to continue, you can close the survey with no negative consequences and none of your answers will be recorded.

Please be as honest as possible.

By agreeing, you understand that your responses are anonymous and that you can stop at any time.

I agree (1)

Q2 How old are you?

Q3 Do you attend the University of Colorado, Boulder?

Yes (1)

No (2)

Q4 Which gender's contraceptives do you use?

- Male (1)
- Female (2)
- Other (3) _____
-

Q5 Which of these contraceptive devices have you, as an individual, used in the past year (Select all that apply)?

- Condom (1)
- Contraceptive Pill (2)
- Vaginal Ring (3)
- Contraceptive Sponge (8)
- Diaphragm (4)
- Intrauterine Device (IUD) (5)
- Contraceptive Implant (6)
- Other (7) _____

End of Block: Default Question Block

Start of Block: Condoms

Display This Question:

If Which of these contraceptive devices have you, as an individual, used in the past year (Select al... = Condom

Q6 How often in the past year have you used condoms?

- Daily (1)
 - A Few Times a Week (2)
 - Once a Week (3)
 - A Few Times a Month (4)
 - Once a Month (5)
 - A Couple Times a Year (6)
 - Other (7) _____
-

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Condom*

Q7 Have you disposed of a condom in any of these methods in the past year?

- Garbage (1)
 - Flushing Down Toilet (2)
 - Recycling (3)
 - Composting (4)
 - Littering (5)
 - Other (6) _____
-

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Garbage

Q8 What percent of the time in the past year have you used this method for disposal (garbage)?

- Under 25% (1)
 - 25 - 50% (2)
 - 50 - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Garbage

Q9 Why did you use this method for disposal (garbage)?

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Flushing Down Toilet

Q10 What percent of the time in the past year have you used this method for disposal (toilet)?

- Under 25% (1)
 - 25 - 50% (2)
 - 50 - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Flushing Down Toilet

Q11 Why did you use this method of disposal (toilet)?

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Recycling

Q12 What percent of the time in the past year have you used this method for disposal (recycling)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Recycling

Q13 Why did you use this method for disposal (recycling)?

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Composting

Q14 What percent of the time in the past year have you used this method for disposal (composting)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Composting

Q15 Why did you use this method for disposal (composting)?

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Littering

Q16 What percent of the time in the past year have you used this method for disposal (littering)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Littering

Q17 Why did you use this method for disposal (littering)?

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Other

Q18 What percent of the time in the past year have you used this method for disposal (other)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you disposed of a condom in any of these methods in the past year? = Other

Q19 Why did you use this method of disposal (other)?

End of Block: Condoms

Start of Block: Contraceptive Pill

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Contraceptive Pill*

Q20 How many months in the past year have you used the contraceptive pill?

- Less than 3 Months (1)
- 3-6 Months (2)
- 7-9 Months (3)
- 10-12 Months (4)
- Over a Year (5)

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Contraceptive Pill*

Q21 Have you ever not finished a full pack of contraceptive pills (for whatever reason) and had to dispose of the rest?

- Yes (1)
- No (2)

Display This Question:

If Have you ever not finished a full pack of contraceptive pills (for whatever reason) and had to di... = Yes

Q22 Have you, in the past year, disposed of the contraceptive pill in any of these methods (select all that apply)?

- Garbage (1)
- Flushing Down Toilet (2)
- Recycling (3)
- Composting (4)
- Littering (5)
- Other (6) _____

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Garbage

Q23 What percent of the time in the past year have you used this method for disposal (garbage)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Garbage

Q24 Why did you use this method for disposal (garbage)?

Display This Question:

*If Have you, in the past year, disposed of the contraceptive pill in any of these methods
(select al... = Flushing Down Toilet*

Q25 What percent of the time in the past year have you used this method for disposal (toilet)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

*If Have you, in the past year, disposed of the contraceptive pill in any of these methods
(select al... = Flushing Down Toilet*

Q26 Why did you use this method for disposal (toilet)?

Display This Question:

*If Have you, in the past year, disposed of the contraceptive pill in any of these methods
(select al... = Recycling*

Q27 What percent of the time in the past year have you used this method for disposal (recycling)?

- Under 25% (1)
 - 25 - 50% (2)
 - 50 - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Recycling

Q28 Why did you use this method for disposal (recycling)?

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Composting

Q29 What percent of the time in the past year have you used this method for disposal (composting)?

- Under 25% (1)
 - 25 - 50% (2)
 - 50 - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Composting

Q30 Why did you use this method of disposal (composting)?

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Littering

Q31 What percent of the time in the past year have you used this method for disposal (littering)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Littering

Q32 Why did you use this method for disposal (littering)?

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Other

Q33 What percent of the time in the past year have you used this method for disposal (other)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you, in the past year, disposed of the contraceptive pill in any of these methods (select al... = Other

Q34 Why did you use this method for disposal (other)?

End of Block: Contraceptive Pill

Start of Block: Vaginal Ring

Display This Question:

If Which of these contraceptive devices have you, as an individual, used in the past year (Select al... = Vaginal Ring

Q35 How often in the past year have you used the vaginal ring?

- Daily (1)
- A Few Times a Week (2)
- Once a Week (3)
- A Few Times a Month (4)
- Once a Month (5)
- A Couple Times a Year (6)
- Other (7) _____

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Vaginal Ring*

Q36 Have you ever disposed of a vaginal ring in any of these methods?

- Garbage (1)
- Flushing Down Toilet (2)
- Recycling (3)
- Composting (4)
- Littering (5)
- Other (6) _____

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Garbage

Q37 What percent of the time in the past year have you used this method for disposal (garbage)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Garbage

Q38 Why did you use this method for disposal (garbage)?

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Flushing Down Toilet

Q39 What percent of the time in the past year have you used this method for disposal (toilet)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Flushing Down Toilet

Q40 Why did you use this method for disposal (toilet)?

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Recycling

Q41 What percent of the time in the past year have you used this method for disposal (recycling)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Recycling

Q42 Why did you use this method for disposal (recycling)?

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Composting

Q43 What percent of the time in the past year have you used this method for disposal (composting)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Composting

Q44 Why did you use this method for disposal (composting)?

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Littering

Q45 What percent of the time in the past year have you used this method for disposal (littering)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Littering

Q46 Why did you use this method for disposal (littering)?

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Other

Q47 What percent of the time in the past year have you used this method for disposal (other)?

- Under 25% (1)
- 25 - 50% (2)
- 50 - 75% (3)
- Over 75% (4)

Display This Question:

If Have you ever disposed of a vaginal ring in any of these methods? = Other

Q48 Why did you use this method for disposal (other)?

End of Block: Vaginal Ring

Start of Block: Contraceptive Sponge

Display This Question:

If Which of these contraceptive devices have you, as an individual, used in the past year (Select al... = Contraceptive Sponge

Q49 How often do you use the Contraceptive Sponge

- Daily (1)
- 2-3 Times a Week (2)
- Once a Week (3)
- 2-3 Times a Month (4)
- Once a Month (5)
- A Couple Times a Year (6)
- Other (7) _____

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Contraceptive Sponge*

Q50 Which of these methods have you used to dispose of a contraceptive sponge in the past year?

- Garbage (1)
- Flushing Down Toilet (2)
- Recycling (3)
- Composting (4)
- Littering (5)
- Other (6) _____

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Garbage

Q51 How often do you use this method for disposal (garbage)?

- Under 25% (1)
 - 25% - 50% (2)
 - 50% - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Garbage

Q52 Why did you use this method of disposal (garbage)?

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Flushing Down Toilet

Q53 How often do you use this method for disposal (toilet)?

- Under 25% (1)
 - 25% - 50% (2)
 - 50% - 75% (3)
 - Over 75% (4)
-

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Flushing Down Toilet

Q54 Why did you use this method of disposal (toilet)?

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Recycling

Q55 How often do you use this method for disposal (recycling)?

- Under 25% (1)
- 25% - 50% (2)
- 50% - 75% (3)
- Over 75% (4)

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Recycling

Q56 Why did you use this method of disposal (recycling)?

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Composting

Q57 How often do you use this method for disposal (composting)?

- Under 25% (1)
- 25% - 50% (2)
- 50% - 75% (3)
- Over 75% (4)

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Composting

Q58 Why did you use this method of disposal (composting)?

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Littering

Q59 How often do you use this method for disposal (littering)?

- Under 25% (1)
- 25% - 50% (2)
- 50% - 75% (3)
- Over 75% (4)

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Littering

Q60 Why did you use this method of disposal (littering)?

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Other

Q61 How often do you use this method for disposal (other)?

- Under 25% (1)
- 25% - 50% (2)
- 50% - 75% (3)
- Over 75% (4)

Display This Question:

If Which of these methods have you used to dispose of a contraceptive sponge in the past year? = Other

Q62 Why did you use this method of disposal (other)?

End of Block: Contraceptive Sponge

Start of Block: Long Term Methods

Display This Question:

If Which of these contraceptive devices have you, as an individual, used in the past year (Select al... = Diaphragm

Q63 How many months in the past year have you used a diaphragm?

- Less than 3 Months (1)
- 3-6 Months (2)
- 7-9 Months (3)
- 10-12 Months (4)
- Over a Year (5)

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Intrauterine Device (IUD))*

Q64 How many months in the past year have you used an Intrauterine Device (IUD)?

- Less than 3 Months (1)
- 3-6 Months (2)
- 7-9 Months (3)
- 10-12 Months (4)
- Over a Year (5)

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Intrauterine Device (IUD))*

Q65 Which Intrauterine Device do you use?

- Hormonal (1)
- Copper (2)

Display This Question:

*If Which of these contraceptive devices have you, as an individual, used in the past year
(Select al... = Contraceptive Implant*

Q66 How many months in the past year have you used the contraceptive implant?

- Less than 3 Months (1)
- 3-6 Months (2)
- 7-9 Months (3)
- 10-12 Months (4)
- Over a Year (5)

End of Block: Long Term Methods

Start of Block: Hypotheticals

Display This Question:

If Which gender's contraceptives do you use? = Female

Q67 Hypothetically, if you lost a pack of oral contraceptives half way through the cycle and had to start a new one, what would you do with the leftover pills?

- Throw the rest of the pack away (1)
- Flush the individual pills and recycle the plastic outside (2)
- Keep it for future use (3)
- Recycle the whole thing (4)
- Compost the pills (5)
- Other (6) _____

Q68 Were you taught about proper contraceptive disposal previously, for example: in your high school health class?

- Yes (1)
- A little (2)
- No (3)

Display This Question:

If Which gender's contraceptives do you use? = Female

Q69 If you are choosing between two birth control methods, and they both have the same effectiveness with "typical use" (including human error), what characteristic would be most important for you to choose between them?

End of Block: Hypotheticals

Appendix B

Correlation Graphs:

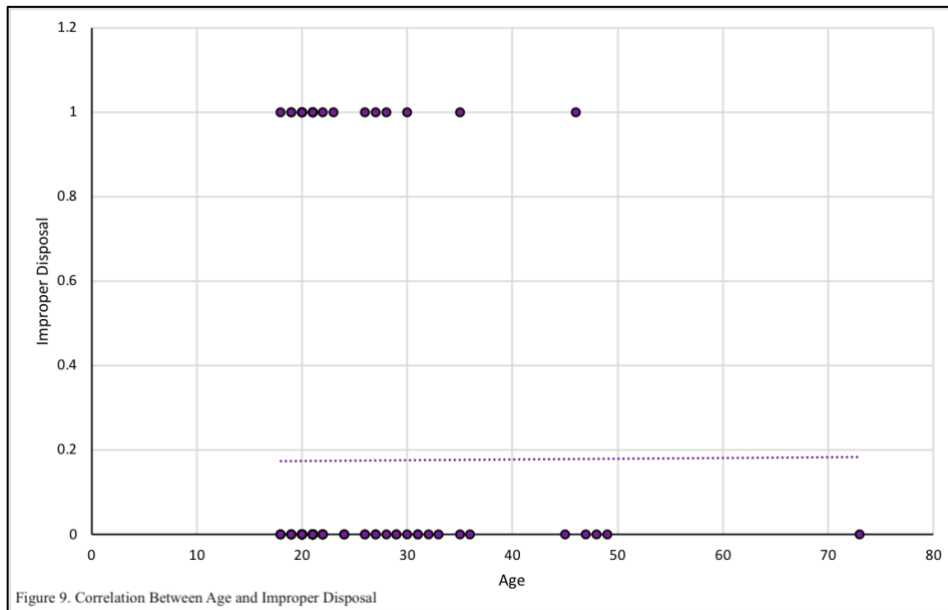


Figure 9. Correlation Between Age and Improper Disposal

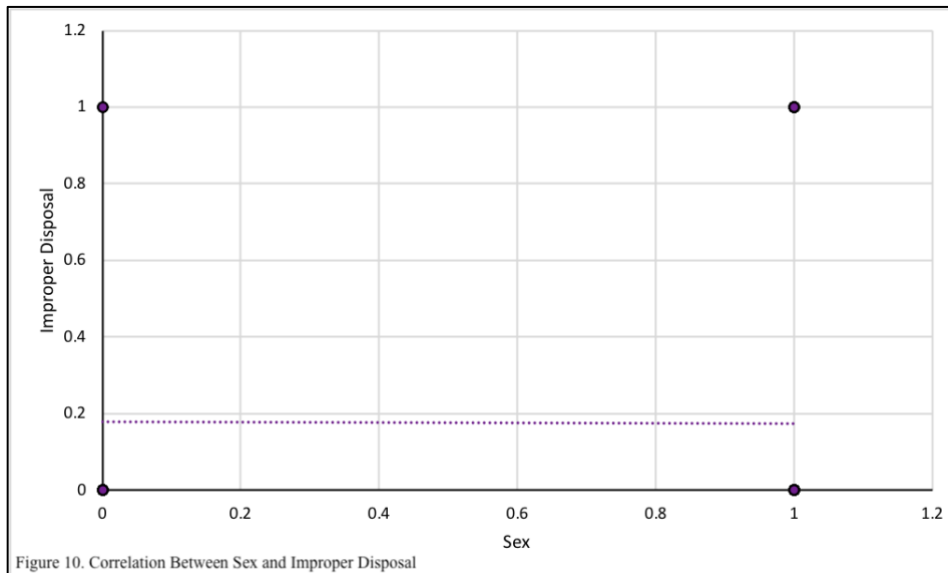


Figure 10. Correlation Between Sex and Improper Disposal