

Unraveling Historical Trends of Increasing Large-body Dissatisfaction: Disentangling Age-period-cohort Using the Case of South Korea

SeungYong Han (✉ shan32@asu.edu)

Obesity Solutions ASU <https://orcid.org/0000-0002-8389-2766>

Cindi SturtzSreetharan

Arizona State University

Alexandra Brewis

Arizona State University

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Abstract

Background

Over the last two decades, body dissatisfaction appears to have increased globally, particularly concerns about being “fat”. These increasingly negative large-body norms reflect the intersections of complex socio-cultural phenomena. A range of anthropological theories derived from ethnographic observations across the globe have posited that both changing socioeconomics and internet exposures have increasingly commodified the value of the body in social advancement – especially for women.

Methods

Using demographic data, here we provide a first attempt to explore the sheer effects of individual (i.e., age) and contextual factors (i.e., period and cohort) on body dissatisfaction by using the Hierarchical Age-Period-Cohort (HAPC-CCREM) approach, with a particular emphasis on period effects of internet expansion and macro-economic shifts. The data are drawn from the Korean National Health and Nutrition Examination Survey (KNHANES) collected repeatedly over the period of 2001 to 2017.

Results

The results show a higher level of body dissatisfaction among Korean women compared to men. Overall period effects indicate a significant increase in the level of body dissatisfaction in the early 2000s, particularly related to increased social media exposure. Although no overall cohort effect was found, early cohorts tend to have a substantial gap in body dissatisfaction levels when examined by socioeconomic status: those with high SES (people with college education and high household income) exhibit a high level of body dissatisfaction and those with low SES exhibit a low level of body dissatisfaction, but over time these begin to converge.

Conclusions

The results suggest a particular role for internet exposure, rather than labor market shifts, in increasing negative classifications of the person’s own body as unacceptably big.

Background

Body norms – socially constructed ideas about how bodies can and should look – are powerful cultural phenomena with important health impacts. Concerns around failing to meet social expectations of thinness are associated with multitudinous health-relevant behaviors, such as how people eat, exercise, seek health care, or elect surgery (e.g., Flint, 2015; Puhl and Suh, 2015; Vartanian and Novak, 2011). Failures to meet what are perceived as acceptable body standards can also act as a psychosocial stressor, underpinning such negative individual health-relevant outcomes as low self-esteem and self-efficacy, eating disorders, and depression (e.g., Sikorski et al., 2015; Hackman et al., 2016; Tomiyama et

al., 2018; Tomiyama, 2019). These probably also pattern to population-level variation and thus link to emergent health disparities (Hatzenbuehler et al., 2013).

Based on analyses of comparative survey data, anti-weight sentiments are suggested to be widespread, and thin-idealism also now dominates in advanced economies (e.g., Puhl et al., 2015; Brewis et al., 2011; Marini et al., 2013). Yet, for the most part, the *basis* of these recent *changes* in body dissatisfaction are only roughly observed, mostly in anthropologists' ethnographic perceptions of what best explains shifts in norms at the community level. On the basis of these fragmented observations, anthropologists have developed two relevant explanations – not necessarily discrete – of what happened to global body norms since around 2000. Increasing media exposures, especially social media, appears to be one exogenous force that anthropologists consistently report as likely important to spurring shifts in cultural norms of thin-preference. This observation began with Becker's (2004) study of the effects of the introduction of television on body norms in young Fijian women, but likely has been particularly accelerated by social media (see Anderson-Fye and Brewis, 2017). More recent studies include observations in Dominica in which much more strongly negative views of large bodies seemed to follow the adoption of Facebook in particular (Council and Placek, 2014).

Another set of propositions relates to a key role for shifting labor (and perhaps marriage: Hruschka and Han, 2017) markets, and particularly the role of the body in creating opportunities for social and economic advancement. The notion of "thin body capital" (Anderson-Fye and Brewis, 2017) is central here. Specifically, the idea that people will adopt and internalize body norms toward thinness when they provide feasible pathways to enhanced social and economic success. In many cases, the assumption is, women stand to benefit relatively more from the social and economic advantages of meeting body norms because they begin with fewer opportunities than men. They are accordingly more likely to adopt and work to meet stringent ideals. The idea that fat-negativity is driven by the recognition of the role of body capital in the cash economy is based in such studies as Anderson-Fye's (2004) explanations of thin-idealism in the context of increased engagement in a tourism-driven cash economy in Belize, and Edmond's (2010) accounts of how women pathway out of poverty by working to attain body-perfection ideals in Brazil.

Yet, beyond these necessarily localized ethnographic interpretations, little scholarship has documented the population-level tempo, scope, and dimensions of these important social changes around how bodies become unacceptable to the person themselves. Here we use a demographic approach and nationally representative data to untangle age, period, and cohort effects in changes in large-body dissatisfaction, using the case of South Korea from 2001-2017. Through this analysis, we can simultaneously test for potential roles for these theorized periodic-cohort factors linked to large-body dissatisfaction – specifically economic up-and-downturns and increasing internet exposure – while also considering such factors as aging and cohort effects, and individual level factors such as gender and socioeconomic status.

South Korea is an extreme case for considering how body norms change, with some attendant analytic advantages. Among the advanced economies, it has one of the lowest levels of obesity (Devaux et al., 2017). In 2016, 6.0% of Korean men and 5.1% of Korean women were categorized as clinically obese ($BMI \geq 30 \text{ kg/m}^2$). For comparison, 38.3% of men and 41.6% of women in the U.S. in the same year and 31.5% of men and 29.3% of women in Australia in 2017 were estimated to be clinically obese in the same year (data available at <http://stats.oecd.org>). Yet, despite the extremely low population levels of obesity – or perhaps even because of it – anti-fat sentiment is reportedly now rampant in South Korea (Marini et al., 2013; Brewis et al., 2017; Noh et al., 2018). It is common to notice disparaging treatment of people with obesity in Korean media (Lim and Kim, 2012). In everyday conversations, more recent studies suggest that people often make judgmental remarks about people who are overweight (Kim, 2014; Schwekendiek et al., 2013). Indeed, managing appearance is one of the most common reasons that Korean men and women report trying to lose weight (Son et al., 2018). Previous studies also confirm an ongoing very high level of disordered eating, body dissatisfaction, dieting, and body modification through surgery among South Koreans (Pike et al., 2014; Han, 2003; Jung and Lee, 2009). While some societies may display cultural ambivalence around large bodies, allowing people to navigate between positive and negative notions of larger bodies (e.g., Hardin et al., 2018; Council, 2015), this is not apparently the case in South Korea (Marini et al., 2013).

More generally, the importance of physical appearance and body size in contemporary Korean society cannot be overstated. Giving attention to self-appearance seems to be linked to a highly competitive educational, career, and social market that rewards those who are perceived as beautiful or handsome; this phenomenon is also known as ‘lookism’ (Marini et al., 2013; Noh et al., 2018). Additionally, Korea has a well-documented stratified society that includes ranked educational institutions and companies; that is, in Korea it is not just about going to university, it is also about going to a top-rated highly selective university which may help an individual find placement in a prestigious workplace (Lee and Brinton, 1996), a phenomenon which is known to have negative effects on men’s body image and mental health (Garrison et al., 2018).

Although such data was not collected before 2000, the widespread use of the phrase “*Mom jjang*” (몸짱; Korean for “perfect body” or “body king”) syndrome – widely used and promoted by the mass media (Bissell and Chung, 2009; Park, 2007) – is suggestive of its potential influence on shaping changing body norms over time. Furthermore, the popularity of “PC rooms” (precursors to the Internet Café) on every street corner of urban and rural South Korea made access to the internet easy from the mid 1990s. These “PC rooms” boasted all forms of entertainment from internet surfing to computer gaming; this frequent and easy exposure to digital social media boosted the emphasis on appearance as exemplified by *eojjang* (얼짱; “face king” syndrome, a person with a handsome or pretty face) (Park, 2007). A face without cosmetic makeup (얼짱; *saengeol*), a young looking face (얼짱; *dongan*), and long legs (장다리; *longdari*) received a lot of attention from the media and the public afterward throughout the 2000s (Park, 2007). Indeed, research among Korean adolescents (ages 17-19) has shown that social media content which emphasizes thinness and physical attractiveness strengthens obesity stigma (Lim and An, 2018). A

qualitative study in the U.S. suggests that the same perhaps holds for adults and negative body image there (Paquette and Kim, 2004).

Body Dissatisfaction: Separating Age, Period, and Cohort (APC) Effects in the Korean Case

There are three potential demographic processes that we consider as we test possible theories as why body dissatisfaction might change (increase) over time at the population level: age, period, and cohort effects. While we discuss these potential effects in relation to South Korea in this section, many of the observations are also generalizable to other cases of advanced economies.

Age Effects: At the individual level, aging can play a role in changing body satisfaction over time. At least based on studies in the US, women appear to become more body-accepting as they get older. Thus, body dissatisfaction reduces (Park et al., 2019, Tiggemann and Lynch, 2001; Stevens and Tiggemann, 1998; Lamb et al., 1993; Grogan, 1999, McCabe and Ricciardelli, 2004). To our knowledge, there are no studies disentangling if this is because women's body norms themselves change also with aging, other than what would be accounted for by period and cohort effects. But if aging matters for individual body (dis)satisfaction, then this could be reflected at the population level as well if the population itself is aging (as is the case in South Korea and many other advanced economies with low birth rates, e.g., Japan, Germany, and Finland).

Period effects: Period effects refer to factors driving exogenous change that happens in a fixed time period, such as the adoption of new technologies or sudden economic upheavals. In terms of body norms, media in general is presumed to provide a common source of new ideas about body image, and for reinforcing or strengthening them (Tiggemann, 2014; Han, 2003; Schwegendiek et al., 2013). In the period 2001-2017, as was the case elsewhere, South Korean internet usage increased dramatically. According to the Survey on the Internet Usage, the proportion of South Korean households that had access to the Internet nearly doubled between 2000 and 2016 (44.7% in 2000 and 88.3% in 2016).

In addition to media exposure, we identify shifting national job insecurity as another exogenous factor that may create South Korean period effects in body image dissatisfaction between 2001 and 2017. The neoliberal reconstruction of the labor market in South Korea started in the 1980s due to the pressure from other countries, but in particular pressure from the U.S. due to the trade surplus. In the late 1990s through to the early 2000s, the economic restructuring was accelerated due to the so-called "IMF crisis" (Shin, 2013; Lee, 2011). The government created a more flexible labor market followed by large scale layoffs, leading to significantly lower job security for most people. The study by Offer et al. (2010) based on the theory of welfare regime (Esping-Anderson, 1990) found that employment security is a strong predictor of obesity particularly in a liberal market setting. They argue that this association is likely due to differentiated bargaining power of individuals in the labor market. Under the liberal labor market with unlimited competition, human capital would play an important role in bargaining power at the individual level. Since there are many candidates with similar skills and education, appearance, as a form of human capital, is likely to gain substantial bargaining power in the labor market. This might have led to more Koreans, both men and women, paying extra attention to their bodies, resulting in a worsening negative

body image at the population level. Taking these societal phenomena into consideration, secular changes (or period effects) in South Korea could lie at the root of more people perceiving themselves as “too fat” or otherwise dissatisfied with their body size/weight.

Cohort effects: Cohort effects are embedded in the shared and distinct experiences of people similarly exposed to a phenomenon – such as people born or entering college in the same year – so that period effects influence people at different ages disproportionately. Specifically, in the 1990s and 2000s, rates of Internet usage and the importance of appearance in the Internet world were the highest particularly among younger generations rather than older generations of South Koreans. The earliest and most enthusiastic social media adopters were those in their teens and twenties, i.e., “generation Z” born in the period of widespread internet (between mid-1990s and early 2000s). In terms of job opportunities and insecurity, those cohorts who are attempting to enter job markets during downturns should be more impacted by them. The cohort most affected by the Korean recession of 2008 would have been graduating from college and entering the job market for the first time (i.e., “IMF generation” born in the middle of the 1990s).

Individual Level Factors to Consider: We begin with the assumption that individual-level factors of gender and socioeconomic status (SES) should moderate aging, period, and cohort effects on changes in large-body dissatisfaction over time. For example, a high income grants more financial resources to invest in one’s body, or at least increase the chances of being around other people that do – thereby perhaps worsening one own’s body dissatisfaction. On the other hand, having more education may increase exposure to greater recognition of and resistance to unrealistic body norms. In a study of breast cancer patients in South Korea, for example, it was found that employed patients had higher levels of body image distress compared to patients who were unemployed (Chang et al., 2014). However, patients who had higher income reported better body image than those with a lower income (less than \$3000/month). They also found that SES (as measured through marital status, education, employment status, and income) was significantly associated with “altered appearance distress, body image, and quality of life” (Chang et al., 2014). Women that were employed or socially active had “significantly higher distress from altered appearance and worse body image compared to housewives or retired people who were relatively socially inactive” (Chang et al., 2014: 8610). Finally, in another study aimed at adolescents, Park et al. (2018) found that a lower SES was associated with higher levels of reported problems with physical appearance especially among South Korean female high school students. While these studies do not replicate the population under consideration here, they show very clearly the importance of taking SES into consideration for issues of body image.

Exactly how gender should matter to temporal increases in large-body dissatisfaction is not clear for South Korea. Certainly, a range of studies have shown that Korean women can present very high rates of body dissatisfaction and other body image concerns (Lee et al., 1998; Ryu et al., 2003; Kim and Kim, 2001). Some prior research suggests that male body ideals in South Korea might in some contexts be even more stringent than female ideals, in that women must be slim but men must be neither too heavy nor too thin (Son et al., 2018). Also, qualitative studies demonstrate that South Korean men – especially

younger men – are particularly susceptible to constant (and often unattainable) familial pressures to excel in their careers (Lee and Brinton, 1996; Garrison et al., 2018; Chin and Kim, 2016; Je and Shim, 2015), and good looks are often assumed by workers to be central to their ability to advance professionally (Lee, 2008; Hamermesh, 2013; Chae, 2019). Chae (2019) found that employed Korean people accepted “lookism” and engaged in behavior which maintained it. Thus the general cross-cultural observations discussed above, whereby women are likely more susceptible to large-body dissatisfaction period effects (like social media exposure or economic downturns), or that women place more importance on the benefits of “body capital,” cannot be assumed to necessarily hold in this specific country case.

Methods

The data are from the Korean version of the National Health and Nutrition Examination Survey (KNHANES), a nationally representative sample of people residing in South Korea. This repeated cross-sectional study has been repeated in seven phases covering twenty years: 1998 (phase 1), 2001 (phase 2), 2005 (phase 3), 2007–2009 (phase 4), 2010–2012 (phase 5), 2013–2015 (phase 6), and 2016-2017 (phase 7). The details of the data are well described elsewhere (Kweon et al., 2014). For this analysis, the data reflects only phases 2 (2001) through 7 (2017), in which relevant, comparable body dissatisfaction questions were included in the survey. The analytic sample is all surveyed adults over 19-years old grouped into thirteen periods (survey year 2001, 2005, 2007-2009, 2010-2012, 2013-2015, and 2016-2017) and eleven cohort groups (born in or before 1936, 1936-40, 1941-45, 1946-50, 1951-55, 1956-60, 1961-65, 1966-70, 1971-75, 1976-80, and after 1980). Birth years were used for cohort membership. The total sample size is 73,412 (31,330 male Koreans and 42,082 female Koreans) after excluding individuals with missing data in any variables used for analysis, including body dissatisfaction, BMI, and SES.

The main outcome variable, body dissatisfaction, was based on the key survey question: “How do you consider your weight?” (체중을 어떻게 생각하십니까?). Respondents then were asked to describe themselves as very thin (매우 마른 사람), thin (마른 사람), normal (정상), obese (비만) or very obese (매우 비만). Similar to English, Korean terms used in the survey for “obese” and “very obese” have strongly negative social connotations. For the purposes of this analysis, we clumped both categories together as our means to identify a person’s large-body dissatisfaction.

Individual socioeconomic status was measured using education and household income. In the case of education level, the sample was placed into one of two possible categories: college education and less than college education. The first group includes those who were currently enrolled in college level education and those who left or completed college level education at the time of the survey. The second group includes high school graduates or those who received less than a high school education. This categorization is reasonable in that the sample includes the young population who are likely to be in age groups eligible for college education. Likewise, two categories were used for household income level: high and low income. The high household income group included those who belonged to the highest two quartiles and the low-income group included those who belonged to the lowest two quartiles.

Respondents were assigned into household income quartiles based on the household income brackets and percentiles created by Korea Centers for Disease Control and Prevention (KCDC) for each survey. Three groups of socioeconomic status were created by tabulating two groups in education and two groups in household income. As a result, those respondents who possessed college level education and a high level of household income were categorized into the high socioeconomic status group (high education and income) while those who possessed less than college level education and a low household income were categorized into the low socioeconomic status group (low education and income). The rest were categorized into a middle socioeconomic status group (high education and low income; low education and high income). Body mass index based on measured height and weight was used as a proxy for individual body size, also controlled in models.

We used a hierarchical age-period-cohort – cross-classified random effects model (HAPC-CCREM) for data analysis (Yang and Land, 2013). This approach is essentially a multilevel (hierarchical model) approach considering age as an individual factor at level 1 and historical time (period) and cohort membership as contextual factors at level 2. It is considered superior to a traditional APC approach which assumes linearity and additivity of the three effects (Yang and Land, 2013:191). In addition to overcoming this identification problem, HAPC-CCREM framework provides the ability to examine other important factors that are considered to have significant effects on the outcome variable at the individual level (level 1) as well as the contextual level (level 2).

Four HAPC-CCREM models were specified for analysis. First, the baseline model (Model 1) with random period and cohort effects was specified to look at the overall patterns regardless of socioeconomic status. In detail, to model the likelihood of body dissatisfaction (1=self-classified as obese or very obese / 0=else) for an individual i ($=1, 2, \dots$) within cohort j ($=1, 2, \dots, 11$ birth cohorts) and period k ($=1, 2, \dots, 13$ survey years) controlling for body mass index (BMI) and SES (low, middle, and high), we specified the following HAPC mixed model. Age and BMI are continuous and were centered on the grand mean within each gender and included in the model. This model specified that the intercept has random time period and birth cohort effects.

[Level 1]

$$\begin{aligned} \text{Logit Pr}(\text{Body Dissatisfaction}_{ijk} = 1) \\ = \beta_{0jk} + \beta_{1jk}AGE_{ijk} + \beta_{2jk}AGE_{ijk}^2 + \beta_{3jk}BMI_{ijk} + \beta_{4jk}LOW_SES_{ijk} \\ + \beta_{5jk}MIDDLE_SES_{ijk} \end{aligned}$$

[Level 2]

$$\begin{aligned} \beta_{0jk} &= \gamma_0 + u_{0j} + v_{0k} \\ \beta_{1jk} &= \gamma_1 \ \& \ \beta_{2jk} = \gamma_2 \ \& \ \beta_{3jk} = \gamma_3 \ \& \ \beta_{4jk} = \gamma_4 \ \& \ \beta_{5jk} = \gamma_5 \end{aligned}$$

where $u_{0j} \sim N(0, \tau_{u0})$ and $v_{0k} \sim N(0, \tau_{v0})$

Second, age, period and cohort patterns were examined by three SES groups (high, middle, and low). The first model (Model 2a) added the interaction between age and SES to the baseline model to examine the age variation by SES. This model specified that the intercept and SES have random time period and birth cohort effects. The second model (Model 2b) allowed random period and cohort effects to vary by SES without the interaction term in Model 2a.

Lastly, two key contextual factors with high periodicity were added to the baseline model (Model 3) to examine how much variation in period and cohort effects estimated in Model 1 can be explained by two contextual factors. Internet use (%) was a proxy for social media/internet exposure, as one key aspect of period effects. Unemployment rates (%) were used as proxy for periodic shifts in the market economy relevant to employment opportunity.

Results

Figure 1 shows the proportions of self-reports of large-body dissatisfaction between 2001 and 2017. In all years, male Koreans showed a lower level of large-body dissatisfaction compared to female Koreans. For both male and female, there seems to be a notable increase in large-body dissatisfaction in the early 2000s, especially between the 2001 and 2007 data collection rounds. Though interesting, these periodic patterns are descriptive and do not help us further understand the underlying age, period, and cohort effects separately. The APC analysis based on HAPC-CCREM framework enables us to examine further and look at each effect controlling for the other two and beyond.

Patterns Testing for Age Effects

The overall age patterns in each study phase show that Korean women were consistently more likely to define themselves as obese or very obese compared to Korean men, but most especially in young age groups. The discrepancy in the level of body dissatisfaction between male and female was about 40% in their 20s, then decreased as an effect of age. The gap converged at about 20% when male and female Koreans were 68 years old. The overall age patterns of change, at the average BMI (24.08 kg/m² for male; 23.45 kg/m² for female) and middle household income for each gender (Model 1) and the age patterns by SES (Model 2a), are visualized together in Figure 2 (see *Appendix Table 1* for the full results of Model 1; *Appendix Table 2a* for the full results of Model 2a). In this and all following figures, a thick semi-transparent line represents the overall pattern, and the other three types of lines (solid, dashed, and dotted) represent high, middle, and low SES, respectively. Predicted probabilities are calculated using the estimates in the Appendix Table 1. For example, the period effect of the year 2001 for male Koreans is calculated as -1.6661 ($= -0.9841 - 0.6820$), where -0.9841 is the intercept and -0.6820 is the period-specific random effect coefficient. This period effect is converted to the probability which is about $.16$ ($\approx \text{exponential}(-1.6661) / (1 + \text{exponential}(-1.6661))$). It means that about 16% of men in South Korea at the mean age and BMI in the year of 2001 identified themselves as obese or very obese.

The age patterns by SES (solid, dashed and dotted lines) do also vary by gender. There are significant differences in the rates of change for age between low and high SES groups (p -value=.0394) and between middle and high SES groups (p -value=.0123) for Korean men. Korean men with middle and high SES started at a similar level of body dissatisfaction (40%) but the gap between those two SES groups widened as they age. On the other hand, Korean men with low SES had a substantially lower level of body dissatisfaction in the early 20s compared to the other two SES groups, and the gap between low and high SES groups stayed the same regardless of age. The patterns are similar for Korean women, but women showed a much higher level of body dissatisfaction. All three SES groups of Korean women started at a similar level of body dissatisfaction (around 80%) but body dissatisfaction among Korean women with low SES dropped at a faster rate than those with middle and high SES. The difference in the rate of change between middle and high SES was also significant with a greater drop rate for female Koreans with middle SES.

Patterns Testing for Period Effects

The overall period patterns (Model 1) and the period patterns by SES (Model 2b) were visualized in Figure 3 (see *Appendix Table 2b* for the full results of Model 2b). There is a significant variation in the overall period effects for both Korean women and men (p -value=.01 for both). By period, the level of large-body dissatisfaction for both significantly increased over a decade since 2001 and stayed around 30% for male and 50% for female. It is important to note that this period effect is independent of age and cohort effects within the HAPC-CCREM framework. However, the results do not indicate a significant variation in the period patterns by SES for both Korean genders. Period patterns by SES do not deviate from the overall period patterns.

Patterns Testing for Cohort Effects

There is marginally significant variation in the overall cohort effects for Korean women only (p -value=.0872). The overall cohort patterns (Model 1) and the cohort patterns by SES (Model 2b) are visualized in Figure 4 (see *Appendix Table 2b* for the full results of Model 2b). In fact, the patterns for Korean men do not show any variation regardless of SES across birth cohorts, while for women there is a substantial variation by SES across different birth cohorts. However, when the 95% confidence intervals were compared, the gap between low and high SES groups for the cohort 1946-50 (23.3%) was only significant at the p -value .05 level.

Additional Effects of Gender and SES

Two contextual factors, internet use (%) and unemployment rate (%) by gender, were selected as possible factors that can explain the variation in random period and cohort effects estimated in Model 1. The results (Model 3) show that about 44% and 76% of the variation in the period effect for male and female Koreans, respectively, were explained by adding internet use (%) and unemployment rate (%) (see *Appendix Table 3* for the full results of Model 3). Internet use, particularly, proved a significant factor in increase in large-body dissatisfaction for both women and men, controlling for age, BMI, SES, and

exogenous unemployment rate. Unemployment rate was not significantly associated with changing large-body dissatisfaction, regardless of gender and controlling for age, BMI, SES, and exogenous internet use rate.

Discussion

The main analytic purpose of this paper is to disentangle age, period, and cohort patterns of historical trends in increasing large-body dissatisfaction in South Korea between 2001 and 2017. We confirmed that large-body dissatisfaction increased through time, and levels were consistently higher for women than men. Aging provided some moderating effects on large-body dissatisfaction, particularly for women. Except as highlighted below, cohort effects were muted or absent.

We will highlight three additional key findings related to observed period-cohort effects. First, we observe a meaningful increase in the level of large-body dissatisfaction until about 2009; after this point the upward trend appears to slow. This reflects the changing point was in a period of accelerated internet exposure [from 56.6% in 2001 to 77.2% in 2009 (Kim, 2019)]. Also, it encompassed the aftermath of the South Korean economic recession that began in 2007. We found in the analysis however that much of the variation in the period effect was explained by internet use. Little was explained by unemployment rates, the marker of exogenous economic change. The effect was stronger for women.

Our second key finding is that earlier-born Korean women did pattern differently by individual-level SES, with cohort effects being evident. High SES women are most at risk of large-body dissatisfaction, regardless of their own body size (BMI), or any age, period, or cohort effects (although age tempers the gaps in levels among these three groups). Similarly, although overall levels of body dissatisfaction are lower among men, men in the high SES group reported the most large-body dissatisfaction based on how they self-categorized their bodies. In detail, however, earlier cohorts with high SES showed a substantially higher level of body dissatisfaction than early cohorts with middle and low SES. In other words, there was no or little variation in the level of body dissatisfaction across different cohorts of Korean women with high SES while the level of body dissatisfaction *increased* for Korean women with middle and low SES. In contrast, no variation was found by SES across different male cohorts. This could suggest an increasing recognition of the body as a mechanism for upward mobility in the general population, not just those with existing advantage. This is a pattern that has been described ethnographically in a number of different global contexts in this same time period, such as Brazil (Edmonds, 2010).

Third, Korean women started at a higher level of large-body dissatisfaction compared to Korean men and showed a faster rate of increase in dissatisfaction compared to Korean men over the years encompassed by this study. For example, 80% of Korean women in their early 20s, regardless of SES, classified themselves as “obese” or “very obese”; for Korean men of the same age it was about 40% for those with middle and high SES and just over 30% for those with low SES. When compared with the high SES group (those with college education and high household income) within each gender, those with lower SES (middle and low SES) showed the highest rate of increase in body-dissatisfaction. Based on this, we

suggest that South Korean women may – similarly to what has been described for other advanced economies – be more susceptible to body dissatisfaction. But another way to interpret this, based on the anthropological literature cited above, is that Korean women are increasingly and comparatively more invested in the body capital associated with slimness (or rather, lack thereof associated with high body weight) than are Korean men.

The approach in our study has several limitations. This research used a single question about how Korean people perceived their body size as the outcome, which is the only available question in KNHANES across years as a measure of body dissatisfaction. Though the question captures an important aspect of body image, large-body dissatisfaction, it does not allow us to explore body image from different angles, which is the first limitation. In addition, the modeling approach used to entangle age, period, and cohort effects of large-body dissatisfaction, HAPC-CCREM, could not integrate survey weights for KNHANES by design to make it a representative sample of the Korean population.

Conclusion

This analysis of population representative data from South Korea, based on repeated surveys over a two-decade period, provides new insights about how age, period, and cohort effects might each or together help explain trends of increasing large-body dissatisfaction. Internet exposure provides the best explanation of period effects in rising body dissatisfaction. Cohort effects help explain the reduced relationships between women's heightened large-body dissatisfaction and high individual socioeconomic status. Aging was somewhat protective against large-body dissatisfaction, most particularly for women. Overall, this South Korean case empirically confirms a general assumption: that increasingly negative cultural views of large bodies have been particularly accelerated by the spread of the internet and social media.

Abbreviations

APC: Age, Period, and Cohort

BMI: Body Mass Index

HAPC-CCREM: Hierarchical Age-Period-Cohort – Cross-Classified Random Effects Model

IMF: International Monetary Fund

KNHANES: Korean version of the National Health and Nutrition Examination Survey

KCDC: Korea Centers for Disease Control and Prevention

SES: Socioeconomic Status

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The data used for this study is from Korean National Health and Nutrition Examination Survey (KNHANES) which is available to the general public. Details of the analysis itself can be obtained from the first author, Dr. SeungYong Han.

Competing interest

The authors declare that they have no competing interests.

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None.

Authors' contributions

SYH conceptualized and designed the study, did analyses, drafted the initial manuscript, and reviewed and revised the manuscript. CS conceptualized and designed the study and reviewed and revised the manuscript. AB conceptualized the study and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Tables

Table 1. Sample Characteristics by Gender, South Korea, 2001-2017								
	Male				Female			
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.
	or %				or %			
<i>Dependent Variable</i>								
Feeling obese or very obese	36.3%		0	1	43.9%		0	1
<i>Level 1 Variables</i>								
Age	49.56	16.40	19	92	49.62	16.59	19	99
BMI (kg/m ²)	24.08	3.21	12.76	45.30	23.45	3.52	12.14	53.54
Socioeconomic status								
High	32.2%		0	1	39.3%		0	1
Middle	36.6%		0	1	37.2%		0	1
Low	31.1%		0	1	23.4%		0	1
Education								
Less than college	58.6%		0	1	69.0%		0	1
College education	42.4%		0	1	31.0%		0	1
Household income								
Low (Q1 and 2)	44.5%		0	1	47.0%		0	1
High (Q3 and 4)	56.5%		0	1	53.0%		0	1
<i>Level 2 Variables</i>								
Internet use (%)	83.3	7.2	63.0	92.7	74.1	9.2	50.2	87.7
Unemployment rates (%)	3.8	0.3	3.3	4.5	3.2	0.3	2.6	3.6
Period			2001	2017			2001	2017
Cohort			1910	1998			1906	1998
	31,330				42,082			
Note: not adjusted for sampling weight.								

Figures

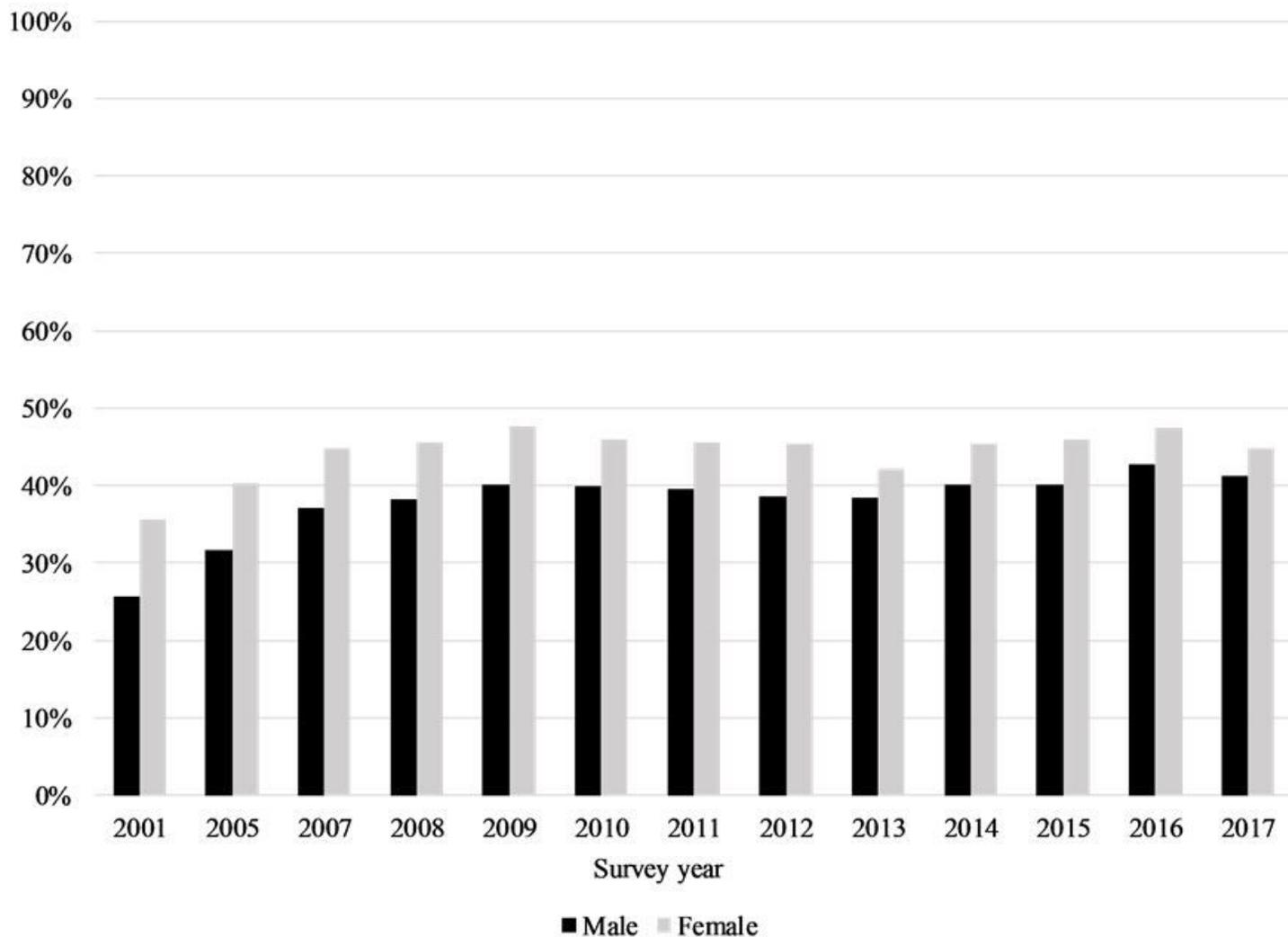


Figure 1

Proportion of Body Dissatisfaction by Gender and Period, South Korea. Data source: Korea National Health and Nutrition Examination Survey (KNHANES), 2001 (phase 2), 2005 (phase 3), 2007-2009 (phase 4), 2010-2012 (phase 4), 2013-2015 (phase 6), and 2016-2017 (phase 7). Note: adjusted for sample weight.

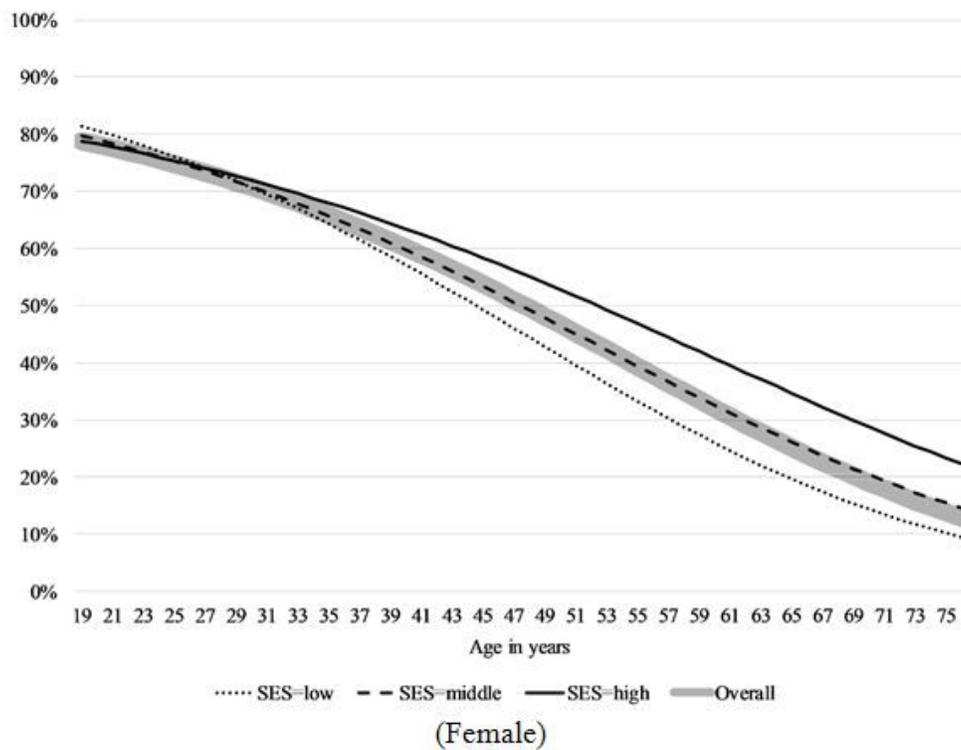
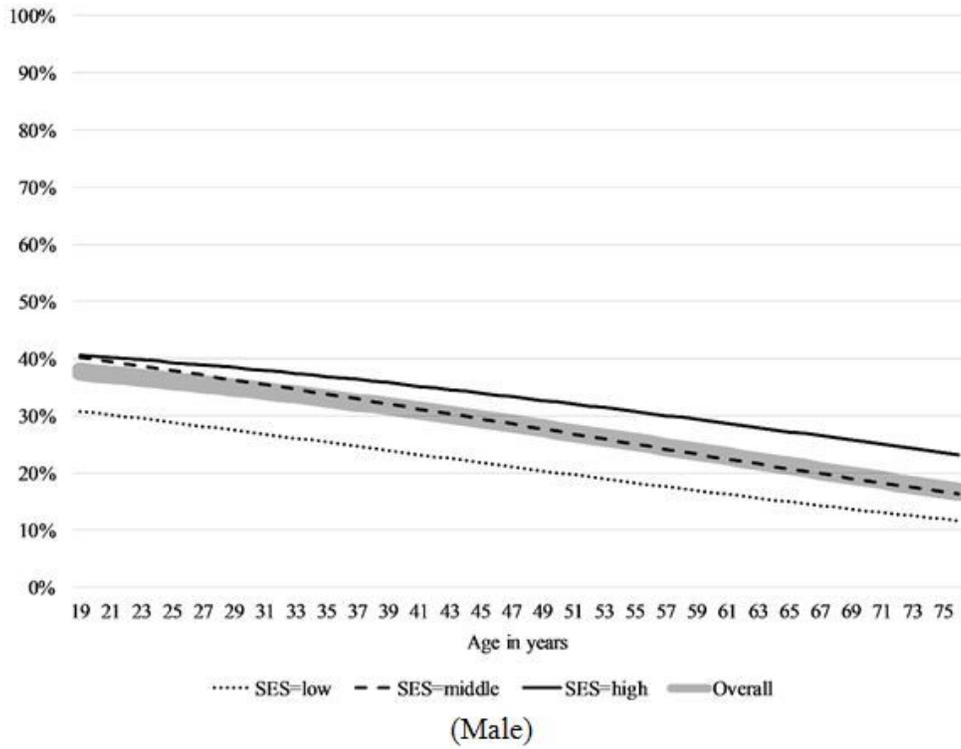


Figure 2

Predicted Probabilities of Body Dissatisfaction, Age Patterns by Gender and SES, South Korea.

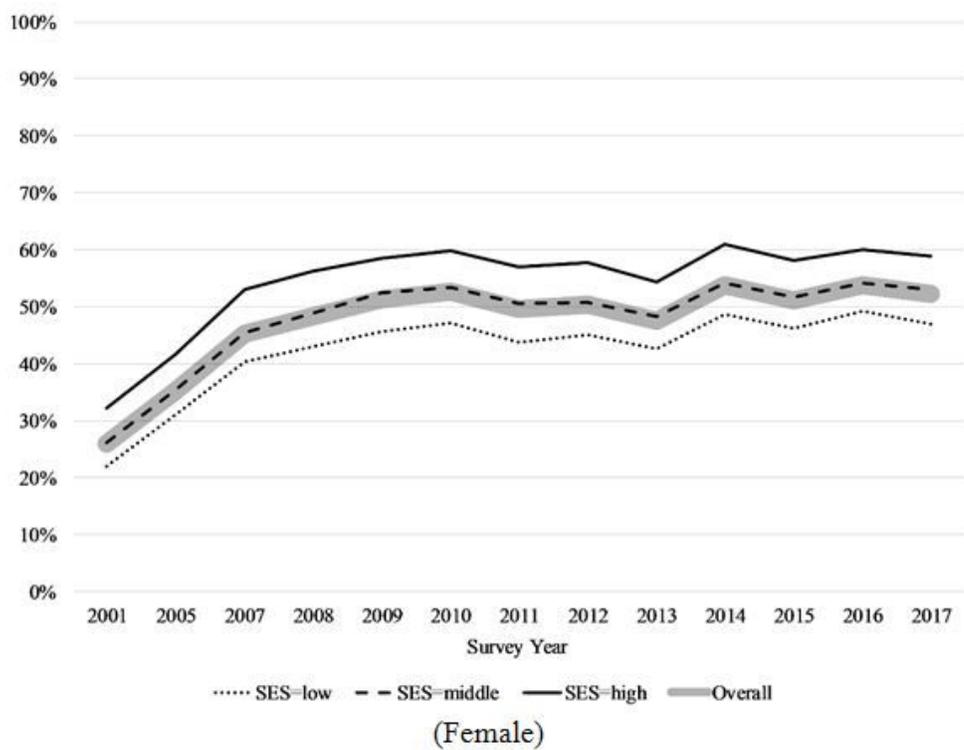
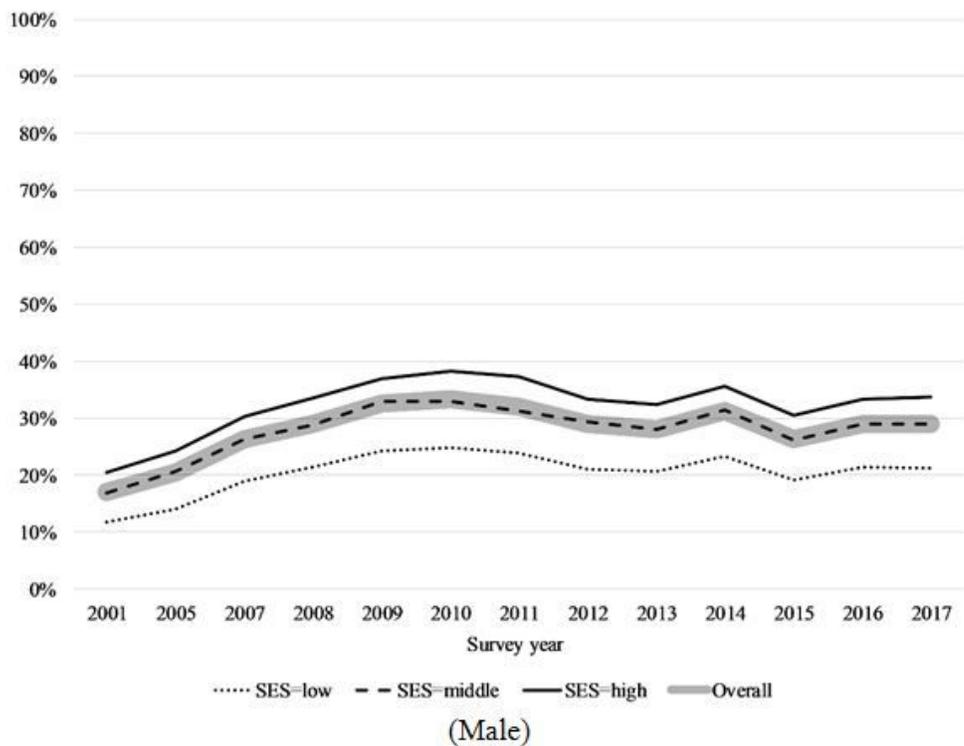


Figure 3

Predicted Probabilities of Body Dissatisfaction, Period Patterns by Gender and SES, South Korea.

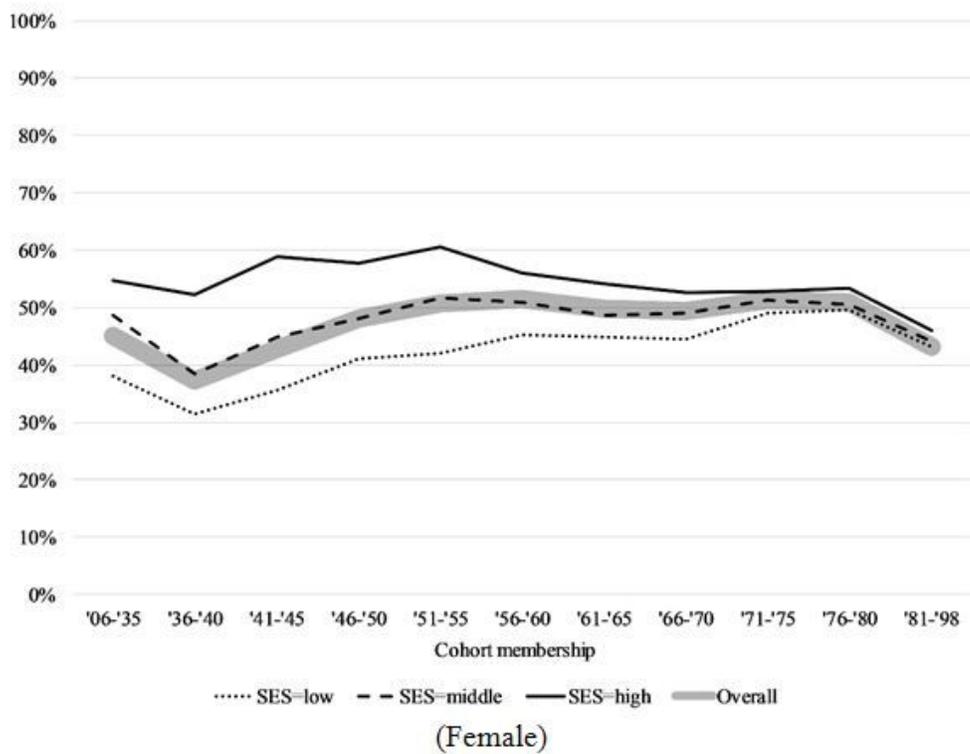
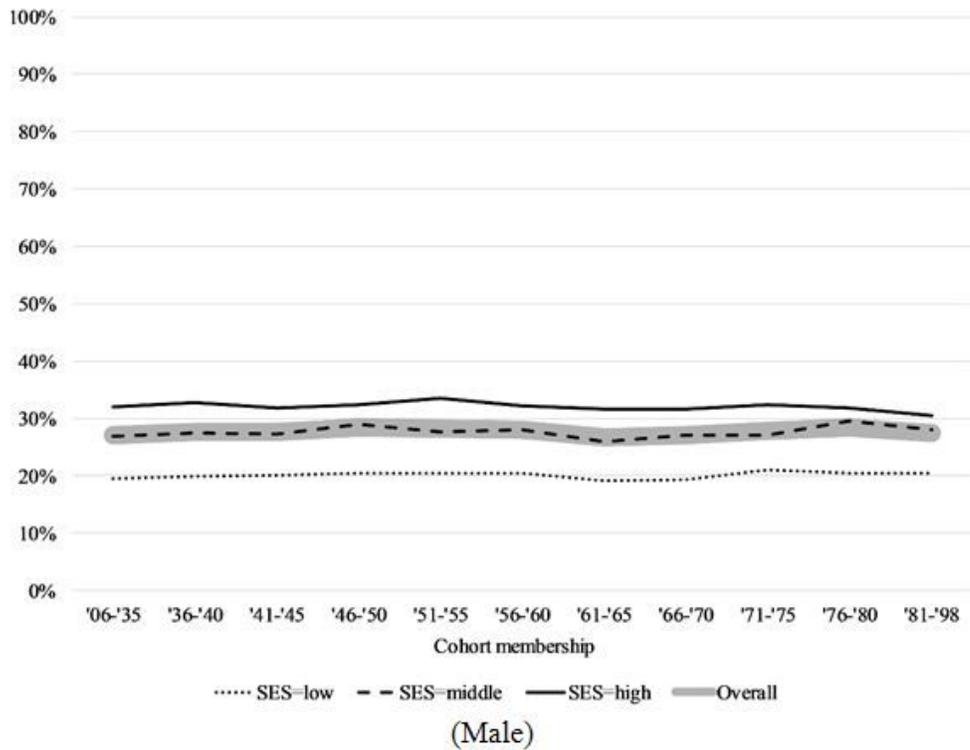


Figure 4

Predicted Probabilities of Body Dissatisfaction, Cohort Patterns by Gender and SES, South Korea.

Supplementary Files

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- [AppendixTable1to3.doc](#)
- [STROBEchecklistcrosssectional.pdf](#)