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# Psychosocial Intervention

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## Does One Size Fit All? Socioeconomic Moderators of Post-divorce Health and the Effects of a Post-divorce Digital Intervention

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### A B S T R A C T

Public health efforts to reduce divorce-induced health adversities are gaining momentum and positive interventional outcomes of the online Cooperation After Divorce (CAD) digital platform for divorcees have been documented by previous research. However, it is unknown whether socioeconomic characteristics previously associated with prolonged divorce recovery are also associated with post-divorce intervention efficacy, and if so, in what way. Multilevel modeling was employed using a sample of 1,856 recently divorced Danes, who participated in an RCT study of the CAD digital platform, to investigate whether educational and income level (1) predict post-divorce health, (2) moderate the time-induced trajectories of post-divorce health, and (3) moderate the intervention-induced trajectories on post-divorce health over the first 12-months following legal divorce. The findings indicated that lower education and lower income predicted worse post-divorce health over one year post-divorce. Furthermore, it was indicated that education moderated post-divorce anxiety so that lower-educated participants experienced a larger reduction in symptoms of anxiety over time. However, except for depression, no moderating effect of income and education on the intervention effect of CAD was found. Our results suggest a beneficial effect of the CAD digital platform across socioeconomic characteristics in the post-divorce period, bolstering claims of the scalability of post-divorce interventions. Moreover, the findings suggest that, theoretically, the intervention may work to compensate for the lack of educational resources in reducing the health gap in post-divorce recovery.

### ¿Una talla única para todos? Los moderadores socioeconómicos de la salud tras el divorcio y los efectos de una intervención digital postdivorcio

### R E S U M E N

Las campañas de salud pública para disminuir las consecuencias negativas del divorcio para la salud están tomando impulso, y los resultados positivos de la intervención de la plataforma digital para divorciados, Cooperación tras el Divorcio (CTD), han sido documentados con investigaciones previas. No obstante, es incierto que las características socioeconómicas, antes asociadas a la recuperación prolongada del divorcio, también se asocien a la eficacia de la intervención tras el divorcio, y si es así, de qué modo. Se han utilizado modelos multinivel en una muestra de 1,856 daneses divorciados recientemente, los cuales participaron en un estudio RCT de la plataforma digital CTD con el fin de investigar si el nivel educativo y de ingresos (1) predecía la salud tras el divorcio, (2) moderaba las trayectorias de salud postdivorcio inducidas por el tiempo y (3) moderaba las trayectorias inducidas por la intervención en la salud postdivorcio durante los primeros 12 meses tras el divorcio legal. Los resultados indican que un menor nivel educativo y un menor nivel de ingresos eran predictores de peor salud a lo largo de un año después del divorcio. Además se indicaba que el nivel educativo moderaba la ansiedad postdivorcio, de modo que los participantes de menor formación experimentaban una mayor reducción de los síntomas de ansiedad con el tiempo. No obstante, excepto para la depresión, no se encontró efecto moderador alguno de los ingresos y el nivel educativo en los efectos de la intervención de CTD. Los resultados indican que hay un efecto positivo de la plataforma digital CTD independientemente de las características socioeconómicas en el periodo postdivorcio, apoyando la escalabilidad de las intervenciones postdivorcio. Además, los resultados indican que teóricamente la intervención puede servir para compensar a las personas con un menor nivel educativo en la reducción de la brecha en salud que se produce en la recuperación postdivorcio.

#### Palabras clave:

Divorcio conyugal  
Salud mental y física  
Intervención digital  
Moderadores socioeconómicos  
Linear Mixed-effects Modeling

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In the area of public health, little attention, if any, has been given to moderators of post-divorce intervention's effects on mental health. Therefore, it is also unknown whether previously recognized socioeconomic factors that have proven important in health trajectories following divorce (e.g., income and education) are also predictive of intervention effects. Research on potential moderators of intervention efficacy seems crucial for the further development of intervention programs, strategies, and foci. For example, if certain groups of divorcees receive little or no mental health benefits from publicly available or mandated services, post-divorce help for these groups may have to be changed, re-tailored, or rethought. The current study intends to further shed light on this issue by investigating whether educational and income levels (1) predict post-divorce health over one year post-divorce, (2) moderate the time-induced trajectories of post-divorce health, and (3) moderate the intervention-induced trajectories in post-divorce health over the first 12-months following legal divorce, using a sample of 1,856 recently divorced Danes.

In recognition of divorce as one of the most common stressful life events in adulthood (Centers for Disease Control and Prevention, 2016; Cohen et al., 2016; Dohrenwend et al., 1978; European Commission, 2015; Holmes & Rahe, 1967; Nielsen et al., 2008; Strizzi et al., 2021), public health policies increasingly work to provide services and interventions (Becher et al., 2018; Blaisure & Geasler, 2005; Bowers et al., 2011; Bowers et al., 2014; Brodbeck et al., 2017; Schramm & McCaulley, 2012) aimed at reducing stress and stress-induced mental and physical health corollaries of divorce (Amato, 2014; Gähler, 2006; Nielsen et al., 2014; Robards et al., 2012; Rote, 2017; Sutin et al., 2010). In line with this, the Danish government implemented a national digital post-divorce intervention program as part of the legal divorce procedures in April 2019. Research suggests that such interventions may be effective in reducing stress and improving mental and physical health-related outcomes post-divorce (Cipric et al., 2020; Ebata & Curtiss, 2017; Hald, Cipric, Øverup, et al., 2020; Øverup et al., 2020; Sander et al., 2020). However, it is unclear whether these psychoeducational interventions are equally beneficial to all divorcees or depend on demographic, socioeconomic, or other characteristics of divorcees. Given that the goal of public health strategies is to address post-divorce health declines both on the general population-wide level as well as particularly targeting the most severely adversely affected groups of divorcees, it is important to examine whether the characteristics previously associated with prolonged divorce recovery are also associated with post-divorce intervention efficacy and, if so, in what way.

Generally, research suggests that there are differences in post-divorce mental health trajectories, with approximately 20% of divorcees experiencing psychological distress years after their judicial divorce (Perrig-Chiello et al., 2015). In this regard, although findings on the association between demographic characteristics—such as age, gender, and parental status—and health outcomes post-divorce are rather inconsistent (Barrett, 2000; Blekesaune, 2008; Booth & Amato, 1991; Cipric et al., 2020; Cohen & Finzi-Dottan, 2012; Gähler, 2006; Gardner & Oswald, 2006; Leopold & Kalmijn, 2016; Perrig-Chiello et al., 2015; Sander et al., 2020; Strizzi et al., 2021; Symoens et al., 2014; Thuen, 2000; Wang & Amato, 2000; Williams & Dunne-Bryant, 2006), socioeconomic characteristics and post-divorce outcomes show a clear pattern. Lower income and lower education have been found to be predictive of more long-term post-divorce declines in both mental and physical health (Amato, 2014; Barrett, 2000; Booth & Amato, 1991; Cohen & Finzi-Dottan, 2012; Metsä-Simola & Martikainen, 2013; Perrig-Chiello et al., 2015; Symoens, Van de Velde, et al., 2013).

These findings speak to the fact that divorce sets in motion a series of disruptive life changes that reside in the domains of personal economy, family life, and living conditions that individually or collectively may affect post-divorce health in the long run. These changes often include splitting household and income, moving

house, single parenting, or losing custody of children (Wang & Amato, 2000). For example, Booth and Amato (1991) found that economic resources, specifically below-median income, education below the high school level, and unemployment, predicted higher levels of stress experienced in the two years immediately following divorce. Furthermore, lower education (Cohen & Finzi-Dottan, 2012; Hald, Cipric, Sander, et al., 2020; Mandemakers et al., 2010; Øygard, 2004; Perrig-Chiello et al., 2015; Strizzi et al., 2021), lower family income (Barrett, 2000; Hald, Cipric, Sander, et al., 2020; Perrig-Chiello et al., 2015; Strizzi et al., 2021; Symoens et al., 2014; Wang & Amato, 2000), and lower socioeconomic status, in general, have been found to be linked to both psychological and physical health declines as well as higher mortality and suicide rates post-divorce (Mandemakers et al., 2010; Metsä-Simola & Martikainen, 2013).

Theoretically, the divorce-stress-adjustment perspective assumes that post-divorce psychological adjustment depends on people's personal reserve capacity (Amato, 2010; Gallo et al., 2005). The reserve capacity is the presence of individual (e.g., coping skills), interpersonal (e.g., social support), and structural (i.e., socioeconomic factors) coping resources and mechanisms (Amato, 2010; Gallo et al., 2005). Therefore, public health interventions often aim to provide social support (i.e., interpersonal resources; Bowers et al., 2011; Geasler & Blaisure, 1998) and supplement individual coping strategies (i.e., individual resource; Bowers et al., 2011; Geasler & Blaisure, 1998)—however, without addressing individual structural resources. Yet, from the resource substitution perspective, one personal resource could substitute for another by making the absence of another less harmful (Ross & Mirowsky, 2006). In other words, intervention might substitute for the absence of individual structural resources by providing other individual resources. Indeed, stress research suggests that, even in the event of divorce, one's cognitive appraisal of the situational demands with a perception of higher personal ability to cope could reduce the development of stress and stress-induced mental and psychological health difficulties despite the actual magnitude of these demands (Cohen et al., 1997; Dewe, 1997; Lazarus & Folkman, 1984). Therefore, based on this theoretical perspective, and supported by research, public health interventions should aim to help cognitive reappraisal of the post-divorce situation and increase personal coping capacity (Sander et al., 2021).

Among the numerous intervention forms that exist to help divorcees (Becher et al., 2018; Blaisure & Geasler, 2005; Bowers et al., 2011, 2014; Brodbeck et al., 2017; Geasler & Blaisure, 1998), digital self-guided approaches may be particularly promising due to their wide outreach potential, scalability, and cost-effectiveness (Bennett & Glasgow, 2009; Ebata & Curtiss, 2017; Schröder et al., 2016). Specifically, online self-guided interventions have been shown to be as effective as face-to-face parental education post-divorce (Schramm & McCaulley, 2012), and as effective for social anxiety disorder, panic disorder, arachnophobia, depressive symptoms, body dissatisfaction, tinnitus, and male sexual dysfunction (Andersson et al., 2014). Moreover, the Cooperation After Divorce (CAD) digital intervention platform has been found to be effective in reducing well-known adverse health effects of divorce, including stress, depression, anxiety, somatization, and hostility, and in improving general mental and physical well-being (Cipric et al., 2020; Hald, Cipric, Øverup, et al., 2020; Øverup et al., 2020; Sander et al., 2020), with the intervention group showing significant improvements over the 12 months study period post judicial divorce when compared to a control group (Cipric et al., 2020; Hald, Cipric, Øverup et al., 2020; Sander et al., 2020). Further, the intervention group reverted to stress, depression, and anxiety levels comparable to the Danish national norms for the general population one year post judicial divorce, whereas the control group did not (Cipric et al., 2020; Nielsen et al., 2008; Olsen et al., 2006). However, no study has yet investigated whether the intervention effects of CAD are similar across users or differ as a function of socio-economic characteristics. This is especially relevant

since past research has found that socioeconomic characteristics differentially predict physical and mental health following divorce (Gähler, 2006; Hald, Cipric, Sander, et al., 2020; Knöpfli, 2016; Perrig-Chiello, 2015; Strizzi et al., 2021). Accordingly, it may be that these same factors predict differential trajectories in mental and physical health following the use of the CAD intervention. If so, this would influence the generalizability of previous findings related to the CAD intervention and may need to be taken into account when designing future interventions.

Therefore, the aim of the current study is to investigate whether socioeconomic variables of educational and income level (1) significantly predict stress, depression, anxiety, and general mental and physical well-being post-divorce, (2) moderate time-induced trajectories of stress, depression, anxiety, and general mental and physical well-being over the first 12-months following legal divorce, and (3) moderate intervention-induced trajectories on these health outcomes, while controlling for sociodemographic variables (i.e., gender, age, parental status; Brown et al., 2016). We examine this through a series of increasingly complex models.

## Method

### Participants

Data for the present study were survey records from 1,856 participants (66.8% women;  $M_{\text{age}} = 45.32$ ,  $SD_{\text{age}} = 8.66$ ) collected as part of a larger RTC study that focused on the longitudinal assessment of the Cooperation after Divorce (CAD) digital divorce intervention. More on the RCT study of CAD effects on stress, depression, anxiety, mental, and physical health can be found in Hald, Cipric, Øverup, et al. (2020), Cipric et al. (2020), and Sander et al. (2020), but generally these studies found that CAD significantly reduced symptoms of depression, stress and anxiety, and improved mental and physical health. The majority of participants reported low to medium educational attainment (i.e., 39% low level of education, 36% medium level of education, 25% high level of education; please see Measures section) and had at least a national average salary (42.3% below average salary, 42.3% average salary, 15.4% above average salary; please see Measures section). The average marriage duration was 12.83 years ( $SD = 7.99$ ), 88.3% participants reported to be parents ( $M_{\text{children}} = 1.88$ ,  $SD_{\text{children}} = 0.99$ ;  $M_{\text{children age}} = 13.50$ ,  $SD_{\text{children age}} = 8.16$ ), and 88.1% reported this being their first divorce. The average period from the date of judicial divorce to baseline survey response was 4.62 days ( $SD = 7.2$  days). For information on participants' characteristics by group assignment and participants' health scores, see Table 1.

To assess the degree of representativeness, our sample was compared to the background population of people who divorced in Denmark during the study period in terms of sociodemographic variables; data for this was obtained from Statistic Denmark. The sample was representative in terms of age, income, and marriage duration, but included more women,  $\chi^2(1, n = 1856) = 208.45$ ,  $p < .001$ , more highly educated individuals,  $\chi^2(2, n = 1856) = 1135.23$ ,  $p < .001$ , and people who had fewer previous divorces,  $t_{(1855)} = -8.47$ ,  $p < .001$ , compared to the background population sample.

The exact response rates cannot be calculated as participants were invited to the study randomly along with an e-mailed official divorce decree sent out by the Danish State Administration (DSA), who did not keep track of the number of invitations sent out during the study period. As expected for online surveys (Cugelman et al., 2011; Geraghty et al., 2013; Lie et al., 2017), attrition rates were significant and response rates dropped to 27.9% from T1 ( $n = 1,856$ ) to T2 ( $n = 539$ ) and stabilized over the two subsequent follow-ups ( $n_{T3} = 464$  and  $n_{T4} = 416$ ). To assess for possible attrition bias, participants who stayed in the study ( $n = 539$ ) beyond baseline (i.e., responded to one or more subsequent follow-up questionnaires) were compared

to those who only completed the baseline questionnaire ( $n = 1,317$ ) on sociodemographic, socioeconomic, and health outcome variables. The results of multiple logistic regression analyses showed that in the intervention group those who stayed in the study had slightly higher odds of being older (AOR = 0.99,  $p < .05$ ) and of better physical health (AOR = 0.91,  $p < .05$ ). No indicators significantly predicted attrition in the control group and no other difference between the two groups of participants was observed, suggesting a very limited attrition bias. Further details are provided in Appendix. For more detailed information on the sample characteristics, see Hald, Cipric, Øverup et al. (2020), Cipric et al. (2020), and Sander et al. (2020).

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained, and participants were informed about the study, its content, and the voluntary nature of participation. Responses were anonymized and stored in anonymous form on a secure server. The study was approved by the Danish Data Protection Agency. The study was exempt from further ethical evaluations following the rules and regulations as set forth by the Scientific Ethical Committees of Denmark.

**Table 1.** Descriptive Sample Characteristics in a Sample of Recently Divorced Danes

Variable	Control group ( $n = 825$ ) % $M$ ( $SD$ )	Intervention group ( $n = 1,031$ ) % $M$ ( $SD$ )
Gender, women	67.8	66.0
Age, years	45.3 (8.6)	45.4 (8.7)
Having children, yes	87.4	88.9
Education level		
Low education	36.0	36.6
Medium education	40.0	35.1
High education	24.0	28.3
Income, national monthly salary		
Below average	42.8	38.7
Average	42.4	44.4
Above average	14.8	16.9
Health Indicators		
Stress, baseline	19.5 (7.1)	19.5 (7.0)
Depression, baseline	1.46 (0.94)	1.47 (0.94)
Anxiety, baseline	0.88 (0.78)	0.91 (0.80)
Mental health, baseline	34.5 (13.6)	34.4 (13.5)
Physical health, baseline	57.9 (8.1)	57.9 (8.1)

Note. There were no significant between-group differences.

### Procedure

The data presented here were obtained from a 12-month longitudinal randomized controlled trial (RCT) study of a digital post-divorce intervention platform called Cooperation after Divorce (CAD), which spanned from January 2016 to January 2018. The study aimed to test the effectiveness of the CAD digital intervention on well-known physical and psychological detrimental effects of divorce. Outcome measures included health-related quality of life, self-perceived stress, anxiety, depression, hostility, somatization, and parental reports of their children's health-related quality of life (see Cipric et al., 2020; Hald, Cipric, Øverup, et al., 2020; Øverup et al., 2020; Sander et al., 2020).

The CAD intervention platform was launched in 2015 in collaboration with the Danish State Administration (DSA); a run-in trial was performed until January 2016, when data collection was initiated. Legal divorce was initiated through DSA. For most (70%), judicial divorce was granted within 2-3 weeks of applying for the

divorce and without any preceding separation period. For the current study, when individuals received their divorce decree, they were also sent an invitation letter to the present study, as well as a digital link to the questionnaire, accompanied by all relevant information needed for providing informed consent. Upon completion of the baseline survey, a total of 1,882 participants were randomized into either the intervention group (1,050) or the control group (832). The randomization schedule was blinded to the researchers and organized in 28 consecutive 14-day intervals (for a total of 110 weeks) of alternate inclusion to either the intervention or control group. Three more consecutive survey assessments (at 3, 6, and 12 months post-divorce) followed the baseline assessment. The study was approved by the Danish Data Protection Agency and was exempt from further ethical evaluations by the Scientific Ethical Committees of Denmark. To read more about the procedure, please see Cipric et al. (2020), Hald, Cipric, Øverup, et al. (2020), Øverup et al. (2020), and Sander et al. (2020).

#### The Cooperation after Divorce Intervention (CAD) Platform.

The CAD digital intervention platform is an online tool targeting well-known topics relevant to the divorce process with the overall objective of providing divorce-relevant coping strategies and effectuate related attitudinal and behavioral changes on a range of divorce-related topics. The CAD platform comprises 17 learning modules, organized into three areas, each taking 20-45 minutes to complete. The first area is related to the “divorcees themselves” and covers topics on divorce-related life-changes, how to let go and forgive, to cope with grief, to deal with negative thoughts, and to handle crisis and anger. The second is related to “children” and covers topics on how children experience divorce, how to understand children’s feelings and reactions, how to put children’s needs first, and how to communicate with children about divorce. The third area is related to “co-parenting” and covers topics on how to avoid typical pitfalls after divorce, make clear agreements, get through holidays and birthdays, establish good co-parenting communication, deal with conflicts, create good co-parental cooperation, and find common ground in child-rearing. The intervention was built based on user activation strategies by providing psychoeducation through videos, animations, and voice-overs followed by exercises, questions, and/or dilemmas every 2-5minutes. To read more about the intervention platform, please see Cipric et al. (2020), Hald, Cipric, Øverup, et al. (2020), Øverup et al. (2020), and Sander et al. (2020).

## Measures

**Sociodemographic variables.** We assessed relevant sociodemographic variables: a) gender was determined by answering “Are you a

man or a woman?”, with the response options: 1 = man, 2 = woman; b) age at divorce was reported as the date of birth and converted to years and months reflecting the difference between the date of birth and the date of divorce; c) parenthood status was determined by asking “Do you have children?”, with the response options: 1 = yes, 2 = no; d) number of children were determined by asking “How many children do you have?”; e) children’s age was calculated from the children’s birthdate(s) provided by the participants.

**Socioeconomic variables.** We assessed two relevant socioeconomic indicators: a) educational level was reported as the highest formally completed education on an eight-point scale. Response options were subsequently recoded into: 1 = low level of education (e.g., primary school, high school, business high school, vocational education), 2 = medium level of education (e.g., medium-cycle tertiary education, bachelor’s degree), and 3 = high level of education (e.g., master’s degree or higher) only for a descriptive purpose (see Table 1); b) monthly income was reported in 10,000 DKK intervals (approx. 1,500 USD) on a nine-point scale, from 1 = below 10,000 DKK to 8 = more than 80,000 DKK (approx. 12,000 USD). Following national data from Statistics Denmark, salaries were categorized as 1 = below average ( $\leq 30,000$  DKK), 2 = average (30-40,000 DKK), or 3 = above average ( $\geq 40,000$  DKK) for a descriptive purposes (see Table 1).

**Marriage and divorce-related variables.** a) Marriage duration was time from the marriage date to the divorce date; b) Divorce duration was a time in days from the divorce date to the baseline survey response date; c) Number of divorces was determined with the question “How many times have you divorced?”, with response options including 1 = one time, 2 = two times, 3 = three times, and 4 = more than three times.

**Mental and physical health variables.** a) Perceived stress was assessed by the Danish version of the 10-item self-report instrument Perceived Stress Scale (PSS; Eskildsen et al., 2015). The five-point Likert-type response scale (0 = never, 4 = very often) was scored such that higher scores indicate higher perceived stress (score range: 0-40). Sum scores over 15 for men and over 17 for women are considered an indicator of high stress levels (Cohen et al., 1983; Eskildsen et al., 2015; Nielsen et al., 2008). The PSS has been validated cross-culturally (Eskildsen et al., 2015) and demonstrated very good internal reliability in the current study (Cronbach’s  $\alpha = .88-.90$ ). b) Depression and anxiety were assessed by the 13-item depression and the 10-item anxiety subscales from the Danish version of the Symptom Checklist-90-Revised (SCL-90; Derogatis, 2009). The five-point Likert-type response scale (0 = not at all, 4 = very much) was scored and averaged such that higher scores indicate higher symptom severity (score range: 0-4). The measures demonstrated high internal consistency throughout the study ( $\alpha = .78-.95$ ).

**Table 2.** Results for the Likelihood Ratio Tests Comparing the Three Models Tested for Education and Income

	Model 0 vs. Model 1 <sup>1</sup>	Model 1 <sup>1</sup> vs. Model 2 <sup>2</sup>	Model 2 <sup>2</sup> vs. Model 3 <sup>3</sup>
Education			
Stress	$\chi^2(15) = 13.01, p < .001$	$\chi^2(18) = 7.44, p = .059$	$\chi^2(22) = 1.80, p = .774$
Depression	$\chi^2(15) = 25.62, p < .001$	$\chi^2(18) = 11.87, p = .008$	<b><math>\chi^2(22) = 15.19, p = .004</math></b>
Anxiety	$\chi^2(15) = 21.02, p < .001$	<b><math>\chi^2(18) = 9.36, p = .025</math></b>	$\chi^2(22) = 8.99, p = .061$
Mental Health	$\chi^2(15) = 2.81, p < .094$	$\chi^2(18) = 1.89, p = .595$	$\chi^2(22) = 6.19, p = .186$
Physical Health	<b><math>\chi^2(15) = 10.03, p = .001</math></b>	$\chi^2(18) = 2.13, p = .546$	$\chi^2(22) = 3.68, p = .451$
Income			
Stress	<b><math>\chi^2(15) = 31.31, p &lt; .001</math></b>	$\chi^2(18) = 2.26, p = .520$	$\chi^2(22) = 7.35, p = .119$
Depression	<b><math>\chi^2(15) = 33.48, p &lt; .001</math></b>	$\chi^2(18) = 5.72, p = .126$	$\chi^2(22) = 8.78, p = .067$
Anxiety	<b><math>\chi^2(15) = 26.24, p &lt; .001</math></b>	$\chi^2(18) = 6.37, p = .095$	$\chi^2(22) = 6.41, p = .170$
Mental Health	<b><math>\chi^2(15) = 11.18, p &lt; .001</math></b>	$\chi^2(18) = 1.92, p = .589$	$\chi^2(22) = 8.95, p = .062$
Physical Health	<b><math>\chi^2(15) = 64.72, p = .001</math></b>	$\chi^2(18) = 3.41, p = .332$	$\chi^2(22) = 6.66, p = .155$

Note. Bold font denotes estimates of the best fitting model; <sup>1</sup>Model 1 assessed the main effect of education and income; <sup>2</sup>Model 2 assessed the contribution of education and income by time interactions; <sup>3</sup>Model 3 assessed the contribution of education and income by time and intervention interactions.

c) General mental and physical health was assessed by the physical health and mental health summary variables of the second Danish version of the Short Form 36 (SF-36) Health Assessment (Bjørner et al., 1997; Maruish, 2011). The instrument comprises 36

items representing 8 health-related quality of life domains (high internal consistency at all time points,  $\alpha = .81-.93$ ) used to calculate physical and mental health summary scores based on their relative factorial weights (see Maruish, 2011). The assessment is anchored

**Table 3.** Role of Education and Income in Changes over Time in Five Study Outcomes (Linear Mixed Effect Modeling)

Variable	Model 1 <sup>1</sup>				Model 2 <sup>2</sup>				Model 3 <sup>3</sup>			
	Estimate	SE	Cohen's <i>d</i>	<i>p</i>	Estimate	SE	Cohen's <i>d</i>	<i>p</i>	Estimate	SE	Cohen's <i>d</i>	<i>p</i>
<b>Education</b>												
Stress												
Education at baseline	<b>-0.31</b>	<b>0.09</b>	<b>-0.06</b>	<b>&lt; .001</b>	-0.39	0.09	-0.08	< .001	-0.42	0.12	-0.08	< .001
Education 3 months					0.30	0.14	0.06	.031	-0.22	0.28	-0.04	.440
Education 6 months					0.31	0.14	0.06	.030	-0.19	0.29	-0.04	.500
Education 12 months					0.16	0.15	0.03	.290	-0.36	0.30	-0.07	.224
Depression												
Education at baseline	-0.06	0.01	-0.08	< .001	-0.07	0.01	-0.10	< .001	<b>-0.08</b>	<b>0.02</b>	<b>-0.11</b>	<b>&lt; .001</b>
Education 3 months					0.04	0.02	0.06	.014	<b>-0.09</b>	<b>0.03</b>	<b>-0.13</b>	<b>.007</b>
Education 6 months					0.04	0.02	0.06	.019	<b>-0.11</b>	<b>0.04</b>	<b>-0.14</b>	<b>.003</b>
Education 12 months					0.05	0.02	0.07	.011	<b>-0.10</b>	<b>0.04</b>	<b>-0.13</b>	<b>.010</b>
Anxiety												
Education at baseline	-0.04	0.01	-0.07	< .001	<b>-0.05</b>	<b>0.01</b>	<b>-0.09</b>	<b>&lt; .001</b>	-0.06	0.01	-0.10	< .001
Education 3 months					<b>0.03</b>	<b>0.01</b>	<b>0.04</b>	<b>.065</b>	-0.03	0.03	-0.05	.224
Education 6 months					<b>0.03</b>	<b>0.01</b>	<b>0.05</b>	<b>.024</b>	-0.05	0.03	-0.08	.065
Education 12 months					<b>0.03</b>	<b>0.02</b>	<b>0.06</b>	<b>.019</b>	-0.08	0.03	-0.13	.008
Mental Health												
Education at baseline	0.28	0.16	0.03	.094	0.34	0.17	0.04	.049	0.58	0.23	0.06	.011
Education 3 months					-0.34	0.26	-0.04	.193	0.90	0.53	0.09	.088
Education 6 months					-0.12	0.27	-0.01	.654	1.04	0.54	0.11	.055
Education 12 months					-0.22	0.29	-0.02	.455	0.60	0.58	0.06	.304
Physical Health												
Education at baseline	<b>0.31</b>	<b>0.10</b>	<b>0.05</b>	<b>.002</b>	0.30	0.10	0.05	.003	0.23	0.13	0.04	.085
Education 3 months					0.14	0.14	0.02	.301	0.02	0.28	0.00	.942
Education 6 months					-0.10	0.14	-0.02	.485	-0.03	0.29	-0.00	.932
Education 12 months					0.01	0.15	0.00	.971	0.45	0.31	0.07	.145
<b>Income</b>												
Stress												
Income at baseline	<b>-0.55</b>	<b>0.10</b>	<b>-0.11</b>	<b>&lt; .001</b>	-0.55	0.10	-0.11	< .001	-0.62	0.13	-0.12	< .001
Income 3 months					-0.12	0.14	-0.02	.387	-0.73	0.29	-0.14	.011
Income 6 months					0.10	0.16	0.02	.517	0.46	0.31	-0.09	.145
Income 12 months					0.11	0.16	0.02	.487	-0.12	0.33	-0.02	.720
Depression												
Income at baseline	<b>-0.08</b>	<b>0.01</b>	<b>-0.11</b>	<b>&lt; .001</b>	-0.08	0.01	-0.11	< .001	-0.09	0.02	-0.12	< .001
Income 3 months					-0.02	0.02	-0.02	.385	-0.10	0.04	-0.15	.003
Income 6 months					0.02	0.02	0.02	.437	-0.05	0.04	-0.07	.221
Income 12 months					0.04	0.02	0.05	.072	-0.04	0.04	-0.06	.337
Anxiety												
Income at baseline	<b>-0.06</b>	<b>0.01</b>	<b>-0.09</b>	<b>&lt; .001</b>	-0.06	0.01	-0.10	< .001	-0.07	0.01	-0.12	< .001
Income 3 months					-0.01	0.01	-0.01	.660	-0.06	0.03	-0.11	.021
Income 6 months					0.03	0.02	0.05	.029	0.02	0.03	-0.03	.504
Income 12 months					0.01	0.02	0.02	.382	-0.03	0.03	-0.05	.379
Mental Health												
Income at baseline	<b>0.62</b>	<b>0.18</b>	<b>0.06</b>	<b>&lt; .001</b>	0.55	0.20	0.06	.005	0.79	0.25	0.08	.001
Income 3 months					0.29	0.27	0.03	.289	1.50	0.54	0.15	.006
Income 6 months					0.30	0.29	0.03	.311	0.63	0.59	0.06	.288
Income 12 months					-0.01	0.31	0.00	.976	0.13	0.63	0.01	.833
Physical Health												
Income at baseline	<b>0.89</b>	<b>0.11</b>	<b>0.14</b>	<b>&lt; .001</b>	0.93	0.12	0.15	< .001	0.74	0.15	0.12	< .001
Income 3 months					-0.07	0.14	-0.01	.63	0.12	0.29	0.02	.675
Income 6 months					-0.28	0.16	-0.05	.07	0.18	0.31	0.03	.574
Income 12 months					-0.04	0.16	-0.01	.81	0.13	0.33	0.02	.694

Note. Bold font denotes estimates of the best fitting model; Model estimates marked in bold are the most appropriate model according to the likelihood ratio tests; <sup>1</sup>Model 1 assessed the main effect of education and income; <sup>2</sup>Model 2 assessed education and income by time interaction; <sup>3</sup>Model 3 assessed education and income by time and intervention interaction.

on either Likert-type scale options or yes/no response options with higher scores indicating better health. The analyses focus on physical and mental health summary scores.

## Data Analysis<sup>1</sup>

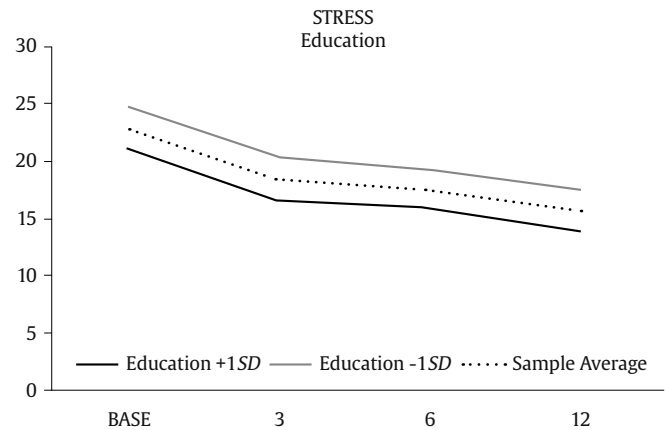
In order to investigate the association of education and income with post-divorce health outcomes and to inspect for the moderation of the intervention effect, the linear mixed-effect regression modeling (LME) with the lme4 package for R version 3.5.3 was used. The mixed-effect specification accounted for random intercepts (i.e., individual differences in initial levels of the outcome), while slopes were estimated as fixed effects. The restricted maximum likelihood (REML) estimation approach, as employed by lme4, handles missing data on the observed predictor variable, thereby protecting the robustness of longitudinal estimates (Little, 2013). In order to address research questions, two sets of complementary analyses were performed. The first set inspected the association of education with the outcomes while controlling for income, and the second set inspected the association of income with the outcomes while controlling for education. We specified four different models. Model 0 assumed no effects of education and/or income (i.e., the relevant predictor was not included in the analyses). Model 1 assumed an additive effect of education and/or income (the relevant predictor was included as a time-invariant predictor). Model 2 assumed education and/or income-specific trajectories across time (time-variant, education/income \* time interaction), and Model 3 assumed a moderation of intervention effect (three-way interaction, education/income \* time \* intervention). These models were compared using likelihood ratio chi-square tests in order to assess the goodness of fit to the data. For all models, a random intercept accounted for individual differences in initial outcome levels. Gender, age, and the number of children were added as covariates; Model 0 and 1 also controlled for intervention vs. control group placement. Education and income were entered as continuous variables, while time and intervention group placement were specified as categorical. Effects are quantified as mean differences at each time point and reported with Cohen's *d* effect size estimate. In the case of significant interactive effects, these were plotted according to Aiken and West (1991), probing at  $\pm 1$  SD from the mean (i.e., high and low values for education/income). For the sake of ease of presentation, we include the figures of all three models (Model 1, 2, and 3) in Figures 1a, 1b, and 1c.

## Results

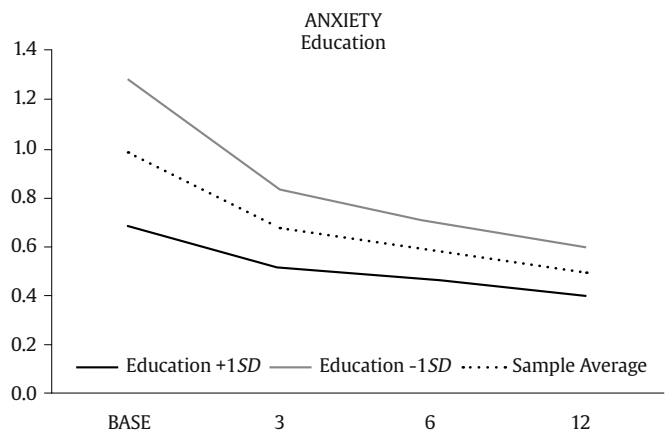
### Education

Pertaining to the first study aim, which was to inspect whether education predicts post-divorce health, we compared against Model 0, which assumed no association of education with health outcomes. The likelihood ratio test suggested that Model 0 was the most appropriate model for general mental health (see Table 2 and 3). However, likelihood ratio tests suggested that Model 1, which assumed an additive association of education with health outcomes, was the most appropriate model for stress and physical health (see Table 2 and 3, and Figure 1a). The results indicated that higher education was associated with lower levels of stress and a higher level of physical health. Pertaining to the second study aim, likelihood ratio tests suggested that Model 2, which assumed that education level moderates the trajectories of outcome variables over the first 12-months post-divorce, was the most appropriate model for anxiety (see Table 2 and 3, and Figure 1b). The results indicated that, on average, a lower education level was associated

with a larger reduction in anxiety symptoms over time. And finally, pertaining to the third study aim, likelihood ratio tests suggested that Model 3, which assumed that education level moderates the intervention effect on outcome variables over the first 12-months post-divorce, was the most appropriate model for depression (see Table 2 and 3, and Figure 1c). The results indicated that intervention group participants with lower education levels experience bigger declines in depressive symptoms over time relative to intervention group participants with higher levels of education. There was no moderation of time effects evident for the control group. Figures 1a, 1b, and 1c show Model 1 for stress, Model 2 for anxiety, and Model 3 for depression as these were the only interactive effects found.



**Figure 1a.** Study Outcome Trajectories generated by Linear Mixed Effects Regression Modeling for Education: Linear Association (i.e., Model 1). Note. Linear associations were found with respect to all the outcomes for income, and with respect to stress, mental, and physical health for education. Stress is presented as an example of a “typical” outcome.

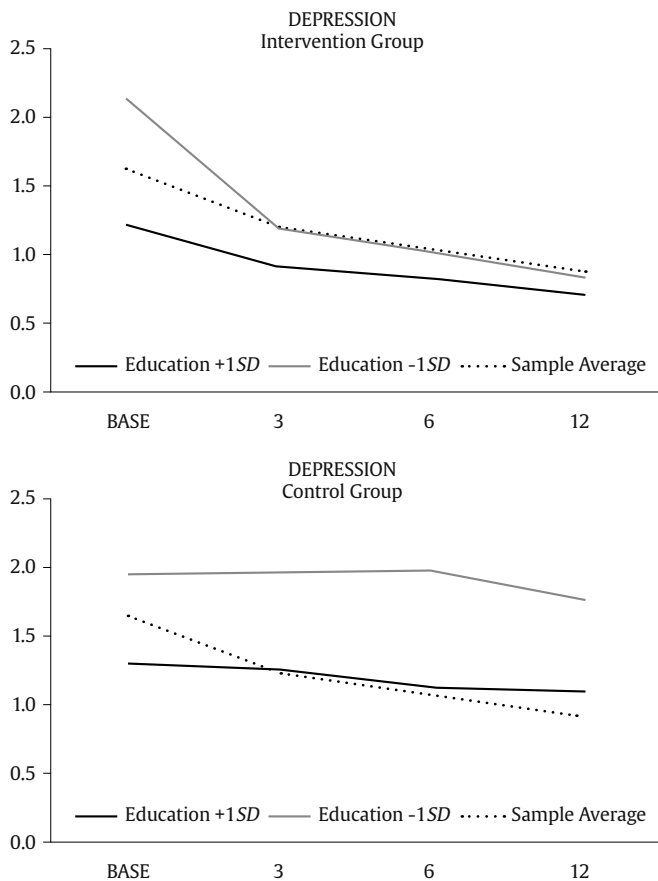


**Figure 1b.** Study Outcome Trajectories generated by Linear Mixed Effects Regression Modeling for Education: Two-way Interaction (i.e., Model 2). Note. Model 2 provides the depiction of the 2-way interaction found for anxiety (i.e., Model 2).

### Income

Concerning the role of income, and as to the first study aim, likelihood ratio tests suggested that Model 1, which assumed an additive association of income level with health outcomes, was the

most appropriate model for all the outcomes (see Table 2 and 3). Figure 1a presents Model 1 for stress as a visual example, but the same pattern applies to the rest of the outcomes. As to the second and the third study aim, model comparisons for higher-order models (Model 2: income \* time interaction and Model 3: income \* time \* intervention group interaction) suggested that these models did not provide a better fit to the data. Thus, the results indicated that higher income was associated with lower levels of stress, lesser symptoms of depression and anxiety, and higher levels of mental and physical health at baseline.



**Figure 1c.** Study Outcome Trajectories generated by Linear Mixed Effects Regression Modeling for Education: Three-way Interaction (i.e., Model 3).

Note. Model 3 provides the depiction of the 3-way interaction found for depression (i.e., Model 3).

## Discussion

Despite the increased utilization of post-divorce public health intervention measures, no research has inspected possible moderators of digital post-divorce interventions' effects on mental and physical health. Thus, it is unknown whether the socioeconomic factors of education and income, which have previously been documented to influence health trajectories following divorce (Strizzi et al., 2021; Wang & Amato, 2000), also influence the effectiveness of post-divorce interventions.

Pertaining to the first study aim, and in corroboration with the previous research (Amato, 2014; Barrett, 2000; Booth & Amato, 1991; Cohen & Finzi-Dottan, 2012; Metsä-Simola & Martikainen, 2013; Perrig-Chiello et al., 2015; Symoens, Van de Velde, et al., 2013), our findings showed that lower education and lower income predicted worse post-divorce health, such that lower income was associated

with higher levels of stress, depression, anxiety, and mental health, and poorer physical health over one year post-divorce, while lower education was associated with higher levels of stress and poorer physical health. Moreover, pertaining to our second study aim, we found that education moderated post-divorce anxiety such that lower-educated participants experienced a larger reduction in symptoms of anxiety over time. However, pertaining to our third study aim, and with one notable exception, education and income were not associated with differential health benefits related to the intervention program. The exception concerned the finding that divorcees with lower levels of education experienced a larger intervention-induced reduction in depression symptoms compared to peers with higher levels of education. No other moderation of intervention effects was found.

Although there is theory to support our interactive findings, specifically that of the differential intervention effectiveness in terms of depression, it is important to note two methodological considerations potentially influencing these results. Firstly, these findings may be the results of an inflated family-wise error rate. Secondly, compared to participants with higher levels of education, participants with lower levels of education initially scored higher on anxiety and depression, which provided them with more "space" within which to recover. That is, the larger reduction in anxiety scores over time and the larger intervention effects for those with lower education levels may result from their worse initial anxiety and depression scores.

However, we tentatively propose a theoretical rationale for the positive effect of lower education on the intervention-related reduction in symptoms of post-divorce depression. A link between lower educational attainment and higher depression levels has consistently been documented (Mirowsky & Ross, 2003). Previous studies have posited that the association between education and depression may be mediated by an individual's sense of personal control (Chou & Chi, 2001; Finkelstein et al., 2007; Ross & Mirowsky, 2013). Reserve capacity theory posits that lower education may predict more severe psychological reactivity to stressors, due to a deficiency in psychological resources that reinforce a sense of personal control over the situation (Chou & Chi, 2001; Gallo, 2009; Gallo et al., 2005; Griffin et al., 2002). Even so, our findings speak to the resource substitution hypothesis (Ross & Mirowsky, 2006), suggesting that intervention participation may substitute for lower levels of education in post-divorce recovery by inducing a reduction in depression symptoms. Moreover, there was no pronounced intervention effect in higher-educated groups, which aligns with assumptions that intervention participation may serve as a resource more so for those who have fewer alternative resources (e.g., lower education) than for those who have more alternative resources (e.g., higher education; Ross & Mirowsky, 2006). Therefore, our findings speak to the possibility that public health interventions may compensate for (the lack of) educational resources and enhance the sense of personal control over the situation.

The current study findings are of interest to public health policy-makers and practitioners involved with digital intervention programs. Consistent with recent findings on predictors and moderators of stress (Drozd et al., 2013) and teenage well-being interventions (Wang et al., 2017), the effects of the Danish online intervention program for recently divorced individuals did not differ according to most socioeconomic characteristics. This indicates the program's potential to not only facilitate divorcees' resilience across social strata but also reduce post-divorce inequalities in health. Although more research is needed to understand education-based differences in responses to intervention and mechanisms underlying intervention-related health improvements, our results bolster the claim that digital divorce interventions are scalable and effective at the population level.



## Study Limitations

While the current study has a number of strengths, including a large RCT sample of new divorcees undergoing the intervention at the time of their divorce, there are also limitations. Shortcomings related to the RCT part of the study can be found in Ciprić et al. (2020), Hald, Ciprić, Øverup, et al. (2020), Øverup et al. (2020), and Sander et al. (2020). In addition, substantial attrition pointed to possible selection biases (Cugelman et al., 2011; Eysenbach, 2005), which we attempted to assess in the logistic regression analysis. According to its results, there was a slight overrepresentation of older individuals that did not seem to affect the sample's overall representativeness, as suggested by its comparison to the general population (Ciprić et al., 2020; Hald, Ciprić, Øverup, et al., 2020; Øverup et al., 2020; Sander et al., 2020). However, there may be numerous factors related to self-selection into the study, many of which we have likely not assessed. Thus, we are unable to fully examine the scope and bias related to self-selection. However, one interesting factor that may have related to selection bias is parental status. The majority of our participants reported being parents (88.3%). As the study was advertised as "improving cooperation after divorce", people who were parents may have self-selected in, as they may have perceived that the study and the intervention were of greater relevance to them, relative to people who were not parents, given the (likely) greater amount of post-divorce contact with and through the children.

As noted, we experienced significant attrition from baseline to subsequent follow-up time points. While this attrition rate is comparable to other research on online interventions (Donkin et al., 2011; Eysenbach, 2005; Geraghty et al., 2013), and we found no evidence of a substantial attrition bias, there are implications for statistical power. Specifically, we cannot be sure that our lack of findings at later time points reflect true null-effects or whether our analysis was insufficiently powered to detect true differences. Future research should seek to replicate current findings with an eye on minimizing attrition.

Moreover, future studies should seek to examine the effects of the intervention and socioeconomic predictors cross-culturally as present findings are limited to the context of the Danish welfare society. Denmark is ninth on the global scale of income equality (OECD, 2018). Thus, the absence of socioeconomic predictors of the intervention effect could be an artifact of the little income inequality of the Danish welfare state. Lastly, the current study focused on a population of previously married individuals; it is unclear whether the effects found in the current study hold for unmarried cohabiting unions. Future research should seek to assess this.

## Conclusion

Using a sample of 1,856 recently divorced Danes, who were part of a large-scale RCT study of digital post-divorce intervention, the study explored socioeconomic moderators of the efficacy of the CAD intervention program on mental and physical health. Our findings indicated that although lower levels of education and lower income levels predicted lower post-divorce health, with one exception, the intervention effects of the program were not influenced by education or income. Therefore, the findings speak to the generality of the intervention effectiveness on a population level.

## Conflict of Interest and Author Disclosure Statement

For due diligence, we would like to declare that the University of Copenhagen, Denmark, where the authors work, owns the digital intervention platform 'Cooperation after Divorce (CAD)' while two of the co-authors (Gert Martin Hald and Søren Sander) holds the

commercial license and intellectual property rights to the platform through the Company 'Cooperation after Divorce' (Samarbejde Efter Skilsmisse ApS).

## Acknowledgements

We wish to thank the Egmont Foundation for its support with the development of the digital platform 'Cooperation After Divorce' and the Danish State Administration for help during the data collection process.

## Note

<sup>1</sup>Due to data sensitivity, data cannot be shared publicly. The Data analysis syntax is available upon request.

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## Appendix

### Logistic Regression Analysis of Drop-out from Baseline to 3 Months

To determine if the attrition rate resulted in an attrition bias, multiple logistic regression analysis was performed to compare participants who completed only the baseline questionnaire to the rest of the sample. Predictors were RCT group assignment (intervention vs. control), sociodemographic variables (gender, age at survey, education, income), divorce-related characteristics (times divorced, marriage duration, number of children, conflict degree with a former spouse), and mental and physical health indicators (physical and mental health, stress, anxiety, and depression).

Variable	Estimate	Std. Error	Exp(B)	p-value
Control (vs. Intervention)	-0.02	0.02	0.96	.432
Women (vs. Men)	0.01	0.03	1.02	.803
Age	-0.00	0.00	1.00	.028
Education	-0.00	0.00	1.00	.438
Income	0.00	0.02	1.00	.884
Number of children	-0.01	0.01	0.98	.467
Times divorced	0.02	0.03	1.05	.467
Marriage duration	-0.00	0.00	1.00	.481
Conflict degree	0.00	0.00	1.00	.454
Health Indicators				
Physical health	-0.04	0.02	0.91	.010
Mental health	0.00	0.02	1.00	.890
Stress	0.00	0.00	1.00	.851
Depression	-0.02	0.03	0.96	.479
Anxiety	0.03	0.03	1.07	.184

Note. Exp(B) = odds ratio.

