




## CLINICAL INVESTIGATIONS

## Cardiopulmonary Resuscitation in Adults Over 80: Outcome and the Perception of Appropriateness by Clinicians

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See related editorial by Monique Anderson Starks

**OBJECTIVES:** To determine the prevalence of clinician perception of inappropriate cardiopulmonary resuscitation (CPR) regarding the last out-of-hospital cardiac arrest (OHCA) encountered in an adult 80 years or older and its relationship to patient outcome.

**DESIGN:** Subanalysis of an international multicenter cross-sectional survey (REAPPROPRIATE).

**SETTING:** Out-of-hospital CPR attempts registered in Europe, Israel, Japan, and the United States in adults 80 years or older.

**PARTICIPANTS:** A total of 611 clinicians of whom 176 (28.8%) were doctors, 123 (20.1%) were nurses, and 312 (51.1%) were emergency medical technicians/paramedics.

**RESULTS AND MEASUREMENTS:** The last CPR attempt among patients 80 years or older was perceived as appropriate

by 320 (52.4%) of the clinicians; 178 (29.1%) were uncertain about the appropriateness, and 113 (18.5%) perceived the CPR attempt as inappropriate. The survival to hospital discharge for the “appropriate” subgroup was 8 of 265 (3.0%), 1 of 164 (.6%) in the “uncertain” subgroup, and 2 of 107 (1.9%) in the “inappropriate” subgroup ( $P = .23$ ); 503 of 564 (89.2%) CPR attempts involved non-shockable rhythms. CPR attempts in nursing homes accounted for 124 of 590 (21.0%) of the patients and were perceived as appropriate by 44 (35.5%) of the clinicians; 45 (36.3%) were uncertain about the appropriateness; and 35 (28.2%) perceived the CPR attempt as inappropriate. The survival to hospital discharge for the nursing home patients was 0 of 107 (0%); 104 of 111 (93.7%) CPR attempts involved non-shockable rhythms.

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Overall, 36 of 543 (6.6%) CPR attempts were undertaken despite a known written do not attempt resuscitation decision; 14 of 36 (38.9%) clinicians considered this appropriate, 9 of 36 (25.0%) were uncertain about its appropriateness, and 13 of 36 (36.1%) considered this inappropriate.

**CONCLUSION:** Our findings show that despite generally poor outcomes for older patients undergoing CPR, many emergency clinicians do not consider these attempts at resuscitation to be inappropriate. A professional and societal debate is urgently needed to ensure that first we do not harm older patients by futile CPR attempts. *J Am Geriatr Soc* 68:39-45, 2020.

**Key words:** out-of-hospital cardiac arrest; cardiopulmonary resuscitation; adults 80 and older; nursing homes; inappropriate care

The treatment of cardiac arrest in older patients poses significant clinical and ethical challenges. Worldwide, as life expectancy increases, more people are surviving to an older age. In the United States the number of citizens aged 65 or above is projected to more than double by 2060, amounting to 24% of the total population; the number of people aged 85 or older will have more than tripled up to nearly 20 million.<sup>1</sup> In the European Union, the percentage of people aged 65 or above relative to those aged 15 to 64 is projected to rise from 29.6% in 2016 to 51.2% in 2070.<sup>2</sup> In Japan, the proportion of inhabitants aged 65 or older is estimated to increase from 26.6% in 2015 to 30.0% in 2025.<sup>3</sup>

As a consequence of the aging of the population, emergency medicine clinicians are confronted with a rising number of out-of-hospital cardiac arrests (OHCAs). In Sweden the incidence rate of OHCAs among people 90 years or older more than doubled between 1992 and 2013 from 112.4 to 236.0 per 100 000 person-years.<sup>4</sup> In Japan the incidence rate of bystander-witnessed OHCAs among persons 80 years or older increased from 463 to 522 per 100 000 persons between 2005 and 2009.<sup>5</sup>

Although some reports suggest that age is an independent predictor of poor prognosis,<sup>6</sup> the largest study of OHCA in older persons did not demonstrate a significant difference in neurologic outcome with increasing age.<sup>4</sup> Because the number of cardiac arrests with an initial shockable rhythm decreases with increasing age,<sup>4,8</sup> unfavorable cardiac arrest characteristics, together with baseline comorbidities and frailty, are probably more relevant than age itself related to the expected prognosis.<sup>8</sup> Most older patients have cardiac arrest characteristics that have been associated with a poor prognosis, such as non-shockable rhythms, unwitnessed arrest, or no bystander cardiopulmonary resuscitation (CPR). For example, in Japan approximately 74% of OHCA cases in patients aged 75 years or older have asystole as the initial rhythm.<sup>3</sup> As a result of these characteristics, the outcome of OHCA resuscitation in the older population is poor.

Nationwide CPR registries from Denmark and Sweden report a 30-day survival of OHCA among patients 80 years

or older between 2.0% and 4.1%, decreasing with increasing age.<sup>4,7</sup> Recently reported rates of 30-day good neurologic outcome in OHCA patients 85 years or older are between .5% and 1.9%.<sup>8,9</sup> In Japan the improvement in favorable neurologic outcome after OHCA from 2005 to 2009 was not observed in patients 80 years or older.<sup>5</sup> As such, the ethical principle of nonmaleficence may be particularly relevant in this context, not only because of small chances of survival for this population, but also due to a high probability of injury during CPR and functional impairment in older people who survive an OHCA. Ethical decision making in the setting of cardiac arrest does not only include balancing benefits and harms but also entails accounting for the presumed wishes and treatment goals of patients who may attach great importance to their mental and physical abilities.<sup>10,11</sup> To uphold the basic principles of medical ethics, it is warranted to investigate how clinicians perceive their resuscitation practices. No large-scale studies have been conducted on how healthcare professionals think about the balance between benefit and harm of CPR in older patients.<sup>12</sup>

The aims of this study were to determine the prevalence of clinician perception of inappropriate CPR regarding the last (OHCA) encountered in an adult 80 years or older, and the relationship of this perception to patient outcome. Inappropriate CPR is defined as a resuscitation attempt that is disproportionate to the expected prognosis of the patient in terms of survival or quality of life.

## METHODS

### Study Design and Participants

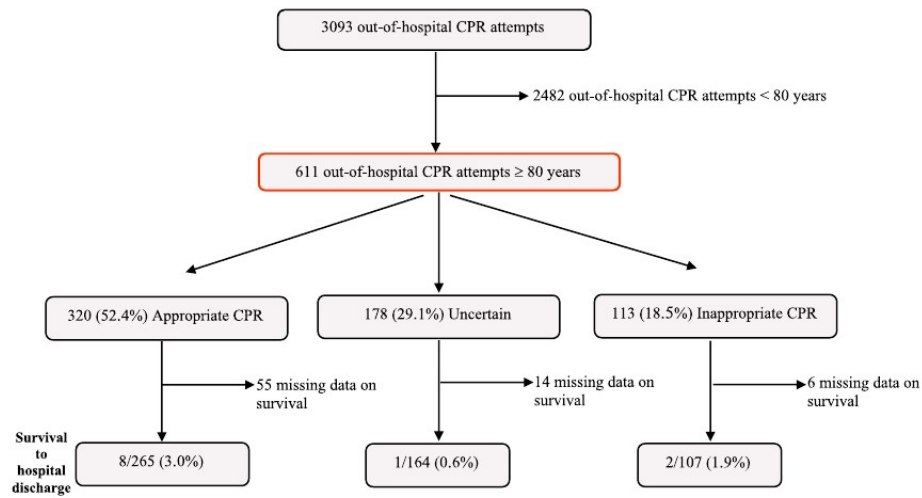
This study is a subanalysis of the REAPPROPRIATE (Resuscitation Appropriateness) study,<sup>13</sup> an international multicenter cross-sectional survey reporting the prevalence of perception of inappropriate CPR of the last cardiac arrest treated by doctors, nurses, and emergency medical technicians/paramedics working in emergency departments and the prehospital setting, and its relationship to patient outcome. After creating a network of national coordinators with a lead position in national or international scientific organizations or conducting research related to emergency medicine, 288 centers were recruited in 24 countries. More in-depth information on the study protocol can be found in an earlier publication.<sup>13</sup>

### Survey

The survey was modified based on a validated questionnaire used in the Appropriateness of Care in Intensive Care Units (APPROPRICUS) study<sup>14</sup> and extended to the setting of emergency medicine. A modified Delphi method was used to adjust the questionnaire that in its final version was translated into the language of each participating country using an adapted Brislin's method.<sup>15</sup> The national coordinators cooperated with the local investigators to ensure access to a secured study website. The data collection took place from March 2015 to November 2015.

### Description of the Survey

In addition to information about their demographic and professional background and working environment, clinicians

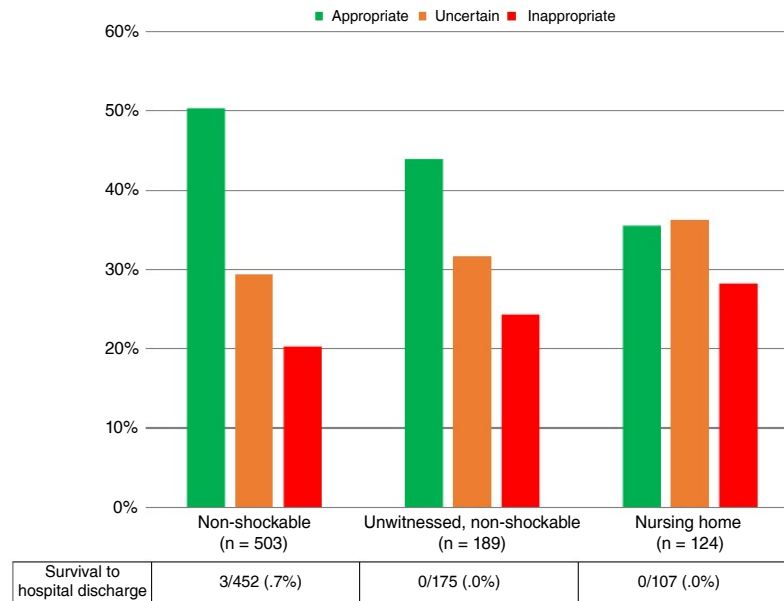


**Figure 1.** Flowchart of survey inclusion; prevalence of perception of (in)appropriateness or of uncertainty about (in)appropriateness of cardiopulmonary resuscitation(CPR); and survival to hospital discharge. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

were asked to recall their last CPR attempt and to answer first whether they “fully agreed with starting the resuscitation” (perception of appropriate CPR), “were unsure resuscitation should have been started” (uncertain about appropriateness of CPR), or “were sure resuscitation should not have been started” (perception of inappropriate CPR). Subsequently the

clinicians were asked about details of the resuscitation circumstances and whether the patient was discharged alive from the hospital.

The prevalence of perception of inappropriate CPR was defined as the percentage of clinicians reporting perception of inappropriate CPR in the last resuscitation they



**Figure 2.** Unfavorable cardiac arrest characteristics in patients 80 years or older versus appropriateness of cardiopulmonary resuscitation (CPR) outcome categories; and survival to hospital discharge. Initial rhythm status data missing for 47/611 patients; combined initial rhythm and witness status data missing for 107/611 patients; site of cardiac arrest status data missing for 21/611 patients; survival to hospital discharge data missing for 51/503 patients with non-shockable rhythm, 14/189 patients with unwitnessed non-shockable cardiac arrest and 17/124 patients in a nursing home. Survival to hospital discharge data are n/N (%).

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attempted in the emergency department or prehospital setting.

### Statistical Analysis

To examine the relationship between the perception of appropriateness outcome categories and survival to hospital discharge,  $\chi^2$  tests were used. A  $P < .05$  was considered significant. Analyses were performed using IBM SPSS Statistics for Windows, v.24.0. (IBM Corp, Armonk, NY).

### Compliance with Ethical Standards

The study was approved by the institutional review board of each center according to the national legislation and the local requirements. In some countries, informed consent of the participating clinician was not required. To guarantee data safety, a HyperText Transfer Protocol secure website, <https://reappropriate.eu>, was designed and signed by a trusted certificate authority, allowing encryption of all transferred data. The anonymity of the patient was guaranteed because all data regarding the CPR attempt were provided by the clinicians, and consultation of medical records was not requested.

### RESULTS

Of the 3093 CPR attempts in the prehospital setting registered in the REAPPROPRIATE study, 611 (19.8%) were in adults 80 years or older. These CPR attempts were reported by 176 of 611 (28.8%) doctors, 123 of 611 (20.1%) nurses, and 312 of 611 (51.1%) emergency medical technicians/paramedics.

The CPR attempt in persons 80 years or older was perceived as appropriate by 320 of 611 (52.4%) of the clinicians; 178 of 611 (29.1%) were uncertain about the appropriateness; and 113 of 611 (18.5%) perceived the CPR attempt as inappropriate. Outcome data were missing in 75 of 611 (12.3%) of the CPR attempts. The survival to hospital discharge was 11 of 536 (2.1%) in the whole cohort, 8 of 265 (3.0%) in the "appropriate" subgroup, 1 of 164 (.6%) in the "uncertain" subgroup, and 2 of 107 (1.9%) in the "inappropriate" subgroup ( $P = .23$ ) (Figure 1).

The initial rhythm status data were missing for 47 of 611 patients, and combined initial rhythm and witness status data were missing for 107 of 611 patients. Initial non-shockable rhythms accounted for 503 of 564 (89.2%) of the CPR attempts, and 189 of 447 (42.3%) were unwitnessed. Overall, 83 of 189 (43.9%) of these non-shockable unwitnessed CPR attempts were perceived as appropriate, clinicians were uncertain about the appropriateness in 60 of 189 (31.7%), and 46 of 189 (24.3%) were perceived as inappropriate. The survival to hospital discharge of unwitnessed arrests with an initial non-shockable rhythm was 0 of 175 (0%); outcome data of 14 patients were missing (Figure 2).

Initial shockable rhythms accounted for 61 of 564 (10.8%) of the CPR attempts, and 45 of 57 (78.9%) were witnessed; 32 of 45 (71.1%) of these shockable witnessed CPR attempts were perceived as appropriate. Clinicians were uncertain about the appropriateness in 11 of 45 (24.4%), and 2 of 45 (4.4%) were perceived as inappropriate. The survival to hospital discharge of witnessed arrests with an initial shockable rhythm was 2 of 31 (6.5%); outcome data of 14 patients were missing.

Table 1 lists the data regarding appropriateness of CPR outcome categories versus survival to hospital discharge for the different cardiac arrest characteristics.

CPR attempts for a nursing home resident accounted for 124 of 590 (21.0%) of the patients reported in this study. These CPR attempts were considered appropriate by 44 of 124 (35.5%) of the clinicians, 45 of 124 (36.3%) were uncertain about its appropriateness, and 35 of 124 (28.2%) perceived inappropriateness. The survival to hospital discharge was 0 of 107 (0%) for this group (Figure 2). An initial non-shockable rhythm was present in 104 of 111 (93.7%) of these CPR attempts, and 46 of 96 (47.9%) were both non-shockable and unwitnessed.

A total of 36 of 543 (6.6%) CPR attempts were undertaken despite the presence of a known written do not attempt resuscitation (DNAR) decision; 14 of 36 (38.9%) clinicians considered the CPR appropriate, 9 of 36 (25.0%) were uncertain about its appropriateness, and 13 of 36 (36.1%) considered this inappropriate. The survival to hospital discharge for the "appropriate" subgroup was 0 of 10 (0%), 0 of 7 (0%) in

**Table 1. Appropriateness of CPR Outcome Categories in Patients 80 Years or Older Versus Survival to Hospital Discharge for the Different Cardiac Arrest Characteristics**

	Perception n/N (%)	Hospital survival n/N (%)	P value
All OHCA for patients ≥80 y	611	11/536 (2.1)	.23
Appropriate	320/611 (52.4)	8/265 (3.0)	
Uncertain	178/611 (29.1)	1/164 (.6)	
Inappropriate	113/611 (18.5)	2/107 (1.9)	
Non-shockable Unwitnessed	189/447 (42.3)	0/175 (0)	NA
Appropriate	83/189 (43.9)	0/74 (0)	
Uncertain	60/189 (31.7)	0/57 (0)	
Inappropriate	46/189 (24.3)	0/44 (0)	
Non-shockable Witnessed	258/447 (57.7)	3/227 (1.3)	.69
Appropriate	147/258 (57.0)	2/122 (1.6)	
Uncertain	64/258 (24.8)	1/60 (1.7)	
Inappropriate	47/258 (18.2)	0/45 (0)	
Shockable Unwitnessed	12/57 (21.1)	0/10 (0)	NA
Appropriate	8/12 (66.7)	0/7 (0)	
Uncertain	4/12 (33.3)	0/3 (0)	
Inappropriate	0/12 (0)	0/0 (0)	
Shockable Witnessed	45/57 (78.9)	2/31 (6.5)	.56
Appropriate	32/45 (71.1)	2/20 (10.0)	
Uncertain	11/45 (24.4)	0/10 (0)	
Inappropriate	2/45 (4.4)	0/1 (0)	

Note: Survival to hospital discharge data missing for 75/611 patients; combined initial rhythm and witness status data missing for 107/611 patients; survival to hospital discharge data missing for 14/189 patients with non-shockable unwitnessed arrest, 31/258 patients with non-shockable witnessed arrest, 2/12 patients with shockable unwitnessed arrest, and 14/45 patients with shockable witnessed arrest.

Abbreviations: CPR, cardiopulmonary resuscitation; NA, not applicable; OHCA, out-of-hospital cardiac arrest.

the “uncertain” subgroup, and 1 of 12 (8.3%) in the “inappropriate” subgroup ( $P = .48$ ).

## DISCUSSION

Despite a poor outcome of CPR for OHCA in persons 80 years or older with an overall survival to hospital discharge of 2.1%, only 18.5% of the surveyed clinicians perceived their last CPR attempt as inappropriate. Even when confronted with an unwitnessed non-shockable cardiac arrest with a survival to hospital discharge of 0% in this study, not more than 24.3% of the clinicians perceived their CPR attempt as inappropriate. The low prevalence of perceptions of inappropriate CPR when resuscitating patients 80 years or older despite a very low survival rate may have several explanations.

First, it is possible that clinicians have insufficient knowledge of well-established unfavorable prognostic factors.<sup>16,17</sup> Clinicians might be well aware of these factors but use denial of the poor outcome of the patient to avoid decision making or as a coping mechanism because they are not allowed to make these decisions themselves. In this case the basic principle of medical ethics “nonmaleficence” is violated because the CPR attempt is disproportionate to the expected prognosis of the patient in terms of survival or quality of life. When a patient has a cardiac arrest in dismal circumstances, attempting CPR can be interpreted as an unjustified disruption of the physical integrity of the patient because of the extremely low probability of survival.<sup>18</sup> Even in cases where the patient survives, significant residual cognitive and physical deficits are highly likely.<sup>19,20</sup> This healthcare-induced vulnerability does not only affect the patient but also families that may experience prolonged suffering when they face a family member living a life incongruous to the person he or she was in the past.<sup>21</sup>

Second, clinicians may attempt CPR out of respect for the alleged autonomy of the patient assuming the patient desires CPR “by default.” Data show that most older patients want CPR, but only a minority of patients want CPR under any circumstances, mostly rating significant mental and physical disability as important reasons to decline resuscitation.<sup>10,11</sup> As such, performing CPR with almost no chance of survival with a good neurologic outcome can be seen as dehumanization because it violates the dignity of the patient.<sup>18</sup> Refraining from CPR in these cases may allow the patient to die a good death, as the therapeutic goal switches from achieving return of spontaneous circulation (ROSC) to supporting the comfort of the patient and the family.<sup>21</sup> In any case, the autonomy of the patient should be carefully balanced against the autonomy of the clinician who has no ethical obligation to offer inappropriate care.<sup>22,23</sup>

Third, current CPR guidelines and algorithms approach cardiac arrest management from a very technical perspective, only allowing the healthcare professional to refrain from resuscitation in cases of irreversible signs of death and leaving no space for clinical insight.<sup>24</sup> Fear of litigation and legal concerns further promote this approach.<sup>25</sup>

Lastly, the clinician may start the resuscitation attempt pending additional historical information such as total no-flow or low-flow time, or comorbidities, and discussion with the family. When a very poor prognosis becomes

evident, the clinician may then decide to stop CPR but also consider the initial CPR initiation as appropriate in the context of the initial lack of information.

This study underscores that in patients of advanced age, all too often the ritual of CPR is performed regardless of prognosis, without knowing whether the patient desires it and without realizing that this may harm the patient and family. To attain a greater synergy between the clinician’s perception of appropriateness of CPR and the expected patient outcome, we propose several interventions. Resuscitation team leaders should invite and take into account the opinion of their team members regarding the appropriateness of a CPR attempt, apart from their clinical role, especially when they are experienced.<sup>13</sup> Closed-loop systems assuring that all clinicians involved in a CPR attempt receive feedback on the patient’s outcome will improve their clinical insight for future encounters. Within teams, time should be made for debriefing and interdisciplinary ethical reflection to improve decision making for the benefit of their patients.<sup>14,26</sup> More education about the outcomes, prognostic factors, and limitations of CPR is needed, not only for healthcare professionals but also for the lay community. Early discussions and realistic information regarding CPR are needed for true shared decision making and advance care planning. Once DNAR decisions are in place, the compliance of clinicians with it must be improved.<sup>25,27</sup> In our study, 39% of emergency medicine clinicians still found it appropriate to attempt CPR despite the presence of a known written DNAR decision.

The frequency of CPR attempts in the nursing home setting has been increasing. In Denmark, the frequency of OHCA with a resuscitation attempt in nursing homes quadrupled from 3.5% in 2002 to 16.5% in 2014.<sup>28</sup> In Japan, the proportion of OHCA treated in nursing homes increased from approximately 12% to almost 20% in a time span of approximately 5 years, partly attributed to an increase in the number of residents.<sup>7</sup> More than one-fifth of the registered cardiac arrest resuscitation attempts in our study took place in a nursing home, and the survival to hospital discharge for this subgroup was 0%. The worldwide reported outcome of OHCA in nursing homes is extremely poor with an average 30-day survival between 1.7% and 2.6%.<sup>8,28,29</sup> In Hong Kong, only .07% of patients had a good neurologic outcome at 30 days reported.<sup>30</sup> In Australia, Andrew et al reported complete absence of good 12-month functional recovery after resuscitation of 2575 patients residing in a nursing home.<sup>29</sup> In this patient cohort, even more than in the general older population, a professional and societal debate based on real-life data around CPR seems warranted.

This study has several limitations. First, recall bias cannot be excluded. Also, despite prompt initiation of CPR, the perception of appropriateness might change when the outcome of the resuscitation attempt is known. We only asked for the clinician’s perception after the incident, thus creating a risk of hindsight bias; however, the questionnaire was structured in such a way that the perception of (in)appropriateness was surveyed first, and questions concerning outcome were listed at the very end. The observed low prevalence of perception of inappropriate CPR in patients with a poor outcome emphasizes the “CPR by default” mindset of clinicians. In the main survey, statistical

adjustment for ROSC did not affect the findings.<sup>13</sup> Second, no linkage was made to medical records; therefore, data on survival to hospital discharge were provided solely by the clinician and were incomplete in some cases. Third, we cannot exclude that some clinicians reported on the same patient, which might influence the outcome results. However, due to the high turnover of staff within emergency services, we think this risk is small. The consistency of our outcome data with the literature also suggests a representative patient sample.<sup>8,9</sup> Lastly, we did not register the neurologic outcome of the survivors of the resuscitation attempt, thus certainly overestimating the outcome.

In conclusion, our findings show that despite an extremely poor outcome for older patients undergoing CPR, many emergency medicine clinicians do not consider these attempts at resuscitation to be inappropriate. CPR for patients of advanced age should be seen as a conditional therapy that may be worthwhile in some older patients with a shockable witnessed cardiac arrest but may cause significant suffering when applied in an undifferentiated way. A professional and societal debate is urgently needed to ensure that first we do not harm older patients by futile CPR attempts.

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**Conflict of Interest:** James Gagg received honoraria from Boehringer Ingelheim within the last 3 years. Conrad Bjørshol is employed by the Regional Competence Centre for Acute Medicine in Western Norway (RAKOS) with financial support from the Norwegian Directorate of Health. He has participated in Global Resuscitation Alliance meetings sponsored by the Laerdal Foundation for Acute Medicine, TrygFonden, and EMS2018. The other authors have declared no conflicts of interest for this article.

**Author Contributions:** Patrick Druwé, Dominique D. Benoit, Koenraad G. Monsieurs, Ruth Piers, Sofie

A. Huybrechts, and Peter De Paepe designed the study. All authors contributed to the final version of the survey. All authors except Koenraad G. Monsieurs, Ruth Piers, Peter De Paepe, and Dominique D. Benoit contributed to the data collection. Patrick Druwé, Dominique D. Benoit, and Ruth Piers analyzed and interpreted the data. Patrick Druwé performed the literature search and wrote the first draft of the report and structured the figures and table. All the authors reviewed the draft, contributed to the revision of the report, and approved the final version of the report.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

**Data S1:** Collaborators of the REAPPROPRIATE study.

