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# Size, Shape, and Other Physical Attributes of Generic Tablets and Capsules

## Guidance for Industry

**U.S. Department of Health and Human Services  
Food and Drug Administration  
Center for Drug Evaluation and Research (CDER)**

**June 2015  
Pharmaceutical Quality/CMC**

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**U.S. Department of Health and Human Services**  
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1                   **Size, Shape, and Other Physical Attributes of Generic**  
2                   **Tablets and Capsules**  
3                   **Guidance for Industry<sup>1</sup>**  
4  
5

6  
7 This guidance represents the current thinking of the Food and Drug Administration (FDA or Agency) on  
8 this topic. It does not create any rights for any person and is not binding on FDA or the public. You can  
9 use an alternative approach if it satisfies the requirements of the applicable statutes and regulations. To  
10 discuss an alternative approach, contact the FDA staff responsible for this guidance as listed on the title  
11 page.  
12

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16 **I. INTRODUCTION**  
17

18 Tablets and capsules are widely manufactured and prescribed and may provide a number of  
19 advantages over other dosage forms, including ease of storage, portability, ease of  
20 administration, and accuracy in dosing.  
21

22 While generic formulations of these drug products are required to be both pharmaceutically and  
23 therapeutically equivalent to a reference listed drug (RLD),<sup>2</sup> we are concerned that differences in  
24 physical characteristics (e.g., size and shape of the tablet or capsule) may affect patient  
25 compliance and acceptability of medication regimens or could lead to medication errors. We  
26 believe these patient safety concerns are important, and we are recommending that generic drug  
27 manufacturers consider physical attributes when they develop quality target product profiles  
28 (QTPPs) for their generic product candidates.  
29

30 The recommendations in this guidance apply to abbreviated new drug applications (ANDAs) and  
31 their supplements for additional strengths that are submitted to the Office of Generic Drugs  
32 (OGD).  
33

34 This guidance does not apply to approved ANDAs (generic drugs) already on the market.<sup>3</sup>  
35 However, if the Agency determines that an approved product should be modified because the  
36 size or shape of a product poses a risk to public health, we will notify the holder of the ANDA.

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<sup>1</sup> This guidance has been prepared by the Office of Generic Drugs and the Office of Pharmaceutical Quality in the Center for Drug Evaluation and Research.

<sup>2</sup> *Reference listed drug* means the listed drug identified by FDA as the drug product upon which an applicant relies in seeking approval of its ANDA. See 21 CFR 314.3(b). FDA publishes the identification of RLDs in the [Approved Drug Products with Therapeutic Equivalence Evaluations](#) (i.e., Orange Book).

<sup>3</sup> If the manufacturer of a RLD makes a postapproval change to the size or shape of a previously approved tablet or capsule, the generic versions generally will not need to be modified. However, the Agency could ask for modifications to the product if there are safety concerns because of the differences in physical characteristics.

## *Contains Nonbinding Recommendations*

37 This guidance is not intended to apply to other oral dosage forms (e.g., chewable tablets, oral  
38 tablets for suspension/solution, orally disintegrating tablets, sublingual tablets, troches, gums).  
39

40 In general, FDA’s guidance documents do not establish legally enforceable responsibilities.  
41 Instead, guidances describe the Agency’s current thinking on a topic and should be viewed only  
42 as recommendations, unless specific regulatory or statutory requirements are cited. The use of  
43 the word *should* in Agency guidances means that something is suggested or recommended, but  
44 not required.  
45

## 46 **II. BACKGROUND**

### 47 **A. Differences in Size and Shape of Tablets and Capsules between a Reference** 48 **Listed Drug and a Drug Product Subject to an Abbreviated New Drug** 49 **Application** 50

#### 51 *I. Size* 52

53  
54 Difficulty swallowing tablets and capsules can be a problem for many individuals and can lead to  
55 a variety of adverse events and patient noncompliance with treatment regimens. It is estimated  
56 that over 16 million people in the United States have some difficulty swallowing, also known as  
57 dysphagia.<sup>4,5</sup> For these individuals, swallowing a tablet or a capsule can be particularly  
58 challenging. A survey of adults on difficulties swallowing tablets and capsules suggests that this  
59 problem goes well beyond the patient population with clinically recognized dysphagia and may  
60 affect as many as 40 percent of Americans. Of those who experience difficulty swallowing  
61 medications, less than a quarter discuss the problem with a health care professional, 8 percent  
62 admit to skipping a dose of prescribed medication, and 4 percent have discontinued therapy  
63 because the tablets and/or capsules were difficult to swallow.<sup>6</sup> Individuals who find it difficult to  
64 swallow tablets and capsules frequently cite the size as the main reason for the difficulty in  
65 swallowing.<sup>7,8</sup>  
66

67 Size and shape of tablets and capsules affect the transit of the product through the pharynx and  
68 esophagus and may directly affect a patient’s ability to swallow a particular drug product.  
69 Larger tablets and capsules have been shown to have a prolonged esophageal transit time. This  
70 can lead to disintegration of the product in the esophagus and/or cause injury to the esophagus,  
71 resulting in pain and localized esophagitis and the potential for serious sequelae including

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<sup>4</sup> Agency for Health Care Policy and Research, March 1999, Diagnosis and Treatment of Swallowing Disorders (Dysphagia) in Acute-Care Stroke Patients. Summary, Evidence Report/Technology Assessment: Number 8.

<sup>5</sup> Robbins J et al., August 21, 2001, July/August 2002, Dysphagia Research in the 21st Century and Beyond: Proceedings From Dysphagia Experts Meeting, Journal of Rehabilitation Research and Development, 39 No. 4, 543-548.

<sup>6</sup> Harris Interactive Inc. for Schwarz Pharma, 2003, Pill-Swallowing Problems in America: A National Survey of Adults. 1–39.

<sup>7</sup> See footnote 4.

<sup>8</sup> Bhosle M, Benner J, DeKoven M, Shelton J., 2009, Difficult to Swallow: Patient Preferences for Alternative Valproate Pharmaceutical Formulations. Patient Prefer Adherence 3, 161-171.

## *Contains Nonbinding Recommendations*

72 ulceration, stricture, and perforation.<sup>9,10</sup> Other adverse events such as pain, gagging, choking,  
73 and aspiration are related to swallowing difficulties in the oropharyngeal phase of swallowing  
74 and increasingly occur at larger tablet and capsule sizes.<sup>11,12</sup>  
75

76 Studies in adults evaluating the effect of tablet and capsule size on ease of swallowing suggest  
77 that increases in size are associated with increases in patient complaints related to swallowing  
78 difficulties at tablet sizes greater than approximately 8 mm in diameter.<sup>13,14,15</sup> The size of the  
79 tablet or capsule influences esophageal transit, irrespective of patient factors and administration  
80 techniques (i.e., use of fluids, patient position). Smaller tablets generally have been shown to  
81 have significantly faster transit times in these studies. Channer and Virjee specifically compared  
82 the transit time of 8 mm diameter round tablets to 11 mm diameter round tablets and 14 mm x 9  
83 mm oval tablets and found the transit times for the 8 mm round tablet to be significantly shorter  
84 than for 11 mm round and 14 mm x 9 mm oval tablets ( $p < .02$  and  $p < .04$ , respectively).<sup>16</sup> In  
85 addition, significantly more patients were aware of the larger round tablets (>8 mm) sticking in  
86 the esophagus compared with the 8 mm round tablets.<sup>17</sup> Although there has been less research  
87 quantifying the effects of size difference on the oropharyngeal phase of swallowing, increasing  
88 tablet or capsule size is believed to correlate with increasing difficulty with oropharyngeal  
89 transfer.

90

### 91 2. *Shape*

92

93 For any given size, certain shapes may be easier to swallow than others. In vitro studies suggest  
94 that flat tablets have greater adherence to the esophagus than capsule-shaped tablets.<sup>18</sup> Studies in  
95 humans have also suggested that oval tablets may be easier to swallow and have faster  
96 esophageal transit times than round tablets of the same weight.<sup>19,20</sup> Patient compliance with  
97 medication regimens may be influenced by the size and shape of a tablet or capsule.  
98

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<sup>9</sup> Drug and Therapeutics Bulletin, 1981; Tablets and Capsules that Stick in the Oesophagus, 19(9), 33-34.

<sup>10</sup> Channer, K, Virjee, JP. 1986, The Effect of Size and Shape of Tablets on their Esophageal Transit. *Journal of Clinical Pharmacology*, 26, 141-146.

<sup>11</sup> Kelly J, D’Cruz G, Wright D, 2010, Patients with Dysphagia: Experiences of Taking Medication. *Journal of Advanced Nursing* 66(1), 82-91.

<sup>12</sup> Jackson LD, Little J, Kung E, Williams EM, Siemiatkowska K, Plowman S, 2008, Safe Medication Swallowing in Dysphagia; A Collaborative improvement Project. *Healthcare Quarterly* 11, 110-116.

<sup>13</sup> See footnote 10.

<sup>14</sup> Wamberg T., Jorgensen, F., Hasselbalch, H., Hey, H., 1983, The Prejudgement of the Esophageal Transfer of Tablets and Capsules. *Archiv der Pharmazie Chemistry in Life Sciences*, Ed. 11, 24-31.

<sup>15</sup> Brotherman, DP., Bayraktaroglu, T.O., Garofalo, R.J., 2004, Comparison of Ease of Swallowing of Dietary Supplement Products for Age-Related Eye Disease. *Journal of American Pharmacists Association*, 44, 587-593.

<sup>16</sup> See footnote 10.

<sup>17</sup> Ibid.

<sup>18</sup> Marvola M., Rajaniemi M., Marttila E., Vahervuo K., Sothmann A., 1983, Effect of Dosage Form and Formulation Factors on the Adherence of Drugs to the Esophagus. *Journal of Pharmaceutical Sciences* 72(9), 1034-1036.

<sup>19</sup> See footnote 10.

<sup>20</sup> Hey H., Jorgensen F., Sorensen K., Hasselbelch H., Wamberg T., 1982, Esophageal Transit of Six Commonly used Tablets and Capsules. *British Medical Journal* 285, 1717-1719.

## *Contains Nonbinding Recommendations*

### 3. *Patient Factors*

The Agency recognizes that a variety of other factors may affect a patient's ability to swallow a tablet or a capsule. For example, age could be a factor. Children and adolescents, as well as the elderly, are more likely to have difficulty swallowing tablets or capsules. Body position, fluid intake, and the presence of certain medical conditions (e.g., multiple sclerosis, muscular dystrophy, Parkinson's disease) may also affect a patient's ability to swallow tablets and capsules.

Although not all patient factors can be addressed through pharmaceutical design and manufacture, the physical characteristics of a product can be addressed. These physical characteristics influence the ability of certain patients to swallow the product, particularly in vulnerable populations. We believe that tablets and capsules can be effectively developed and manufactured to minimize swallowing difficulties, which can encourage and improve patient compliance with medication regimens. FDA recommends that applicants design and develop generic drugs with this in mind.

#### **B. Other Physical Attribute Considerations**

The presence and composition of a coating can also potentially affect the ease of swallowing tablets or capsules. The lack of a film coating can decrease or prevent tablet mobility compared with a coated tablet of the same size and shape. Coating also can affect other factors that contribute to patient acceptance, such as palatability and smell.

The weight of the tablet or capsule also may affect transit time, with heavier tablets or capsules having faster transit times compared to similarly-sized, lighter tablets or capsules. Surface area, disintegration time, and propensity for swelling when swallowed are additional parameters that can influence esophageal transit time and have the potential to affect the performance of the drug product for its intended use. These physical attributes should also be considered when developing a QTPP for generic drug products intended to be swallowed intact.

### **III. RECOMMENDATIONS**

The recommendations in this guidance are based on published literature regarding patient experiences swallowing tablets and capsules and Agency experience with NDAs and ANDAs submitted for oral tablets and capsules. If a tablet or capsule intended to be swallowed intact differs from the criteria recommended in this guidance document, then the applicant should contact OGD with supportive information and justification before establishing the QTPP.

#### **A. Size**

For comparable ease of swallowing as well as patient acceptance and compliance with treatment regimens, the Agency recommends that generic oral tablets and capsules intended to be swallowed intact should be of a similar size to the corresponding RLD. The Agency recommends limiting size differences between therapeutically equivalent tablets as follows:

## *Contains Nonbinding Recommendations*

- 145       • If the RLD is less than 17 mm in its largest dimension,<sup>21</sup> the generic product should be:  
146           ○ No more than 20 percent larger than the RLD in any single dimension (the  
147           resulting single dimension of the generic should not exceed 17 mm).  
148           ○ No more than 40 percent larger than the volume of the RLD.<sup>22</sup>  
149
- 150       • If the RLD is equal to or greater than 17 mm in its largest dimension, the generic product  
151       should be:  
152           ○ No larger than the RLD in any single dimension.  
153           ○ No larger than the volume of the RLD.  
154
- 155       • We recommend that the largest dimension of a tablet or capsule should not exceed 22  
156       mm and that capsules should not exceed a standard 00 size.<sup>23</sup>  
157

158 Additional flexibility may be given for products that are 8 mm or smaller in their largest  
159 dimension, but efforts should be made to develop tablets and capsules that are of a similar size  
160 and shape to the RLD.  
161

162 Under the standard capsule size convention, the allowances described above will generally allow  
163 an increase of one capsule size, when the RLD capsule is of size 3 or smaller. When the RLD  
164 capsule is of size 2 or larger, an increase of one capsule size should only be considered when  
165 adequate justification can be provided for the size increase. These recommendations would allow  
166 an increase of one capsule size when the capsule size is less than capsule size 00.  
167

168 The Agency recognizes that two drug products may have different recommended upper size  
169 limits, but size should be considered as part of a single product risk/benefit profile. When  
170 establishing therapeutic equivalence, the applicant should compare their generic product only to  
171 the RLD.  
172

### **B. Shape**

173  
174  
175 In addition to the size recommendations described above, we recommend manufacturing tablets  
176 and capsules that have a similar shape or have a shape that has been found to be easier to  
177 swallow compared with the shape of the RLD. Evaluating and comparing the largest cross  
178 sectional areas of the RLD and generic product is one strategy to quantify changes in shape.<sup>24</sup>  
179 Tablets and capsules that have a larger cross sectional area (e.g., tablets that are rounder) would  
180 generally be more difficult to swallow than tablets or capsules of the same volume but with  
181 smaller cross sectional areas.  
182

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<sup>21</sup> The largest dimension refers to the length of oval or capsule shaped tablets or the diameter of round tablets.

<sup>22</sup> For the purposes of this guidance, volume refers to the volume occupied by the tablet or capsule.

<sup>23</sup> An internationally accepted numbering system for capsule sizes is used in approved U.S. drug products. For the purpose of this guidance, a liquid fill capsule is considered a capsule.

<sup>24</sup> For the purposes of this guidance, the largest cross sectional area is defined by the largest cross sectional area of the tablet that lies in a plane perpendicular to the longest axis of the tablet. If the shape of tablet is unconventional (e.g., pentagon, triangle, diamond, heart), then the largest cross sectional area will be defined as the area of the smallest circle, oval, or ellipse that would completely enclose this largest cross sectional shape.



## *Contains Nonbinding Recommendations*

183 There are a variety of techniques that may be used to determine the volume measurements of a  
184 tablet or capsule, including use of pycnometers, or calculations based on physical measurements  
185 of the tablet or the die used to produce the tablet. For the purpose of this guidance, spatial  
186 imaging and/or the use of computer models is recommended, because they are more accurate and  
187 applicable to a variety of shapes, although other appropriately validated methods may be used if  
188 properly justified.

189  
190 The size of a tablet or capsule should be provided in the common technical document (CTD)  
191 format,<sup>25</sup> section 3.2.P.1, *Description and Composition of the Drug Product* of the ANDA. Any  
192 studies and/or related information should be provided in the CTD section, 5.3.1.2, *Comparative*  
193 *Bioavailability and Bioequivalence Study Reports*. The Agency may request samples for  
194 evaluation of the physical attributes of a tablet or capsule.

### **C. Other Physical Attributes**

195  
196  
197  
198 Other physical attributes of tablets and capsules should be considered in the context of their effect  
199 on ease of swallowing. For example, tablet coating, weight, surface area, disintegration time,  
200 and propensity for swelling should be considered when developing a QTPP for generic tablets.

201  
202 Description of these physical characteristics should be provided in the CTD section 3.2.P.1,  
203 *Description and Composition of the Drug Product* of the ANDA. A summary of any studies to  
204 support sizes outside the recommendation provided in this guidance should be provided in the  
205 CTD section 3.2.P.2, *Pharmaceutical Development* or CTD section 3.2.P.5.6, *Justification of*  
206 *Specifications*.

### **D. Biowaivers**

207  
208  
209  
210 A biowaiver (i.e., the waiver of in vivo bioequivalence data) for additional strengths of a solid  
211 oral dosage form is generally granted if it meets one of the criteria set forth in the regulations,<sup>26</sup>  
212 one of which is proportional similarity between strengths in active and inactive ingredients.  
213 Compositional proportionality may be particularly relevant when considering tablet size and  
214 tablet formulation for other strengths (both lower and higher) of the same dosage form to be  
215 considered for a waiver of the in vivo bioequivalence study requirement. Although  
216 compositional proportionality may exist when all active and inactive ingredients are in the same  
217 proportion between different strengths, other methods of achieving compositional proportionality  
218 may be more amenable to maintaining appropriate tablet sizes for generic products when  
219 compared with the RLD. A detailed description of how the Agency defines proportional  
220 similarity can be found in the *Guidance for Industry: Bioavailability and Bioequivalence Studies*  
221 *for Orally Administered Drug Products - General Considerations*.<sup>27</sup>

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<sup>25</sup> See ICH guidance for industry [M4Q: The CTD — Quality](http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/default.htm). It is available on the Internet at <http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/default.htm> under International Conference on Harmonisation – Quality.

<sup>26</sup> See 21 CFR 320.22(d).

<sup>27</sup> This guidance is available on the Internet at <http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/default.htm> under Biopharmaceutics.

*Contains Nonbinding Recommendations*

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FDA recommends that applicants consider Agency published guidance, product specific guidance,<sup>28</sup> and relevant regulations<sup>29</sup> on the waiver process when designing and formulating other strengths of the same dosage form that will be studied with bioequivalence studies. For specific questions related to biowaivers, you should contact the appropriate review division within OGD.

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<sup>28</sup> This guidance is available on the Internet at <http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/default.htm> under Bioequivalence Recommendations for Specific Products.

<sup>29</sup> See 21 CFR 320.22.