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1 **Integrating Diabetes, Hypertension and HIV Care in sub-Saharan Africa: A**  
2 **Delphi Consensus Study on international best practice**

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32 **ABSTRACT**

33 **Background:** Although HIV continues to have a high prevalence among adults in sub-Saharan  
34 Africa (SSA), the burden of noncommunicable diseases (NCD) such as diabetes and  
35 hypertension is increasing rapidly. There is an urgent need to expand the capacity of healthcare  
36 systems in SSA to provide NCD services and scale up existing chronic care management  
37 pathways. The aim of this study was to identify key components, outcomes, and best practice  
38 in integrated service provision for the prevention, identification and treatment of HIV,  
39 hypertension and diabetes.

40 **Methods:** An international, multi stakeholder e-Delphi consensus study was conducted over  
41 two successive rounds. In Round 1, 24 participants were asked to score 27 statements, under  
42 the headings 'Service Provision' and 'Benefits of Integration', by importance. In Round 2, the  
43 16 participants who completed Round 1 were shown the distribution of scores from other  
44 participants along with the score that they attributed to an outcome and were asked to reflect  
45 on the score they gave, based on the scores of the other participants and then to rescore if they  
46 wished to. Nine participants completed Round 2.

47 **Results:** Based on the Round 1 ranking, 19 of the 27 outcomes met the 70% threshold for  
48 consensus. Four additional outcomes suggested by participants in Round 1 were added to  
49 Round 2, and upon review by participants, 22 of the 31 outcomes met the consensus threshold.  
50 The five items participants scored from 7-9 in both rounds as essential for effective integrated  
51 healthcare delivery of health services for chronic conditions were improved data collection and  
52 surveillance of NCDs among people living with HIV to inform integrated NCD/HIV  
53 programme management, strengthened drug procurement systems, availability of equipment  
54 and access to relevant blood tests, health education for all chronic conditions, and enhanced  
55 continuity of care for patients with multimorbidity.

56 **Conclusions:** This study highlights the outcomes which may form key components of future  
57 complex interventions to define a model of integrated healthcare delivery for diabetes,  
58 hypertension and HIV in sub-Saharan Africa.

59 **Keywords:** HIV, healthcare utilization, noncommunicable diseases, integration, service  
60 delivery, sub-Saharan Africa

## 61 **INTRODUCTION**

62 While HIV continues to have a high prevalence in sub-Saharan Africa (SSA) among adults,  
63 the burden of noncommunicable diseases (NCD) is increasing rapidly, in particular diabetes  
64 and hypertension (1). Each year over three-quarters (28 million) of global NCD deaths and  
65 most premature deaths from NCDs (82%) occur in low-to-middle-income-countries (LMICs).  
66 Cardiovascular diseases account for most NCD deaths, 17.9 million people annually, followed  
67 by cancers (9.3 million), respiratory diseases (4.1 million), and diabetes (1.5 million) (2). The  
68 International Diabetes Federation reported that the prevalence of diabetes in SSA is anticipated  
69 to double between 2010 and 2030 (3). It is estimated that of approximately 650 million people  
70 in SSA, 10-20 million may have hypertension (4). However, these estimations are based on  
71 scarce heterogenous studies and many countries in SSA still lack detailed up-to-date basic data  
72 on the prevalence of hypertension (5). NCDs are important contributors to the burden of disease  
73 in countries at all stages of economic development. However, the Global Status Report on  
74 NCDs emphasizes that the negative impacts of NCDs are particularly detrimental to  
75 populations with high poverty such as SSA (6), as poverty exacerbates many health conditions  
76 (7).

77 In recent years, there have been rapid improvements in HIV care programmes in SSA.  
78 Substantial global investment in health services has strengthened physical infrastructure,  
79 laboratory capacity, health information systems, healthcare worker capacity development and

80 promoting delivery of antenatal care, family planning and sexually transmitted infection (STI)  
81 management (8). This has led to the expansion of and improvements in life-saving  
82 antiretroviral therapy (ART) which has greatly decreased HIV related morbidity and mortality  
83 (9). Currently, about 65% of all people living with HIV (PLHIV) in Africa regularly access  
84 care with antiretroviral therapy (10). However, this has resulted in an ageing population of  
85 PLHIV, with the population becoming more susceptible to NCDs, such as diabetes and  
86 hypertension (11). In contrast, health service provision for NCDs in SSA remains poor and  
87 evidence on adherence to treatment and retention in care is limited with only 5-20% of people  
88 with diabetes or hypertension thought to be in regular care (12). There is an urgent need to  
89 expand the capacity of healthcare systems in SSA to provide services for managing HIV and  
90 one or more NCDs concurrently.

91 Within healthcare systems in SSA, as concern about the management of NCDs among PLHIV  
92 grows, the infrastructure and lessons learnt from the HIV chronic disease management model  
93 are important resources for those hoping to expand NCD prevention, care, and treatment (13).  
94 These include health services which are stand-alone and vertically delivered and have been  
95 combined with decentralisation and task shifting, allowing primary health centres to treat large  
96 numbers of patients with almost 70% of people living with HIV-infection in regular care (14).  
97 Given the similarities between different chronic diseases (their effects on health and individual  
98 functioning share common pathways and outcomes), the healthcare systems, assessment tools  
99 to diagnose and manage patients, health professional capacity and implementation strategies  
100 developed to provide continuity of care for HIV in SSA means they can potentially be rapidly,  
101 efficiently, and effectively utilized to support services for NCDs, particularly hypertension  
102 and diabetes (13).

103 Potential benefits of HIV-NCD integration for the health system and patients include a  
104 reduction in duplication and fragmentation of services, which would increase efficiency of

105 resource use and help patients remain in care by reducing costs and inconvenience for patients  
106 with multiple morbidities (15). Furthermore, screening for NCDs within HIV care programmes  
107 can improve the identification of undiagnosed NCDs among patients living with HIV and also  
108 contribute to improved health outcomes (16). Leveraging and adapting the existing HIV model  
109 to integrate with newly developing NCD services is key to achieving integrated care systems  
110 that are more convenient for patients. However, although a number of models of integrated  
111 HIV/NCD care in SSA have been established in recent years, the lack of evidence-based care  
112 models for scaling up integrated care makes it difficult for countries to develop effective and  
113 contextually appropriate policy and practice based strategies (17).

114 Given the importance of integrated care models to address the issues outlined above, the aim  
115 of this study was to determine consensus among experts on key components/outcomes and best  
116 practices in integrated service provision for the prevention, identification and treatment of HIV,  
117 hypertension and diabetes.

118

## 119 **METHOD**

120 The study design utilised an international, multi-stakeholder e-Delphi consensus study over  
121 two successive rounds. A web-based system designed to facilitate the building and  
122 management of Delphi surveys (DelphiManager, [http://www.comet-  
123 initiative.org/delphimanager/](http://www.comet-initiative.org/delphimanager/)), was used for data collection. The Delphi consensus technique  
124 is a survey method designed to obtain the opinions of a group of experts on a topic, with each  
125 round providing input to the next (18). This technique differs from other group decision making  
126 processes in four ways: utilising anonymity, iteration and controlled feedback, statistical group  
127 response and expert input (19). The Delphi approach is an iterative consensus technique that  
128 presents a series of sequential questionnaires asking individuals to rank outcomes in terms of

129 priority for inclusion in a key components/outcome set that should be used in interventions to  
130 optimise the prevention, identification and treatment of HIV, diabetes and hypertension in  
131 integrated services in the SSA context.

132 This Delphi consensus study used two rounds with participants being informed of the results  
133 of the prior round and allowed to revise their opinion based on those results. The goal was to  
134 achieve a pre-defined threshold of consensus. Key to the Delphi approach is the anonymity of  
135 participants. By ensuring that participants remain anonymous throughout the process, they are  
136 free to revise their opinion without fear of reputational harm or to refuse to revise their opinion  
137 without pressure from the group to do so (20).

138 Data were collected from the selected group of global expertson integrating diabetes,  
139 hypertension and HIV Care in SSA by using formal consensus methods, defined as “group  
140 facilitation techniques designed to explore the level of consensus among a group of experts by  
141 synthesising and clarifying expert opinions.” (21).

#### 142 *Selection of experts*

143 Consistent with the purposive sampling approach used by many Delphi studies (20), our  
144 sampling strategy focused on identifying potential experts on the topic of interest and inviting  
145 them to participate in the study. We identified potential experts through the ‘INTE-AFRICA’  
146 consortium (n=39) (22) and by contacting the corresponding authors of manuscripts from a  
147 scoping review we conducted on integrating care for diabetes, hypertension and HIV in SSA  
148 (n=38) (23). Expressions of interest to participate in the study were sought from the 77  
149 identified experts.

150 Twenty-four participants returned an expression of interest form and were sent an email  
151 invitation that included information about the purpose and process of the study and a link to  
152 the online version of the questionnaire in DelphiManager. The size of Delphi panels can range

153 widely and the 24 participants that agreed to participate in this study is within the 10-50  
154 typically recommended (24). We asked the experts to commit their participation for two  
155 planned Delphi rounds and informed consent was obtained from all participants. Participants  
156 were recruited between December 2019 and January 2020. Consistent with the COMET  
157 methodology, we included researchers, policymakers, and academics in our sample of experts  
158 to ensure a broad representation of opinions (Table 1). The establishment of this panel was  
159 overseen by the INTE-AFRICA Work Package 3 steering group which was responsible for  
160 providing advice, ensuring delivery of Work Package 3 project outputs. The Delphi panel  
161 participants received no financial incentive to participate in the study.

162 << Insert Table 1 here >>

### 163 *Round 1*

164 Participants were asked to score the importance of 27 statements developed by the steering  
165 group (22) (see Tables 2 and 3) on a 9-point Likert scale. The statements were grouped under  
166 two headings, (Service Provision and Benefits of Integration) which were identified as being  
167 important to enhancing integration of diabetes and hypertension management with HIV  
168 management in SSA. For outcomes under the heading ‘Service Provision’ participants were  
169 asked to rate outcomes on a scale of 1-9 where 1 = lowest priority and 9 = highest priority. For  
170 outcomes under the heading ‘Benefits of Integration’ participants were asked to rate outcomes  
171 on a scale of 1-9 where 1 = strongly disagree and 9 = strongly agree. The Likert scale  
172 corresponds to the conventional format used for comparative assessment and prioritisation of  
173 different health options (25). Participants could suggest additional outcomes during Round 1  
174 by adding their suggested outcome(s) in a free text box. Due to time constraints for completing  
175 the study, participants were given a period of one week to complete round 1 of the survey and  
176 a reminder email was sent to those participants who had not yet completed the survey two days



177 prior to the Round 1 deadline. Eighteen participants participated in Round 1 (with two partial  
178 completions, therefore 16 participants completed). Suggested outcomes from Round 1 were  
179 independently reviewed and coded by the first and second author to determine their novelty  
180 (i.e., that they were not covered by existing outcomes in the questionnaire). The first two  
181 authors could not reach agreement on whether to include two of the suggested outcomes, so  
182 clarification was sought from the last author (WC) and consensus was reached to include four of the  
183 10 suggested outcomes in Round 2..

#### 184 *Round 2*

185 Round 2 included the 27 original outcomes, and four additional outcomes suggested by  
186 respondents in Round 1. The 16 participants, who had completed Round 1, were shown the  
187 distribution of Round 1 scores from other participants along with the score that they attributed  
188 to an outcome. Participants were asked to reflect on the score they had given to each statement,  
189 based on the scores of the other participants. Using the same 9-point Likert scale, they were  
190 invited to rescore if they wanted to. Participants were given one week to complete the second  
191 round of the survey. Through this process, consensus was reached on key  
192 components/outcomes, best practice, and likely benefits in integrated service provision for the  
193 prevention, identification and treatment of HIV, hypertension, and diabetes in SSA.

#### 194 *Analysis*

195 Data analysis was conducted using DelphiManager software. The DelphiManager software  
196 provided the user scores data for each statement. Consensus for each of the statements was  
197 defined a priori as 70% or more of the respondents scoring an outcome from seven to nine and  
198 fewer than 15% scoring it one to three. Meeting the consensus meant an outcome falling in  
199 both categories of threshold  $\geq 70\%$  and  $< 15\%$ . The cut-off points were selected based on the  
200 most widely used cut of points in Delphi studies (18, 24, 26). This would illustrate an outcome

201 agreed as critically important by the majority and as of little or no importance by a small  
202 minority. Although there is no formal guidance for the reporting of e-Delphi studies, we  
203 followed recommendations including that patients and clinicians be involved; researchers and  
204 facilitators avoid imposing their views on participants; and attrition of participants be  
205 minimised as outlined by Sinha et al. (27).

#### 206 *Ethical considerations*

207 Ethical approval for the study was granted by the Human Research Ethics Committee at  
208 University College Dublin (LS-19-91-Cullen) and all methods were performed in accordance  
209 with the relevant guidelines and regulations. Participants were made aware that taking part in  
210 the study was optional and they could withdraw their participation at any time without reason.  
211 All anonymous information was securely stored on a password protected hard drive.

212

## 213 **RESULTS**

### 214 *Round 1*

215 Of the 24 participants who were invited to take part in the study, 18 participated in Round 1 (6  
216 of the invited participants did not commence Round 1 75% response rate). Participants' ranking  
217 of outcome measures for Round 1 is provided in Tables 2 and 3.

218 << Insert Table 2 and 3 here >>

219 Based on Round 1 ranking, 19 of the 27 outcomes for 'Service Provision' & 'Benefits of  
220 Integration' combined met the consensus threshold of  $\geq 70\%$  respondents scoring an outcome  
221 from seven to nine and  $< 15\%$  scoring it one to three. (combined consensus rate = 70.4%).  
222 With regards to the 'Service Provision' items, 11 outcomes met the consensus thresholds  
223 (consensus rate = 73.4%), whilst 4 outcomes (consensus rate = 26.7%) did not. Of the 4

224 outcomes that did not meet thresholds, one item (*'It is important that referral networks from*  
225 *primary to secondary care are not adversely affected by integrated care delivery in primary*  
226 *care'*) did meet the < 15% threshold, but not the  $\geq 70\%$  requirement. Meanwhile, for the 12  
227 Round 1 'Benefits of Integration' items, 8 items met the thresholds (consensus rate= 6.7%),  
228 and four did not (consensus rate = 33.4%) Of the items that did not meet the thresholds, two  
229 (*'Patients are likely to receive better quality of health education within the integrated clinic as*  
230 *within current vertical care clinics'* and *'Patients are likely to spend less time waiting in an*  
231 *integrated clinic'*) met the < 15% threshold, but not the  $\geq 70\%$  criteria. Those statements for  
232 which all respondents scored 7-9 and statements for which most respondents scored 1-3 are  
233 illustrated in Tables 2 and 3.

234

#### 235 *Round 2*

236 Nine of Round 1's 18 participants took part in and completed Round 2. Round 1's participants  
237 suggested that four outcomes be added in Round 2, thus resulting in a new tally of 31 items for  
238 the combined measures. Two outcomes were added to the '*Service Provision*' measure  
239 (*'Integrated clinics may need to be re-launched to avoid being labelled as HIV clinics'* and *'All*  
240 *health workers should undergo training in the provision of integrated chronic care'*) and two  
241 were added to the '*Benefits of Integration*' measure (*'Acceptability of integration of diabetes*  
242 *and hypertension with HIV may not be acceptable to all patients'* and *'The success of integrated*  
243 *care depends on how well the stakeholders work together'*). Twenty-two of the 31 outcomes  
244 (consensus rate = 71.0%) met the  $\geq 70\%$  and < 15% criteria. For the 15 items that were also  
245 on Round 1's '*Service Provision*' measure, 13 met the threshold criteria. Two items that did  
246 not meet the criteria in Round 1 did so in Round 2. These items were *'Drug procurement*  
247 *systems for NCDs and HIV should be integrated'* and *'It is important that referral networks*

248 *from primary to secondary care are not adversely affected by integrated care delivery in*  
249 *primary care*'. Meanwhile, of the two items that were added to Round 2, neither met the  
250 criteria. The second of these items '*All health workers should undergo training in the provision*  
251 *of integrated chronic care*' did meet the  $\geq 70\%$  mark, but not the  $< 15\%$  threshold. As for  
252 Round 2's '*Benefits of Integration*' measure, 7 items (consensus rate = 58.4%) did meet the  
253 threshold criteria and 5 (consensus rate = 41.7%) did not. One item that met the criteria in  
254 Round 1 did not do so in Round 2. This item was '*Integrated care for diabetes, hypertension*  
255 *and HIV can occur within the HIV care programme*'. Of the two items that were added to  
256 Round 2's '*Benefits of Integration*' measure, one met the threshold criteria. This was the  
257 '*...success of integrated care depends on how well the stakeholders work together*' measure.  
258 Those statements for which all respondents scored 7-9 and statements for which most  
259 respondents scored 1-3 are illustrated in Tables 2 and 3. Those statements for which all  
260 respondents scored 7-9 on both rounds are illustrated in Tables 2 and 3.

261

## 262 **DISCUSSION**

263 This study sought to identify key components/outcomes and best practices in integrated service  
264 provision for the prevention, identification and treatment of HIV, hypertension, and diabetes.  
265 The results of our e-Delphi study suggest that key experts largely agree on what key  
266 components/outcomes and best practices should be involved when addressing the high and  
267 increasing dual burden of NCDs and HIV in sub-Saharan Africa.

268 The highest priority for service provisions was given to the strengthening of drug procurement  
269 systems for NCDs within an integrated care programme and the availability of equipment and  
270 access to relevant blood tests for routine monitoring for all conditions. Health education and  
271 community-based education programmes and services were also prioritised to address the

272 stigma within NCD/HIV care. There should be onsite training of healthcare workers on HIV  
273 and NCDs. Participants also believed improved data collection and surveillance of NCDs  
274 among PLHIV should be used to inform integrated NCD/HIV programme management.

275 The results showed that participants strongly agreed that an integrated clinic would provide  
276 better continuity of care and clinical outcomes for patients with multi-morbidities. They believe  
277 patients with chronic diseases are more likely to be retained in an integrated care clinic and this  
278 care can be delivered in the community. Additionally, participants strongly disagreed that  
279 integrating these services may weaken the current HIV programme. One item that met the  
280 criteria in Round 1 did not do so in Round 2. This is a common occurrence with the Delphi  
281 consensus technique as participants are shown the distribution of Round 1 scores from other  
282 participants and asked to reflect on their own Round 1 score and are invited to rescore if they  
283 wanted to.

#### 284 *How this relates to other literature*

285 Although this topic has been studied before (28-30), the best practices in integrated care  
286 provision for the prevention, identification and treatment of hypertension, diabetes and HIV in  
287 SSA has yet to be identified. This study provides a unique perspective by a group of experts  
288 on the topic in order to inform best practice in integrated care provision. The results of this  
289 study reaffirm the view that an integrated clinic will provide better continuity of care for  
290 patients with diabetes, hypertension and HIV.

291 Barriers such as a lack of diagnostic equipment and medication (17, 31), lack of trained staff  
292 or training (31, 32) lack of guidelines and operating protocols (33), and perceived threat of  
293 integration to existing HIV success (34) have all been cited as issues when implementing  
294 integrated HIV/NCD care in SSA. These barriers were also highlighted by participants in this  
295 study as the need to strengthen (35) drug procurement systems for NCDs, improve the

296 availability of equipment, and access to relevant blood tests for routine monitoring for all  
297 conditions were all strongly agreed upon. Health education and community-based education  
298 programmes and services were also prioritized.

299 The results of this study add to the existing literature by highlighting the most important service  
300 provisions and perceived benefits of integration, and particularly useful for the African context  
301 where integrated care is developing. This can be used as a guide to determining key outcomes  
302 and interventions in future trials.

### 303 *Limitations and Strengths*

304 This study employed the ‘Delphi’ consensus technique in an attempt to identify key  
305 components/outcomes and best practice in integrated service provision for the prevention,  
306 identification and treatment of HIV, hypertension, and diabetes. The validity of study findings  
307 depends on the composition of our e-Delphi panel. Recommended best practices in an e-Delphi  
308 study is to involve a diverse set of panellists (24). The presence of diverse perspectives is likely  
309 to result in wider acceptance of the prioritized outcomes deemed important to include in future  
310 trials. To minimise recruitment bias, we invited a range of global and African stakeholder  
311 groups (researchers, policymakers, and academics) to participate in the study. While we could  
312 not control which stakeholders would return an expression of interest to participate in the study,  
313 the 24 expressions of interest and the nine participants who completed both rounds of the  
314 survey reflected a range of stakeholder groups and countries and, thus, captured a broad range  
315 of perspectives (see Table 1). The decision of 70% agreement could be a limitation considering  
316 Round 1 was only completed by 16 participants and Round 2 was only completed by nine  
317 participants, as there is some uncertainty as to what constitutes a consensus (27). However, a  
318 recent systematic review (36) noted that few Delphi studies report response rates for all rounds  
319 and stated that the median number of invited participants was only 17 in Delphi studies.

320 Therefore, we believe that our sample size is sufficient. Additionally, as our sample was chosen  
321 to be purposive, not representative, it can also be concluded that the decrease in participants  
322 from Round 1 to Round 2 is acceptable.

### 323 *Implications for research*

324 Further research is needed to prioritise the outcomes identified in this study into a core outcome  
325 set to identify the best measures required to evaluate the benefits, challenges and cost-  
326 effectiveness of integration of HIV and NCD services in SSA.

### 327 *Conclusions*

328 This study has identified the key components/outcomes that are most important to a range of  
329 key stakeholders in the field including researchers, policymakers, academics. While our Delphi  
330 panel included experts based outside SSA, we do not see this as being problematic as they were  
331 all experts on integrating diabetes, hypertension and HIV Care in SSA. The findings from this  
332 study will help guide future research when choosing key outcomes/interventions for future  
333 trials in this area and the 22 items prioritised here that met the  $\geq 70\%$  and  $< 15\%$  criteria will  
334 be useful to improve evidence synthesis in future systematic reviews. The identified key  
335 components are further essential to the generation of a culturally appropriate and transferable  
336 model of integration for potential operationalisation in Africa.

337

### 338 **List of abbreviations**

339 ART - antiretroviral therapy

340 LMIC - low-to-middle-income-countries

341 NCD - noncommunicable diseases

342 PLHIV - people living with HIV

343 SSA - sub-Saharan Africa (SSA)

344

#### 345 **Declarations**

#### 346 **Ethics approval and consent to participate**

347 Ethical approval for the study was granted by the human research ethics committee at  
348 University College Dublin (LS-19-91-Cullen) and all methods were performed in accordance  
349 with the relevant guidelines and regulations. All participants were briefed fully on the aims and  
350 objectives of the study and informed consent was obtained from all participants prior to taking  
351 part.

#### 352 **Consent for publication**

353 Not applicable

#### 354 **Availability of data and materials**

355 The datasets used and/or analysed during the current study are available from the corresponding  
356 author on reasonable request.

#### 357 **Competing interests**

358 The authors declare that they have no competing interests

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#### 362 **Authors' contributions**



363 GM led the development of the manuscript, developed and conducted the Delphi consensus,  
364 and analysed the data. SM contributed to the development of the manuscript. JL contributed to  
365 the development of the Delphi consensus statements and contributed to the development of the  
366 manuscript. MCVH contributed to the development of the Delphi consensus statements and  
367 contributed to the development of the manuscript. MB contributed to the development of the  
368 Delphi consensus statements and contributed to the development of the manuscript. SJ  
369 contributed to the development of the Delphi consensus statements and contributed to the  
370 development of the manuscript. AG contributed to the development of the Delphi consensus  
371 statements and contributed to the development of the manuscript. KR contributed to the  
372 development of the manuscript. NS contributed to the development of the manuscript. SM  
373 contributed to the development of the manuscript. WC is the principal investigator and  
374 conceived the study, oversaw data analysis and manuscript development. All authors read and  
375 approved the final manuscript.

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